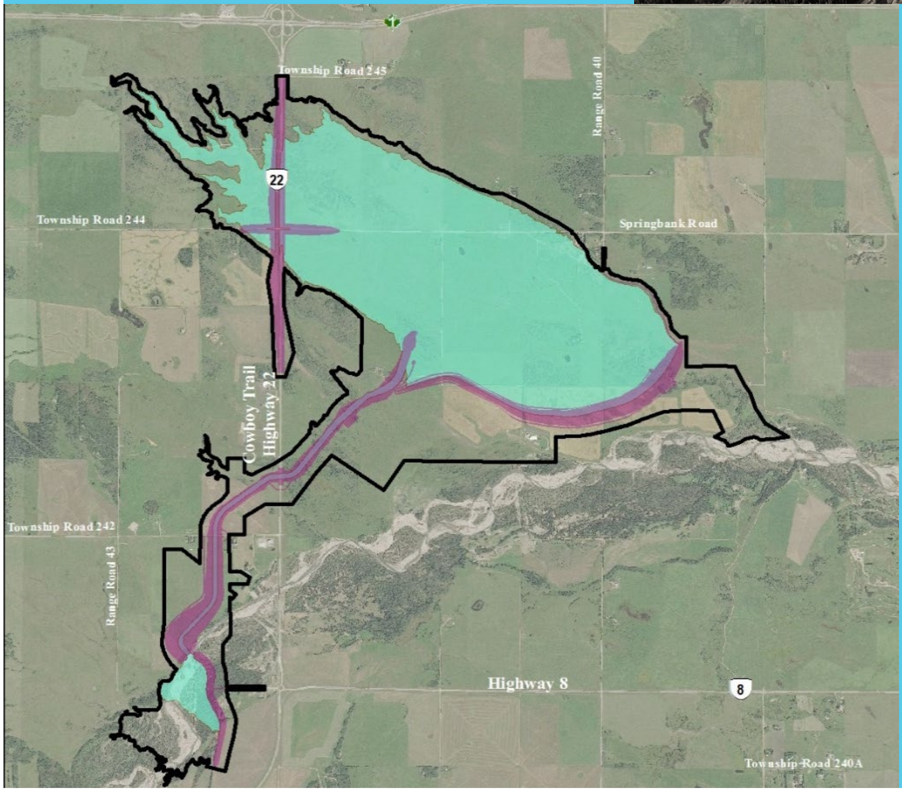
Springbank
Off-stream Reservoir
Project



Impact Assessment Agency of Canada
Annual Report - 2021/2022 Reporting Year

October 2022

Alberta Transportation

SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Impact Assessment Agency of Canada Annual Report - 2021/2022 Reporting Year

Prepared for:
Alberta Transportation

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October 2022

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Executive Summary

The Springbank Off-stream Reservoir Project (the Project; SR1) is a flood mitigation Project under construction to help reduce the effects of future extreme floods on infrastructure, water courses and people in the City of Calgary and downstream communities. The Project is located approximately 15 km west of Calgary in Rocky View County.

Alberta Transportation (AT) received the Impact Assessment Agency of Canada (IAAC) Decision Statement in July 2021 and the Natural Resources Conservation Board (NRCB) Approval in October 2021. AT holds all approvals for the Project until construction completion, thereafter approvals will transfer to Alberta Environment and Parks (AEP) for operation and maintenance. In addition to the IAAC Decision Statement and NRCB approvals, AT obtained all required Provincial and Federal approvals and authorizations prior to the start of construction activities with the exception of temporary construction approvals/permits being obtained by the contractor as needed.

AT is committed to constructing SR1 in accordance with all regulatory approvals, ongoing communications with Indigenous groups, local landowners, and stakeholders. This report comprises a summary of construction activities and environmental monitoring completed during the 2021/2022 reporting year (July 8, 2021 to June 30, 2022) as it pertains to the IAAC approval conditions.

Construction Activities during 2021/2022 Reporting Year

Pre-construction activities commenced in February 2022 with delineating portions of the construction boundary, and tree and shrub clearing and mulching within the Project construction area. Tree and shrub clearing was required in advance of April 1, 2022, as a mitigation measure to minimize potential effects on migratory birds that have the potential to nest within the clearing footprint of the construction area. Wildlife sweeps were conducted within 7 days of work in all areas, in advance of site clearing

Construction activities commenced in early April 2022 with the mobilization of heavy equipment to site, soil stripping, and grubbing activities throughout the Project construction area. The stripped soil was generally stockpiled in the vicinity of the area being stripped, and in some instances relocated to other places for longer storage. Topsoil and subsoil were stockpiled separately to prevent mixing. Temporary wildlife fence was also installed in various locations.

Environmental Management and Mitigation

To manage and minimize impacts to the surrounding environment as a result of construction activities, AT implemented best management practices and adhered to provincial and federal requirements. Sediment and erosion control measures were installed in Project construction areas that were most sensitive to construction activities (e.g. adjacent to Elbow River, wetlands). These were and continue to be routinely inspected and replaced or augmented when necessary.

Water

During the 2021/2022 reporting year, turbidity samples were hand collected in the Elbow River at three locations during construction activities.

No dewatering activities were planned during the 2021/2022 reporting year. Due to a two-day heavy rain event in June, several construction areas within the Project experienced pooling, including upland areas and the area south of Elbow River. Dewatering activities were required to remove the water from the construction areas. Turbidity monitoring was conducted during dewatering activities.

Terrestrial

Pre-construction wildlife surveys were completed in accordance with IAAC approval conditions. Vegetation removal including tree harvesting and mulching were completed prior to April 1, 2021 and in areas where construction activities were planned during the migratory bird breeding period, pre-construction wildlife sweeps were completed. No active nests or dens were identified in the Project construction area prior to tree removal and mulching activities. Wildlife sweeps also included amphibian surveys in wetlands and waterbodies located within the construction boundary

Two wetlands directly adjacent to the construction boundary in NE-22-24-4-W5M were impacted beyond approved *Water Act* limits in June 2022. The incident was reported to AEP in accordance with *Water Act* approval conditions as well as IAAC and Indigenous groups under the IAAC conditions. The contractor is actively working with AEP (who regulates wetlands in Alberta) to develop a restoration plan for the two impacted wetlands.

Air and Noise

The air quality monitoring network was established in late spring 2022 using temporary rental equipment. Supply chain and logistical issues around power supply and land agreements prevented earlier deployment of the monitoring network. The data was and continues to be collected and assessed continuously since inception of the monitoring network. Any concentrations of total suspended particulates (TSP), coarse particulate matter (PM_{10}), or fine particulate matter ($PM_{2.5}$) above the Alberta Ambient Air Quality Objectives (AAAQO) were investigated and when necessary, dust mitigation measures were implemented. The dust and emission control mitigations were implemented including speed limits on roads within the Project construction areas, a no-idling policy, application of water or calcium chloride to roads to suppress dust generation, visual inspection of roads and Project construction areas for dust, and adaptive mitigation in response to dust complaints and elevated ambient particulate monitoring concentrations at the monitoring stations.

During the 2021/2022 reporting year, no noise complaints were received.

Indigenous Monitor and Independent Environmental Monitor

In accordance with IAAC Condition 9.1, AT retained, prior to construction, the services of Indigenous Monitors to observe, record, and report to AT and Indigenous groups on the implementation, throughout construction, of requirements set out in the Decision Statement.

Additionally, AT retained a third-party Independent Environmental Monitor for the construction phase. The Independent Environmental Monitor and Indigenous Monitors observed Project activities for adherence to IAAC approval conditions.

Monitoring Plans

AT developed mitigation and monitoring measures which were captured in various Monitoring Plans for SR1. The monitoring plans that were required to be finalized prior to the start of construction were sent to Indigenous groups and appropriate regulators (e.g. IAAC, Health Canada, Environment and Climate Change Canada (ECCC)) for review prior to implementation. Monitoring during construction was and continues to be completed, and mitigation measures are implemented as necessary. No updates to Monitoring Plans were required during the 2021/2022 reporting year.

Résumé

Le projet de réservoir hors cours d'eau de Springbank (le projet; SR1) est un projet d'infrastructure d'atténuation des crues destiné à prévenir les effets d'éventuels événements extrêmes sur les infrastructures, les cours d'eau et la population de la ville de Calgary et des villes en aval. Le projet est situé à environ 15 km à l'ouest de Calgary, dans le comté Rocky View.

L'agence Alberta Transportation (AT) a reçu la déclaration de décision de l'Agence d'évaluation d'impact du Canada (AEIC) en juillet 2021 et les autorisations de l'organisme Natural Resources Conservation Board (NRCB) en octobre 2021. L'AT a obtenu toutes les autorisations pour la construction du projet, après quoi l'organisme Alberta Environment and Parks (AEP) devra obtenir les autorisations relatives à l'exploitation et à l'entretien. En plus de la déclaration de décision de l'AEIC et des autorisations du NRCB, l'AT a obtenu tous les permis et autorisations nécessaires des autorités provinciales et fédérales avant le début des travaux de construction, sauf les permis et autorisations de construction temporaires que doit obtenir au besoin l'entrepreneur.

L'AT s'est engagée à construire SR1 dans le respect de toutes les autorisations réglementaires et à entretenir des communications continues avec les groupes autochtones, les propriétaires fonciers locaux et les intervenants. Le présent document dresse un résumé des activités de construction et de surveillance environnementale réalisées au cours de la période de déclaration 2021/2022 (8 juillet 2021 au 30 juin 2022) conformément aux conditions d'autorisation de l'AEIC.

Activités de construction réalisées au cours de la période de déclaration 2021/2022

Les activités préconstruction ont commencé en février 2022, soit la délimitation de parties du périmètre de construction, la coupe des arbres et arbrisseaux, et le paillage dans les zones de construction du projet. La coupe des arbres et arbrisseaux a été réalisée conformément aux exigences avant le 1er avril 2022 pour constituer une mesure d'atténuation visant à minimiser les effets potentiels sur les oiseaux migrateurs qui sont susceptibles d'établir leur nid dans les aires à débroussailler des zones de construction. Des relevés fauniques ont été effectués dans toutes les zones dans les 7 jours précédant les travaux de coupe.

Les activités de construction ont commencé au début avril 2022, soit le déploiement de la machinerie lourde sur le site et les activités de décapage du sol et d'essouchement dans les zones de construction. La terre retirée a été en majeure partie entassée à proximité de l'aire décapée, sinon transportée à d'autres endroits à des fins de stockage à plus long terme. La terre végétale et le sous-sol ont été entassés séparément pour éviter tout risque de mélange. Des clôtures temporaires ont aussi été installées à divers endroits pour tenir à l'écart les animaux sauvages.

Gestion environnementale et mesures d'atténuation

Pour gérer et minimiser les effets sur les milieux environnants des activités de construction, l'AT a adopté des pratiques exemplaires de gestion et respecté les exigences des autorités provinciales et fédérales. Des mesures d'atténuation de l'érosion et du rejet des sédiments ont été mises en place dans les zones du projet les plus sensibles aux activités de construction (par exemple, les zones adjacentes à la rivière Elbow et les milieux humides). Ces mesures ont fait (et font toujours) l'objet d'une surveillance régulière, et ont été augmentées ou modifiées au besoin.

Eau

Au cours de la période de déclaration 2021/2022, des échantillons d'eau ont été manuellement prélevés à trois endroits dans la rivière Elbow durant les activités de construction afin d'en mesurer la turbidité.

Aucune activité d'assèchement n'avait été prévue pour la période de déclaration 2021/2022. En juin, un événement de pluie intense d'une durée de deux jours a entraîné des accumulations d'eau dans plusieurs zones de construction sur le site du projet, dont des terres hautes et la zone au sud de la rivière Elbow. Des activités d'assèchement ont été nécessaires pour retirer l'eau des zones de construction. Un suivi de la turbidité des eaux a été mené durant les activités d'assèchement.

Environnement terrestre

Des relevés fauniques ont été réalisés avant les activités de construction, conformément aux conditions d'autorisation de l'AEIC. L'enlèvement de la végétation, la récolte des arbres et le paillage ont été effectués avant le 1er avril 2021, et dans les zones où des activités de construction étaient prévues durant la période de nidification des oiseaux migrateurs, des relevés fauniques préconstruction ont été réalisés. Aucun nid ou tanière avec activité visible n'a été trouvé dans les zones de construction du projet avant les activités d'enlèvement des arbres et de paillage. Des relevés des amphibiens ont aussi été réalisés dans les milieux humides et les plans d'eau situés à l'intérieur du périmètre de construction.

Deux milieux humides directement adjacents à la zone de construction NE-22-24-4-W5M ont subi en juin 2022 des effets environnementaux négatifs qui dépassent les limites indiquées dans la loi provinciale *Water Act*. L'incident a été signalé à l'AEP conformément aux conditions d'autorisation de la loi *Water Act*, ainsi qu'à l'AEIC et aux groupes autochtones en vertu des conditions de l'AEIC. L'entrepreneur s'emploie avec l'AEP (qui réglemente les milieux humides en Alberta) à élaborer un plan de restauration des deux milieux humides altérés.

Bruit et qualité de l'air

Le réseau de surveillance de la qualité de l'air a été mis en place à la fin du printemps 2022 au moyen d'appareils loués temporaires. Des problèmes d'approvisionnement et logistiques concernant l'alimentation électrique et les ententes au sujet des terrains ont empêché de mettre en place plus tôt le réseau de surveillance. Depuis l'installation des appareils, les données sont recueillies et la qualité de l'air est continuellement évaluée. Dans tous les cas où la concentration des particules totales en suspension (PTS), des particules en suspension < 10 µm (PM_{10}) ou des particules fines ($PM_{2,5}$) a dépassé les limites fixées dans les lignes directrices Alberta Ambient Air Quality Objectives (AAAQO), une enquête a été menée et des mesures de réduction des poussières ont été prises au besoin. Des mesures de réduction des poussières et des émissions ont été mises en place, dont l'établissement de limites de vitesse sur les routes du projet, une politique interdisant le fonctionnement des moteurs au ralenti, l'application d'eau ou de chlorure de calcium comme abat-poussière, l'inspection visuelle des routes et des zones de construction du projet relativement aux poussières, ainsi que des mesures d'atténuation adaptées en réponse aux plaintes relatives à la poussière et aux concentrations élevées de particules en suspension mesurées aux stations de surveillance.

Aucune plainte relative au bruit n'a été reçue pour la période de déclaration 2021/2022.

Surveillance environnementale effectuée par les Autochtones et un surveillant indépendant tiers

Conformément à la condition 9.1 de l'AEIC, l'AT a fait appel, avant la construction, aux services de surveillants autochtones pour observer et documenter, durant la construction, au sujet de la mise en œuvre des conditions énoncées dans la déclaration de décision et en rendre compte à l'AT et aux groupes autochtones.

De plus, l'AT a retenu les services d'un surveillant environnemental indépendant tiers pour effectuer la surveillance pendant la construction. Le surveillant environnemental indépendant et les surveillants autochtones font la surveillance des activités du projet relativement au respect des conditions énoncées dans la déclaration de décision de l'AEIC.

Programmes de suivi

L'AT a élaboré des mesures d'atténuation et des activités de surveillance qui figurent dans les différents programmes de suivi du projet SR1. Les programmes de suivi qui devaient être finalisés avant le début des activités de construction ont été transmis aux groupes autochtones et aux autorités réglementaires appropriées (AEIC, Santé Canada, Environnement et Changement climatique Canada) pour examen avant leur mise en œuvre. Depuis le début de la construction, la surveillance est réalisée de manière continue et les mesures d'atténuation nécessaires ont été mises en œuvre. Aucune mise à jour des programmes de suivi n'a été nécessaire pour la période de déclaration 2021/2022.

Abbreviations

AAAQO	Alberta Ambient Air Quality Objectives
ACSW	Alberta Culture and Status of Women
AEP	Alberta Environment and Parks
AQMP	Air Quality Monitoring Plan
AT	Alberta Transportation
BTEX	benzene, toluene, ethylbenzene, xylenes
C	carbon
CAAQS	Canadian Ambient Air Quality Standards
CFT7	Community Futures Treaty 7
DO	Dissolved oxygen
DOC	dissolved organic carbon
EBAM	environmental beta-attenuation mass monitors
EC	Electrical conductivity
ECCC	Environment Climate Change Canada
EIA	Environmental Impact Assessment
FNLUAC	First Nations Land Use Advisory Committee
FRL	Fish Research License
HADD	harmful alteration, disruption, and destruction
HRA	*Historical Resources Act*
IAAC	Impact Assessment Agency of Canada
JLUAC	Joint Land Use Advisory Committee
KWBZ	Key Wildlife Biodiversity Zone
LOC	Licenses of Occupation

MeHG	methylmercury
N	nitrogen
NO	Nitrogen oxides
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NRCB	Natural Resources Conservation Board
ORP	oxidation-reduction potential
PDA	Project Development Area
$PM_{2.5}$	fine particulate matter
PM_{10}	coarse particulate matter
QAES	Qualified Aquatic Environmental Specialist
RAP	Restricted Activity Period
RTMP	Royal Tyrell Museum of Palaeontology
SARA	*Species at Risk Act*
SIR	Supplemental Information Requests
SR1; Project	Springbank Off-stream Reservoir Project
SWMP	Surface Water Monitoring Plan
TDL	Temporary Diversion License
TOR	Terms of Reference
TFA	Temporary Field Authorization
THg	Total mercury
TSP	Total suspended particulates
TSS	Total Suspended Solids
WMMP	Wildlife Mitigation and Monitoring Plan

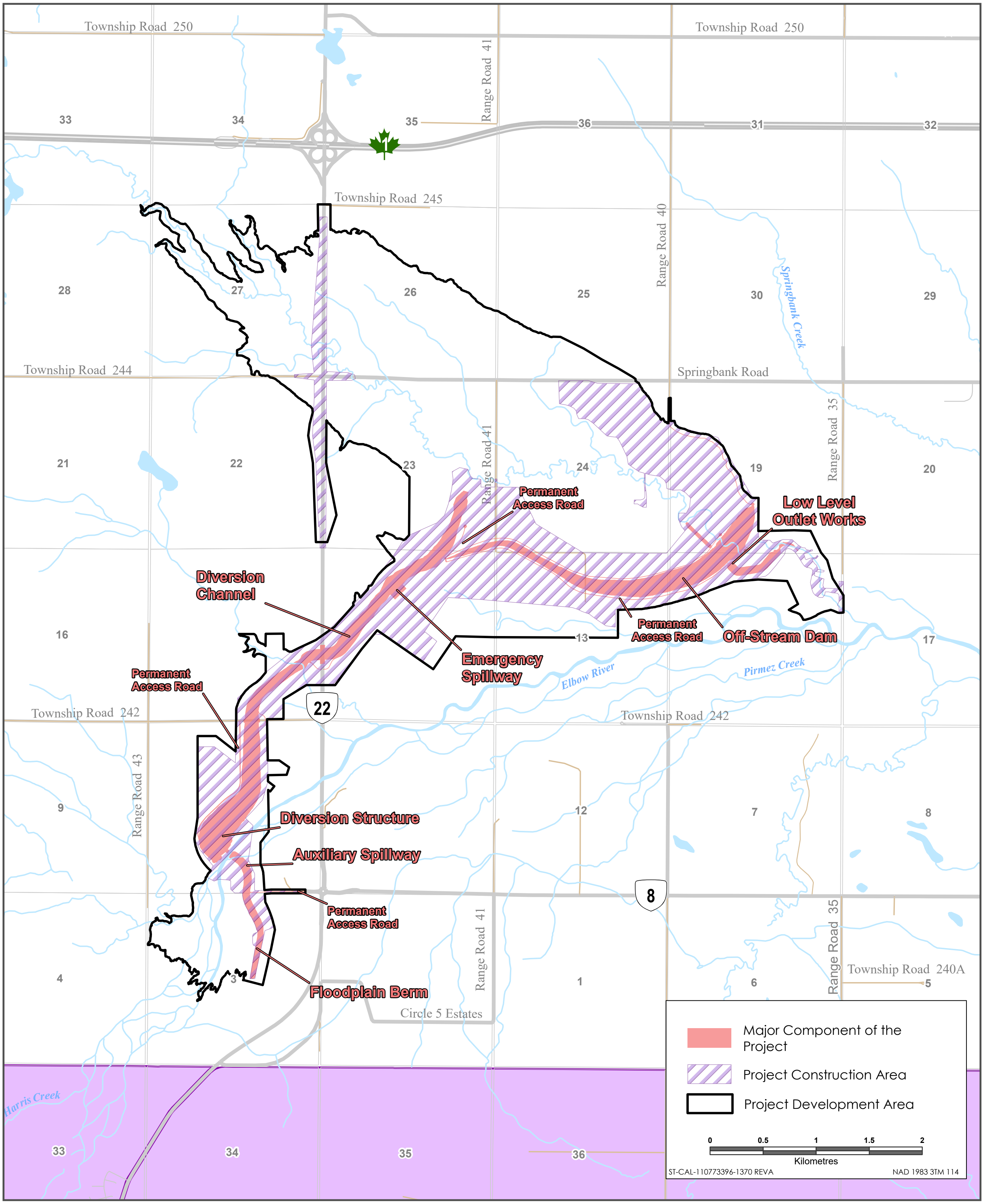
1.0 INTRODUCTION

The Springbank Off-stream Reservoir Project (the Project; SR1) is located in the Springbank area of Rocky View County 15 km west of the City of Calgary, Alberta (see Figure 1.1). The Project is a flood diversion system that will divert excess flood water from Elbow River to an off-stream reservoir where it will be held until the risk of flooding has passed. At that time, the retained flood water will be returned to Elbow River in a controlled manner.

AT received Project approvals for SR1 from the Impact Assessment Agency of Canada (IAAC) in July 2021, and the Natural Resources Conservation Board (NRCB) in October 2021. The Government of Alberta Order in Council was signed in October 2021. IAAC approval conditions for Project construction and operations outline federal reporting requirements to be carried out during all phases of the Designated Project.

Pre-construction activities began in February 2022 with site preparation and tree and shrub clearing, construction activates began in April 2022 with soil stripping. Onsite construction activities were restricted to the construction footprint (see Figure 1.1).

A concordance table in Appendix A provides a summary of the IAAC approval conditions and indicates the sections of this report where these conditions are addressed.



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta
Service Layer Credits:

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
10/25/2022

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Project Location

Figure 1.1

1.1 REPORT STRUCTURE

AT is committed to regulatory compliance. The following annual report provides a summary of all activities completed for SR1 undertaken by AT during 2021/2022 reporting year (July 8, 2021, to June 30, 2022) of the construction period as required by IAAC approval condition 2.11. The report has been organized into the following sections:

- Regulatory Update
- Monitoring Plans Update
- Project Activities and Status

2.0 REGULATORY UPDATE

AT holds all regulatory permits and approvals for the Project. Should they be required, the Prime Contractor is responsible for obtaining any additional temporary permits required in order to complete construction activities in accordance with provincial and federal regulations.

2.1 PROJECT APPROVALS

Table 2.1 summarizes the Project approvals, authorizations, and notifications received prior to the start of construction activities.

Table 2.1 SR1 Project Approvals

Subject Matter/Commitment	Approval Number	Approval Received	Approval Expiry
***Canadian Environment Assessment Act 2012* (CEAA)**			
IAAC Decision Statement	139551E	8-Jul-21	N/A
***Natural Resources Conservation Board Act* (NRCB)**			
Decision Statement	NR-2021-1	19-Oct-21	N/A
Alberta Environment and Parks			
Water Act Approval for Wetland Disturbance	DAUT008702	08-Feb-22	31-Dec-72
Temporary Field Authorization (TFA) - Watercourse Realignment/Reconstruction	TFA221088	13-Aug-2021	31-Mar-25
TFA Incidental Activity – Temporary Workspace	TFA221119	13-Aug-2021	31-Mar-25
Public Lands Act (PLA) Licences of Occupation (LOC) – Water Diversion – Outfall	DLO210186	09-Feb-22	08-Feb-47
PLA LOC - Water Diversion – Water Intake	DLO200141	09-Feb-22	08-Feb-47
Fisheries and Oceans Canada			
Fisheries Act Authorization also Acting as a Permit under the *Species at Risk Act* (Elbow River)	16-HCAA-00537	18-Mar-22	31-Mar-32
Transport Canada			
Canadian *Navigation Protection Act*	2021-604875	14-Dec-21	N/A
Alberta Culture and Status of Women			
Historical Resources Act[1]	4825-15-0004-009	11-Feb-22	N/A

NOTE:

[1] Two archaeological sites have outstanding *Historical Resources Act* (HRA) requirements for further investigation; these were identified prior to the start of construction and no construction activity has taken place at these site locations based on the nature of their historic values. Work is ongoing to address the outstanding requirements in order to receive clearance under the HRA.

2.2 PERMITS RECEIVED

In addition to the approvals, authorizations and notifications, the Prime Contractor, on behalf of AT obtained the following permits for construction activities:

- Fish Research License (FRL) Pre-Approved Assessment and Salvage (RL-PAAS 22-5008) under Alberta Environment and Parks (AEP): for Elbow River and Unnamed Creek
- AEP Translocation of Amphibians – Research & Collection Permit (License No. #22-262)
    - Effective as of April 26, 2022 and expires December 31, 2022
- Temporary Diversion License (TDL) (License No. DAUT0009542DL)
    - Effective as of June 10, 2022, and expires June 9, 2023

3.0 MONITORING PLANS UPDATE

Mitigation and monitoring measures developed and captured in various plans for SR1 (see Table 3.1 below for a list of plans) that are consistent with the measures identified in the Environmental Impact Assessment (EIA), Supplemental Information Requests (SIRs) and in accordance with approval conditions identified by IAAC and the NRCB.

Table 3.1 provides a summary of activities and results pertaining to the monitoring plans for the Project.

Table 3.1 Summary of Activities

Monitoring Plans	Summary of Activities
Air Quality Monitoring Plan (AQMP) *(IAAC Approval Condition(s) 6.4, 7.10)*	An Air Quality Management Plan was prepared based on the final decision documents from IAAC and NRCB. As per the AQMP the air quality monitoring network was established in late spring 2022 using temporary rental equipment. Supply chain and logistical issues around power supply and land agreements prevented earlier deployment of the monitoring network. The data is being collected and assessed continuously since inception of the monitoring network. Any concentrations of total suspended particulates (TSP), coarse particulate matter (PM_{10}), or fine particulate matter ($PM_{2.5}$) above the Alberta Ambient Air Quality Objectives (AAAQO) were investigated and when necessary, dust mitigation measures were implemented. Monthly calibration and maintenance were conducted. See Section 4.9 for details on air quality monitoring during the 2021/2022 reporting year.
Wildlife Mitigation and Monitoring Plan (WMMP) *(IAAC Approval Condition(s) 4.1 to 4.10; 4.11; 5.1; 5.2 to 5.5; 8.1; 8.3 to 8.5)*	Pre-construction wildlife surveys were completed in accordance with IAAC approval conditions including little brown myotis roost survey (IAAC approval condition 5.1), species at risk amphibian survey (IAAC approval condition 5.2), and grizzly bear den survey (IAAC approval condition 8.3). In accordance with IAAC approval condition 4.6, construction activities were scheduled to avoid the migratory bird breeding period (April 1 to August 31) where possible. Vegetation removal including tree harvesting and mulching were completed prior to April 1, 2021. In areas where construction activities were planned during the migratory bird breeding period, pre-construction wildlife sweeps were completed by qualified wildlife biologists to reduce potential disturbance to nesting birds and appropriate setback buffers were implemented where necessary, consistent with conditions 4.6 and 4.8 as well as direction provided in the WMMP. In accordance with IAAC approval condition 4.11.1, and the Bank Swallow Mitigation Plan, bank swallow use was monitored during Project construction where active residences were checked twice yearly between May 1 and August 31. Monitoring focused on the previously identified bank swallow colony on Elbow River. See Section 4.7.2 and Appendix B.1 for details on the WMMP during the 2021/2022 reporting year.

Table 3.1 Summary of Activities

Monitoring Plans	Summary of Activities
Surface Water Monitoring Plan (SWMP) *(IAAC Approval Condition 3.19)*	During the 2021/2022 reporting year, turbidity samples were hand collected and will continue to do so until the continuous turbidity sondes are procured and installed in the sampling locations specified in the SWMP. Due to procurement complications the installation of continuous turbidity sondes as described in the SWMP did not take place during the 2021/2022 reporting year. During the 2021/2022 reporting year, turbidity sampling was conducted daily in the Elbow River at three locations during construction activities. See Section 4.8.1 for details of the surface water quality monitoring completed during the 2021/2022 reporting year.
Fish Tissue Program *(IAAC Approval Condition 7.8)*	Fish tissue samples were obtained for baseline mercury and methylmercury analysis in 2021 and will be used to compare future measurements. A summary of baseline results is presented in Section 4.8.4 and Appendix B.2. This monitoring program was not initiated in the 2021/2022 reporting year because it is not required until flood/post flood operations.
Fish Rescue and Fish Health Monitoring and Mitigation *(IAAC Approval Condition 3.18)*	This monitoring program was not initiated in the 2021/2022 reporting year because it is not required until flood/post flood operations
Fish Passage *(IAAC Approval Condition 3.17)*	Construction of the fish passage v-weirs has not been initiated in the first year of construction, however, these will be constructed in subsequent construction years. Fish passage monitoring is expected to occur in the 2022/2023 reporting year following the installation of these structures. Baseline hydrology information was obtained in 2021 to support this program and the results are summarized in Section 4.8.4 and Appendix B.2.
Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan *(IAAC Approval Condition 8.13)*	In accordance with IAAC approval conditions 3.5, 8.1, 8.2 and 9.8, equipment arrived clean and free of debris at site and soil stockpiles were monitored for weeds and erosion. Fuel and other harmful substances have been stored and re-fueling conducted a minimum of 100 m from waterbodies and wetlands and spill containment measures were in place. Reclamation has not started as construction is on-going in disturbed areas.

Table 3.1 Summary of Activities

Monitoring Plans	Summary of Activities
Archaeological and Heritage Management Plan *(IAAC Approval Condition 9.3)*	Archaeological pre-impact investigation was completed for the Project as required by Alberta Culture and Status of Women (ACSW) and conditional approval was granted apart from two archaeological sites and a requirement for palaeontological construction monitoring. HRA approval will be obtained before construction occurs in the two archaeological site areas that are located within the construction area. The Archaeology and Heritage Management Plan was developed with Indigenous Communities and ACSW and submitted to IAAC. Archaeological monitoring of tree clearing activities was completed in February and March, 2022 as required by ACSW. Indigenous communities observed archaeological work on July 21, 2021, and June 15, 2022. Palaeontological construction monitoring is occurring as required by ACSW. During this reporting period, one microvertebrate site was reported to the Royal Tyrrell Museum of Palaeontology (RTMP). The RTMP had no questions or concerns, and no additional mitigation was required.
Groundwater Monitoring Plan (GWMP) (*IAAC Approval Condition 7.9*)	The final GWMP was prepared in accordance with IAAC approval conditions 7.6, 7.9, and domestic well baseline testing commitments made during the NRCB hearing. Groundwater monitoring network development, monitoring and sampling was completed between May 2021 and May 2022. Monitoring network development included decommissioning of wells as per IAAC approval condition 7.6 and replacement of wells outside of the design flood wetted perimeter where required. Spring and fall 2021 and Spring 2022 groundwater monitoring and sampling programs were completed and are summarized in Section 4.8.2 and Appendix B.3.

3.1 CONSULTATION

AT is committed to ongoing communication with the Indigenous groups involved in the Project. As such AT continues to communicate with:

- Blood Tribe/Kainai
- Siksika Nation
- Piikani Nation
- Stoney Nakoda Nations
- Tsuut'ina Nation
- Ermineskin Cree Nation
- Louis Bull Tribe
- Montana First Nation

- Samson Cree Nation
- Métis Nation of Alberta Region 3
- Foothills Ojibway Society

Following receipt of the IAAC Decision Statement in July 2021 and the signed NRCB Approval in October 2021, AT fulfilled its commitments to provide Indigenous groups opportunities to review the monitoring plans prior to finalizing them, undertake site visits, and conduct ceremonies prior to the start of construction.

As required by IAAC approval conditions 2.4, 2.5, and 2.10 Indigenous groups have been provided written notice of opportunities to present their views on various monitoring plans, to participate in ceremonies prior to the start of construction activities and offered opportunities to observe historical resource pre-impact investigations.

AT developed draft monitoring plans for the Project which outlined key mitigations and monitoring commitments during construction and dry operations and shared them with Indigenous groups between Q3 2021 and Q1 2022 for a 30-day review period and requested for feedback. The monitoring plans that were developed and shared with Indigenous groups for review include:

- AQMP (November 19, 2021)
- Archaeological and Heritage Management Plan (November 18, 2021)
- GWMP (December 14, 2021)
- SWMP (December 14, 2021)
- Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan (January 20, 2022)
- WMMP (November 18, 2021)
- Fish Rescue and Fish Health Monitoring and Mitigation Plan (December 15, 2021)

Specific to the Archaeological and Heritage Management Plan, AT sent an annotated table of contents to all Indigenous groups engaged on the Project and to ACSW. On September 21, 2021, a meeting was held with available Indigenous groups, which included: Ermineskin Cree Nation, Louis Bull Tribe, Métis Nation of Alberta Region 3, Samson Cree Nation, Tsuut'ina Nation, and ACSW to discuss the table of contents, intent of the plan and reporting requirements. This approach was taken because the Archaeological and Heritage Management Plan contains monitoring and reporting requirements specific to both heritage resources and traditional and cultural resources. During the meeting, the following feedback was received and accounted for in the Plan (IAAC approval condition 11.5.3):

- If historical resources are found at the Project site, Indigenous groups would like the opportunity to monitor the excavation and offer ceremonies, if needed.

- Provide Indigenous groups a response period during the chance find reporting to ACSW. If responses are provided from groups, this information is communicated to ACSW.
- Directly send chance find reports to Indigenous groups as a standard protocol, rather than on a request basis.

AT did not receive any feedback from Indigenous groups on any of the monitoring plans (IAAC approval condition 2.5), however, AT did receive feedback from ECCC on the following plans:

- AQMP
- SWMP
- WMMP

AT has since addressed ECCC feedback and finalized the various monitoring plans listed above to incorporate regulatory approval decisions and conditions from the NRCB and IAAC and has taken into account any feedback received from Indigenous groups during the regulatory phase of the Project. The finalized plans were shared with Indigenous groups prior to the start of construction.

In addition to the monitoring plans, AT prepared and sent the following documents to Indigenous groups for a 15-day review period:

- Environment Construction Spill Response Plan
- Construction Spill Response and Communications Plan
- Communication Plan

No feedback was received from Indigenous groups.

4.0 PROJECT ACTIVITIES AND STATUS

4.1 SUMMARY OF WORK COMPLETED ON SITE

The following pre-construction and construction activities took place during the 2021/2022 reporting year:

- Pre-construction activities
  - Site Preparation
    - Set up of a laydown yard and mobilization of equipment.
    - Installation of protection measures (i.e., flagging and fencing) around environmental and historically sensitive areas, Project construction area, vegetated areas that are to remain in place, fences/roadways, survey and monitoring stations.
    - Removal of barbed wire fencing within the active construction area
  - Site Clean up
    - Demolition, salvage, recycling and disposal of existing buildings, roadways, drives, and utilities that fall within the active construction area.
  - Site Clearing
    - Removal of trees and shrubs within the Project construction area. Note that tree and shrub clearing in wetlands took place only in the wetlands where provincial *Water Act* Approval (No. DAUT0008702 dated February 8, 2022) had been received.
    - Disposal of cleared debris (i.e., shrubs) by means of mulching and spreading over the cleared construction areas and other designated areas. Excess slash south of the Elbow River has been stockpiled for future disposal.
- Construction activities
  - Soil Stripping and Stockpiling (see Section 4.1.2.1 for further details)
    - Installation of protection measures (i.e., fencing and erosion and sediment control measures) around environmental and historically sensitive areas, vegetated areas that are to remain in place, fences/roadways, survey and monitoring stations.
  - Construction of the following Project components were started during 2021/2022 reporting year:
    - auxiliary spillway
    - floodplain berm
    - early works for the Elbow River temporary diversion (dug-outs)
    - diversion structure

  - low-level outlet gate structure
  - Township Road 242 bridge over the diversion channel
  - Highway 22 bridge over the diversion channel
  - raising of Highway 22 and Springbank Road

No construction activities took place in NE-18-24-3W5 in the 2021/2022 reporting year since there are outstanding HRA requirements as discussed in Section 3.0, Table 3.1.

All equipment and machinery were inspected daily for drips, leaks, presence of invasive alien species and noxious weeds. Drip trays were placed under idle equipment and machinery as well as fueling equipment.

Additionally, utility relocates were undertaken by the corresponding utility owners. The utility owners were responsible for managing and mitigating potential impacts to the environment (e.g., erosion and sediment control, dust).

4.1.1 Pre-Construction Activities

4.1.1.1 Site Clearing (Timber Salvage, Grubbing, Mulching)

Tree and shrub clearing was required in advance of April 1, 2022, as a mitigation measure to minimize potential effects on migratory birds that have the potential to nest within the clearing footprint of the construction area. Equipment required for site clearing arrived at the Project construction area on February 8, 2022, and work commenced on February 9, 2022. At the time clearing was scheduled, there were two outstanding regulatory requirements affecting clearing activities; the *Fisheries Act* Authorization and certain HRA approval requirements, which are discussed below.

Critical habitat for bull trout is protected under the *Species at Risk Act* (SARA) and clearing of trees within 30 m of the high-water mark where critical habitat exists was not permitted without a SARA compliant *Fisheries Act* authorization. To reduce risks associated with trees with migratory raptor, or owl nesting potential, a Letter of Advice (File No.: 22-HCAA-00155) was provided to AT from DFO on January 26, 2022, with regards to clearing very high-risk and high-risk trees within 30 m of the Elbow River (i.e., trees with the potential for nesting) and outlined conditions applicable to hand clearing activities within 30 m of the Elbow River. Clearing of the remaining trees and shrubs within the 30 m buffer was completed after the *Fisheries Act* Authorization was received in March 2022.

HRA Approval 4825-15-0004-010 was obtained on January 10, 2022, for activities such as tree and shrub clearing in the Project construction area except for specified locations within NE-3-24-4-W5 and SE-19-24-3-W5. ACSW required hand clearing of trees and shrubs and monitoring by a permit holding archaeologist within NE-3-24-4-W5 and SE-10-24-3-W5. These requirements were met within NE-3-24-4-W5 and were not required in SE-19-24-3-W5 as the clearing activities occurred approximately 20 m from the historical resources area within the quarter section. The tree line in the vicinity of the area of interest was flagged and Project laydown or use was not allowed beyond this flagged area.

Only the trees and shrubs located within the active Project construction area were removed during the 2021/2022 reporting year. Merchantable timber was removed from the active construction footprint of the diversion structure, auxiliary spillway and floodplain berm areas immediately to the north and south of the Elbow River. Non-merchantable timber, including stumps and slash, was stockpiled within the active construction area to be disposed of in Q4 2022/Q1 2023. Mulching also took place during 2021/2022 reporting year elsewhere in the construction footprint. The mulched material was spread over the active construction area.

4.1.2 Construction Activities

4.1.2.1 Earthworks

From April to end of June 2022, topsoil and subsoil in several areas within the Project construction area were stripped:

- the north bank of the Elbow River (diversion structure)
- diversion channel
- off-stream dam area including the low level outlet
- auxiliary spillway and floodplain berm
- Highway 22 in the area road construction was to occur

The stripped soil was generally stockpiled in the vicinity of the area being stripped, and in some instances relocated to other places for longer storage. Stockpiles near Elbow River were placed at least 50 meters from the top of the bank. Topsoil and subsoil were stockpiled separately to prevent mixing; stockpiles were spaced at least 3 meters apart. In order to place the stripped topsoil back in the same general area, or as required by IAAC approval condition 3.8, topsoil stockpile locations have been documented.

Stockpiles were inspected to determine the appropriate erosion and sediment control measures. For instance, to protect the topsoil and subsoil from erosion and sediment discharge, silt fences were installed at the downstream side of stockpiles. In some locations, wattles were installed as a measure to protect from erosion and sediment release; for example, this occurred on the South bank of the Elbow River, on the cliff on the north bank of the Elbow River and at the low level outlet.

A Soil Specialist conducted routine inspections of the Project construction area to assess the stripped areas and the stockpiles. The quality of the stripped soil was not impacted. It was noted that the stripping operations were performed with negligible admixing of soils, and that the topsoil recovery was excellent.

4.1.2.2 Civil Works

During the 2021/2022 reporting year, Civil Works construction activities started in two areas: the concrete works at the auxiliary spillway and pile driving at the diversion channel bridge at Township Road 242.

Each construction activity area was provided with various waste skips (receptacles) to collect construction wastes depending on their type (wood, metal, concrete) for further segregation and disposal. Each location where concrete was poured had a dedicated skip to collect the wastewater from cleaning the gully of the concrete truck at the end of the pouring.

Any equipment that was filled with fuel was provided with a drip-tray to contain spillage in case of incident; the drip-trays were appropriate size (able to collect 110% of the main content of the hazardous substance container). For example, all generators (diesel powered) at the auxiliary spillway were provided with drip-trays and replaced as required. Spill-kits of suitable size were also available should they have been required.

Equipment fueling, cleaning, and maintenance activities maintained a distance of 100 m from waterbodies and wetlands and utilized secondary containment.

4.2 EROSION AND SEDIMENT CONTROL

Specific erosion and sediment control measures are described in Section 4.1.2 above and 4.3.1 below. In general, erosion and sediment control measures included:

- Installation of straw wattles
- Installation of silt/sediment fences
- Installation of fiber rolls
- Covering of exposed areas using geotextile or other suitable material
- Placing stockpiles at least 50 meters from Elbow River

A combination of the above measures were used to control erosion and sedimentation as and where needed. These measures were inspected routinely and replaced or augmented when necessary.

In addition, extra erosion and sediment control supplies and equipment were available onsite to be used as needed.

4.3 WATER MANAGEMENT

4.3.1 Surface Drainage/Runoff

Surface water and runoff within the Project construction area was managed as follows:

- Where water pooled naturally, and there were no potential impacts to the surrounding environment, it was left to naturally seep into the ground. In the event of potential impacts to surrounding environments, pooled water was pumped into nearby dug-outs (see Section 4.3.2 for details surrounding dewatering activities).
- Silt fences were installed at the perimeter of wetlands where there was the potential of water to flow into the wetland from the Project. For areas where the topography sloped away from a wetland, a 10m vegetated buffer was maintained.
- Along unnamed creek, erosion and sediment control measures were installed to direct water away from unnamed creek.
- Straw wattles were installed parallel of Elbow River to control potential surface water flows into Elbow River.
- An earthen berm was constructed along the top of the north bank of Elbow River to prevent water and debris from falling into Elbow River.

4.3.2 Dewatering

During the 2021/2022 reporting year there were no planned dewatering activities. However, due to a two-day rain event in June (76 mm of rain), several upland areas within the Project construction area experienced pooling. Following the rain event and verification of the status of the erosion and sediment control measures throughout the Project construction area, four (4) small dug-outs were constructed, and the pooled water was pumped into the dug-outs to be used for dust mitigation as needed.

In addition to the dewatering in these upland areas, the south bank of Elbow River at the auxiliary spillway was also impacted by the mid-June rain event. The rain event caused river water to rise rapidly and resulted in naturally occurring overland flow upstream of the Project which flowed into the auxiliary spillway area and two excavated ponds. Following the rain event, an initial inspection was completed, and a plan developed to carry out dewatering in these areas. Dewatering activities occurred from June 18 to June 20, 2022. Pooled water in the auxiliary spillway was pumped into the excavated pond on the west end. The second excavated pond (east end) was filled completely with water during the rain event and, under the direction of a Qualified Aquatic Environmental Specialist (QAES), was dewatered via pumping into the Elbow River. Pumping was monitored, and turbidity sampling was completed throughout the dewatering period (see Section 4.8.1.2). Turbidity sampling was completed at four locations: one upstream and three downstream of the pumping location and, based on the sampling results, adjustments were made to the downstream discharge location and sediment bags installed to further reduce erosion and sedimentation impacts. Once water levels were low enough in the east end excavated pond to safely access the area, electrofishing activity took place in order to determine fish presence; no fish were observed. Water levels in the west excavation pond remained high at the end of the 2021/2022 reporting year. Dewatering activities at the west end excavation pond was completed in July 2022, details will be provided in the 2022/2023 reporting year annual report.

4.3.3 Watercourse Diversion

Not applicable; Elbow River and unnamed creek were not diverted during the 2021/2022 reporting year.

4.3.4 Work in River

Not applicable; there were no construction activities in Elbow River during the 2021/2022 reporting year.

4.4 ACCIDENTS AND MALFUNCTIONS

As required by IAAC approval condition 11.2, Accident and Malfunction measures that AT was proposing for the construction phase were presented to Indigenous groups in a letter for review and comment. No feedback on the proposed accident and malfunction measures were received. AT used the measures to develop the Construction Spill Response and Communications Plan which was submitted to IAAC and Indigenous groups in March 2022. The Plan outlines the following information:

- Types of spills that could result at the Project site
- Hazardous materials spills, handling, and containment procedures & practices
- Reporting requirements

During the 2021/2022 reporting year of construction, the site recorded one reportable spill, a fuel and hydraulic fluid release, on May 26, 2022. IAAC and Indigenous groups were notified of the spill. The spill was the result of a buggy scrapper that accidently rolled over, where 30 litres (L) of diesel fuel and 15 L of hydraulic fluid leaked from the overturned equipment. The affected soil was immediately removed by an excavator and stored in a containment cell, and the release was reported to the AEP spill reporting hotline. On May 31, 2022, a soil specialist inspected the incident area and took soil samples to confirm all contamination had been removed. AT issued the 30-day and 90-day post-spill reports to IAAC as required by approval conditions 11.5.3 and 11.5.4 on June 24, 2022 and August 26, 2022 respectively.

4.5 ONSITE MONITORS

4.5.1 Indigenous Monitoring Program

In accordance with IAAC approval condition 9.1, AT retained, prior to construction, the services of Indigenous monitors to observe, record, and report to AT and Indigenous groups on the implementation, throughout construction, of requirements set out in the Decision Statement including the Archeological and Heritage Management Plan referred to in IAAC approval condition 9.3.

Prior to construction, AT consulted with each Indigenous group about whether they wished to participate as Indigenous monitors. A letter was sent on January 3, 2022, requesting a response by January 20, 2022. AT received feedback from the following Indigenous groups expressing their wish to participate as Indigenous monitors:

- Blood Tribe/Kainai Nation
- Metis Nation of Alberta Region 3
- Tsuut'ina Nation

Since January 20, 2022, several additional Indigenous groups have followed up with AT to express their interest in participating in the Indigenous monitoring program. These additional Indigenous groups include:

- Ermineskin Cree Nation
- Louis Bull Tribe
- Montana First Nation
- Samson Cree Nation
- Siksika Nation
- Stoney Nakoda Nations

AT has entered into contract agreements with Ermineskin Cree Nation, Montana First Nation, Métis Nation of Alberta Region 3, and Samson Cree Nation. Louis Bull is currently actively recruiting an Indigenous Monitor and once identified, onboarding and mobilization to will occur. Discussions with the remaining Indigenous groups are ongoing in an effort to finalize contracts and ultimately mobilize their Indigenous Monitors.

Indigenous Monitors from Ermineskin Cree Nation, Métis Nation of Alberta Region 3 and Samson Cree Nation are observing, recording and reporting on the implementation, throughout construction, of requirements set out in the IAAC Decision Statement including the Archaeological and Heritage Management Plan referred to in IAAC approval condition 9.3.

All Indigenous monitors, prior to mobilizing to the construction site, were provided onboarding training to discuss their role, review the Environmental Monitoring Plans, and the IAAC approval conditions to prepare for their role. They also participated in a safety orientation prior to entering the construction site.

The Indigenous monitors worked onsite with an Indigenous Relations Coordinator to observe construction activities on a daily basis. Each day, the Indigenous monitor recorded their observations of the implementation of requirements in an online tool developed for the Indigenous monitors. The Indigenous Monitor daily reports were shared with their Indigenous group. Each month, a Monthly Observation report was developed by the Indigenous Relations Coordinator and verified by the Indigenous Monitors. These reports were shared with AT and each Indigenous group engaged on the Project.

4.5.2 Independent Environmental Monitor

AT retained a third-party Independent Environmental Monitor for the construction phase of the Project. The Independent Environmental Monitor observed and recorded the implementation of the IAAC approval conditions and submitted a monthly report directly to IAAC. The monthly reports summarized what was observed during the month and recommendations AT should take, via the Prime Contractor, with respect to the approval conditions. The monthly reports are retained by AT.

4.6 SCHEDULES

Schedules required under IAAC approval conditions 12.1 (schedule for the IAAC approval conditions), and IAAC approval condition 12.2 (activities required to carry out the Project) were prepared and submitted to the Agency and Indigenous groups on December 14, 2021 providing adequate notice prior to commencing pre-construction activities (i.e., site clearing) in February 2022. Following the completion of IAAC Annual Reporting period 1 (2021/2022), there are no changes to either schedule.

Also on December 14, 2021 the Agency and Indigenous groups were provided figures illustrating the final project design and the Project construction area as part of IAAC approval conditions 8.7 and 9.6.

4.7 TERRESTRIAL

4.7.1 Vegetation and Wetland Management

4.7.1.1 Weed Management and Invasive Species

In accordance with IAAC approval condition 3.5, all equipment that was brought to site during the 2021/2022 reporting year of construction was inspected for the presence of invasive alien and noxious weeds, and soil debris. To access the areas that required tree and shrub clearing, existing roads and farm trails were used. Additionally, topsoil and subsoil stockpiles were monitored for weed growth during the 2021/2022 reporting year.

4.7.1.2 Vegetation and Reclamation Monitoring

As discussed in Section 4.1.2.1, soil stripping activities commenced in April 2022. Topsoil and subsoil within the active construction area were stockpiled separately in temporary locations. Permanent locations for both topsoil and subsoil stockpiles will be determined, and the stockpiles will be relocated during reporting Year 2. During the 2021/2022 reporting year , key soil stripping mitigation measures included but were not limited to:

- applying stripping and stockpiling practices which prevent admixing with other soil horizons
- placing stockpiles within the construction footprint area and 50 m from the top of the bank of the Elbow River
- monitoring topsoil piles for erosion and weed growth, and sloping stockpiles at appropriate angles to reduce erosion risk

Vegetation removal and soil stripping was done in phases and soil handling was avoided during excessively windy conditions and inclement weather (e.g., heavy rain) to reduce the area of exposed soils vulnerable to wind and water erosion. Soil stockpiles were stabilized as soon as possible and silt fences were installed at the toe side of several stockpiles. Silt fences were routinely inspected. Site specific conditions did not allow for the installation of silt fences at all stockpiles. For these stockpiles, other forms of erosion and sediment control measures (e.g. retaining a vegetated buffer were implemented and/or installed.

Reclamation was not started during the 2021/2022 reporting year as construction was on-going in all disturbed areas. Reclamation is anticipated to begin prior to the completion of Project construction in areas where active construction activities are complete.

4.7.1.3 Wetland

In fulfillment of IAAC approval conditions 5.8 and 5.9, IAAC and the Indigenous groups were provided with a figure showing the wetlands to be permanently removed as a result of construction activities.

Existing roads and farm trails were used to access areas requiring tree and shrub clearing; water bodies and wetlands were not crossed for access. Equipment fueling, cleaning, and maintenance activities maintained a distance of 100 m from waterbodies and wetlands and utilized secondary containment. Hand fueling of chain saws was done at crew vehicles and spills kits were in construction supervisor vehicles. Substances with potential to cause harmful effects to the environment were stored over 100 m from water bodies and wetlands.

Two wetlands directly adjacent to the Project construction area in NE-22-24-4-W5M were impacted beyond the *Water Act* approved limits on June 16, 2022. The Prime Contractor notified AT June 17, 2022, of the wetland disturbance. Soil stockpiling activities in NE-22-24-4-W5M had extended outside of the construction boundary, disturbing 0.39 ha of wetlands that were not previously approved for disturbance under the *Water Act* approval (Approval No. DAUT0008702). The incident was reported to AEP in accordance with the approval conditions, and the Agency under the IAAC approval conditions. Indigenous groups were also notified of the wetland disturbance. A stop-work order was issued at site, the wetland polygon was flagged, and a buffer was created in order to avoid further unauthorized disturbance. The contractor is AT actively working with AEP Compliance to determine the course of action to restore the impacted wetlands and is developing a restoration plan.

4.7.2 Wildlife

4.7.2.1 Preconstruction Surveys

A summary of wildlife pre-construction surveys as well as mitigation and monitoring implemented during the 2021/2022 reporting year are provided below. For detailed discussion of wildlife preconstruction survey methods and results see Appendix B.1.

Bat Roost Survey

A bat roost survey was completed in accordance with IAAC approval condition 5.1, which required AT to determine the presence of little brown myotis (*Myotis lucifugus*) roosting sites in the Project Development Area (PDA). Little brown myotis is listed as endangered on Schedule 1 of SARA and listed as endangered by the province of Alberta in 2021.

An initial habitat assessment was completed on August 9-10, 2021, to identify potential roost sites (e.g., buildings and large diameter balsam poplar with cavities and/or sloughing bark) in the PDA. Eight potential roost trees were identified during the habitat assessment as well as one building (Weatherly cabin) at Kamp Kiwanis (south side of Elbow River) that provide potential roost sites. In addition, six barns in NE-24-24-4-W5 were identified as potential roost sites.

Bat emergence surveys were completed at potential roost trees and/or buildings on August 11, 17 and August 27-28, 2021. Five bat species were recorded including little brown myotis, silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*) as well as one recording of either long-legged myotis or long-eared myotis; however, no bats were visually observed emerging from the trees nor was there any sign of bat activity at or near the potential roost trees (e.g., guano), Weatherly cabin or barns in NE-24-24-4-W5.

Amphibian Survey

A diurnal (visual) amphibian survey was completed to update the 2016 baseline survey results and to meet IAAC approval condition 5.2, which required AT to determine the presence of amphibian species listed on Schedule 1 of SARA including northern leopard (*Lithobates pipiens*), western toad (*Anaxyrus boreas*), and western tiger salamander (*Ambystoma mavoritium*).

Diurnal amphibian surveys were on completed on July 14 and July 15, 2021, as well as July 22 and July 23, 2021, following provincial protocols (ESRD 2013). Similar to the 2016 baseline survey results, boreal chorus frog (*Pseudacris maculata*) and wood frog (*Lithobates sylvaticus*) were the only amphibian species observed. No amphibian species at risk breeding wetlands/waterbodies were observed during systematic surveys; however, one of the Indigenous observers indicated to the field crew lead they saw a tiger salamander at the Kiwanis wetland on July 23, 2021. AT was not able to confirm the sighting, however, appropriate mitigation (e.g., silt fencing) was implemented prior to construction traffic along the Kiwanis access road.

Grizzly Bear Den Survey

In accordance with IAAC approval condition 8.3, a grizzly bear den survey was completed prior to construction to determine the presence of grizzly bear dens in the PDA. The survey was completed in eight quarter sections on November 2-3, 2021, and December 9-10, 2021, in areas of suitable habitat. No signs of grizzly bear (visual, rack, scat) or other bear dens were observed.

Yellow Rail

A nocturnal rail call-playback survey was completed to update 2016 baseline survey results regarding rail use of wetlands in the PDA as well as suitable wetland habitat in the Local Assessment Area (LAA) within 100 m of the PDA. The survey focused on yellow rail, which is a migratory bird listed on Schedule 1 of the SARA.

One three-person field crew, which consisted of two qualified wildlife biologists and one Indigenous assistant, completed the nocturnal rail call-playback survey on June 3 and June 13, 2021. Weather conditions were suitable during both survey periods with no precipitation, temperatures between 10°C and 20°C, and winds < 5 km/h.

Eleven of sixteen survey stations previously completed in 2016 were surveyed; five stations were not surveyed in 2021 due to land access constraints. Similar to the 2016 baseline survey, yellow rail was not detected. During 2021, however, sora were detected (heard) at eight of the eleven stations surveyed (72.7%) during both sampling visits, which is more than twice the detected occupancy rate compared to 2016 (31%). A total count of 20 sora were detected during the 2021 survey, which was twice the total count of 10 sora detected in 2016.

4.7.2.2 Wildlife Sweeps

Pre-construction wildlife sweeps were completed as recommended in the WMMP to identify potential active wildlife features (e.g., nests, dens). No active nests or dens were identified in the Project construction area prior to tree removal and mulching activities.

Wildlife sweeps also included amphibian surveys in wetlands and waterbodies located within the Project construction area. Site-specific mitigation was implemented in accordance with IAAC approval conditions related to migratory birds and amphibian species at risk including IAAC approval conditions 4.1, 4.6, 4.8, and 5.2.

Migratory Birds

In accordance with IAAC approval condition 4.6, construction activities that may affect migratory birds were scheduled to avoid the migratory bird breeding period (April 1 to August 31) where possible. Pre-construction activities (i.e., vegetation removal including tree harvesting and mulching) were completed prior to April 1, 2021. In areas where construction activities were planned during the migratory bird breeding period, pre-construction wildlife sweeps were completed to reduce potential disturbance to nesting birds by implementing an appropriate setback buffer consistent with IAAC approval conditions 4.6 and 4.8 as well as direction provided in the WMMP. No active nests were observed within the Project construction area.

The birds listed below were incidentally observed during pre-construction and in advance of soil stripping activities. Wildlife sweeps occurred between February 2022 and May 2022 (please note: these birds are not SARA listed species):

- American robin (*Turdus migratorius*)
- black-capped chickadee (*Poecile atricapillus*)
- hairy woodpecker (*Leuconotopicus villosus*)
- northern flicker (*Colaptes auratus*)

- black-billed magpie (*Pica hudsonia*)
- common raven (*Corvus corax*)
- ruffed grouse (*Bonasa umbellus*)
- bald eagle (adult) (*Haliaeetus leucocephalus*)
- great-horned owl (*Bubo virginianus*)
- bohemian waxwing (*Bombycilla garrulus*)
- red-tailed hawk (*Buteo jamaicensis*)
- rough-legged hawk (*Buteo lagopus*)
- Canada geese (*Branta canadensis*)
- common merganser (*Mergus merganser*)

Most of the incidental bird observations included winter residents; however, great horned owl nests were encountered but outside of the 100-m clearing area buffer. As such no mitigation was recommended during pre-construction activities. During the wildlife sweeps, an active Canada goose nest was observed along the north bank of the Elbow River in the diversion structure area. A setback buffer was established and maintained at the top of the cliff until the nest was no longer active. A pair of Red-tailed hawks were also observed near a nest site along unnamed creek near the low-level outlet. Although construction activities were further than 100 m from the Red-tailed hawks, a 100 m setback buffer was installed and maintained. To discourage nesting in the diversion structure area, broadcasting alarm calls of predatory birds were installed and repeat human visits were conducted.

Amphibians

No amphibian species listed on Schedule 1 of SARA including northern leopard (*Lithobates pipiens*), western toad (*Anaxyrus boreas*), and western tiger salamander (*Ambystoma mavoritium*) were observed in wetlands/waterbodies within the active construction boundary during 2021/2022 reporting year of construction.

Amphibian sweeps were completed in wetlands located within the active construction boundary) from May to end of the 2021/2022 reporting year (June 30). Egg masses from wood frogs and boreal chorus frogs as well as adult wood frogs and boreal chorus frogs were translocated to a pond outside of the construction boundary as required by the AEP Translocation of Amphibians – Research & Collection Permit [License No. #22-262].

In addition, one tiger salamander was encountered on June 9, 2022, during a Historical Resource survey in NE-18-24-3-W5 near unnamed creek. This area did not fall in the active construction boundary in 2021/2022 reporting year of construction. The salamander was relocated to a suitable release site as outlined in the AEP Translocation of Amphibians – Research & Collection Permit conditions (License No. #22-262).

An evaluation of wildlife monitoring results relative to performance indicators and targets identified in the WMMP is provided in Table 4.1.

Table 4.1 Summary of Wildlife Monitoring Outcomes, Performance Indicators and Targets used to Evaluate Mitigation Effectiveness during Construction 2022

Residual Effect	Performance Indicator	Target	Monitoring Outcome
Change in Habitat (sensory disturbance)	• Number of active wildlife features that remain in use to meet species breeding needs (i.e., successful nesting, denning due to effective setback buffers) •	• 100% of active wildlife features receive an effective setback buffer that results in nesting or denning success (i.e., evidence of fledging, or no den abandonment)	All active bird nests received appropriate setback buffers until the nests were complete (i.e., juvenile birds had had fledged) No dens were identified during the February-June 2022 construction period.
Change in Movement (Ungulate Movement/ Habitat Use)	• Number of days construction activities occur during the Restricted Activity Period (RAP) for the Key Wildlife Biodiversity Zone (KWBZ) along Elbow River (December 15 to April 30)	• Minimize the number of days construction activities occur during the RAP for the KWBZ along Elbow River (December 15 to April 30	Construction activity occurred during 60% of the KWBZ RAP (81 of 135 days), primarily along Elbow River near Kamp Kiwanis. Based on the results of the remote camera monitoring program, relative abundance (photographic rates) of white-tailed deer along Elbow River varied with survey station during winter 2022 construction. Two stations recorded slight increases in photographic rates, one station had a similar photographic rate, and three stations recorded a decrease in relative abundance compared to winter pre-construction. Overall, however, white-tailed deer relative abundance (photographic rates) increased during construction across all cameras (see Appendix B.1). Elk was detected more frequently in upland areas compared to Elbow River (Appendix B.1).

Table 4.1 Summary of Wildlife Monitoring Outcomes, Performance Indicators and Targets used to Evaluate Mitigation Effectiveness during Construction 2022

Residual Effect	Performance Indicator	Target	Monitoring Outcome
Change in Mortality Risk	• Number of active wildlife features (i.e., nests, dens, roost sites, hibernacula) destroyed	• Zero active wildlife features destroyed	Pre-construction wildlife sweeps were completed to reduce potential mortality risk. No active wildlife features were destroyed.
	• Number of animal-vehicle collisions (AVC) in the LAA (e.g., Hwy 22, Springbank Road) that can be attributed to the Project (i.e., construction traffic)	• Zero AVC in the LAA that can be attributed to the Project	There were no reports of AVC collisions due to the Project.
	• Number of reported wildlife–human conflicts	• Zero wildlife-human conflicts	There were no wildlife-human conflicts during this reporting period.
	• Number of problem (i.e., conflict) wildlife animals removed from the Project site	• Zero problem wildlife removed from the PDA due to human-wildlife conflicts • All workers (100%) on site receive wildlife awareness training (e.g., Bear Smart)	There was no problem wildlife removed from the PDA due to human wildlife conflicts. All workers on site received the appropriate safety training prior to all field surveys.

4.7.2.3 Remote Camera Program Summary

As part of the remote camera monitoring program, remote cameras were deployed to monitor wildlife use in the PDA and LAA during pre-construction and construction phases. The pre-construction monitoring period extended from September 16, 2021, to February 7, 2022, which overlapped two seasons including fall (September 16 to November 30) and winter (December 1 to February 7, 2022). The construction monitoring period was limited to the winter season for this annual report, which extended from February 8, 2022, to March 31, 2022. The number of cameras deployed varied across seasons and phases: fall pre-construction n=20; winter pre-construction n=27; winter construction n=25.

Seven medium to large mammal species were detected during the 2021 fall pre-construction monitoring period including white-tailed deer *(Odocoileus virginianus*), elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), moose (*Alces alces*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*) and cougar (*Puma concolor*). The wildlife species detected were similar to the species detected in 2016; however, there were no black bear (*Ursus americanus*) or grizzly bear (*Ursus arctos*) detected during fall 2021. During the 2021 fall pre-construction monitoring period, white-tailed deer was the most frequently detected wildlife species followed by elk and coyote. Overall, these results are similar to the 2016 baseline survey where both white-tailed deer and elk were the most frequently detected and abundant wildlife species in the LAA.

Remote cameras deployed along Hwy 22 near the proposed bridge over the diversion channel had the lowest level of wildlife activity during fall. These two monitoring stations recorded very high numbers of cars and trucks. Remote cameras deployed along Township Road 242 also recorded relatively high traffic levels; however, deer and elk were still detected travelling on the north side of the road.

During the winter construction monitoring period, seven mammal species were detected including white-tailed deer, elk, moose, mule deer, coyote, red fox and bobcat (*Lynx rufus*). White-tailed deer had the highest photographic rate followed by elk and coyote. Overall, elk were detected at similar photographic rates during winter, construction (43.9 detections/ 100 camera-days) compared to winter pre-construction (47.3 detections/100 camera-days) whereas white-tailed deer relative abundance increased during winter construction (70.8 detections/100 camera-days) compared to winter pre-construction (48.8 detections/ 100 camera-days).

Detailed methods and results of the remote camera monitoring program are provided in Appendix B.1.

4.7.2.4 Bank Swallow

The bank swallow work overlapped with both the 2021/2022 and the 2022/2023 reporting year. For simplicity the full accounting of the 2022 bank swallow work is presented in this report.

In accordance with IAAC approval condition 4.11.1, and the Bank Swallow Mitigation Plan, bank swallow use was monitored during Project construction where active residences were checked twice yearly between May 1 and August 31. As discussed in the Bank Swallow Mitigation Plan, monitoring focused on the previously identified bank swallow colony on Elbow River (see Appendix B.1).

The status of the previously identified bank swallow colony on Elbow River (NE-18-24-03-W5) was surveyed on June 2, 2022, and July 13, 2022. In addition, a breeding bird point count was completed at one station (BBS-25) where there were previous bank swallow observations during the 2016 breeding bird survey.

The survey of the previously identified bank swallow colony on June 2, 2022, was completed by one qualified biologist and one Indigenous assistant. The colony was not present at the previous location as the vertical banks that provided suitable nesting habitat were no longer available, likely due to changes (i.e., erosion, collapse) in the riverbank (see Appendix B.1). However, there was an active bank swallow colony (BANS_BY01) observed approximately 115 m further west along the north side of Elbow River. Six active burrows and approximately 12 individuals were observed at the colony (see Appendix B.1), In addition, there were two small colonies (10 individuals each) identified on June 2, 2022 and June 8, 2022 in NW-18-24-03-W5 along Elbow River (BANS_BY02 and BANS_BY03) A total of 20 individuals were observed in this area including eight bank swallows (flyovers) at BBS-25 (see Figure B.5, Appendix B.1) where individuals were emerging from and flying back to the slope south of the survey station. All bank swallows were observed foraging along Elbow River outside of the Project development area.

A second visit was completed at three bank swallow colonies and at BBS-25 on July 13, 2022. Only two individuals were observed at one bank swallow colony (BANS_BY01) compared to 12 individuals on June 2, 2022. However, access to the previous observation point was not possible due to high water levels in Elbow River. The other two bank swallow colonies observed on June 2 and June 8, 2022 (BANS_BY02 and BANS_BY03) remained active on July 13, 2022 (see Figure B.5, Appendix B.1). However, there were fewer individuals and burrows observed, which were likely related to the slope failure that occurred on the north side of Elbow River (due to natural processes). An estimated four individuals (two pairs) were observed at BANS_BY03. More detailed results are provided in Appendix B.1.

An evaluation of bank swallow monitoring results relative to performance indicators and targets identified in the WMMP is provided in Table 4.2.

Table 4.2 Summary of Bank Swallow Monitoring Outcomes, Performance Indicators and Targets– Construction 2022

Performance Indicator	Target	Monitoring Outcomes
• Number of breeding pairs and active bank swallow burrows in the PDA	• Continued use of the PDA each monitoring year as indicated by the number of breeding pairs of bank swallow observed during construction and dry operations.	• Monitoring results indicate continued use of suitable habitat along Elbow River in the vicinity of the previously identified colony. • Maximum number birds observed at BANS_BY01 was 12 individuals (6 pairs) and 6 burrows. • Maximum number of birds observed at BANS_BY02 (10 individuals) and BANS_BY03 (10 individuals) was 20 individuals. Number of burrows was undetermined. • Heavy rain during June 2022 resulted in slope failure along Elbow River where colonies existed.
• Number of residences destroyed or created due to project activities	• Zero residences destroyed	• No residences were destroyed due to Project activities

4.8 WATER AND AQUATICS

4.8.1 Water Quality

4.8.1.1 Daily/Monthly Sampling During Construction

Turbidity Monitoring in the Elbow River

Turbidity sampling was conducted daily in the Elbow River at four locations (see Figure 4.1) during construction activities:

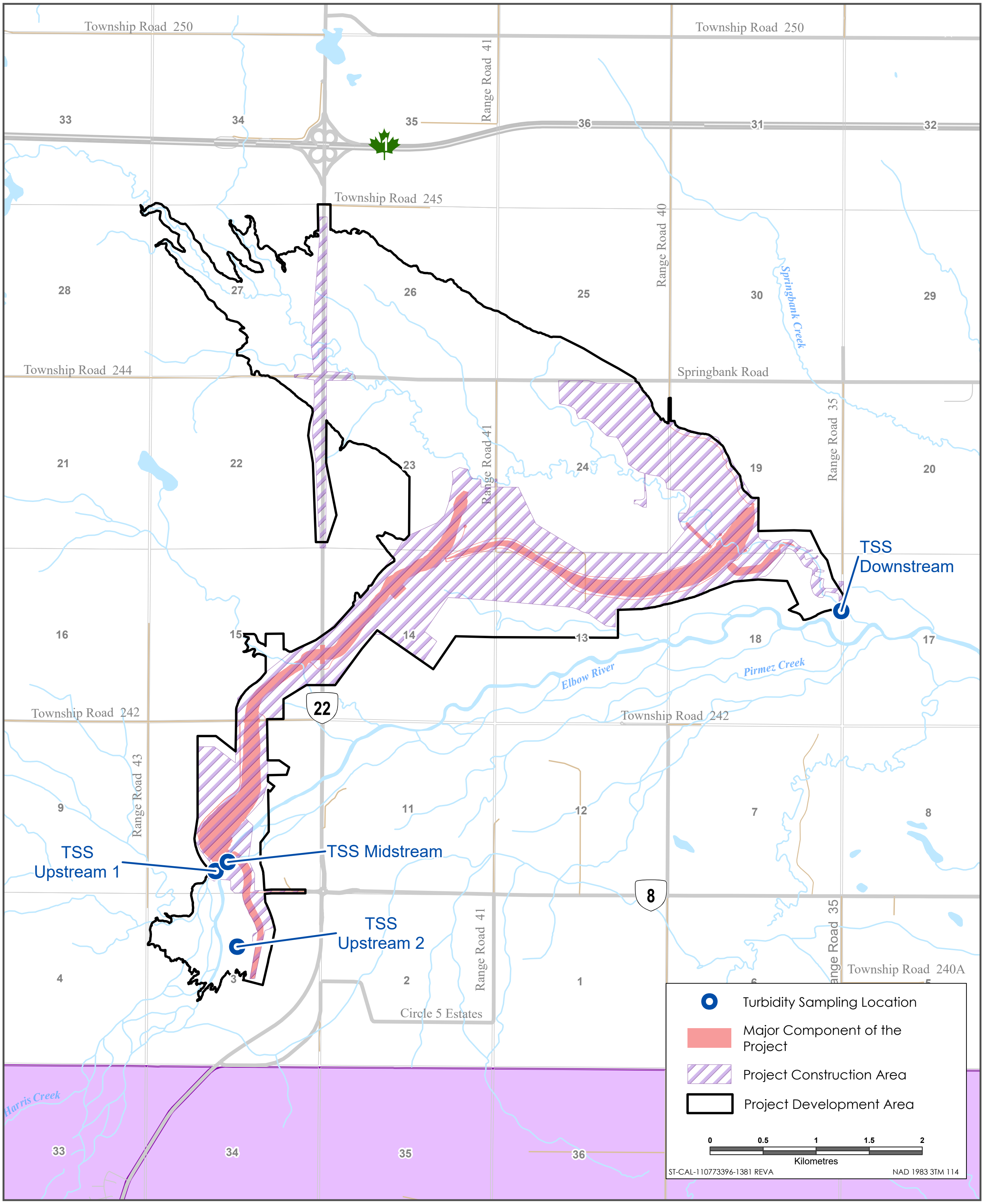
- Elbow River upstream of construction activity near Kamp Kiwanis (sampling started April 20^{t} 2022)
    - The upstream station was moved further upstream on May 12 since construction was moving further upstream. This station was labelled “Upstream 2”. The initial station was labelled “Upstream 1”

- Elbow River immediately downstream of a river side-channel where construction activities occurred at the end of April/early May. This site, labelled "Midstream", was meant to represent the area of influence immediately downstream of construction activities at this time (sampling started April 28, 2022)
- Elbow River downstream of the entire Project boundary. Located downstream of Unnamed Creek confluence (sampling started April 20, 2022)

Prior to conducting turbidity monitoring, baseline samples were collected to establish a Total Suspended Solids (TSS, mg/L) – Turbidity (Nephelometric Turbidity Units or NTU) Curve as per *Alberta Transportation Special Provision – Turbidity (2021)*. The calculated relationship was used to determine the normally occurring linear relationship between TSS and turbidity in the watercourses as per the conversion relationship between NTU into mg/L. This relationship was used in the field to determine the TSS (mg/L) based on the turbidity measured. Turbidity monitoring has been collected in the field as NTU with a hand-held meter, and then converted to TSS (mg/L). The TSS/Turbidity regression curves are provided in Figure 4.2 and Figure 4.3 below.

Daily Elbow River turbidity and TSS monitoring data are provided in Table 4.3 and Table 4.4, respectively. TSS concentrations were derived using the Elbow River TSS-Turbidity Curve in Figure 4.2. Measured average turbidity values ranged from 0.45 NTU (1.11 mg/L TSS) on May 18, 2022 at Upstream 2 location to 1,350 NTU (3,362 mg/L TSS) on June 15, 2022 at the downstream location. During several days of sampling, the upstream turbidity values and TSS concentrations were higher than downstream values and concentrations. During the sampling events and environmental inspections, no Project-related source for increasing turbidity values and TSS concentrations was observed. Rather, the reach of the Elbow River from the upstream to downstream sampling sites likely has natural sources of sediment (such as an eroding cliff face).

In addition, Unnamed Creek flowed from June 14 to 24, 2022 due to rain events and turbidity was monitored in the creek. Turbidity ranged from 1.7 NTU on the 14, spiked to 20 NTU on the 15, and returned to 1.7 NTU on the last day of flow in the creek on June 24.



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta
Service Layer Credits:

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Turbidity Sampling Location

Figure 4-1

Figure 4.2 Elbow River TSS-Turbidity Curve

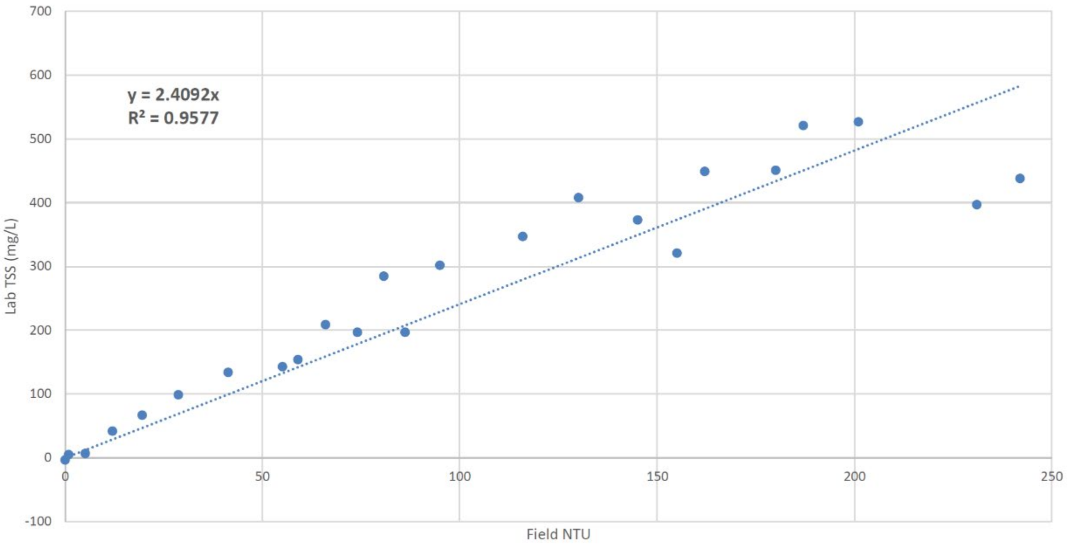


Figure 4.3 Unnamed Creek TSS-Turbidity Curve

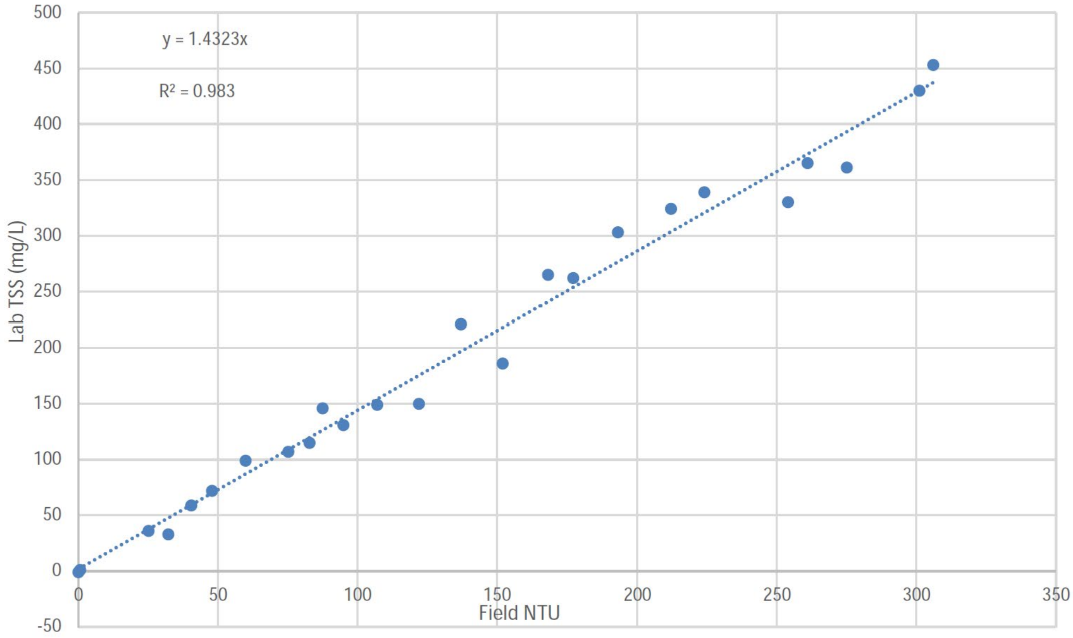


Table 4.3 Elbow River Turbidity (NTU) Monitoring Data During the 2021/2022 Reporting Year

		Elbow River Upstream 1				**Elbow River Upstream 2**				**Elbow River Midstream Camp Kiwanis Side Channel with Excavation**				**Downstream of Elbow River and Unnamed Creek Confluence**				
Date	**Time**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Comments**
20-Apr-22	15:15	1.85	0.75	0.61	**1.07**	-	-	-	-	-	-	-	-	0.73	0.9	0.76	**0.80**	Upstream 1 was sampled from April 20 to May 13, 2022. This was upstream of construction activities at the time.
21-Apr-22	20:15	0.69	0.78	1.34	**0.94**	-	-	-	-	-	-	-	-	-	-	-	-	Access issues due to high water levels
22-Apr-22	20:50	0.57	0.57	0.55	**0.56**	-	-	-	-	-	-	-	-	-	-	-	-	Access issues due to high water levels
23-Apr-22	21:12	0.99	1.04	1.10	**1.04**	-	-	-	-	-	-	-	-	-	-	-	-	Access issues due to high water levels
24-Apr-22	20:46	3.12	3.55	3.20	**3.29**	-	-	-	-	-	-	-	-	-	-	-	-	Access issues due to high water levels
25-Apr-22	14:08	1.98	1.68	1.73	**1.80**	-	-	-	-	-	-	-	-	-	-	-	-	Access issues due to high water levels
26-Apr-22	10:14	1.49	1.49	1.47	**1.48**	-	-	-	-	-	-	-	-	-	-	-	-	Access issues due to high water levels
27-Apr-22	11:36	1.46	1.28	1.08	**1.27**	-	-	-	-	-	-	-	-	0.73	1.11	1.11	**0.98**	
28-Apr-22	15:00	0.74	1.00	0.89	**0.88**	-	-	-	-	1.58	1.31	1.23	**1.37**	0.92	0.79	0.90	**0.87**	
29-Apr-22	13:15	0.88	0.93	0.96	**0.92**	-	-	-	-	1.05	0.88	0.93	**0.95**	0.90	1.06	0.84	**0.93**	
30-Apr-22	13:15	0.67	0.72	0.51	**0.63**	-	-	-	-	0.73	0.99	0.71	**0.81**	0.94	0.83	0.75	**0.84**	
1-May-22	10:15	0.87	0.72	0.57	**0.72**	-	-	-	-	0.79	0.72	0.62	**0.71**	1.04	0.96	1.13	**1.04**	
2-May-22	10:00	1.34	1.03	1.00	**1.12**	-	-	-	-	1.09	1.18	1.04	**1.10**	1.12	0.69	0.91	**0.91**	
3-May-22	10:00	1.10	1.09	0.96	**1.05**	-	-	-	-	1.03	0.90	0.91	**0.95**	1.02	1.06	1.03	**1.04**	
4-May-22	9:45	0.78	1.08	1.10	**0.99**	-	-	-	-	0.90	0.80	0.74	**0.81**	0.92	0.87	0.97	**0.92**	
5-May-22	13:15	1.08	1.13	1.08	**1.10**	-	-	-	-	3.40	1.12	3.77	**2.76**	2.19	1.95	1.95	**2.03**	
6-May-22	11:00	0.55	0.82	0.89	**0.75**	-	-	-	-	1.04	1.18	0.80	**1.01**	0.65	1.14	0.77	**0.85**	
7-May-22	11:47	1.06	0.85	1.18	**1.03**	-	-	-	-	0.79	1.03	1.08	**0.97**	1.42	1.14	1.72	**1.43**	
8-May-22	10:22	1.00	1.04	0.98	**1.01**	-	-	-	-	0.81	0.73	0.79	**0.78**	1.25	0.77	2.33	**1.45**	
9-May-22	10:02	1.32	2.10	1.88	**1.77**	-	-	-	-	1.87	1.37	1.05	**1.43**	1.57	2.58	1.55	**1.90**	
10-May-22	9:12	0.81	1.05	1.45	**1.10**	-	-	-	-	0.63	0.62	0.87	**0.71**	1.06	0.77	1.52	**1.12**	
11-May-22	11:10	2.13	1.40	1.32	**1.62**	-	-	-	-	2.07	1.82	1.17	**1.69**	0.74	1.13	1.82	**1.23**	
12-May-22	11:30	1.04	1.10	0.79	**0.98**	1.72	0.60	1.26	**1.19**	0.91	1.60	0.36	**0.96**	1.01	2.09	1.34	**1.48**	Upstream 2 was a new upstream sampling location that was created when construction was moving upstream of Upstream 1. This sampling location was sampled from May 12 to June 30, 2022.

Table 4.3 Elbow River Turbidity (NTU) Monitoring Data During the 2021/2022 Reporting Year

		Elbow River Upstream 1				Elbow River Upstream 2				Elbow River Midstream Camp Kiwanis Side Channel with Excavation				Downstream of Elbow River and Unnamed Creek Confluence				
Date	**Time**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Comments**
13-May-22	11:30	1.14	1.06	1.05	**1.08**	0.76	1.04	0.99	**0.93**	1.09	0.99	1.04	**1.04**	1.09	1.33	0.97	**1.13**	
14-May-22	11:30	-	-	-	**-**	0.78	0.49	1.34	**0.87**	1.02	0.93	0.40	**0.78**	0.94	0.70	1.24	**0.96**	
15-May-22	11:00	-	-	-	**-**	0.59	1.00	0.29	**0.63**	0.78	0.64	1.12	**0.85**	0.69	1.20	0.69	**0.86**	
16-May-22	14:30	-	-	-	**-**	1.14	1.46	1.33	**1.31**	1.60	1.36	1.15	**1.37**	0.68	0.69	0.68	**0.68**	
17-May-22	10:07	-	-	-	**-**	0.79	1.17	0.83	**0.93**	0.90	1.22	0.83	**0.98**	1.00	0.74	0.93	**0.89**	
18-May-22	9:41	-	-	-	**-**	0.68	0.25	0.41	**0.45**	0.60	0.48	0.95	**0.68**	0.52	0.55	1.20	**0.76**	
19-May-22	9:44	-	-	-	**-**	0.63	0.74	0.76	**0.71**	0.87	0.79	0.85	**0.84**	0.93	0.66	0.97	**0.85**	
20-May-22	11:41	-	-	-	**-**	1.10	1.50	1.30	**1.30**	1.30	1.34	1.04	**1.23**	1.41	1.12	1.14	**1.22**	
21-May-22	9:00	-	-	-	**-**	1.83	0.93	1.33	**1.36**	1.34	1.72	1.01	**1.36**	1.15	0.75	1.10	**1.00**	
22-May-22	9:51	-	-	-	**-**	1.14	1.21	1.00	**1.12**	1.19	0.97	1.61	**1.26**	0.64	0.63	0.84	**0.70**	
23-May-22	10:42	-	-	-	**-**	1.19	0.95	0.78	**0.97**	0.89	1.03	1.05	**0.99**	1.19	0.98	1.00	**1.06**	
24-May-22	15:55	-	-	-	**-**	17.79	17.10	17.46	**17.45**	11.08	11.20	11.50	**11.26**	1.45	1.23	1.28	**1.32**	
25-May-22	14:58	-	-	-	**-**	1.42	1.34	1.07	**1.28**	1.77	1.61	2.09	**1.82**	1.35	1.11	0.66	**1.04**	
26-May-22	9:14	-	-	-	**-**	1.29	1.54	1.91	**1.58**	1.44	1.20	1.17	**1.27**	1.07	1.14	1.23	**1.15**	
27-May-22	8:18	-	-	-	**-**	0.85	0.88	1.16	**0.96**	1.03	0.86	1.30	**1.06**	1.17	0.80	1.32	**1.10**	
28-May-22	8:41	-	-	-	**-**	1.04	0.78	0.94	**0.92**	0.94	1.09	0.84	**0.96**	1.20	1.26	0.83	**1.10**	
29-May-22	9:37	-	-	-	**-**	1.65	1.62	2.29	**1.85**	1.83	1.42	1.33	**1.53**	1.63	1.63	1.78	**1.68**	
30-May-22	8:19	-	-	-	**-**	1.55	1.73	1.94	**1.74**	1.97	1.46	1.88	**1.77**	2.36	1.68	2.07	**2.04**	
31-May-22	10:58	-	-	-	**-**	1.44	1.65	1.77	**1.62**	1.87	1.43	1.66	**1.65**	1.53	2.01	2.15	**1.90**	
1-Jun-22	16:00	-	-	-	**-**	1.67	1.53	2.92	**2.04**	2.22	1.44	3.03	**2.23**	2.13	1.71	1.84	**1.89**	
2-Jun-22	10:00	-	-	-	**-**	2.71	1.95	2.11	**2.26**	1.56	1.61	1.60	**1.59**	2.01	1.73	1.22	**1.65**	
3-Jun-22	13:00	-	-	-	**-**	3.59	1.81	1.67	**2.36**	1.36	2.74	1.58	**1.89**	1.81	3.19	1.87	**2.29**	
4-Jun-22	11:00	-	-	-	**-**	1.65	2.16	2.19	**2.00**	2.84	2.30	2.84	**2.66**	2.53	2.32	2.12	**2.32**	
5-Jun-22	11:00	-	-	-	**-**	6.76	5.98	5.66	**6.13**	4.91	5.03	5.17	**5.04**	5.26	5.71	5.69	**5.55**	
6-Jun-22	14:00	-	-	-	**-**	40.60	39.70	40.80	**40.37**	38.00	42.60	40.90	**40.50**	57.50	57.50	58.30	**57.77**	
7-Jun-22	13:00	-	-	-	**-**	46.70	47.80	40.70	**45.07**	46.40	45.70	49.00	**47.03**	63.10	58.10	69.70	**63.63**	
8-Jun-22	12:30	-	-	-	**-**	11.37	11.89	11.60	**11.62**	21.50	19.80	16.95	**19.42**	29.30	30.50	31.40	**30.40**	
9-Jun-22	10:30	-	-	-	**-**	11.10	8.77	9.39	**9.75**	16.86	15.22	15.30	**15.79**	20.10	18.12	17.17	**18.46**	

Table 4.3 Elbow River Turbidity (NTU) Monitoring Data During the 2021/2022 Reporting Year

		Elbow River Upstream 1				**Elbow River Upstream 2**				**Elbow River Midstream Camp Kiwanis Side Channel with Excavation**				**Downstream of Elbow River and Unnamed Creek Confluence**				
Date	**Time**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Sample 1**	**Sample 2**	**Sample 3**	**Average NTU**	**Comments**
10-Jun-22	11:00	-	-	-	**-**	16.61	18.20	17.94	**17.58**	18.80	16.94	16.97	**17.57**	16.18	16.78	15.94	**16.30**	
11-Jun-22	9:30	-	-	-	**-**	51.10	58.10	53.80	**54.33**	47.00	53.00	46.60	**48.87**	80.00	83.30	84.40	**82.57**	
12-Jun-22	11:00	-	-	-	**-**	24.20	23.10	23.20	**23.50**	23.30	25.70	25.40	**24.80**	36.30	26.90	39.60	**34.27**	
13-Jun-22	16:04	-	-	-	**-**	64.40	72.00	68.20	**68.20**	54.30	63.30	56.70	**58.10**	109.00	114.00	113.00	**112.00**	
14-Jun-22	12:54	-	-	-	**-**	986.00	960.00	999.00	**981.67**	964.00	1,159.00	1,207.00	**1,110.00**	1,106.00	1,067.00	1,412.00	**1,195.00**	
15-Jun-22	9:13	-	-	-	**-**	-	-	-	**-**	-	-	-	**-**	1,482.00	1,243.00	1,325.00	**1,350.00**	Unable to sample upstream and midstream points due to flooding
16-Jun-22	10:47	-	-	-	**-**	374.00	358.00	373.00	**368.33**	-	-	-	**-**	524.00	522.00	537.00	**527.67**	
17-Jun-22	17:05	-	-	-	**-**	310.00	292.00	304.00	**302.00**	-	-	-	**-**	393.00	400.00	410.00	**401.00**	
18-Jun-22	17:00	-	-	-	**-**	467.00	462.00	459.00	**462.67**	-	-	-	**-**	372.00	378.00	387.00	**379.00**	
19-Jun-22	10:25	-	-	-	**-**	379.00	373.00	383.00	**378.33**	-	-	-	**-**	436.00	407.00	421.00	**421.33**	
20-Jun-22	11:58	-	-	-	**-**	209.00	218.00	209.00	**212.00**	-	-	-	-	187.00	176.00	181.00	**181.33**	
21-Jun-22	9:10	-	-	-	**-**	121.00	93.50	111.00	**108.50**	-	-	-	-	149.00	153.00	152.00	**151.33**	
22-Jun-22	10:05	-	-	-	**-**	92.80	89.40	93.10	**91.77**	-	-	-	-	105.00	101.00	104.00	**103.33**	
23-Jun-22	20:38	-	-	-	**-**	74.00	75.20	67.10	**72.10**	-	-	-	-	80.80	80.40	84.50	**81.90**	
24-Jun-22	9:41	-	-	-	**-**	50.20	45.10	51.90	**49.07**	-	-	-	-	65.60	57.50	61.80	**61.63**	
25-Jun-22	15:24	-	-	-	**-**	23.90	22.60	22.20	**22.90**	-	-	-	-	40.90	36.20	40.20	**39.10**	
26-Jun-22	10:53	-	-	-	**-**	15.72	14.53	14.85	**15.03**	-	-	-	-	30.10	29.10	31.20	**30.13**	
27-Jun-22	7:57	-	-	-	**-**	12.79	12.13	12.15	**12.36**	-	-	-	-	26.20	22.90	26.00	**25.03**	
28-Jun-22	10:09	-	-	-	**-**	21.00	19.20	21.50	**20.57**	19.40	18.90	16.48	**18.26**	35.20	34.80	32.70	**34.23**	Midstream sampling point resumed
29-Jun-22	14:26	-	-	-	**-**	59.00	61.30	61.90	**60.73**	57.40	55.30	61.90	**58.20**	70.40	70.30	76.80	**72.50**	
30-Jun-22	8:27	-	-	-	**-**	33.10	34.00	31.90	**33.00**	27.50	27.80	25.90	**27.07**	49.40	46.90	48.80	**48.37**	

Table 4.4 Elbow River TSS (mg/L) Monitoring Data During the 2021/2022 Reporting Year[1]

		Elbow River Upstream 1				Elbow River Upstream 2				Elbow River Midstream Camp Kiwanis Side Channel with Excavation				Downstream of Elbow River and Unnamed Creek Confluence			
Date	**Time**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**
20-Apr-22	15:15	10.14	1.87	1.52	**1.27**	-	-	-	**-**	-	-	-	**-**	1.82	2.24	1.89	**1.98**
21-Apr-22	20:15	1.72	1.94	3.34	**2.33**	-	-	-	**-**	-	-	-	**-**	-	-	-	**-**
22-Apr-22	20:50	1.42	1.42	1.37	**1.40**	-	-	-	**-**	-	-	-	**-**	-	-	-	**-**
23-Apr-22	21:12	2.47	2.59	2.74	**2.60**	-	-	-	**-**	-	-	-	**-**	-	-	-	**-**
24-Apr-22	20:46	7.77	8.84	7.97	**8.19**	-	-	-	**-**	-	-	-	**-**	-	-	-	**-**
25-Apr-22	14:08	4.93	4.18	4.31	**4.47**	-	-	-	**-**	-	-	-	**-**	-	-	-	**-**
26-Apr-22	10:14	3.71	3.71	3.66	**3.69**	-	-	-	**-**	-	-	-	**-**	-	-	-	**-**
27-Apr-22	11:36	3.64	3.19	2.69	**3.17**	-	-	-	**-**	-	-	-	**-**	1.82	2.76	2.76	**2.45**
28-Apr-22	15:00	1.84	2.49	2.22	**2.18**	-	-	-	**-**	3.93	3.26	3.06	**3.42**	2.29	1.97	2.24	**2.17**
29-Apr-22	13:15	2.19	2.32	2.39	**2.30**	-	-	-	**-**	2.61	2.19	2.32	**2.37**	2.24	2.64	2.09	**2.32**
30-Apr-22	13:15	1.67	1.79	1.27	**1.58**	-	-	-	**-**	1.82	2.47	1.77	**2.02**	2.34	2.07	1.87	**2.09**
1-May-22	10:15	2.17	1.79	1.42	**1.79**	-	-	-	**-**	1.97	1.79	1.54	**1.77**	2.59	2.39	2.81	**2.60**
2-May-22	19:30	3.34	2.56	2.49	**2.80**	-	-	-	**-**	2.71	2.94	2.59	**2.75**	2.79	1.72	2.27	**2.26**
3-May-22	10:00	2.74	2.71	2.39	**2.61**	-	-	-	**-**	2.56	2.24	2.27	**2.36**	2.54	2.64	2.56	**2.58**
4-May-22	09:45	1.94	2.69	2.74	**2.46**	-	-	-	**-**	2.24	1.99	1.84	**2.03**	2.29	2.17	2.42	**2.29**
5-May-22	13:15	2.69	2.81	2.69	**2.73**	-	-	-	**-**	8.47	2.79	9.39	**6.88**	5.45	4.86	4.86	**5.06**
6-May-22	11:00	1.37	2.04	2.22	**1.88**	-	-	-	**-**	2.59	2.94	1.99	**2.51**	1.62	2.84	1.92	**2.12**
7-May-22	11:47	2.64	2.12	2.94	**2.56**	-	-	-	**-**	1.97	2.56	2.69	**2.41**	3.54	2.84	4.28	**3.55**
8-May-22	10:22	2.49	2.59	2.44	**2.51**	-	-	-	**-**	2.02	1.82	1.97	**1.93**	3.11	1.92	5.80	**3.61**
9-May-22	10:02	3.29	5.23	4.68	**4.40**	-	-	-	**-**	4.66	3.41	2.61	**3.56**	3.91	6.42	3.86	**4.73**
10-May-22	09:12	2.02	2.61	3.61	**2.75**	-	-	-	**-**	1.57	1.54	2.17	**1.76**	2.64	1.92	3.79	**2.78**
11-May-22	11:10	5.30	3.49	3.29	**4.03**	-	-	-	**-**	5.15	4.53	2.91	**4.20**	1.84	2.81	4.53	**3.06**
12-May-22	11:30	2.59	2.74	1.97	**2.43**	4.28	1.49	3.14	**2.97**	2.27	3.98	0.90	**2.38**	2.52	5.20	3.34	**3.69**
13-May-22	11:30	2.84	2.64	2.61	**2.70**	1.89	2.59	2.47	**2.32**	2.71	2.47	2.59	**2.59**	2.71	3.31	2.42	**2.81**
14-May-22	11:30	-	-	-	**-**	1.94	1.22	3.34	**2.17**	2.54	2.32	1.00	**1.95**	2.34	1.74	3.09	**2.39**
15-May-22	11:00	-	-	-	**-**	1.47	2.49	0.72	**1.56**	1.94	1.59	2.79	**2.11**	1.72	2.99	1.72	**2.14**
16-May-22	14:30	-	-	-	**-**	2.84	3.64	3.31	**3.26**	3.98	3.39	2.86	**3.41**	1.69	1.72	1.69	**1.70**
17-May-22	10:07	-	-	-	**-**	1.97	2.91	2.07	**2.32**	2.24	3.04	2.07	**2.45**	2.49	1.84	2.32	**2.22**
18-May-22	09:41	-	-	-	**-**	1.69	0.62	1.02	**1.11**	1.49	1.20	2.37	**1.69**	1.29	1.37	2.99	**1.88**

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[1] Turbidity measurements in NTU were converted to total suspended solids (TSS) mg/L using the Elbow River TSS-turbidity rating curve provided in Figure 4.2.

Table 4.4 Elbow River TSS (mg/L) Monitoring Data During the 2021/2022 Reporting Year[1]

		Elbow River Upstream 1				Elbow River Upstream 2				Elbow River Midstream Camp Kiwanis Side Channel with Excavation				Downstream of Elbow River and Unnamed Creek Confluence			
Date	**Time**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**
19-May-22	09:44	-	-	-	**-**	1.57	1.84	1.89	**1.77**	2.17	1.97	2.12	**2.08**	2.32	1.64	2.42	**2.12**
20-May-22	11:41	-	-	-	**-**	2.74	3.74	3.24	**3.24**	3.24	3.34	2.59	**3.05**	3.51	2.79	2.84	**3.05**
21-May-22	09:00	-	-	-	**-**	4.56	2.32	3.31	**3.39**	3.34	4.28	2.52	**3.38**	2.86	1.87	2.74	**2.49**
22-May-22	09:51	-	-	-	**-**	2.84	3.01	2.49	**2.78**	2.96	2.42	4.01	**3.13**	1.59	1.57	2.09	**1.75**
23-May-22	10:42	-	-	-	**-**	2.96	2.37	1.94	**2.42**	2.22	2.56	2.61	**2.47**	2.96	2.44	2.49	**2.63**
24-May-22	15:55	-	-	-	**-**	44.30	42.58	43.48	**43.45**	27.59	27.89	28.64	**28.04**	3.61	3.06	3.19	**3.29**
25-May-22	14:58	-	-	-	**-**	3.54	3.34	2.66	**3.18**	4.41	4.01	5.20	**4.54**	3.36	2.76	1.64	**2.59**
26-May-22	09:14	-	-	-	**-**	3.21	3.83	4.76	**3.93**	3.59	2.99	2.91	**3.16**	2.66	2.84	3.06	**2.86**
27-May-22	08:18	-	-	-	**-**	2.12	2.19	2.89	**2.40**	2.56	2.14	3.24	**2.65**	2.91	1.99	3.29	**2.73**
28-May-22	08:41	-	-	-	**-**	2.59	1.94	2.34	**2.29**	2.34	2.71	2.09	**2.38**	2.99	3.14	2.07	**2.73**
29-May-22	09:37	-	-	-	**-**	4.11	4.03	5.70	**4.62**	4.56	3.54	3.31	**3.80**	4.06	4.06	4.43	**4.18**
30-May-22	08:19	-	-	-	**-**	3.86	4.31	4.83	**4.33**	4.91	3.64	4.68	**4.41**	5.88	4.18	5.15	**5.07**
31-May-22	10:58	-	-	-	**-**	3.59	4.11	4.41	**4.03**	4.66	3.56	4.13	**4.12**	3.81	5.01	5.35	**4.72**
1-Jun-22	16:00	-	-	-	**-**	4.16	3.81	7.27	**5.08**	5.53	3.59	7.55	**5.55**	5.30	4.26	4.58	**4.71**
2-Jun-22	10:00	-	-	-	**-**	6.75	4.86	5.25	**5.62**	3.88	4.01	3.98	**3.96**	5.01	4.31	3.04	**4.12**
3-Jun-22	13:00	-	-	-	**-**	8.94	4.51	4.16	**5.87**	3.39	6.82	3.93	**4.71**	4.51	7.94	4.66	**5.70**
4-Jun-22	11:00	-	-	-	**-**	4.11	5.38	5.45	**4.98**	7.07	5.73	7.07	**6.62**	6.30	5.78	5.28	**5.79**
5-Jun-22	11:00	-	-	-	**-**	16.83	14.89	14.09	**15.27**	12.23	12.53	12.87	**12.54**	13.10	14.22	14.17	**13.83**
6-Jun-22	14:00	-	-	-	**-**	101.10	98.86	101.60	**100.52**	94.63	106.08	101.85	**100.85**	143.19	143.19	145.18	**143.85**
7-Jun-22	13:00	-	-	-	**-**	116.29	119.03	101.35	**112.23**	115.55	113.80	122.02	**117.12**	157.13	144.68	173.57	**158.46**
8-Jun-22	12:30	-	-	-	**-**	28.31	29.61	28.89	**28.94**	53.54	49.31	42.21	**48.35**	72.96	75.95	78.19	**75.70**
9-Jun-22	10:30	-	-	-	**-**	27.64	21.84	23.38	**24.29**	41.98	37.90	38.10	**39.33**	50.05	45.12	42.76	**45.98**
10-Jun-22	11:00	-	-	-	**-**	41.36	45.32	44.67	**43.79**	46.82	42.18	42.26	**43.75**	40.29	41.79	39.69	**40.59**
11-Jun-22	09:30	-	-	-	**-**	127.25	144.68	133.97	**135.30**	117.04	131.98	116.04	**121.69**	199.22	207.43	210.17	**205.61**
12-Jun-22	11:00	-	-	-	**-**	60.26	57.52	57.77	**58.52**	58.02	64.00	63.25	**61.76**	90.39	66.99	98.61	**85.33**
13-Jun-22	16:04	-	-	-	**-**	160.37	179.29	169.83	**169.83**	135.22	157.63	141.19	**144.68**	271.43	283.88	281.39	**278.90**
14-Jun-22	12:54	-	-	-	**-**	2,455.34	2,390.59	2,487.71	**2,444.55**	2,400.55	2,886.14	3,005.67	**2,764.12**	2,754.16	2,657.04	3,516.16	**2,975.79**
15-Jun-22	09:13	-	-	-	**-**	-	-	-	-	-	-	-	-	3,690.48	3,095.32	3,299.52	**3,361.77**
16-Jun-22	10:47	-	-	-	**-**	931.33	891.49	928.84	**917.22**	-	-	-	-	1,304.86	1,299.88	1,337.24	**1,314.00**
17-Jun-22	17:05	-	-	-	**-**	771.96	727.14	757.02	**752.04**	-	-	-	-	978.65	996.08	1,020.98	**998.57**

Table 4.4 Elbow River TSS (mg/L) Monitoring Data During the 2021/2022 Reporting Year[1]

		Elbow River Upstream 1				Elbow River Upstream 2				Elbow River Midstream Camp Kiwanis Side Channel with Excavation				Downstream of Elbow River and Unnamed Creek Confluence			
Date	**Time**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**	**Sample 1**	**Sample 2**	**Sample 3**	**Average mg/L**
18-Jun-22	17:00	-	-	-	**-**	1,162.92	1,150.47	1,143.00	**1,152.13**	-	-	-	-	926.35	941.30	963.71	**943.79**
19-Jun-22	10:25	-	-	-	**-**	943.79	928.84	953.75	**942.13**	-	-	-	-	1,085.73	1,013.51	1,048.37	**1,049.20**
20-Jun-22	11:58	-	-	-	**-**	520.45	542.86	520.45	**527.92**	-	-	-	-	465.67	438.28	450.73	**451.56**
21-Jun-22	09:10	-	-	-	**-**	301.31	232.83	276.41	**270.19**	-	-	-	-	371.04	381.00	378.51	**376.85**
22-Jun-22	10:05	-	-	-	**-**	231.09	222.62	231.84	**228.52**	-	-	-	-	261.47	251.51	258.98	**257.32**
23-Jun-22	20:38	-	-	-	**-**	184.27	187.26	167.09	**179.54**	-	-	-	-	201.21	200.21	210.42	**203.95**
24-Jun-22	09:41	-	-	-	**-**	125.01	112.31	129.24	**122.19**	-	-	-	-	163.36	143.19	153.89	**153.48**
25-Jun-22	15:24	-	-	-	**-**	59.52	56.28	55.28	**57.03**	-	-	-	-	101.85	90.15	100.11	**97.37**
26-Jun-22	10:53	-	-	-	**-**	39.15	36.18	36.98	**37.44**	-	-	-	-	74.96	72.46	77.69	**75.04**
27-Jun-22	07:57	-	-	-	**-**	31.85	30.21	30.26	**30.77**	-	-	-	-	65.24	57.03	64.75	**62.34**
28-Jun-22	10:09	-	-	-	**-**	52.29	47.81	53.54	**51.22**	48.31	47.06	41.04	**45.47**	87.66	86.66	81.43	**85.25**
29-Jun-22	14:26	-	-	-	**-**	146.92	152.65	154.14	**151.24**	142.94	137.71	154.14	**144.93**	175.31	175.06	191.25	**180.54**
30-Jun-22	08:27	-	-	-	**-**	82.43	84.67	79.44	**82.18**	68.48	69.23	64.50	**67.40**	123.02	116.79	121.52	**120.44**

4.8.1.2 Compliance Monitoring – Turbidity Monitoring During Dewatering Activities

See Section 4.3.2 for a description of dewatering activities on site. The Project Contractor retained an environmental sub-consultant to conduct environmental inspections and monitoring on the Project. Work to remove water from an excavation that was filled during the June flooding event occurred between June 17 to June 19, 2022. Dewatering of the excavation pit to the Elbow River was completed using pump intake screens with opening diameter size of 2.54 mm, as per DFO guidance. Compliance turbidity monitoring was completed at the following four locations on the Elbow River:

- Location 1: Background Monitoring – 30 m upstream (u/s) of construction area
- Location 2: Compliance Monitoring – 30 m downstream (d/s) of construction area
- Location 3: Compliance Monitoring – 60 m d/s of construction area
- Location 4: Compliance Monitoring – 90 m d/s of construction area

At each location, three turbidity samples were collected during each sampling event, and the results were averaged. Samples were collected from the shore. Sampling started 30 minutes prior to daily construction activities until 30 minutes after construction activities were completed. Samples were collected at each location at least once per hour.

On June 17, 2022 a QAES inspected the excavation pit and planned discharge location in the Elbow River, collected water samples, and formalized a plan for dewatering activities. After inspecting the site and gathering turbidity samples of the Elbow River and the water in the pit, it was deemed acceptable to discharge the water from the pit directly into the Elbow River. The water within the pit was less turbid than the Elbow River. This met regulatory guidelines for discharging into the river (i.e., no increase in turbidity).

On June 18, 2022 discharge from the pit to the Elbow River occurred. Turbidity sampling occurred at one location upstream and three locations downstream of the pumping location in the Elbow River. Sampling in this manner indicated that the location where the pump discharge was located caused a slight increase in turbidity above background levels in the Elbow River. The QAES recommended moving the discharge location further downstream and the installation of sediment bags on the ends of the discharge lines to help contain sediment as well as dissipate the energy of the water to help reduce/prevent erosion. The turbidity sampling results that were subsequently collected indicated a decrease in turbidity levels that met criteria at the downstream transects in the Elbow River (they were below the upstream control at the next sampling event). Sampling results remained below criteria for the rest of the sampling events that night.

On June 19 and 20, 2022 discharge from the pit to the Elbow River, as well as regular turbidity sampling, continued. Two sampling events showed increased turbidity relative to the background levels, triggering a pause in pumping until turbidity levels returned to background.

On June 20, 2022, a sampling event showed slightly increased levels of turbidity downstream of the discharge location, a second sample was immediately taken which showed turbidity values to be within criteria. See Section 4.3.2 for additional information on dewatering of this pit.

4.8.2 Groundwater

Groundwater monitoring network development and groundwater monitoring activities were completed between May 2021 and May 2022 and are described in detail in the Groundwater Monitoring Report in Appendix B.3. The groundwater monitoring was completed based on the GWMP.

The monitoring network includes three monitoring tiers that are summarized below and described in detail in Appendix B.3:

- Tier 1 monitoring wells will be shallow and located within or immediately adjacent to Project infrastructure (dam, diversion structure and channel) and used for geotechnical monitoring and also to support groundwater monitoring.
- Tier 2 monitoring wells are shallow and within or very near the wetted perimeter of the off-stream reservoir and diversion channel. They are installed specifically for the Project in both the unconsolidated and shallow bedrock deposits. A subset of Tier 2a wells are also included specifically to monitor drawdown near the diversion channel during construction and dry operations to address NRCB approval condition 11.5 a[2]). The Tier 2a wells are domestic water wells and are based on voluntary participation (all landowners within the potential drawdown area were invited to participate).
- Tier 3 monitoring wells are situated beyond the area of predicted project effects at locations of some of the closest potential receptors to the Project. The main purpose of these monitoring wells is to provide early detection of potential effects on groundwater that are propagating outward from the LAA. Tier 3 wells are primarily domestic water wells where landowners wished to participate.

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[2] "monitor water levels in domestic water wells west of the diversion channel to the boundary of the local assessment area that may be impacted by dewatering during the Project construction. During flood and dryland operation, monitoring of the wells should be continued by the Operator for a minimum of five years or until it can be demonstrated that permanent lowering of the water level does not significantly impact yields from the water wells, "

To address IAAC approval condition 7.6, eight monitoring wells were decommissioned from inside the construction footprint or wetter perimeter of the design flood and replaced (where required) outside that boundary. An additional seven monitoring wells were installed to further develop the monitoring network.

Groundwater monitoring and sampling was completed in May 2021, November 2021, January 2022 and May 2022. The monitoring and sampling included the Tier 2 monitoring wells, Tier 2a monitoring wells, Tier 3 domestic wells, one-time domestic wells (NRCB hearing commitment), and the legacy EIA Project wells. The locations and descriptions of the monitoring tiers and additional Project and domestic wells are presented in Appendix B.3.

The monitoring programs included measurement of groundwater levels, field parameters (dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, electrical conductivity (EC)) and installation of data logging pressure transducers. The transducers were deployed to measure and record near continuous water level, temperature, and electrical conductivity at the Tier 2, Tier 2a and Tier 3 monitoring wells. Groundwater samples were collected and submitted to an accredited laboratory for routine potability parameters, major ions, bacteriological parameters, dissolved organic carbon (DOC), dissolved metals, nutrients, benzene, toluene, ethylbenzene, xylenes (BTEX), and F1 to F2 fraction hydrocarbons.

No Project related changes to groundwater levels were noted, nor were they expected considering there was no construction dewatering of groundwater during the reporting period. Groundwater quality in the 2021/2022 reporting year was consistent with historical results and, while there are numerous exceedances of the Guidelines for Canadian Drinking Water Quality (Health Canada 2022), no exceedances were attributed to Project effects.

The results of the monitoring and sampling events are presented in Appendix B.3.

4.8.3 Channel Morphology

Not applicable; channel morphology will be monitored following a flood as is required by IAAC approval condition 3.20.

4.8.4 Fish and Fish Habitat

4.8.4.1 Preconstruction (Baseline)

Several construction best management practices have been implemented during the 2021/2022 reporting year that pertain to the protection of fish habitat and aquatic life and measures that are listed in approval condition 3 of the IAAC Decision Statement. These construction practices are generally described through various sections of this report.

4.8.4.2 Fish Passage

It is expected that construction of the fish passage rock v-weirs (IAAC approval condition 3.13) will occur in the 2022/2023 reporting year; upon which fish passage evaluations will be completed.

AT completed baseline data collection in the Elbow River on June 11, August 20 to 23, and October 12, 2021. The sampling periods aligned with the biologically significant periods (BSPs) that have been previously identified for fish passage evaluation as it pertains to the Project.

Field data was collected upstream and at the Project location during June, August, and October 2021. Downstream sites were measured in June and August 2021. Three transects were established at each monitoring site, and additional transects were measured at side channels and flood plain channels in June and August 2021 to account for high water levels (locations are presented in Appendix B.2).

Baseline fish passage data was evaluated for fish swimming performance as it pertains to three size categories of fish under the salmon and walleye swimming database: 25 mm, 250 mm, and 1,000 mm (Katapodis and Gervais 2016), as described in the Springbank Off-stream Reservoir Project Fish Passage Monitoring Plan. Because the baseline data does not evaluate fish passage structures, distance (i.e., distance between two fish passage structures and burst speed between v-weirs) was not incorporated into the baseline analysis. Future iterations of the fish passage analysis will evaluate velocity and distance for fish size categories at the fish passage structures and comparisons will be made to the baseline data contained herein in the future. For the purpose of this baseline evaluation, the following maximum velocities are assumed for fish passage at cruising speeds that can be maintained for distances of at least 1 km (i.e., pools, deep runs):

- 25 mm: 1 m/s
- 250 mm: 1.3 m/s
- 1,000 mm: 2.5 m/s

The maximum velocities described above align with the velocities that were used to evaluate fish passage in the EIA and will be carried forward in future evaluations of the fish passage structures. Additional velocity thresholds will be considered for burst speeds between the fish passage structures following construction to align with the methods described in the EIA.

A summary of fish passage results and velocities at each transect are presented in Appendix B.2. Baseline average velocities were all within an acceptable range for fish swimming capabilities at each size class of the Elbow River fish population. Future monitoring programs (IAAC approval condition 3.17) will evaluate post-construction Elbow River velocities in the context of the baseline results presented herein.

4.8.4.3 Fish Tissue

Baseline (pre-construction) fish tissue and benthic invertebrate samples were collected between July 29, 2021 and August 7, 2021. Fish tissue was comprised of longnose dace for a prey indicator species, and brook trout as a predator indicator species. Water samples and in situ data were collected on August 23, 2021, and November 12, 2021. Results of the water quality samples are discussed in Section 4.8.1.

The parameters that were analyzed included:

- water quality concentration values for total mercury (THg) and methylmercury (MeHg) discussed in Section 4.8.1.
- fish tissue concentration values for THg, MeHg
- fish tissue carbon-13 (C-13) and nitrogen-15 (N-15) stable isotopes
- fish tissue carbon (C) content and nitrogen (N) content
- fish age and morphometric data (fork length and weight)
- invertebrate concentration values for THg and MeHg
- invertebrate C-13 and N-15 stable isotopes
- invertebrate C content and N content

Three sites were sampled for the program: an upstream site at Bragg Creek Provincial Park (Site 1), one site near the diversion structure (Site 2), and one site downstream at Clearwater Dog Park (Site 3) west of the City of Calgary. A description of sampling methodology, and a summary of the results of this program are presented in Appendix B.2.

THg and MeHg concentrations in brook trout tissue and MeHg in longnose dace increased from the upstream site (Site 1, Figure 2.1 of Appendix B.2) on the Elbow River to the most downstream sampling site (Site 3), while THg concentrations in longnose dace were the highest near the Project (Site 2, Figure 2.1 of Appendix B.2) compared to other sites. THg and MeHg concentrations in longnose dace were higher than in brook trout tissue, except at the downstream site (Site 3, Figure 2.1 of Appendix B.2) where THg was lower. The percentage of C-13 and N-15 in brook trout increased slightly in the downstream direction, while C content and N content decreased slightly in the downstream direction. The percentage of C-13 and N-15 and C and N content in longnose dace was similar between sites.

THg and MeHg concentrations in invertebrate tissue increased from the upstream site (Site 1) to the downstream sampling site (Site 3). These concentrations were lower in invertebrate tissue than in fish tissue. C-13 and C content were similar between both fish species and the invertebrates, while N-15 and N content were higher in both fish species compared to the invertebrates.

Future iterations of the invertebrate and fish tissue sampling program will be conducted as required by IAAC approval condition 7.8 following a flood event and results of those future studies will consider the baseline data described herein.

4.8.4.4 Offsetting

AT prepared an Offset Measures Plan as part of the Application for Authorization under the *Fisheries Act* for the Project. The Offset Measures Plan included three conceptual offset measures for the Project that were approved by DFO in the Project Authorization dated March 18, 2022. The Authorization outlines Project activities that may result in the harmful alteration, disruption, and destruction (HADD) of fish habitat, including critical habitat for bull trout, a species at risk. The Authorization also outlines Project activities that may result in the death of fish, including bull trout, a species at risk (IAAC approval condition 3.9). The Offset Measures Plan addresses these effects of the Project through the following fish habitat designs:

- Elbow River Side Channels
- Brook Trout Removal Program
- Elbow River Watershed Remediation

The Offset Measures Plan was driven by Project requirements, regulatory objectives, and stakeholder feedback, including feedback received from Indigenous groups and the AEP fisheries management group. Offset measures are required in the Elbow River watershed to address objectives in the Recovery Strategy for the Bull Trout (*Salvenius confluentus*), Saskatchewan-Nelson Rivers populations, in Canada (Government of Canada 2020). In addition, AT committed to an adaptive management plan that addresses uncertainty associated with the death of fish that may result from Project operation. This adaptive management approach associated with the *Fisheries Act* Authorization states that AT will offset for potential death of fish estimates based on an initial estimate proposed for the Project (and carried forward in the Authorization). Post-flood monitoring will confirm whether initial estimates were appropriate. If post-flood monitoring suggests that the initial death of fish estimates were appropriate, no additional offsetting measures would be required. If post-flood monitoring confirms that the initial death of fish estimates were underestimated, additional offset measures will be instituted by AEP (as the reservoir operator) under authorization from DFO.

The Elbow River Side Channel design is currently in the final stages of development. Indigenous feedback has been received on this design (November 26, 2020 and January 26, 2021) and potential environmental effects associated with the offset measure (IAAC approval condition 3.10). The final designs will be submitted to IAAC prior to implementation.

Designs related to the Brook Trout Removal Program and the Elbow River Watershed Remediation program are currently in development. AT is continuing to work with DFO and AEP on the offsetting options. Preliminary designs will be shared with Indigenous groups prior to finalization for comment on the design and discussion of potential environmental effects related to the offset measure (IAAC approval condition 3.10), and final designs will be submitted to the Agency prior to implementation.

4.9 AIR QUALITY, NOISE AND DUST

4.9.1 Air Quality and Dust

The AQMP was submitted to ECCC and Health Canada on November 16, 2021. Review comments from ECCC and Health Canada were incorporated into the AQMP which was finalized in January 2022. Detailed planning was completed to finalize monitoring locations, determine logistical requirements, acquire equipment, and establish the air monitoring program outlined in the AQMP (detail provided in Section 4.9.1.1).

Initial pre-construction activities occurred during the winter and early spring months. During this period, the Project area conditions were generally snow covered or frozen soil with minimal potential for dust emissions.

4.9.1.1 Air Quality Monitoring

IAAC Approval Condition 6.1 – Vehicle Emissions

As per the AQMP, all vehicles and stationary equipment operating on the site meet or exceed the current emission standards. The construction contractor continued to ensure that all the equipment used in the Project is properly operated, regularly inspected, and maintained according to manufacture specifications. This included all equipment being operated by sub-contractors and consultants involved in the Project.

IAAC Approval Condition 6.2 – No-Idling Policy

As per the AQMP, vehicles were turned off when not being actively used within the Project development areas unless there was a specific technical or safety reason for not doing so.

IAAC Approval Condition 6.3 – Baseline Air Quality and CAAQS

As per the AQMP, an air quality monitoring network was established to monitor the concentrations of fine particulate matter ($PM_{2.5}$), coarse particulate matter (PM_{10}), total suspended particulates (TSP) at three sites located near the Project development areas in late spring, 2022, using environmental beta-attenuation mass monitors (EBAM). The $PM_{2.5}$ EBAM station was equipped with meteorological instrumentation to measure wind speed, wind direction, ambient temperature, and relative humidity at station height.

A monitoring site was established at Calaway Park to monitor the concentrations of $PM_{2.5}$ and TSP with the cooperation of Calalta Amusements Ltd. (Calalta). Calalta provided ongoing access to the site and supplied power from Calaway Park to the EBAM stations. It should be noted that due to supply chain issues the $PM_{2.5}$ and TSP EBAM stations from one of the perimeter sites (Site 2) were reallocated to Calaway Park. Once Calaway Park closes for the season the EBAM stations will be removed until the park re-opens in May 2023.

A site was selected, and agreements acquired with Rocky View County for an air quality monitoring station (AQMS) located in the community of Springbank. This AQMS will be equipped with $PM_{2.5}$, nitrogen oxides (NO_X), nitrogen dioxide (NO_2), and nitric oxide (NO) analyzers as well as a 10 m meteorological tower to measure wind speed and direction. Temperature, relative humidity, atmospheric pressure, and precipitation data will be collected at the AQMS at ground-level (i.e., within 3 m above the ground surface). The deployment of this site has been delayed due to routing of adequate power to the site. It is expected that the AQMS should be operating in the late fall of 2022. As a temporary alternative, meteorological data was collected from the Springbank Airport site (within the Springbank community) that is operated by Navigation Canada and ECCC.

These sites have been operated and maintained to collect the $PM_{2.5}$, PM_{10}, TSP, and NO_2 concentrations around the Project and downwind of the Project. These substances were compared to the applicable Alberta Ambient Air Quality Objectives and Guidelines (AAAQO&G) and the Canadian Ambient Air Quality Standards (CAAQS). The monitoring data was transmitted to a data center and regularly reviewed for potential concentrations near or above the AAAQO&G and CAAQS. The equipment was programmed to automatically send alerts to designated persons for high concentrations, concentrations above the AAAQO&G, loss of communications with the EBAM, or malfunctions with the equipment. Any events with measured concentrations above or near the AAAQO&G or CAAQS were investigated to determine the potential cause of the high concentrations and, where needed, communicated to the Construction Manager to implement applicable mitigation measures. Instances where there was loss of communications or malfunctions with the equipment were investigated and any required maintenance or replacement of the EBAM stations was completed. There were no recoded AAAQO&G and CAAQS exceedances during the 2021/2022 reporting year.

This monitoring network will remain in place for the remainder of the construction phase.

IAAC Approval Condition 6.4 & 7.10 – Verification of the Accuracy of the Environmental Assessment

As the AQ monitoring network is just being established there has not been enough data collected to fully evaluate the tasks under this condition. The AQMP was designed to collect the information for a verification study and was reviewed by ECCC and Health Canada. Specific to each sub-condition:

- Monitoring locations were located at the perimeter of the planned Project development area as per the AQMP. The site location at Calaway Park was selected based on the consultation with Calalta, the owner and operator of the park. The location of the Springbank AQMS site was discussed with Rocky View County and Springbank Park for all Seasons.
- Ambient air quality analyzer to monitor NO_X, NO_2, and NO will be part of the Springbank AQMS.
- $PM_{2.5}$, PM_{10}, and TSP are being monitored by EBAM stations located at three sites around the Project development area and will be operated throughout the construction phase at:
    - Site 1: between the permanent access road and diversion channel.
    - Site 2: south of the dry dam construction site.
    - Site 3: east side of dry dam area near borrow source sites.
- Visual observations are being completed by on-site construction staff
- Meteorological parameters of wind speed, wind direction, and temperature are being collected at each of the three monitoring sites and the Calaway Park site at instrument height (i.e., approximately 2 m above ground surface). Meteorological data is also being collected from the Springbank Airport site that is operated by Navigation Canada and ECCC to supplement the monitoring program.
- CAAQS are part of the evaluation of the $PM_{2.5}$ and NO_2 ambient air quality data collected by the EBAM stations and Springbank AQMS.
- AAAQO&G are being used to evaluate the hourly, 24-hour, and annual concentrations of $PM_{2.5}$ and TSP.
- The results of the evaluation of the CAAQS and AAAQO&G are used to determine the application of mitigation strategies or changes to the air quality monitoring network using adaptive management.

IAAC Approval Condition 6.5 & 7.11 – Indigenous Group Plain Language Bi-Annual Reporting

The air quality monitoring program has only been in operation since June 2022, as such no plain language reporting has been prepared for Indigenous Groups at this time. The AQMP was provided to Indigenous Groups to review but no response was received from the groups. It is planned to deliver the reports once the program has six months of data collection and then every six months after that unless otherwise requested by the Indigenous Groups.

IAAC Approval Condition 7.5 – Fugitive Dust Emission Mitigation

Speed limits have been implemented as per the AQMP on roads within the Project construction areas.

Road watering to suppress the road dust being generated by Project and non-Project equipment was completed based on both visual and ambient particulate monitoring at the EBAM stations.

Two separate dust complaints were made in May 2022. Following an investigation, it was determined that the dust was associated with work being completed by a third-party company within the Project area. Following discussions and confirmation with Rocky View County and the third-party company, calcium chloride was applied along Range Road 41 to suppress the dust.

4.9.2 Noise

4.9.2.1 Noise Monitoring

During the 2021/2022 reporting, AT did not receive any noise complaints. There were no blasting activities during the 2021/2022 reporting year.

4.10 ARCHAEOLOGICAL AND HERITAGE RESOURCES

In accordance with IAAC approval condition 9.2 and as required by ACSW, archaeological impact assessment studies are ongoing. During the 2021/2022 reporting year, the pre-impact assessment was completed, which included a shovel testing and deep testing program (the latter in conjunction with palaeontology). Site-specific archaeological field studies were also completed at sites nine sites. Conditional HRA approval was received for eight of the nine sites and approval requested for the ninth. Field studies were initiated as required at one additional archaeological site, which included mitigative archaeological hand excavation. Additionally, tree clearing was monitored by a qualified archaeologist, as required by ACSW in the winter of 2022.

Indigenous communities were invited to observe the archaeological work as per IAAC approval condition 9.5 and visits occurred on July 21, 2021 and June 15, 2022.

As required by IAAC approval condition 9.3 and 9.9, an Archaeological and Heritage Resource Management Plan was developed in late 2021 with involvement from Indigenous communities and ACSW. This was submitted to Indigenous groups on November 17, 2021, for review and comment, as well as IAAC on November 18, 2021. AT has not received any feedback on the Plan to date. The Plan was reviewed following the chance find identified (see Section 4.10.1 below for further details) and an updated Plan incorporating additional information will be re-issued to IAAC and Indigenous groups for review in Q4 2022.

4.10.1 Chance Finds

On February 28, 2022, a chance find was identified by the Indigenous Monitor. The chance find procedure as detailed in the Archaeological and Heritage Resource Management Plan was initiated. The chance find was determined to be of cultural nature and Indigenous groups engaged on the Project were notified and asked to provide comments or complete a desktop assessment as per the Plan. The cultural find was mitigated by an Indigenous group engaged on the Project within 10 days of its identification.

4.10.2 Cultural Awareness Training

A cultural awareness training session was held in January 2022 prior to the start of pre-construction activities. The training was developed by an Elder’s Circle coordinated by Community Futures Treaty 7 (CFT7) to provide a history of Treaty 7, aspects of cultural awareness that are important for the Project, and time for open discussion by attendees and the Elder’s were also included. The training was attended by members of the construction management team (AT and its Consultant) who were working on the Project leading up to the session.

The Prime Contractor, who will be responsible for the provision of all labor and materials, construction, and commissioning of the SR1, was awarded in late February has as part of their Construction contract a requirement to organize cultural awareness sessions to comply with IAAC approval condition 9.4. A second cultural awareness training session was held in early May prior to the start of construction activities; the session was provided by CFT7 and was attended by members of the construction management team (AT, its Consultant, and the Prime Contractor).

In order for new hires to attend sessions, the Prime Contractor, working collaboratively with CFT7, Tsuut’ina Nation (due to proximity to the Project), Treaty 6 Nations and Métis Nation of Alberta Region 3, will schedule quarterly sessions. CFT7, Treaty 6 Nations and Métis Nation of Alberta Region 3 will be provided the opportunities to facilitate or provide the training.

Additionally, the Prime Contractor has prepared material in a PowerPoint presentation format that is included in new hires orientation package and workplace orientation attended by new hires on their first day working on the Project. CFT7, Tsuut'ina Nation, Treaty 6 Nations and Métis Nation of Alberta Region 3 were sent the material for review and to date no feedback has been received.

4.10.3 Palaeontology

As per IAAC approval condition 9.7 and as required by ACSW, palaeontological construction monitoring was completed where required during the 2021/2022 reporting year by a qualified palaeontologist. As per Condition 9.7.1 and 9.7.2 monitoring occurred during bedrock excavation of the emergency spillway and diversion system. During this reporting period, one microvertebrate site has been reported to the RTMP. The RTMP had no questions or concerns, and no additional mitigation was required.

A deep testing program was completed during the reporting period in conjunction with the archaeology pre-impact assessment as required by ACSW and in accordance with IAAC approval condition 9.2.

4.11 LAND USE PLANNING

4.11.1 First Nation Land Use Advisory Committee

Condition 8.8 Progress to date

In late summer-fall of 2021, the process of establishing a First Nations Land Use Advisory Committee (FNLUAC) began. This committee was established to support a collaborative process with First Nations on development of the land use plan to ensure First Nations have priority use within the project development area to support the exercise of Treaty rights and traditional use activities. This direction will be included in the land use plan.

The draft land use planning process is adhering to the *Draft Guiding Principles and Direction for Future Land Use* document that was approved as part of the Springbank Off-Stream Reservoir application process.

A map of the land use planning area was submitted to IAAC on May 20, 2022. The FNLUAC also received the map as part of the Terms of Reference.

The land use planning project staff have noted a requirement for signage and will ensure inclusion in the land use plan.

Condition 8.11 Progress to date

Work to establish the FNLUAC was initiated in the fall of 2021. This included setting up internal processes to support the committee, securing capacity funding to support First Nations' participation in the planning process and work to scope a committee Terms of Reference (TOR) based on approval conditions. This advisory committee is composed of 13 First Nations from Treaty 6 and Treaty 7. First Nations participating in the committee include those engaged by AT during the regulatory phase of the Project and an additional two (2) First Nations (marked with an "*") that Alberta regularly engages with in this region for land planning purposes. The First Nations participating in the committee include:

- Blood Tribe (Kainai First Nation)
- Ermineskin Cree Nation
- Louis Bull Tribe
- Montana First Nation
- O'Chiese First Nation*
- Piikani Nation
- Samson Cree Nation
- Siksika Nation
- Sunchild First Nation*
- Stoney Nakoda Nation (Bearspaw, Chiniki and Goodstoney –formerly known as Wesley Band)
- Tsuut'ina Nation

The FNLUAC held their first meeting in March, followed by meetings in April, May and June 2022. Additional one-on-one conversations were arranged, as needed, between meetings. This allowed for meaningful and respectful discussions in the collaborative development of the TOR, which was submitted to IAAC on May 4, 2022. The TOR includes information specific to the direction relating to IAAC approval conditions 8.11.1to 8.11.6, and the TOR will remain a living document throughout the life of the Project. Ongoing communications with the First Nations consist of Project FNLUAC meetings, emails, one-on-one phone calls and a secure online SharePoint site to share information and feedback on specific topics.

A Joint Land Use Advisory Committee (JLUAC) was also established in April 2022. The establishment of this JLUAC is a condition of the NRCB approval and is composed of Indigenous peoples, stakeholders, municipal governments and local landowners. A collaborative workshop between FNLUAC and the JLUAC was held on May 25, 2022. This collaborative workshop enabled participants to understand land use planning components, guiding principles and approval conditions. The workshop also provided an opportunity for participants to share experiences and perspectives. FNLUAC members have also been invited to attend all JLUAC meetings.

Additional First Nations and Métis organizations identified by IAAC and involved in engagement activities with AT during the regulatory phase (Foothills Ojibway First Nation, Ktunaxa Nation Council, Métis Nation of Alberta Region 3, Métis Nation of British Columbia) are included in the JLUAC to ensure their perspectives and recommendations are included in the development of the land use plan.

Condition 8.14

A *Preliminary Approach for Monitoring and Evaluation of the Land Use Plan* was submitted to IAAC on May 26, 2022 to provide early direction on a monitoring and evaluation strategy to meet Condition 8.14.2 - 8.14.4. The monitoring and evaluation strategy will be fully developed and incorporated into the final Land Use Plan to ensure that the exercise of Treaty rights and traditional uses have been adequately addressed.

5.0 REFERENCES

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ESRD (Alberta Environment and Sustainable Resource Development). 2013. Sensitive Species Inventory Guidelines. Available at: https://open.alberta.ca/dataset/93d8a251-4a9a-428f-ad99- 7484c6ebabe0/resource/f4024e81-b835-4a50-8fb1-5b31d9726b84/download/2013- sensitivespeciesinventoryguidelines-apr18.pdf. Accessed March 2022.

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Health Canada. 2022. Guidelines for Canadian Drinking Water Quality—Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Katopodis, C., and R. Gervais. 2016. Fish swimming performance database and analyses. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/002. Vi + 550 p.

APPENDIX A
IAAC APPROVAL CONDITIONS CONCORDANCE TABLE

	Condition #	Summary of Condition	Annual Report Section
Definitions and General Conditions	**1.1 to 1.37**	Definitions	Condition is acknowledged
	2.1 to 2.3	General conditions	Condition is acknowledged
Consultation	**2.4**	2.4 The Proponent shall, where consultation is a requirement of a condition set out in this Decision Statement: 2.4.1 provide a written notice of the opportunity for the party or parties being consulted to present their views and information on the subject of the consultation; 2.4.2 provide all information available and relevant to the scope and the subject matter of the consultation and a period of time agreed upon with the party or parties being consulted, not to be less than 30 days for consultation pertaining to Current use of lands and resources for traditional purposes, Physical and cultural heritage and structures, sites or things of historical, archaeological, paleontological or architectural significance, and Species at risk, and not less than 15 days for other consultation activities, to prepare their views and information; 2.4.3 undertake an impartial consideration of all views and information presented by the party or parties being consulted on the subject matter of the consultation; and 2.4.4 advise in a timely manner the party or parties being consulted on how the views and information received have been considered by the Proponent, including a rationale for why the views have, or have not, been integrated.	3.1
	2.5	The Proponent shall, where consultation with Indigenous groups is a requirement of a condition set out in this Decision Statement, communicate with each group with respect to the manner to satisfy the consultation requirements referred to in condition 2.4, including methods of notification, the type of information and the period of time to be provided when seeking input, the process to be used by the Proponent to undertake impartial consideration of all views and information presented on the subject of the consultation, and the period of time and the means to advise groups of how their views and information were considered by the Proponent.	3.1
Follow-up requirements	**2.6**	The Proponent shall, where a follow-up program is a requirement of a condition set out in this Decision Statement, determine, as part of the development of each follow-up program and in consultation with the party or parties being consulted during the development, the following information: 2.6.1 the methodology, location, frequency, timing and duration of monitoring associated with the follow-up program; 2.6.2 the scope, content and frequency of reporting of the results of the follow-up program; 2.6.3 the frequency at which the follow-up program must be updated; 2.6.4 the levels of environmental change relative to baseline that would require the Proponent to implement modified or additional mitigation measure(s), including instances where the Proponent may require Designated Project activities to be stopped; and 2.6.5 the technically and economically feasible mitigation measures to be implemented by the Proponent if monitoring conducted as part of the follow-up program shows that the levels of environmental change referred to in condition 2.6.4 have been reached or exceeded.	Condition is acknowledged
	2.7	The Proponent shall update the information determined for each follow-up program pursuant to condition 2.6 during the implementation of each follow-up program, at the minimum frequency determined pursuant to condition 2.6.3 and in consultation with the party or parties being consulted during the development of each follow-up program.	Condition is acknowledged
	2.8	The Proponent shall provide the follow-up programs referred to in conditions 3.17, 3.18, 3.19, 3.20, 4.11, 6.4, 7.8, 7.9, 7.10, 8.13, 8.14 and 9.9 to the Agency and to the party or parties being consulted during the development of each follow-up program prior to the implementation of each follow-up program. The Proponent shall also provide any update made pursuant to condition 2.7 to the Agency and to the party or parties being consulted during the development of each follow-up program within 30 days of the follow-up program being updated.	3; Table 3.1
	2.9	The Proponent shall, where a follow-up program is a requirement of a condition set out in this Decision Statement: 2.9.1 implement the follow-up program according to the information determined pursuant to condition 2.6; 2.9.2 conduct monitoring and analysis to verify the accuracy of the environmental assessment as it pertains to the particular condition and/or to determine the effectiveness of any mitigation measure; 2.9.3 determine whether modified or additional mitigation measure(s) are required based on the monitoring and analysis undertaken pursuant to condition 2.9.2; and 2.9.4 if modified or additional mitigation measures are required pursuant to condition 2.9.3, develop and implement these mitigation measure(s) in a timely manner and monitor them pursuant to condition 2.9.2.	Condition is acknowledged

	Condition #	Summary of Condition	Annual Report Section
Annual reporting	**2.10**	Where consultation with Indigenous groups is a requirement of a follow-up program, the Proponent shall discuss the follow-up program with each group and shall determine, in consultation with each group, opportunities for their participation in the implementation of the follow-up program, including the conduct of monitoring, the analysis and reporting of follow-up results and whether modified or additional mitigation measure(s) are required, as set out in condition 2.9	Condition is acknowledged
	2.11	The Proponent shall prepare an annual report that sets out, for that reporting year (see sub-sections 2.11.1 - 2.11.8)	2.1, 3, 3.1
	2.12	The first reporting year for which the Proponent shall prepare an annual report pursuant to condition 2.11 shall start on the day the Minister of the Environment issues the Decision Statement to the Proponent pursuant to subsection 54 (1) of the *Canadian Environmental Assessment Act, 2012*.	Condition is acknowledged
	2.13	The Proponent shall submit to the Agency and the First Nation Land Use Committee referred to in condition 8.11 the annual report referred to in condition 2.11, including a plain language executive summary in both official languages, no later than October 31 following the reporting year to which the annual report applies.	See Executive summary
Information Sharing	**2.14**	The Proponent shall keep these documents publicly available for 15 years following their publication	Condition is acknowledged
	2.15	When the development of any plan is a requirement of a condition set out in this Decision Statement, the Proponent shall submit the plan to the Agency prior to construction, unless otherwise required through the condition.	3; 3.1
Change in Proponent	**2.16**	The Proponent shall notify the Agency and Indigenous groups in writing no later than 30 days after the day on which there is any transfer of ownership, care, control of Management of the Designated Project in whole or in part	Condition is acknowledged
Change to the Designated Project	**2.17**	If the Proponent is proposing to carry out the Designated Project in a manner other than described in condition 1.5, the Proponent shall notify the Agency in writing in advance. As part of the notification, the Proponent shall provide: 2.17.1 a description of the proposed change(s) to the Designated Project and the environmental effects that may result from the change(s); 2.17.2 any modified or additional measure to mitigate any environmental effect that may result from the change(s) and any modified or additional follow-up requirement; and 2.17.3 an explanation of how, taking into account any modified or additional mitigation measure referred to condition 2.18.2, the environmental effects that may result from the change(s) may differ from the environmental effects of the Designated Project identified during the environmental assessment.	Condition is acknowledged
	2.18	The Proponent shall submit to the Agency any additional information required by the Agency about the proposed change(s) referred to in condition 2.18, which may include the results of consultation with Indigenous groups and relevant authorities on the proposed change(s) and environmental effects referred to in condition 2.18.1 and the modified or additional mitigation measures and follow-up requirements referred to in condition 2.18.2	Condition is acknowledged
Fish and fish habitat	**3.1**	The Proponent shall develop, prior to construction, and implement and maintain during all phases of the Designated Project, measures to control erosion and sedimentation within the project development area in a manner consistent with the *Fisheries Act* and its regulations.	4.1.2, 4.2, 4.3.1
	3.2	The Proponent shall inspect all erosion and sediment control measures installed within the project development area pursuant to condition 3.1 including during flood operation and post flood operation, except when not feasible for safety reasons, and document and repair any defective or damaged control measure as soon as technically feasible such that any impacts to fish and fish habitat resulting from the defective or damaged control measures are minimized or avoided.	Not applicable during the 2021/2022 reporting year
	3.3	The Proponent shall isolate in-water construction activities and shall use temporary access structures for any in-stream construction activity.	Not applicable during the 2021/2022 reporting year
	3.4	The Proponent shall maintain machinery and construction equipment in working order and inspect all machinery and construction equipment for the presence of drips and leaks daily. If the presence of drips or leaks is found on any machinery or equipment, the Proponent shall remove the equipment or machinery from service immediately and not return it to service until the repairs have been completed by a certified mechanic.	4.1
	3.5	The Proponent shall inspect all vehicles machinery and construction equipment before it enters the project development area for the presence of invasive alien species and noxious weeds, taking into account Alberta's Decontamination protocol for work in or near water: quick reference guide. The Proponent shall remove all invasive alien species or noxious weeds found on any machinery or equipment before it enters the project development area.	4.1, 4.7.1.1
	3.6	The Proponent shall not deposit any debris in watercourses that may cause adverse environmental effects on fish and fish habitat during all phases of the Designated Project and shall remove, after each flood, debris accumulated at the debris deflector identified in Figure 5 of the environmental assessment report.	4.2; 4.3.1
	3.7	The Proponent shall implement measures to allow sediment to settle before releasing dewatering discharge from construction and post-flood maintenance activities into a water body.	4.2, 4.3.1
	3.8	The Proponent shall remove, during construction, the topsoil from the diversion channel and store it for later use in the restoration of the diversion channel prior to operation.	4.1.2.1.1

	Condition #	Summary of Condition	Annual Report Section
Fish and fish habitat (cont'd)	**3.9**	The Proponent shall finalise, prior to construction, in consultation with Indigenous groups and to the satisfaction of Fisheries and Oceans, an offsetting plan related to the bull trout (*Salvenlinus confluentus*) and the fish population of the Elbow River. When finalising the plan, the Proponent shall include the adaptive offset measures approach proposed in its Conceptual Offset Measures Plan (Canadian Impact Assessment Registry Reference Number 80123, Document Number 1366). The Proponent shall implement the plan. The Proponent shall submit any approved offsetting plan(s) to the Agency prior to implementation.	4.8.4.4
	3.10	The Proponent shall, for any fish habitat offsetting measure(s) proposed in any offsetting plan(s) referred to in condition 3.9 that may cause adverse environmental effects not considered in the environmental assessment, develop and implement measures to mitigate those effects. The Proponent shall submit these measures to the Agency before implementing them.	4.8.4.4
	3.11	See specific conditions on physical activities the Proponent shall do during and install construction specific to working in water (i.e. debris removal, maintain fish passage, rock v-weir, temporary water intake system, graded drainage)	Not applicable during the 2021/2022 reporting year
	3.12	The Proponent shall maintain fish passage in the Elbow River during all phases of the Designated Project. In doing so, the Proponent shall maintain flows downstream of the bypass channel.	Not applicable during the 2021/2022 reporting year; baseline data collected (B.2)
	3.13	The Proponent shall install, prior to operation and in consultation with Transport Canada and Fisheries and Oceans Canada, rock v-weirs between the service spillway and low-level outlet to mitigate the effects of the Designated Project on fish passage in the Elbow River stream.	Not applicable during the 2021/2022 reporting year
	3.14	The Proponent shall design, install and operate the temporary water intake system used during construction in fish-bearing waterbodies in a manner which mitigates the incidental capture of fish by entrainment and impingement of fish through the use of an appropriately sized fish screen, taking into account Fisheries and Oceans Canada's Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater and in a manner consistent with the Fisheries Act and its regulations.	4.3.2; 4.8.1.2
	3.15	The Proponent shall construct and maintain graded drainage areas within the reservoir during post-flood operation to prevent stranding of fish during release of stored floodwater from the reservoir. In doing so, the Proponent shall re-grade areas of the reservoir during post-flood operation as necessary.	Not applicable during the 2021/2022 reporting year
	3.16	The Proponent shall develop and implement, prior to operation, a protocol to rescue juvenile and adult fish during post-flood operation. See 3.16.1 to 3.16.4 for conditions specific to the protocol.	Not applicable during the 2021/2022 reporting year
	3.17	The Proponent shall develop and implement a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to fish passage in the Elbow River. See 3.17.1 to 3.17.3 for conditions to be included in the program.	Table 3.1; 4.8.4.2
	3.18	The Proponent shall develop and implement a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to fish rescue. See 3.18.1 to 3.18.2 for conditions to be included in the program.	Not applicable during the 2021/2022 reporting year
	3.19	The Proponent shall develop and implement a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to water quality. See sub-sections 3.19.1 to 3.19.6 for conditions to be included in the program.	Condition 3.19.1 - 4.8.1; remaining sub-conditions are not applicable during the 2021/2022 reporting year
	3.20	The Proponent shall develop and implement a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to channel morphology. As part of the follow-up program, the Proponent shall monitor channel morphology of the Elbow River and outlet channel during post-flood operation.	Not applicable during the 2021/2022 reporting year
Migratory Birds	**4.1**	The Proponent shall carry out the Designated Project in a manner that protects migratory birds and avoids harming, killing or disturbing migratory birds or destroying, disturbing or taking their nests or eggs. In this regard, the Proponent shall take into account Environment and Climate Change Canada's *Guidelines to reduce risk to migratory birds*. The Proponent's actions when carrying out the Designated Project shall be in compliance with the *Migratory Birds Convention Act, 1994, the Migratory Birds Regulations and with the Species at Risk Act.*	Table 3.1; 4.1.1.1; 4.7.2.1
	4.2	The Proponent shall give preference to the use of existing access roads and disturbed areas for temporary workspaces and transportation activities over building new access roads and temporary workspace in undisturbed areas, and shall revegetate any area where native vegetation was removed for temporary workspace.	Condition is acknowledged
	4.3	The Proponent shall control the lighting required for Designated Project activities throughout all phases of the Designated Project, including its direction, duration of use, intensity, spectrum colour and brightness, to mitigate the adverse effects of the Designated Project on migratory birds and species at risk caused by sensory disturbances due to light, while complying with operational health and safety requirements.	Condition is acknowledged
	4.4	The Proponent shall identify, in consultation with Indigenous groups and relevant authorities, dates of breeding season for migratory birds and notify the Agency of these dates prior to construction.	Condition is acknowledged; 3.1 - captured in the WMMP

	Condition #	Summary of Condition	Annual Report Section
Migratory Birds (cont'd)	**4.5**	The Proponent shall develop, prior to construction, in consultation with Environment and Climate Change Canada and taking into account Environment and Climate Change Canada's Description of Residence for bank swallow (Riparia riparia) in Canada, measures to mitigate the adverse environmental effects on bank swallow (Riparia riparia) attributed to the Designated Project. The Proponent shall establish a schedule for the implementation of the measures and shall, as part of these measures: 4.5.1 maintain foraging habitat within 500 metres of bank swallow residences. If it is not technically feasible for the Proponent to maintain a distance of 500 metres, the Proponent shall provide a rationale to relevant authorities and develop and implement additional mitigation measures, in consultation with relevant authorities, to avoid effects on bank swallow. The Proponent shall submit these measures to the Agency prior to implementing them; 4.5.2 install, prior to construction, and in consultation with Environment and Climate Change Canada, artificial nesting structures in suitable habitat to compensate for the loss of nesting sites within the project development area and identified in Appendix H, Figure 3- 1, of the Environmental Impact Statement. The Proponent shall perform maintenance on the nesting structures annually and maintain their accessibility and integrity during all phases of the Designated Project and shall ensure the presence of foraging habitat within 500 metres of the artificial nesting structures. If it is not technically feasible for the Proponent to ensure the presence of foraging habitat within a distance of 500 metres, the Proponent shall provide a rationale to relevant authorities and develop and implement additional mitigation measures, in consultation with relevant authorities, to avoid effects on bank swallow. The Proponent shall submit these measures to the Agency prior to implementing them; 4.5.3 maintain the slope of topsoil, soil and sediment stockpiles located within the project development area and not used as artificial nesting structures in accordance with condition 4.5.2 at less than 70 degrees; and 4.5.4 demonstrate how any other offsetting measures implemented by the Proponent will compensate for the adverse environmental effects on bank swallow (Riparia riparia) attributed to the Designated Project in the project development area.	Table 3.1; 4.7.2.4; Appendix B.1
	4.6	The Proponent shall conduct vegetation removal, and any other activity that could potentially disturb migratory birds, within the project development area outside of the breeding season(s) for migratory birds identified in condition 4.4. If vegetation removal or the conduct of other disturbance activity outside of the breeding season(s) is not technically feasible during any given year, the Proponent shall develop and implement additional mitigation measures, in consultation with relevant authorities, to avoid harm to migratory birds and their nests or eggs. The Proponent shall submit these measures to the Agency prior to implementing them.	4.1.1.1; 4.7.1.2; 4.7.2.2
	4.7	The Proponent shall remove debris in the off-stream reservoir within seven days after the draining of the reservoir. If it is not technically feasible for the Proponent to remove debris within seven days after the draining of the reservoir, the Proponent shall provide a rational to Indigenous groups and relevant authorities and develop and implement additional mitigation measures, in consultation with relevant authorities, to avoid harm to migratory birds and their nests or eggs. The Proponent shall submit these measures to the Agency prior to implementing them.	Not applicable during the 2021/2022 reporting year
	4.8	For any active migratory bird nests identified during construction or operation, the Proponent shall establish and implement, in consultation with relevant authorities, mitigation measures to avoid destroying, disturbing or taking the nest(s), including by implementing a disturbance setback buffer during construction and dry operation and by following the approach outlined in the Response to Information Request Round 2 Package 4 -01 to -04, IR4-03 (Canadian Impact Assessment Registry Reference Number 80123, Document Number 1311) during flood operation.	4.7.2.1; 4.7.2.2
	4.9	The Proponent shall develop and implement, in consultation with Indigenous groups and relevant authorities, a protocol to prevent harm to migratory birds, including migratory birds species at risk identified in Table 3 of the environmental assessment report, within the project development area. The Proponent shall develop the protocol prior to construction and implement it prior to flood operation. The protocol shall include: 4.9.1 flood forecasting undertaken prior to inventories conducted in accordance with condition 4.10; and 4.9.2 measures to rescue migratory birds chicks and eggs.	Not applicable during the 2021/2022 reporting year; protocol captured in the WMMP
	4.10*	The Proponent shall conduct, in consultation with Indigenous groups, inventories of potential migratory bird habitat, including the collection of information on breeding bird densities and the presence of ground nesting birds, as well as mapping of important habitat features, shrub lands, wetlands and grassland within the project development area every five years starting the first year of operation, and update the migratory bird protocol referred to in condition 4.9 based on the results of the inventories.	Table 3.1; 4.1.1.1; Table 4.1; 4.7.2.4; Table 4.3

	Condition #	Summary of Condition	Annual Report Section
Migratory Birds (cont'd)	**4.11**	The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and to determine the effectiveness of all mitigation measures to avoid harm to migratory birds, including migratory birds that are listed species at risk, their eggs and nests. The follow-up program shall include the mitigation measures used to comply with conditions 4.1 to 4.10. As part of the development of the follow-up program, the Proponent shall identify performance indicators that shall be used by the Proponent to evaluate the effectiveness of mitigation measures. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the follow-up program, the Proponent shall: 4.11.1 monitor, annually during construction, for the first three years of operation and every five years thereafter, bank swallow use of the project development area.	3; 4.1.1.1; 4.7.2.4
Species at Risk	**5.1**	The Proponent shall conduct pre-construction surveys to determine the presence of little brown myotis (*myotis lucifugus*) roosting sites in the project development area. The Proponent shall establish, in consultation with Indigenous groups and relevant authorities, buffer zones around little brown myotis (*myotis lucifugus*) active roosts identified during the pre-construction surveys or found by the Proponent or brought to the attention of the Proponent by an Indigenous group during any phase of the project. The Proponent shall maintain the buffer zones until it is determined the roosts are no longer active.	4.7.2.1; 4.7.2.2
	5.2	The Proponent shall conduct breeding habitat surveys for the northern leopard frog (*Lithobates pipiens*), western toad (*Anaxyrus boreas*), and western tiger salamander (*Ambystoma mavoritium*) within the project development area.	4.7.2.1; 4.7.2.2; Appendix B.1
	5.3	For any construction activity within 100 metres of breeding habitat identified under condition 5.2 for the northern leopard frog (*Lithobates pipiens*), western toad (*Anaxyrus boreas*), or western tiger salamander (*Ambystoma mavoritium*) during the breeding season, the Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, measures to prevent northern leopard frog (*Lithobates pipiens*), western toad (*Anaxyrus boreas*), and western tiger salamander (*Ambystoma mavoritium*) from accessing the active construction areas. See 5.3.1 and 5.3.2 for measures.	4.7.2.1; 4.7.2.2
	5.4	If the results of the monitoring conducted in accordance with condition 5.3.2 identify the presence of northern leopard frog (Lithobates pipiens), western toad (Anaxyrus boreas), or western tiger salamander (Ambystoma mavoritium) in active construction areas within 100 metres of their breeding habitat, the Proponent shall implement additional species-specific mitigation measures in consultation with Indigenous groups and relevant authorities.	4.7.2.1; 4.7.2.2
	5.5	The Proponent shall develop and implement, in consultation with Indigenous groups and relevant authorities, a protocol to prevent the mortality of amphibians, including northern leopard frog (*Lithobates pipiens*), western toad (*Anaxyrus boreas*), and western tiger salamander (*Ambystoma mavoritium*) during flood operation within the reservoir footprint. The Proponent shall develop the protocol prior to construction, taking into account the flood forecasting undertaken in accordance with condition 4.9.1. The protocol shall include measures to rescue and relocate northern leopard frog (*Lithobates pipiens*), western toad (*Anaxyrus boreas*), and western tiger salamander (*Ambystoma mavoritium*) to suitable habitat outside the reservoir footprint.	Not applicable during the 2021/2022 reporting year; protocol captured in the WMMP
	5.6	The Proponent shall implement the Designated Project in a manner that avoids adverse environmental effects of the Designated Project on wetlands and wetland functions. To avoid adverse effects, the Proponent shall maintain wetlands and their functions over minimizing adverse effects on wetlands and their functions. When the loss of wetlands and their functions cannot be avoided, the Proponent shall mitigate the adverse effects on wetlands and their functions instead of compensating for affected wetlands and their functions.	4.7.1.3
	5.7	In the case of the adverse environmental effects of the Designated Project on wetlands and their functions located in the project development area that cannot be avoided or mitigated pursuant to condition 5.6, the Proponent shall develop, in consultation with Indigenous groups, Environment and Climate Change Canada and other relevant authorities, and taking into account the Alberta Wetland Policy, a wetland replacement plan to compensate for the loss of wetlands and their functions.	4.7.1.3
	5.8	The Proponent shall direct during construction any drainage pathway, constructed or modified as part of the Designated Project, away from wetlands and shall identify prior to construction wetlands where drainage pathway should not be directed during operation. The Proponent shall provide a map of the wetlands to be avoided to the Agency prior to construction.	4.3.1; 4.7.1.3
	5.9	The Proponent shall submit to the Agency, prior to construction, a map of all wetlands that will be permanently removed for the construction of the Designated Project and shall not grub vegetation when undertaking construction work in wetlands except for those wetlands that will be permanently removed.	4.7.1.3
	5.10	The Proponent shall maintain a distance of 100 metres from any water body and wetland when undertaking vehicle, machinery, and equipment cleaning, fueling, and maintenance, when storing substances with the potential to cause harmful effects to the receiving environment, including fuel and lubricant storage tanks, and when undertaking maintenance activities in the off-stream reservoir. If it is not technically feasible for the Proponent to maintain a distance of 100 metres, the Proponent shall provide a rationale to relevant authorities and develop and implement additional mitigation measures, in consultation with relevant authorities, to avoid effects on species at risk. Additional mitigation measures shall include the use of secondary containment. The Proponent shall submit these measures to the Agency prior to implementing them.	4.1.2.2; 4.7.1.3

	Condition #	Summary of Condition	Annual Report Section
Atmospheric Environment	**6.1**	See specific condition regarding vehicles and emission standards	4.9.1.1
	6.2	The Proponent shall develop, prior to construction, and implement, during construction, a no-idling policy for all vehicles within the project development area. The Proponent shall require that all persons abide by this policy, unless not technically feasible or not feasible for health or safety reasons. The Proponent shall submit the policy to the Agency prior to construction.	4.9.1.1
	6.3	The Proponent shall develop, prior to construction and in consultation with relevant authorities, and implement during all phases of the Designated Project, measures to maintain baseline air quality and prevent exceedance of the Canadian Council of Ministers of the Environment' Canadian Ambient Air Quality Standards.	4.9.1.1
	6.4	The Proponent shall develop, prior to construction, and implement during all phases of the Designated Project, a follow-up program to verify the accuracy of the environmental assessment and determine the effectiveness of mitigation measures as it pertains to adverse changes to air quality attributed to the Designated Project. See 6.4.1 to 6.4.6 for conditions to include in the program.	4.9.1.1
	6.5	The Proponent shall provide Indigenous groups with the results of the follow-up program referred to in condition 6.4 in plain language at a minimum twice annually, at a time determined in consultation with Indigenous groups.	4.9.1.1
Human Health	**7.1**	The Proponent shall not exceed the noise limits set out in the U.S. Environmental Protection Agency Office of Noise Abatement and Control document titled Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety for short-term noise exposure during construction.	4.9.2.1
	7.2	For any blasting activities required for the Designated Project, the Proponent shall take into account Environment and Climate Change Canada's Environment Code of Practice for Metal Mines for the control of noise and vibration from blasting and thresholds and mitigation measures for blasting noise identified in Health Canada's Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise.	4.9.2.1
	7.3	The Proponent shall develop, prior to construction and in consultation with Indigenous groups, a protocol for receiving complaints related to exposure to noise attributable to the Designated Project. The Proponent shall provide the protocol to the Agency prior to construction and shall implement it during construction. As part of the implementation of the protocol, the Proponent shall respond to any noise complaint attributed to any component of the Designated Project within 48 hours of the complaint being received and shall implement any corrective action, if required to reduce exposure to noise, in a timely manner.	Condition is acknowledged; 3.1
	7.4	The Proponent shall develop a communication plan in consultation with Indigenous groups. The Proponent shall develop the communication plan prior to construction and shall implement and keep it up to date during all phases of the Designated Project. See 7.4.1 - 7.4.3 for conditions to include in the plan.	3.1
	7.5	The Proponent shall implement, during all phases of the Project, measures to mitigate fugitive dust emissions attributable to the Designated Project. As part of the measures, the Proponent shall: 7.5.1 establish speed limits on Designated Project roads during all phases of the Designated Project and require that all persons abide by these speed limits; and 7.5.2 apply dust suppressant on the Designated Project permanent access roads and parking areas during all phases of the Designated Project. The Proponent shall select, in consultation with relevant authorities, dust suppressants with the least potential effects on human health and the environment.	4.9.1.1
	7.6	The Proponent shall decommission and plug off water wells located within the project development area that are not used to monitor groundwater quality pursuant to condition 7.9.1, prior to the start of operation.	4.8.2
	7.7	The Proponent shall monitor, at a minimum twice prior to construction and weekly during flood operation, total mercury and methylmercury levels in the Elbow River upstream of the diversion system, in the off-stream reservoir, and in the low-level outlet downstream of the off-stream reservoir outlet gate, unless not feasible for safety reasons.	4.8.1
	7.8	The Proponent shall develop, in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to contamination of country food. See 7.8.1 to 7.8.4 for conditions to be included in the program.	4.8.1
	7.9	The Proponent shall develop prior to operation, and implement, in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to drinking water quality. See 7.9.1 to 7.9.3 for conditions that need to be included in the plan.	4.8.2; Appendix B.3
	7.10	The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and to determine the effectiveness of all measures to mitigate fugitive dust emissions attributable to the Designated Project.	4.9.1.1

	Condition #	Summary of Condition	Annual Report Section
Human Health (cont'd)	**7.11**	The Proponent shall provide Indigenous groups with the results of the follow-up program referred to in condition 7.10 in plain language at a minimum twice annually, at a time determined in consultation with Indigenous groups.	4.9.1.1
Current use of lands and resources for traditional purposes	**8.1**	The Proponent shall undertake, in consultation with Indigenous groups and relevant authorities, progressive reclamation of areas disturbed by the Designated Project, including bank and riparian areas. In doing so, the Proponent shall: 8.1.1 identify agronomic plant species and plant species native to the regional assessment area to use for revegetation, including plant species suitable as habitat for migratory birds and native seed mix suitable for wetlands; 8.1.2 revegetate the portions of the diversion channel excavated through soil and the earthen dam embankment free of rip rap; 8.1.3 reclaim non-native plant areas to equivalent baseline land functions after construction and during post flood operation; and 8.1.4 reclaim the surface drainage patterns of the area after construction.	4.7.1.2
	8.2	The Proponent shall manage noxious weeds and invasive alien species as necessary to promote successful revegetation that includes traditional plant establishment and growth. In doing so, the Proponent shall not use herbicide within 30 metres of wetlands and waterbodies in the project development area.	4.7.1.1
	8.3	The Proponent shall conduct pre-construction surveys to determine the presence of grizzly bear (Ursus arctos) western population active dens in the project development area. The Proponent shall establish, in consultation with Indigenous groups and relevant authorities, no-work buffer zones around grizzly bear (*Ursus arctos*) western population active dens identified during the pre- construction surveys or found by the Proponent or brought to the attention of the Proponent by an Indigenous group during any phase of the Designated Project. The Proponent shall maintain the buffer zones from their establishment and until the active den is no longer occupied.	4.1.1; Appendix B.1
	8.4	The Proponent shall follow the timing restrictions on industrial activities identified in the Alberta's Recommended Land Use Guidelines: Key Wildlife and Biodiversity Zones when undertaking construction and maintenance activities in the Key Wildlife and Biodiversity Zone identified along the Elbow River. 8.4.1 If it is not economically or technically feasible for the Proponent to follow the timing restrictions on industrial activities identified in the Alberta's *Recommended Land Use Guidelines: Key Wildlife and Biodiversity Zones*, develop and implement additional mitigation measures, in consultation with Environment and Climate change Canada and other relevant authorities. The Proponent shall submit these measures to the Agency prior to implementing them.	4.1.1; Appendix B.1
	8.5	The Proponent shall install and maintain, during construction and operation, one underpass under Highway 22 where it crosses the diversion channel and wildlife friendly fences to provide passage for grizzly bear western population (*Ursus arctos*) and ungulates. The Proponent shall install the wildlife friendly fences as identified in Figure IR 15-1 submitted in the Response to Information Requests Round 1 Package 2 (Canadian Impact Assessment Registry Reference Number 80123, Document Number 1260), taking into account Alberta Conservation Association *Landholder's Guide to Wildlife Friendly Fencing*, to prevent access by livestock and allow safe passage for wildlife. The Proponent shall maintain the fences during all phases of the Designated Project.	Condition is acknowledged
	8.6	The Proponent shall maintain navigation on the Elbow River during all phases of the Designated Project. The Proponent shall establish and maintain a portage route around the diversion system gate and the service spillway locations to maintain navigation on the Elbow River during construction of these project components and install safety signage to signal the presence of the diversion system gate and location of the portage route until such time that the portage route is no longer required to maintain navigation on the Elbow River.	Not applicable during the 2021/2022 reporting year
	8.7	The Proponent shall provide the Agency and Indigenous groups with the final project design within seven days of its finalization and shall consult with Indigenous groups at least 60 days in advance of construction activities to understand locations and timing needed to allow Indigenous groups to catalogue, harvest and transplant traditional and medicinal plants present within the project development area, in a culturally appropriate way.	4.6
	8.8	The Proponent shall start developing, prior to construction and complete at the latest 1 year prior to start of operation, in consultation with Indigenous groups, a Land Use Plan to support Indigenous groups' use of the project development area, and implement the plan during all phases of the Designated Project. The Proponent shall submit the final plan to the First Nation Land Use Advisory Committee referred to in condition 8.11, First Nations and the Agency within seven days of its finalization. See sub-section 8.8.1 to 8.8.4 for conditions to be captured in the plan.	4.11
	8.9	The Proponent shall establish, in consultation with First Nations, a staging area for traditional use activities in close proximity to the land use areas identified in condition 8.8. The Proponent shall allow and provide sufficient space within the staging area for the construction of semi-permanent structures. The Proponent shall provide maps to the Agency and First Nations of the staging area prior to construction.	4.11
	8.10	The Proponent shall provide unimpeded access for First Nations to the staging area identified in condition 8.9, except during the flood operation, when access to the staging area may be prohibited for safety reasons and if not possible for maintenance purposes. The Proponent shall communicate to First Nations the closure of the staging area when required for safety reasons and during flood season	4.11

	Condition #	Summary of Condition	Annual Report Section
Current use of lands and resources for traditional purposes (cont'd)	**8.11**	The Proponent shall establish, prior to construction and in consultation with First Nations, and maintain, throughout construction and operation, a First Nation Land Use Advisory Committee (the committee) to support the development and implementation of the plan identified in condition 8.8. When establishing the committee, the Proponent shall consult with each First Nation with respect to whether they wish to participate as members of the committee and shall prioritize the selection of representatives from First Nations who wish to participate as members in the committee. As part of the establishment of the committee, the Proponent shall co-develop Terms of Reference for the committee with First Nations and update the Terms of Reference every 10 years. The Proponent shall provide the completed Terms of Reference to the Agency prior to construction and any update within 30 days of the Terms of Reference being updated. See sub-sections 8.11.1 - 8.1.11-7 for Terms of Reference conditions.	4.11
	8.12	The Proponent shall include any Indigenous groups for which Aboriginal or Treaty Rights under section 35 of *The Constitution Act, 1982* are recognized by the Government of Alberta after the issuance of this Decision Statement in the Land Use Plan, the staging area and the First Nations Land Use Advisory Committee referred to in conditions 8.9, 8.10 and 8.11.	4.11
	8.13	The Proponent shall develop, prior to operation, and in consultation with Indigenous groups, a follow-up program to verify the accuracy of the environmental assessment as it pertains to natural re-vegetation of the drained reservoir during post-flood operation. See sub-sections 8.13.1 and 8.13.2 for items to include in the follow up program.	Condition is acknowledged
	8.14	The Proponent shall develop, prior to construction and in consultation with Indigenous groups, a follow-up program to verify the accuracy of the environmental assessment and to determine the effectiveness of mitigation measures as it pertains to the adverse environmental effects of the Designated Project on the current use of lands and resources for traditional purposes. See sub-sections 8.14.1 - 8.14.5 for monitoring conditions.	Not applicable during the 2021/2022 reporting year
Physical and cultural heritage and structures, sites or things of historical, archaeological, paleontological or architectural significance	**9.1**	The Proponent shall retain, prior to construction, the services of Indigenous monitors to observe, record, and report to the Proponent and Indigenous groups on the implementation, throughout construction, of requirements set out in this Decision Statement including the archeological and heritage management plan referred to in condition 9.3. Prior to retaining the services of Indigenous monitors, the Proponent shall consult with each Indigenous group with respect to whether they wish to participate as Indigenous monitor. When retaining the services of Indigenous monitors from each Indigenous group who wishes to participate, the Proponent shall determine, in consultation with these Indigenous groups, the scope, purpose and objectives of the participation of each Indigenous monitor and shall provide that information to the Agency	4.5.1
	9.2	The Proponent shall develop and implement, prior to construction and in consultation with Indigenous groups and Alberta Ministry of Culture, Multiculturalism and Status of Women, a historic resource impact assessment of the project development area. The Proponent shall apply the archaeological and heritage management plan pursuant to condition 9.3 to structures, sites, or things of historical, archaeological, paleontological, or architectural significance or physical or cultural heritage resources identified as part of the historic resource impact assessment.	3, 3.1
	9.3	The Proponent shall develop, prior to construction and in consultation with Indigenous groups, Alberta Ministry of Culture, Multiculturalism and Status of Women, and implement, during construction and operation, an archaeological and heritage management plan for any structures, sites, or things of historical, archaeological, paleontological, or architectural significance or physical or cultural heritage resources within the project development area, including, but not limited to sites and things subject to the *Alberta Historical Act*. See sub-sections 9.3.1 - 9.3.4 for conditions to include in the plan.	4.10.1
	9.4	The Proponent shall develop, prior to construction and in consultation with Indigenous groups, cultural awareness training for all employees associated with the Designated Project. The Proponent shall implement the training prior to the start of construction and during all phases of the Designated Project.	4.10.2
	9.5	The Proponent shall, prior to construction and in consultation with Indigenous groups, provide access to Indigenous groups to the project development area for the purpose of conducting ceremonies, to the extent that such access is safe.	3.1
	9.6	The Proponent shall provide the Agency and Indigenous groups with a map of the final construction site within seven days of its finalization	Condition is acknowledged
	9.7	The Proponent shall have a qualified individual conduct paleontological monitoring during construction when: 9.7.1 excavating bedrock for the diversion system; 9.7.2 excavating 4 metres of bedrock or greater, including for the emergency spillway; 9.7.3 excavating bedrock for new road alignments including on Highway 22; and 9.7.4 pipeline operators are using open cut methods for relocation of pipelines and utilities under the diversion channel.	4.10.3
	9.8	The Proponent shall strip and stockpile topsoil during construction and shall prevent mixing of topsoil with other soil horizons. The Proponent shall replace the topsoil during progressive reclamation pursuant to condition 8.1.	4.1.2.1; 4.7.1.2

	Condition #	Summary of Condition	Annual Report Section
Physical and cultural heritage and structures, sites or things of historical, archaeological, paleontological or architectural significance (cont'd)	**9.9**	The Proponent shall develop, prior to construction and in consultation with Indigenous groups and Alberta Ministry of Culture, Multiculturalism and Status of Women, a follow-up program to verify the accuracy of the environmental assessment and to determine the effectiveness of all mitigation measures for effects to any structures, sites, or things of historical, archaeological, paleontological, or architectural significance or physical or cultural heritage resources. The Proponent shall implement the follow-up program during all phases of the Designated Project and submit the results of the follow-up program to Alberta Ministry of Culture, Multiculturalism and Status of Women.	3.1; 4.10
Independent Environmental Monitor	**10.1**	The Proponent shall retain, prior to construction, the services of a third-party independent environmental monitor, who is a qualified individual as it pertains to environmental monitoring in Alberta, to independently observe and record on the implementation of the conditions set out in this Decision Statement during construction and to report findings to the Proponent and the Agency.	4.5.1
	10.2	The Proponent shall require the independent environmental monitor to report to the Proponent, in writing, about the implementation of any condition set out in this Decision Statement during construction. The Proponent shall also require the independent environmental monitor to recommend to the Proponent, in writing, which action(s) in their view should be taken by the Proponent with respect to the implementation of conditions set out in this Decision Statement during construction	4.5.1
	10.3	The Proponent shall require the independent environmental monitor to provide to the Agency, at a frequency to be determined in consultation with the Agency, the information reported to the Proponent pursuant to condition 10.2 at the same time that the Proponent receives that information.	4.5.1
	10.4	The Proponent shall require the independent environmental monitor to retain the information reported to the Proponent pursuant to condition 10.2 for five years following submission to the Agency pursuant to condition 10.3.	Condition is acknowledged
Accidents and Malfunctions	**11.1**	The Proponent shall take all reasonable measures to prevent accidents and malfunctions that may result in adverse environmental effects and to mitigate any adverse environmental effect from accidents and malfunctions that do occur. See sub-sections 11.1.1 to 11.1.5 for measures.	4.4
	11.2	The Proponent shall consult, prior to construction, Indigenous groups on the measures to be implemented to prevent accidents and malfunctions.	4.4
	11.3	The Proponent shall develop an accident and malfunction response plan in relation to, and for the construction of the Designated Project and an accident and malfunction response plan in relation to, and for the operation of the Designated Project. The Proponent shall develop the accident and malfunction response plan in relation to, and for construction of the Designated Project prior to construction and the accident and malfunction response plan in relation to, and for the operation of the Designated Project prior to the first flood operation. See 11.3.1 to 11.3.6 for conditions that need to captured in the plan.	4.4
	11.4	The Proponent shall maintain the accident and malfunction response plan referred to in condition 11.3 up-to-date during all phases of the Designated Project. The Proponent shall submit any updated accident and malfunction response plan to the Agency and to the parties being consulted during the development of the plan within 30 days of the plan being updated	4.4
	11.5	In the event of an accident or malfunction with the potential to cause adverse environmental effects, the Proponent shall immediately implement the measures appropriate to the accident or malfunction referred to in condition 11.3.2. See sub-sections 11.5.1 - 11.5.4 for measures.	4.4
	11.6	The Proponent shall develop, in consultation with Indigenous groups and potentially affected parties, a communication plan for accidents and malfunctions occurring in relation to the Designated Project, including accidents and malfunctions occurring within the project development area which may affect area(s) outside of the project development area. The Proponent shall develop the communication plan prior to construction and shall implement and keep it up-to-date during all phases of the Designated Project. See sub-section 11.6.1 to 11.6.3 for plan specifics.	3.1, 4.4
Schedules	**12.1**	The Proponent shall submit to the Agency a schedule for all conditions set out in this Decision Statement no later than 60 days prior to the start of construction. This schedule shall detail all activities planned to fulfill each condition set out in this Decision Statement and the commencement and estimated completion month(s) and year(s) for each of these activities.	4.6
	12.2	The Proponent shall submit to the Agency a schedule outlining all activities required to carry out all phases of the Designated Project no later than 60 days prior to the start of construction. The schedule shall indicate the commencement and estimated completion month(s) and year(s) and duration of each of these activities.	4.6

	Condition #	Summary of Condition	Annual Report Section
Schedules (cont'd)	**12.3**	The Proponent shall submit to the Agency in writing an update to schedules referred to in conditions 12.1 and 12.2 every year no later than October 31.	Condition is acknowledged
	12.4	The Proponent shall provide Indigenous groups with the schedules referred to in conditions 12.1 and 12.2, and any update to the initial schedule made pursuant to condition 12.3 at the same time the Proponent provides these documents to the Agency.	Condition is acknowledged
Records	**13.1**	The Proponent shall maintain all records relevant to the implementation of the conditions set out in this Decision Statement. The Proponent shall provide the aforementioned records to the Agency upon demand within a timeframe specified by the Agency.	Condition is acknowledged
	13.2	The Proponent shall retain all records referred to in condition 13.1 at a facility in Canada and shall provide the address of the facility to the Agency. The Proponent shall notify the Agency at least 30 days prior to any change to the physical location of the facility where the records are retained, and shall provide to the Agency the address of the new location.	Condition is acknowledged

APPENDIX B
TECHNICAL MEMOS

B.1

Summary of 2021 Pre-Construction Wildlife Surveys and 2021/2022 Remote Camera and Bank Swallow Monitoring Programs

SPRINGBANK OFF-STREAM RESERVOIR PROJECT SUMMARY OF 2021 PRE-CONSTRUCTION WILDLIFE SURVEYS AND 2021/2022 MONITORING PROGRAMS

October 2022

Prepared for:
Alberta Transportation

Prepared by:
Stantec Consulting Ltd.

Project Number:
110773396

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Acronyms / Abbreviations

%	percent
<	less than
>	greater than
≤	less than or equal to
AEP	Alberta Environment and Parks
cm	centimetre
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DBH	diameter at breast height
EC	Environment Canada
ESRD	Alberta Environment and Sustainable Resource Development
FLIR	Forward-looking infrared
GOA	Government of Alberta
GOC	Government of Canada
IAAC	Impact Assessment Agency of Canada
km	kilometre
km/h	kilometres per hour
LAA	local assessment area
m	metre
ºC	degrees Celsius
PDA	Project development area
SARA	*Species at Risk Act*
SOMC	species of management concern
UTM	Universal Transverse Mercator
WMMP	Wildlife Mitigation and Monitoring Plan

1 Introduction

This report summarizes the results of the 2021-2022 wildlife surveys completed to meet the Impact Assessment Agency of Canada (IAAC) conditions. Specifically, this report provides detailed methods and results of pre-construction surveys completed for yellow rail (*Coturnicops noveboracensis*), amphibian species at risk including western toad (*Anaxyrus boreas*), northern leopard frog (*Lithobates pipiens*), and western tiger salamander (*Ambystoma mavortium*) as well as results of bat roost surveys and grizzly bear (*Ursus arctos*) den surveys. In addition, the methods and results of the remote camera monitoring program are summarized as part of the Wildlife Mitigation and Monitoring Plan (WMMP) (i.e., follow-up program).

2 Rail Survey

A nocturnal rail call-playback survey was completed to update 2016 baseline survey results regarding rail use of wetlands in the Project Development Area (PDA) as well as suitable wetland habitat in the Local Assessment Area (LAA) within 100 m of the PDA. The survey focused on yellow rail, which is a migratory bird listed on Schedule 1 of the *Species at Risk Act* (SARA).

2.1 Methods

The rail survey was completed following methods consistent with the provincial *Sensitive Species Inventory Guidelines* (ESRD 2013). Surveys were completed by qualified biologists with experience conducting rail call-playback survey at stations used for 2016 baseline surveys, where land access was granted. Each station was visited twice 10 days apart; surveys began one hour after sunset and ended no later than one hour before sunrise.

Surveyors waited for one minute upon arrival at each station to allow noise from the surveyors to subside. The survey began with a 5-minute silent listening period, followed by a broadcast of rail calls using a FOXPRO Inc. game caller, with the following sequence: 30 seconds of yellow rail male attraction calls, 30 seconds of silence, 30 seconds of Virginia rail (*Rallus limicola*) calls, 30 seconds of silence, and 30 seconds of sora (*Porzana carolina*) calls (after Conway 2011). The survey concluded with a 2-minute silent listening period.

The location of yellow rails (and other rail species) seen or heard during the survey were recorded digitally on a mobile device with georeferencing capabilities using Stantec's data collection program for ESRI's ArcGIS Field Maps. Surveys were completed under AEP Wildlife Research Permit and Collection Licence No. 21-140 for low-risk activities.

2.1.1 DATA ANALYSIS

Detected occupancy rate, defined as the number of survey stations occupied by a species divided by the number of stations surveyed was calculated. The total count of rails detected is presented as the maximum number of rails recorded at each station during either of the two site visits. Although there were repeat visits (twice) to each survey station, the probability of detection was not accounted for; therefore, the detected occupancy rate represents a naïve occupancy estimate (Mackenzie et al. 2002, 2006).

2.2 Results

One three-person field crew, which consisted of two qualified wildlife biologists and one Indigenous assistant, completed the nocturnal rail call-playback survey on June 3 and June 13, 2021. Weather conditions were suitable during both survey periods with no precipitation, temperatures between 10°C and 20°C, and winds < 5 km/h.

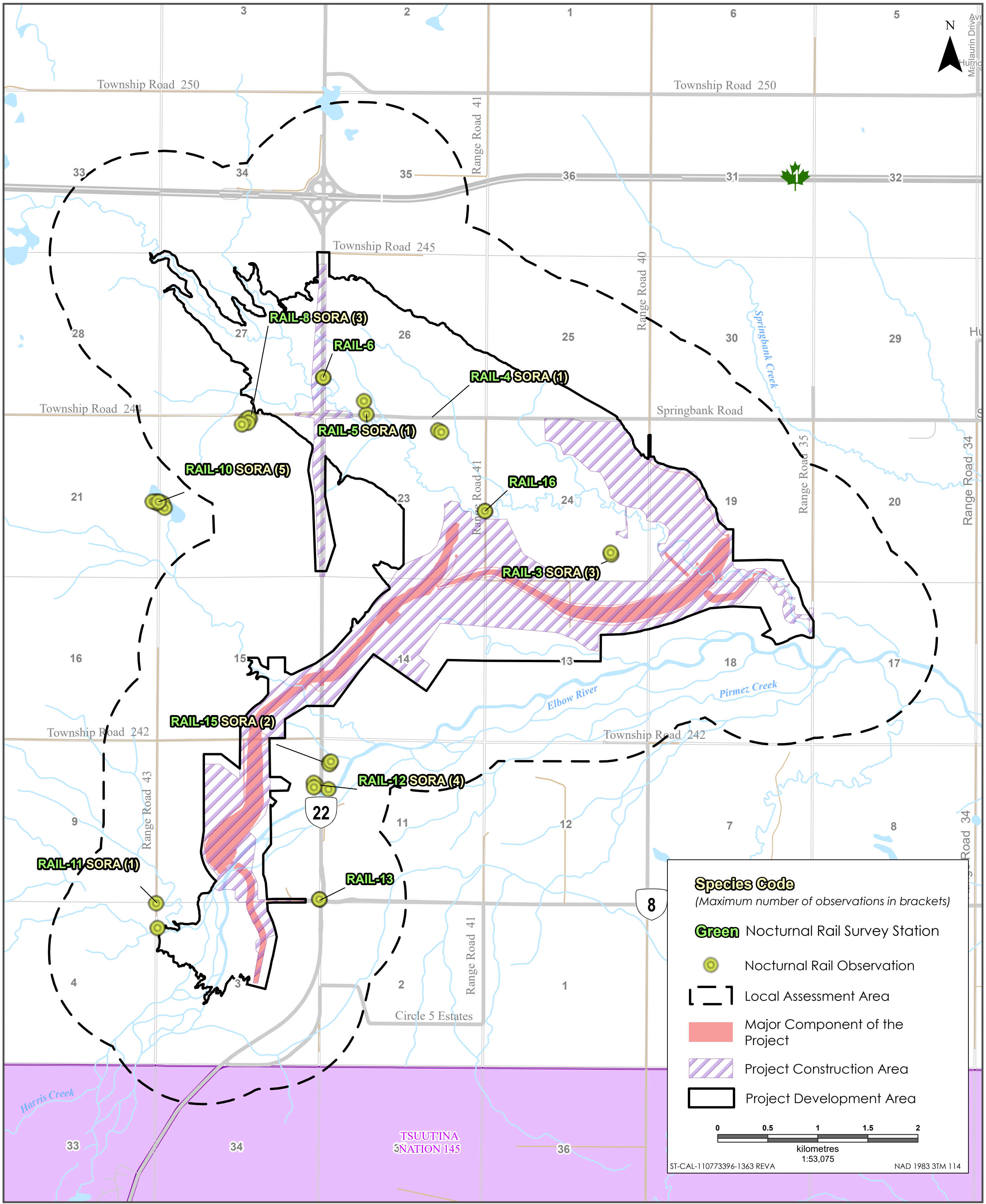
Eleven of sixteen survey stations previously completed in 2016 were surveyed; five stations were not surveyed in 2021 due to land access constraints (Table 2.1; Figure 1). Similar to the 2016 baseline survey, yellow rail was not detected. During 2021, however, sora were detected (heard) at eight of the eleven stations (72.7%) during both sampling visits, which is more than twice the detected occupancy rate compared to 2016 (31%). A total count of 20 sora were detected during the 2021 survey, which was twice the total count of 10 sora detected in 2016 (Table 2.1).

Table 2.1 The Number of Sora Detected during Nocturnal Rail Surveys

Rail Survey Station	Habitat Type	Number of Sora Detected [a]	
		2016	2021
RAIL-03	graminoid marsh	4	3
RAIL-04	graminoid marsh, shrubby swamp, open water	0	1
RAIL-05	graminoid marsh, open water	0	1
RAIL-06	graminoid marsh	0	0
RAIL-08	graminoid marsh, shallow open water, dugout	0	3
RAIL-10	graminoid marsh, shallow open water	1	5
RAIL-11	graminoid marsh, open water	1	1
RAIL-12	graminoid marsh, open water, dugout	3	4
RAIL-13	dugout	0	0
RAIL-15	graminoid marsh, open water, dugout	1	2
RAIL-16	graminoid marsh, open water	0	0
Total Count		**10**	**20**

NOTE:

[a] number of sora detected represents a maximum count over two survey visits.



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
10/25/2022

Nocturnal Rail Survey Stations and Observations in the LAA

Figure 1

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

3 Diurnal Amphibian Survey

A diurnal (visual) amphibian survey was completed to update the 2016 baseline survey results and to meet IAAC condition 5.2, which required Alberta Transportation to determine the presence of amphibian species listed on Schedule 1 of SARA including northern leopard frog (*Lithobates pipiens*), western toad (*Anaxyrus boreas*), and western tiger salamander (*Ambystoma mavoritium*). Amphibian diurnal surveys are designed to survey amphibian species which cannot be readily identified by their call using auditory surveys, such as western tiger salamander.

3.1 Methods

The amphibian survey focused on selected wetlands and waterbodies (e.g., unnamed creek) within 100 m of the construction footprint. Wetlands surveyed during 2016 were revisited as well as other wetlands potentially affected, where landowner access was granted. The shore, shoreline, and shallow water areas of wetland habitat were searched on foot for amphibians (i.e., adults, young-of-year, tadpoles, and egg masses). A dipnet was used in shallow water to search for tadpoles and assist with species identification. Following ESRD (2013) guidelines, suitable wetlands were visited twice and spaced approximately seven days apart. Surveys were conducted during daylight hours and were delayed or suspended if the air temperature was below 5°C, wind speed was greater than 20 km/h, under heavy cloud conditions, or if precipitation was heavier than a light rain (ESRD 2013) because such conditions diminish detectability of amphibian eggs and tadpoles. Surveyors used recommended hygiene practices outlined in the *Sensitive Species Inventory Guidelines* (ESRD 2013) to disinfect rubber boots and dip nets after contact with each wetland. Data were recorded digitally on a mobile device with georeferencing capabilities using Stantec’s data collection program for ESRI’s ArcGIS Field Maps. Surveys were completed under AEP Wildlife Research Permit and Collection Licence No. 21-140 for low-risk activities. Indigenous groups were invited to observe this field survey, which included 11 Indigenous observers.

3.1.1 DATA ANALYSIS

Detected occupancy rate was used to estimate amphibian species presence, which is defined as the number of survey stations occupied by a species divided by the number of stations surveyed. Although there were repeat visits (twice) to each survey station, the probability of detection was not accounted for; therefore, the detected occupancy rate represents a naïve occupancy estimate (Mackenzie et al. 2002, 2006).

3.2 Results

Diurnal amphibian surveys were completed on July 14 and July 15, 2021, as well as July 22 and July 23, 2021 by one three-person field crew, which consisted of two qualified wildlife biologists and one Indigenous assistant. Weather conditions were suitable during the survey periods with no precipitation, light winds (≤12 km/h) and temperatures between 15ºC and 33ºC (x = 25°C).

A total of 17 diurnal amphibian stations/wetlands were surveyed (Figure 2). Six stations previously sampled in 2016, were surveyed during 2021 as well as 11 new survey stations. Similar to the 2016 baseline survey results, boreal chorus frog (*Pseudacris maculata*) and wood frog (*Lithobates sylvaticus*) were the only amphibian species observed. No amphibian species at risk were observed during systematic surveys. However, one of the First Nations observers indicated to the field crew lead they saw a tiger salamander at the Kiwanis wetland on July 23, 2021. Stantec was not able to confirm the sighting, however, appropriate mitigation (e.g., silt fencing) was implemented prior to construction activities along the Kiwanis access road. One tiger salamander was incidentally observed by a Historical Resources crew in NE-18-24-3-W5 near unnamed creek on June 9, 2022. The salamander was relocated to a pond near Springbank Road.

During the 2021 diurnal amphibian survey, both boreal chorus frog and wood frog were observed at 10 of 17 survey stations (58.8%) (Table 3.1). Overall, detected occupancy rate for both amphibian species was greater compared to 2016 when detected occupancy rates varied between 6-41% for boreal chorus frogs and 11-36% for wood frog depending on survey type (i.e., nocturnal, diurnal). All age classes of boreal chorus frog were observed including tadpoles, froglets and adults whereas wood frog observations were mostly adults with the exception of VES-02 and VES-16 where 50 and three tadpoles were observed respectively (Table 3.1).

Table 3.1 Amphibian Species Observed during Diurnal Amphibian Surveys in the LAA

Visual Amphibian Survey Station	Habitat Type	Number of Boreal Chorus Frog				Number of Wood Frog			
		Year				**Year**			
			2021				**2021**		
		2016[a]	**T**	**Y**	**A**	**2016[a]**	**T**	**Y**	**A**
VES-01	dugout	0	0	0	0	0	0	0	0
VES-02	graminoid marsh	0	0	9	0	0	50	0	1
VES-03	graminoid marsh	0	1	0	3	0	0	0	1
VES-06	graminoid marsh, open water	0	0	4	0	0	0	0	3
VES-13	graminoid marsh, shrubby swamp	1	N/A			0	N/A		
VES-14	graminoid marsh, open water, dugout	0	N/A			2	N/A		
VES-15	graminoid marsh	0	0	0	0	0	0	0	0
VES-16	open water graminoid marsh	0	1	1	0	0	3	0	1

Table 3.1 Amphibian Species Observed during Diurnal Amphibian Surveys in the LAA

Visual Amphibian Survey Station	Habitat Type	Number of Boreal Chorus Frog				Number of Wood Frog			
		Year				Year			
			2021				2021		
		2016[a]	T	Y	A	2016[a]	T	Y	A
VES-18	graminoid marsh	0	N/A			1	N/A		
VES-19	graminoid marsh	N/A	0	0	6	N/A	0	0	1
VES-20	graminoid marsh	N/A	0	0	0	N/A	0	0	0
VES-21	graminoid marsh	N/A	0	0	10	N/A	0	0	0
VES-22	graminoid marsh	N/A	0	2	0	N/A	0	0	2
VES-23	graminoid marsh, open water	N/A	0	1	1	N/A	0	0	4
VES-24	graminoid marsh	N/A	0	0	0	N/A	0	0	1
VES-25	graminoid marsh	N/A	0	1	0	N/A	0	0	0
VES-26	graminoid marsh	N/A	0	0	0	N/A	0	0	0
VES-27	graminoid marsh	N/A	0	0	0	N/A	0	0	1
VES-28	graminoid marsh, open water	N/A	0	1	0	N/A	0	0	6
VES-29	graminoid marsh, open water	N/A	0	4	0	N/A	0	0	0
Total		**1**	**3**	**23**	**20**	**3**	**53**	**0**	**21**

NOTES:

Counts represent the maximum number of individuals observed for each amphibian species and age class over two survey visits

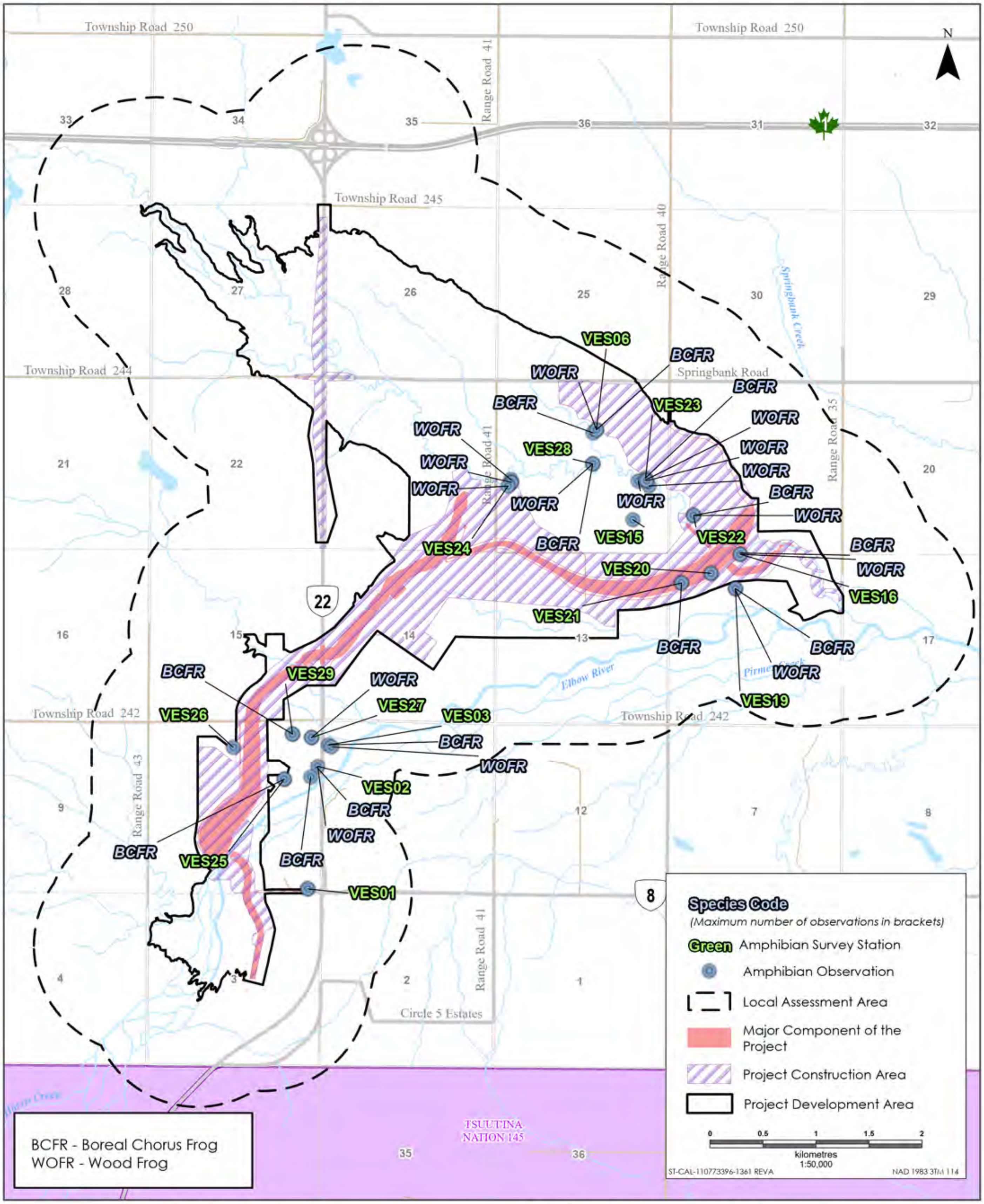
T = tadpole

Y = young of the year (toadlet, froglet)

A = Adult

[a] All amphibians observed during 2016 were adults

N/A – represents a station that was surveyed in 2021 but not in 2016 and vice-versa.



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
10/25/2022

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Diurnal Amphibian Survey Stations and Observations in the LAA

Figure 2

4 Bat Roost Survey

A bat roost survey was completed in accordance with IAAC approval condition 5.1, which required Alberta Transportation to identify roosts of little brown myotis (*Myotis lucifugus*) roosting sites in the project development area. Little brown myotis is listed as endangered on Schedule 1 of SARA (GOC 2022) and is also scheduled to be listed as endangered by the province of Alberta (GOA 2022).

4.1 Methods

The bat roost survey was completed in two stages: (i) a habitat assessment, which focused on identifying potential roost sites (e.g., buildings and large diameter balsam poplar with cavities and/or sloughing bark) (Coleman and Barclay 2011, EC 2015) and (ii) an acoustic emergence survey focused on identifying bat activity at potential roost sites using a bat detector and visual observations of bats exiting a potential roost site. The locations of potential roost sites in the PDA and adjacent 100-m buffer were identified by targeting ecosites that potentially support large diameter (>25 cm diameter at breast height [DBH]) balsam poplar (*Populus balsamifera*) or white spruce (*Picea glauca*) trees (Olsen and Barclay 2013, Olsen and Flach 2016). Deciduous (broadleaf), coniferous and mixed forest land cover units that occur along Elbow River were chosen to focus survey efforts where riparian ecosites were expected to contained large diameter balsam poplar (Figure 3). In addition, any known abandoned buildings or barns were also surveyed where landowner access permitted. Potential roost sites were checked for evidence of bat activity (e.g., guano in or below cavities, scratch marks/scuffing at cavity entrances).

The emergence survey was completed between 30 minutes before dusk to 1 hour after sunset. Observers positioned themselves with a view of the potential roost(s) exit holes and in an open area to obtain high quality recordings of bat calls in a low cluttered environment. Recordings of bat calls were collected using Echo Meter Touch 2 Pro (iOS) bat detectors (Wildlife Acoustics) connected to iPads. Recordings were initially identified using the Echo Meter App Auto ID function and later manually processed using Kaleidoscope Pro software (v.5.4.8). Not all bat calls can be identified to the species level due to various factors, including the quality of the recording, type of recording (e.g., search phase vs. approach/terminal phase calls) and similarity of calls between species. Where possible, calls were identified to species; however, some calls were labeled as species groups (e.g., MYOVOL/MYOEVO, which indicates the call was made by either long legged myotis (*Myotis volans*) or long-eared myotis (*Myotis evotis*), when diagnostic features needed to differentiate were not present.

4.2 Results

The bat roost habitat assessment survey was completed on August 9-10, 2021, by two qualified wildlife biologists and one Indigenous assistant. Eight potential roost trees were identified at Kamp Kiwanis (south side of Elbow River) that provide potential roosting sites (Figure 3). The potential roost trees at Kamp Kiwanis were relatively large (30-65 cm DBH) balsam poplar with evidence of internal decay, woodpecker cavities and sloughing bark (Table 4.1).

Bat emergence surveys were completed during dusk at the Kamp Kiwanis potential roost trees on August 11, and August 27-28, 2021 at three stations Figure 3). A bat emergence survey was also completed at the abandoned Weatherly cabin at Kamp Kiwanis on August 27, 2021 (Figure 3; Table 4.1). A bat emergence survey was also completed at two stations near six buildings in NE 24-24-4-W5 on August 17, 2021 (Figure 3; Table 4.1). Weather conditions were suitable for acoustic surveys, with clear to partly cloudy skies, no precipitation, light winds (<20 km/h) and temperatures from 10°C to 16°C.

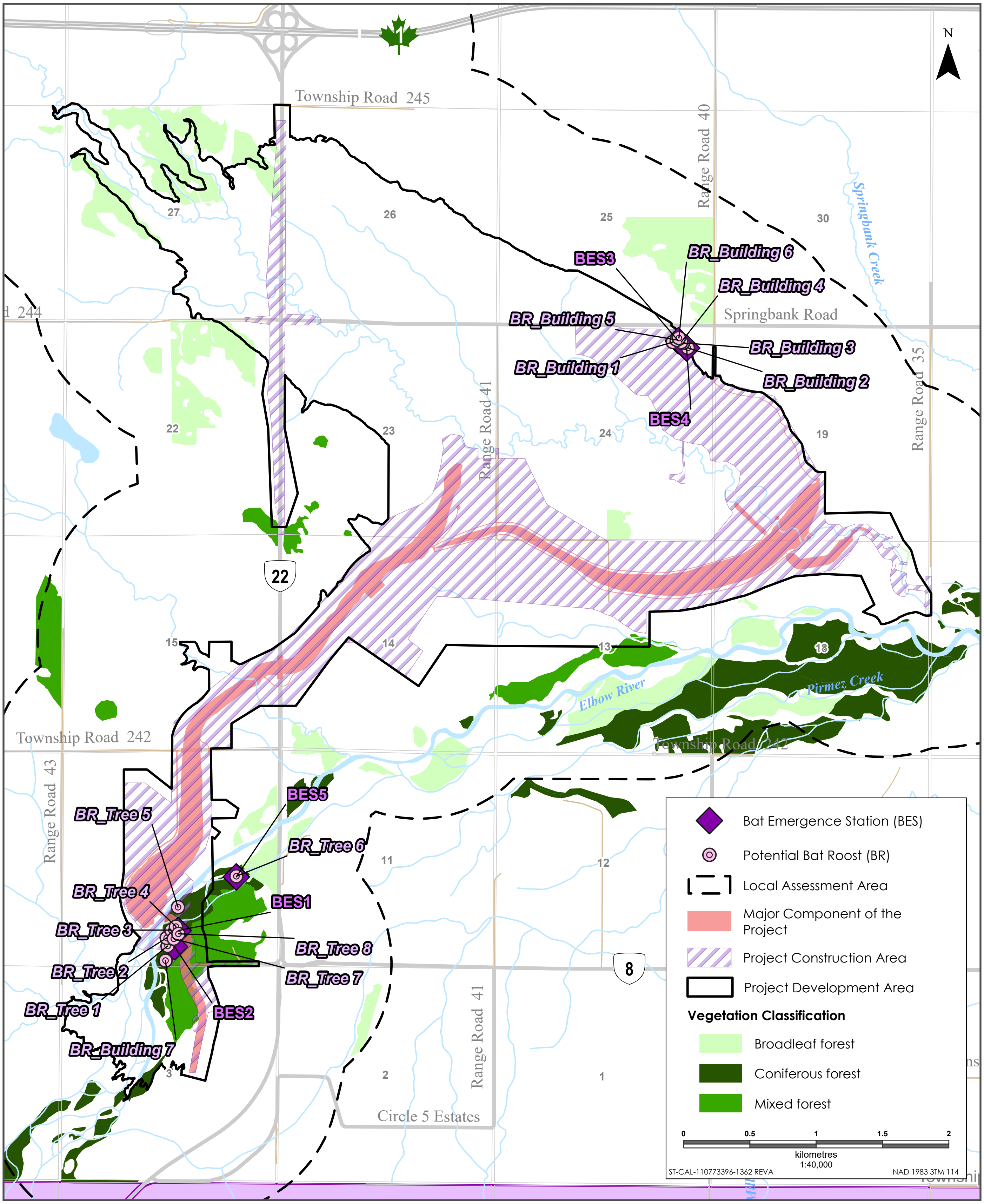
Bat calls were detected at all stations including three of eight potential roost trees at Kamp Kiwanis including (Tree 1, Tree 2 and Tree 7) as well as fly-bys (single bats) near Weatherly cabin (Table 4.1). Five bat species were recorded including little brown myotis, silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), and eastern red bat (*Lasiurus borealis*) as well as one recording of either long-legged myotis or long-eared myotis); however, no bats were visually observed emerging from the trees nor was there any sign of bat activity at or near the potential roost trees (e.g., guano) or at Weatherly cabin. As such, no roost trees or roosting sites were observed during the emergence survey. Similarly, there were no bats observed emerging from the barns located in NE-24-24-4-W5 or bat sign (guano). Two bat species were detected near the barns including little brown myotis and hoary bat.

Table 4.1 Summary of Potential Bat Roost Locations and Emergence Survey Results

Potential Roost ID	Location	Potential Roost Type	Tree Species	Diameter at Breast Height (DBH)	UTM Easting	UTM Northing	Emergence Survey Date and (Station)	Comments
Roost Tree 1	Kamp Kiwanis	Tree	balsam poplar	65 cm	676819	5655593	August 11, 2021 (BES2)	No bats/activity observed at potential roost site; however, bat calls recorded in area
Roost Tree 2	Kamp Kiwanis	Tree	balsam poplar	46 cm	676810	5655653	August 11, 2021 (BES2)	No bats/activity observed at potential roost site; however, bat calls recorded in area including little brown myotis
Roost Tree 3	Kamp Kiwanis	Tree	balsam poplar	31 cm	676842	5655713	August 11, 2021 (BES1)	No bats/activity observed at potential roost site
Roost Tree 4	Kamp Kiwanis	Tree	balsam poplar	35 cm	676876	5655741	August 11, 2021 (BES1)	No bats/activity observed at potential roost site
Roost Tree 5	Kamp Kiwanis	Tree	balsam poplar	38 cm	676886	5655888	August 11, 2021 (BES1)	No bats/activity observed at potential roost site
Roost Tree 6	Kamp Kiwanis	Tree	balsam poplar	28 cm	677316	5656139	August 28, 2021 (BES5)	No bats/activity observed at potential roost site
Roost Tree 7	Kamp Kiwanis	Tree	balsam poplar	36 cm	676864	5655649	August 11, 2021 (BES2)	No bats/activity observed at potential roost site; however, bat calls recorded in area
Roost Tree 8	Kamp Kiwanis	Tree	balsam poplar	31 cm	676897	5655687	August 11, 2021 (BES2)	No bats/activity observed at potential roost site
Weatherly Cabin	Kamp Kiwanis	Building	N/A	N/A	676808	5655482	August 27, 2021 (BR_Building7)	No bats/activity observed at potential roost site; however, bat calls recorded in area

Table 4.1 Summary of Potential Bat Roost Locations and Emergence Survey Results

Potential Roost ID	Location	Potential Roost Type	Tree Species	Diameter at Breast Height (DBH)	UTM Easting	UTM Northing	Emergence Survey Date and (Station)	Comments
Barn 1	NE-24-24-4-W5	Building	N/A	N/A	680440	5660297	August 17, 2021 (BES3)	No bats/activity observed at potential roost site; however, bat calls recorded in area
Barn 2	NE-24-24-4-W5	Building	N/A	N/A	680555	5660257	August 17, 2021 (BES 3)	No bats/activity observed at potential roost site; however, bat calls recorded in area
Barn 3	NE-24-24-4-W5	Building	N/A	N/A	680516	5660292	August 17, 2021 (BES3)	No bats/activity observed at potential roost site; however, bat calls recorded in area
Barn 4	NE-24-24-4-W5	Building	N/A	N/A	680503	5660299	August 17, 2021 (BES4)	No bats/activity observed at potential roost site; however, bat calls recorded in area
Barn 5	NE-24-24-4-W5	Building	N/A	N/A	680470	5660314	August 17, 2021 (BES4)	No bats/activity observed at potential roost site; however, bat calls recorded in area
Barn 6	NE-24-24-4-W5	Building	N/A	N/A	680485	5660329	August 17, 2021 (BES4)	No bats/activity observed at potential roost site; however, bat calls recorded in area



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
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Potential Bat Roost and Emergence Survey Station Locations in the LAA

Figure 3

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

5 Grizzly Bear Den Survey

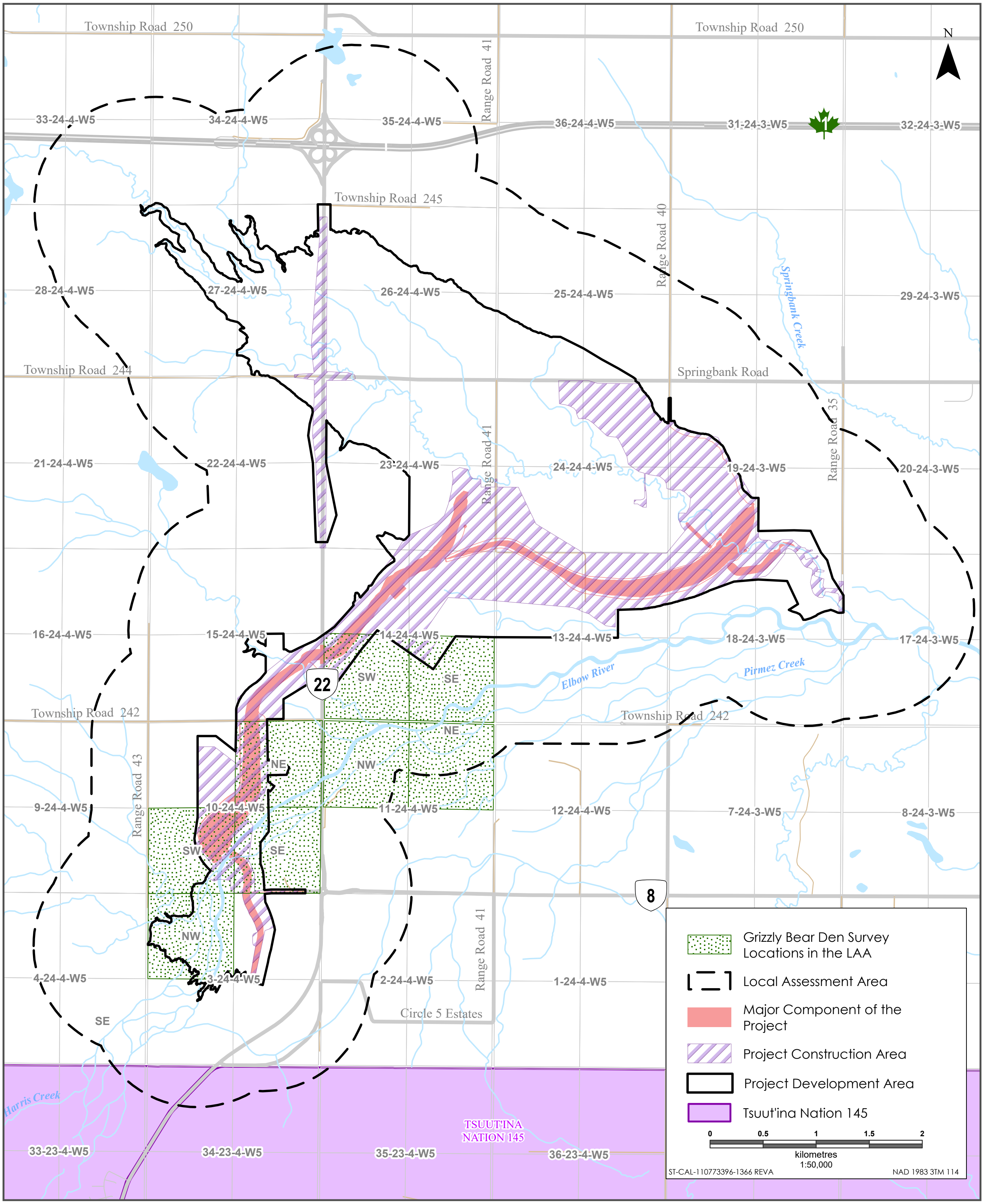
In accordance with IAAC condition 8.3, a grizzly bear den survey was completed prior to construction to determine the presence of grizzly bear dens in the PDA.

5.1 Methods

The ground-based survey involved field crews walking transects spaced approximately 25 m apart and searching for grizzly bear dens within the PDA up to 750 m from the edge of the PDA, which is the maximum setback distance for active grizzly bear dens (GOA 2021). The survey was focused in areas that provided potential denning habitat for grizzly bear, which primarily included mature coniferous forests along Elbow River (Figure 4). The field crews searched for dens looking for holes excavated under mature tree root wads, especially in dry areas with steep slopes as well as in areas with other bear sign (e.g., tracks, scat, rub trees, evidence of digging). Data were recorded digitally on a mobile device with georeferencing capabilities using Stantec's data collection program for ESRI's ArcGIS Field Maps. Forward-looking infrared (FLIR) was also used to look for heat signatures associated with active dens. Other dens, including black bear were also recorded incidentally.

5.2 Results

The survey was completed by two qualified wildlife biologists and two Indigenous assistants on November 2-3, 2021, and December 9-10, 2021. Eight quarter sections with potential denning habitat were surveyed (Figure 4); however, no sign of grizzly bear or bear dens was observed. Incidental wildlife observations included bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) as well as fresh cougar (*Puma concolor*) tracks observed in NW-3-24-4-W5. One quarter section in the southwest corner of the LAA (SE 4-24-4-W5) with potential grizzly bear denning habitat was not surveyed due to landowner access constraints. Although this quarter section was not surveyed, it occurred greater than 750 m from the PDA; and therefore, no direct disturbance to potential grizzly bear denning habitat is expected.



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Grizzly Bear Den Survey Locations

Figure 4

6 Wildlife Sweeps

Stantec completed pre-construction wildlife sweeps as recommended in the WMMP to identify potential sensitive raptor stick nests (e.g., bald eagle, osprey) and owl nests prior to construction. Stantec completed seven wildlife sweeps from February 3, 2022 to March 8, 2022. The Prime Contractor completed wildlife sweeps during the remainder of March 2022 and into the migratory bird nesting and amphibian season. Pre-construction wildlife sweeps were completed, and site-specific mitigation implemented in accordance with IAAC conditions related to migratory birds including approval condition 4.1, 4.6., 4.8. Stantec's and the Prime Contractor's wildlife sweep methods are described below.

6.1 Methods

6.1.1 STANTEC

The wildlife sweep was completed by systematically walking parallel transects spaced 5-10 m apart in the search area plus a 100 m buffer and scanning suitable nesting habitat and other sensitive wildlife features with binoculars. A nest or other wildlife feature was confirmed by physically observing the feature, (e.g., often identified by flushing a bird or mammal, or by observation of breeding behaviour (e.g., auditory signs, alarm calls, defense calls, screeching]; distraction displays; nest defense behaviors [e.g., diving); birds carrying nesting material, food; observation of nestlings or fledglings; or repeated flying towards a specific location). All nests and evidence of breeding activity as well as all wildlife species observed and heard during the wildlife sweep were recorded digitally on a mobile device with georeferencing capabilities using Stantec's data collection program for ESRI's ArcGIS Field Maps.

6.1.2 PRIME CONTRACTOR

The wildlife sweeps were conducted by a qualified wildlife biologist following the AEP Sensitive Species Inventory Guidelines Protocols (AEP 2020) for wildlife sweeps and investigating every potential nest/den/hibernaculum site for use and occupancy. The biologist conducted a walkthrough along meandering parallel transects across the areas proposed for disturbance and further out to 100 m from the disturbance edges to complete an informed area search for all wildlife sightings and signs, important habitat, and features. Visual scans from the disturbance edge were conducted out to 1 km using binoculars.

6.2 Results

A summary of the results of the wildlife sweeps is provided in the IAAC annual report – 2021/2022 reporting year, Section.4.7.2.2.

7 Bank Swallow Monitoring

In accordance with IAAC condition 4.11.1, bank swallow (*Riparia riparia*) use was monitored during Project construction. Monitoring focused on the bank swallow colony previously identified on Elbow River during 2016 baseline surveys.

7.1 Methods

The bank swallow colony previously identified on Elbow River (NE-18-24-03-W5) during 2016 was visited on foot to determine if it was active in 2022. Other suitable banks along Elbow River were also scanned using binoculars for potential bank swallow nesting activity. Bank swallow colonies were observed for approximately 15 minutes. The number of individuals and number of active burrows (e.g., burrow excavation, adults entering or exiting burrows, or nestlings visible in burrows) were recorded.

In addition, a point-count station near the colony was surveyed (station BBS-25) where bank swallows were previously recorded during 2016 baseline surveys. All bank swallows observed during a 10-minute period within a 100-m radius were recorded. The point-count station and potential bank swallow nesting habitat were surveyed twice during breeding period (June/July).

7.2 Results

The bank swallow work overlapped with both the 2021/2022 and the 2022/2023 reporting year. For simplicity the full accounting of the 2022 bank swallow work is presented in this report.

The previously identified bank swallow colony on Elbow River was visited on June 2, 2022 and June 8, 2022 (due to logistical constraints). The survey was completed by a qualified biologist and an Indigenous assistant. Weather conditions were suitable during the survey periods with no precipitation, temperatures from 10ºC to 18ºC and winds <10 km/h.

The previously identified colony was no longer present as the vertical banks that provided suitable nesting habitat were no longer available, likely due to changes (i.e., erosion, collapse) in the riverbank (Photo 1). A newly established bank swallow colony (BANS_BY01) was observed approximately 115 m further west along Elbow River from the original colony (Figure 5, Photo 2). Six active burrows and 12 individuals were observed at the colony. In addition, there was another small colony (10 individuals) identified in NW-18-24-03-W5 along Elbow River (BANS_BY02), approximately 450 m west of the newly established colony (Figure 5, Photo 3). Another small bank swallow colony (10 individuals) was also observed along the banks of Elbow River approximately 600 m west of BANS_BY03 (Figure 5, Photo 4) on June 8, 2022. Overall, a total of 20 individuals were observed along this section of Elbow River during the June 2 and June 8, 2022 surveys where individuals were observed emerging from and flying back to the riverbank. All bank swallows were observed foraging along Elbow River.

A second visit was completed at three bank swallow colonies and at BBS-25 on July 13, 2022 (Figure 5). Weather conditions were suitable during the survey periods with no precipitation, temperature of 14°C and winds below 20 km/hr. Only two individuals were observed at one bank swallow colony (BANS_BY01) compared to 12 individuals on June 2, 2022. However, access to the previous observation point was not possible due to high water levels in Elbow River. The other two bank swallow colonies observed on June 2 and June 8, 2022 (BANS_BY02 and BANS_BY03) remained active on July 13, 2022. However, there were fewer individuals (five) and burrows observed, which were likely related to the slope failure that occurred on the north side of Elbow River (Photo 5). An estimated four individuals (two pairs) were observed at BANS_BY03.

Photo 1 Bank swallow previously identified in 2016 colony along Elbow River that has collapsed due to bank erosion

Photo 2 **Active bank swallow colony (BANS_BY01) along Elbow River (west of historic location)**

Photo 3 **Active bank swallow colony locations along Elbow River in NW-18-24-03-W5 (BANS_BY02)**

Photo 4 **Active bank swallow colony locations along Elbow River in NW-18-24-03-W5 (BANS_BY03)**

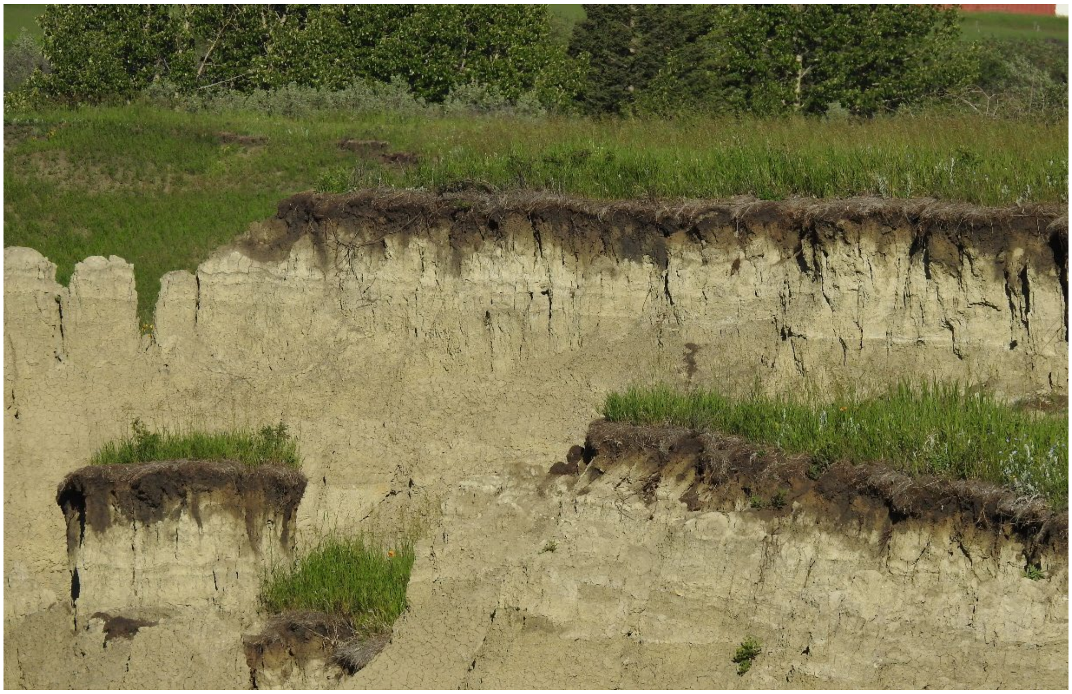
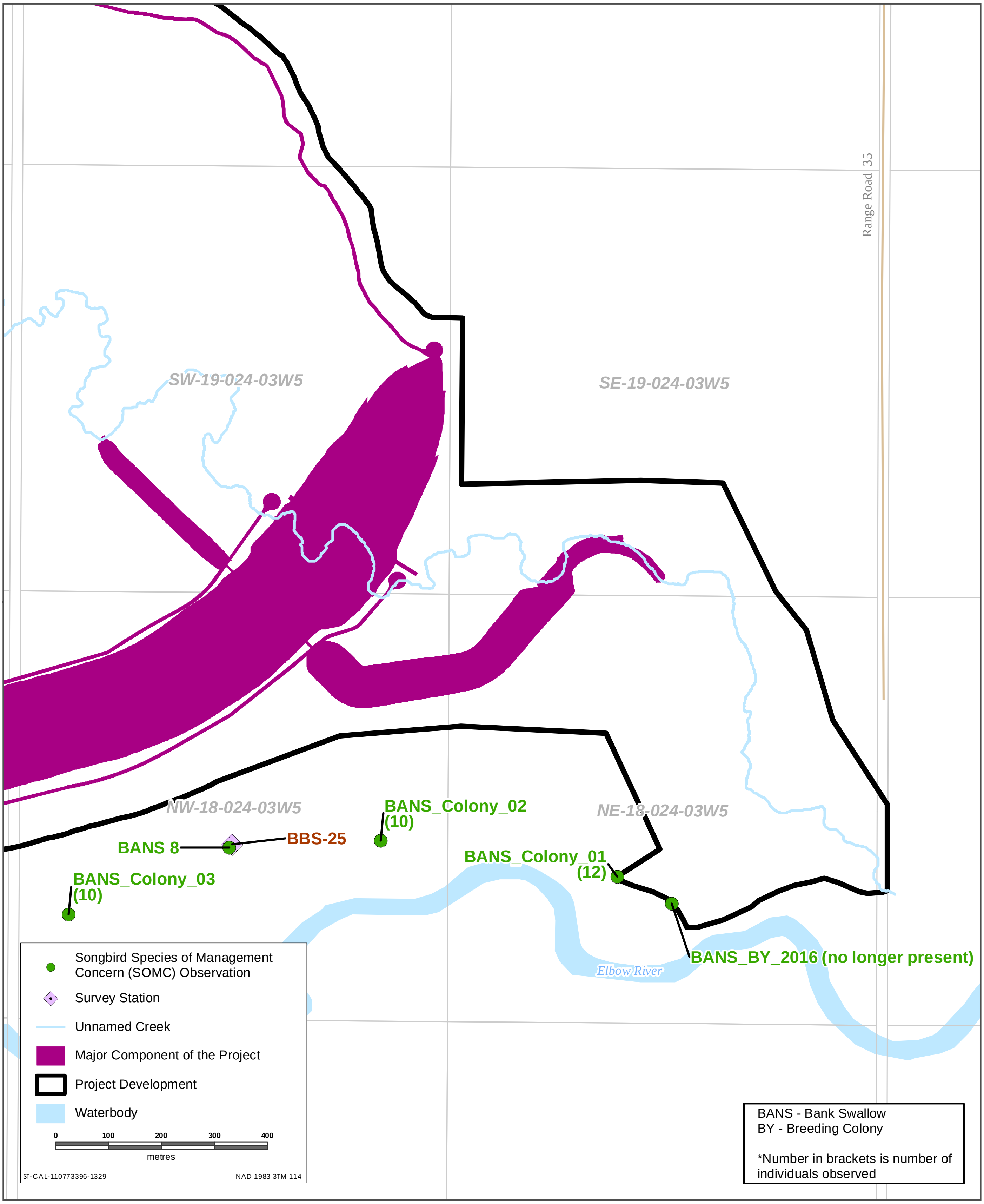


Photo 5 **Bank Swallow Colony Location and Slope Failure along Elbow River (BANS_BY02)**



Sources: Thematic Data - Stantec. Base Data - Government of Alberta, Stantec

Bank Swallow Colony Locations and Observations
Along Elbow River During 2022 Monitoring

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Figure 5

8 Remote Camera Monitoring Program

8.1 Objectives

As stated in the WMMP, the objectives of the remote camera monitoring program are to evaluate potential Project effects on wildlife habitat use and movement as well as to evaluate the effectiveness of mitigation measures. Overall, the remote camera monitoring program is designed to monitor large and medium-sized mammals including species of cultural importance (e.g., deer [*Odocoileus* spp.], elk [*Cervus canadensis*], grizzly bear [(*Ursus arctos*] coyote [*Canis latrans*], red fox [*Vulpes vulpes*]).

The remote camera monitoring program has been designed to answer two key questions:

1. Is there a measurable change in the relative abundance (photographic rate) of large and medium-sized mammals in the LAA during construction and dry operations compared to baseline/pre-construction?
2. What is the wildlife crossing success or crossing rate for Project permanent structures including the Hwy 22 underpass, Hwy 22 culvert, diversion channel, floodplain berm, wildlife-friendly fencing, off-stream dam, and low-level outlet? (i.e., do mitigation measures facilitate wildlife movement in the LAA?)

The results presented in this annual report were collected during the 2021 pre-construction period as well as the initial stages of construction, which began on February 8, 2022. As such, the remote camera data collected during construction extended from February 8, 2022 to the next camera maintenance check, which occurred on April 13, 2022. However, there was only two weeks of spring data (April 1 to April 13) collected during this reporting period; and therefore, only the remote camera data collected during winter construction (February 8 to March 31) are discussed in this Annual Report. The spring 2022 data will be analyzed when the remainder of the data are collected later this year and presented in the second Annual Report scheduled to be submitted in 2023.

Mitigation measures proposed to reduce potential Project effects on wildlife movement due to Project permanent structures including the installation of wildlife-friendly fencing (key question 2) have yet to be implemented and are not included in this annual report.

8.2 Methods

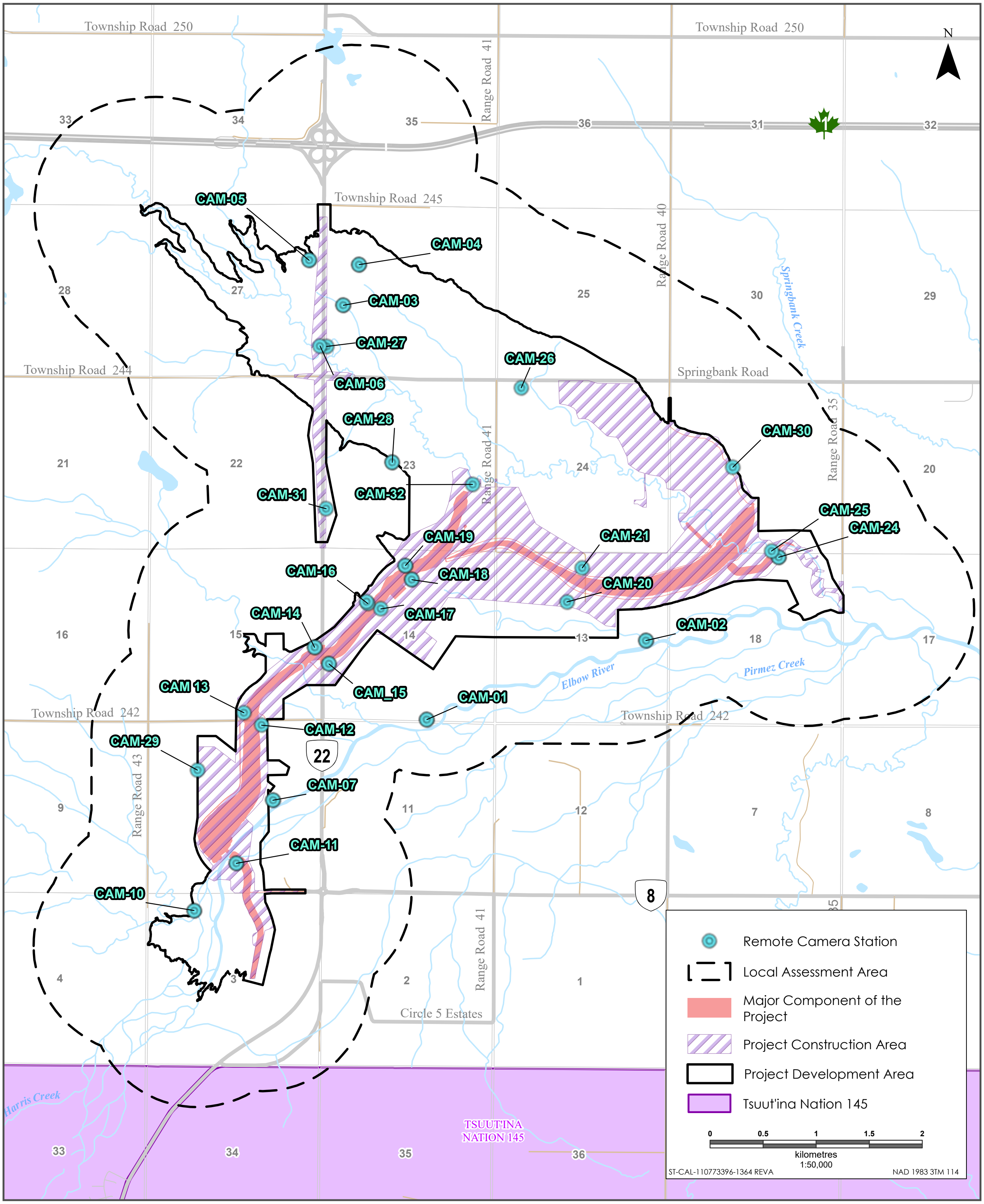
8.2.1 SITE SELECTION

8.2.1.1 Pre-Construction

Thirty-one remote cameras (Reconyx Hyperfire 2™) were installed during 2021 to monitor wildlife use in the LAA using a before-after study design. The pre-construction sampling design and locations were largely determined by Project permanent structure components (e.g., diversion channel) including areas where future mitigation measures will be applied (e.g., underpasses) during dry operations. Landowner access constraints also affected when and where remote cameras were deployed.

Five remote cameras were installed at the same locations along Elbow River that were monitored during 2016 including one camera located upstream of the proposed diversion structure, one camera near the proposed floodplain berm and the remaining three cameras located downstream of the diversion structure between the diversion and low-level outlet channels (Figure 6). Similarly, two remote cameras were installed on either side of the proposed raising of Highway 22 at the same 2016 monitoring locations. In addition to the nine remote cameras installed at the 2016 baseline survey locations, another 22 remote cameras were installed in the PDA to provide pre-construction data near proposed Project permanent structures including along vegetated sections of the diversion channel (e.g., Highway 22 and Township Road 242 bridges over the diversion channel), floodplain berm, off-stream dam, the Hwy 22 culvert where the highway will be raised and sections where wildlife-friendly fencing will be installed (Figure 6).

Cameras were deployed to maximize the probability of animal detection (habitat use, movement) in the PDA and LAA by installing cameras on wildlife and/or human trails, where possible. The cameras were installed on trees, fence posts, or t-posts, using screws and cable locks, and were approximately 1.0 - 1.5 m above ground with an unobstructed view of the surrounding area. Similar to the 2016 remote camera monitoring program, cameras were set to high sensitivity to take five pictures per trigger with no delay between triggers. The location of each camera was recorded as well as surrounding vegetation, aspect, height, and presence of wildlife sign, including trails, tracks, and scat. Maintenance visits to clear vegetation around cameras, collect data and assess functionality (e.g., battery, memory cards, locks, trigger function) were completed approximately every four months. A summary of remote camera locations during the pre-construction period relative to land cover and habitat type is provided in Table 8.1.



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
10/25/2022

Remote Camera Survey Locations
2021 Pre-Construction

Figure 6

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Table 8.1 Summary of Remote Camera Monitoring Stations by Land Cover Type - 2021 Pre-Construction Period

Camera ID	Location within PDA/LAA	Land Cover	Habitat Description	Monitoring Station Photo
CAM-01	Elbow River (KWBZ)	Mixed Forest/ Shrubland	Riparian – aspen/balsam poplar/snowberry/silverberry/wild rose	
CAM-02	Elbow River (KWBZ)	Broadleaf Forest	Riparian – balsam poplar/aspen/wild rose	
CAM-03	East Side Hwy 22 (future raised section)	Shrubland	Tall willow shrubs/grassland and scattered spruce trees	
CAM-04	East Side Hwy 22 (future raised section)	Shrubland	Tall willow shrubs/grassland and patches of aspen trees	
CAM-05	West Side Hwy 22 (future raised section)	Shrubland/ Broadleaf Forest	Tall willow shrubs with scattered aspen trees	
CAM-06	West Side Hwy 22 (future raised section adjacent to Unnamed Creek)	Graminoid Marsh	Riparian - willow shrubs and scattered aspen trees.	

Table 8.1 Summary of Remote Camera Monitoring Stations by Land Cover Type - 2021 Pre-Construction Period

Camera ID	Location within PDA/LAA	Land Cover	Habitat Description	Monitoring Station Photo
CAM-07	Elbow River (KWBZ)	Mixed Forest	Riparian – willow shrubs/scattered spruce and aspen trees	
CAM-09	Elbow River (KWBZ)	Mixed Forest	Riparian – balsam poplar/spruce/shrubs (red-osier dogwood, silverberry, wild rose)	
CAM-10	Elbow River (KWBZ)	Mixed Forest	Riparian - white spruce/aspen forest/silverberry	
CAM-11	Elbow River – floodplain berm (KBWZ)	Coniferous Forest	White spruce/balsam poplar/shrubs (silverberry)	
CAM-12	South Side Township Road 242 (future bridge over diversion channel)	Agricultural Land	Tame grassland/hayland	
CAM-13	North Side Township Road 242(future bridge over diversion channel)	Agricultural Land	Hayland	

Table 8.1 Summary of Remote Camera Monitoring Stations by Land Cover Type - 2021 Pre-Construction Period

Camera ID	Location within PDA/LAA	Land Cover	Habitat Description	Monitoring Station Photo
CAM-14	West Side Hwy 22 (future Hwy 22 bridge over diversion channel)	Agricultural Land	Tame Pasture	
CAM-15	East Side Hwy 22 (future Hwy 22 bridge over diversion channel)	Shrubland	Willow shrub and patches of young aspen trees	
CAM-16	Future Diversion Channel – vegetated side slopes	Agricultural Land	Tame pasture/ aspen tree patches	
CAM-17	Future Diversion Channel – vegetated side slopes	Agricultural Land	Tame pasture, willow shrubs; low shrubs	
CAM-18	Future Diversion Channel – vegetated side slopes	Grassland	Native grassland/ tall willow shrubs; low shrubs	
CAM-19	Future Diversion Channel – vegetated side slopes	Grassland	Tame pasture/ tall willow shrubs; low shrubs	

Table 8.1 Summary of Remote Camera Monitoring Stations by Land Cover Type - 2021 Pre-Construction Period

Camera ID	Location within PDA/LAA	Land Cover	Habitat Description	Monitoring Station Photo
CAM-20	Future Earthen Dam	Agricultural Land	Cultivated field - hayland	
CAM-21	Future Earthen Dam	Agricultural Land	Cultivated field - hayland	
CAM-22	Future Earthen Dam	Agricultural Land	Cultivated field – cropland/tame pasture	
CAM-23	Future Earthen Dam	Agricultural Land	Cultivated field – cropland/tame pasture	N/A
CAM-24	Future Low-Level Outlet	Agricultural Land	Open field - tame pasture	
CAM-25	Future Low-Level Outlet	Mixed Forest (Unnamed Creek)	Riparian - aspen/spruce forest	
CAM-26	Future wildlife-friendly fencing – Springbank Road NW-24-24-4	Agricultural Land	Tame pasture/tall willows	

Table 8.1 Summary of Remote Camera Monitoring Stations by Land Cover Type - 2021 Pre-Construction Period

Camera ID	Location within PDA/LAA	Land Cover	Habitat Description	Monitoring Station Photo
CAM-27	Future Culvert Crossing at Raised Intersection of Hwy 22 and Springbank Road -	Grassland	Native grassland/ tame pasture	
CAM-28	Future wildlife-friendly fencing – PDA perimeter NW 23-24-4	Mixed Forest/ Agricultural Land	Tall willow shrubs, aspen trees, tame pasture	
CAM-29	Future wildlife-friendly fencing – PDA perimeter NW 10-24-4	Agricultural Land	Tame pasture/cropland	
CAM-30	Future wildlife-friendly fencing – PDA perimeter NW-19-24-3	Agricultural Land	Tame pasture	
CAM-31	East Side Hwy 22 (near known deer Hwy 22 crossing location – SW-23-24-4-W5)	Grassland	Native grassland on slope	
CAM-32	North end of diversion channel	Shrubland	Tall willow shrubs/tame pasture	
NOTE: N/A – no picture available because remote camera (CAM-23) was destroyed/lost.				

8.2.1.2 Construction

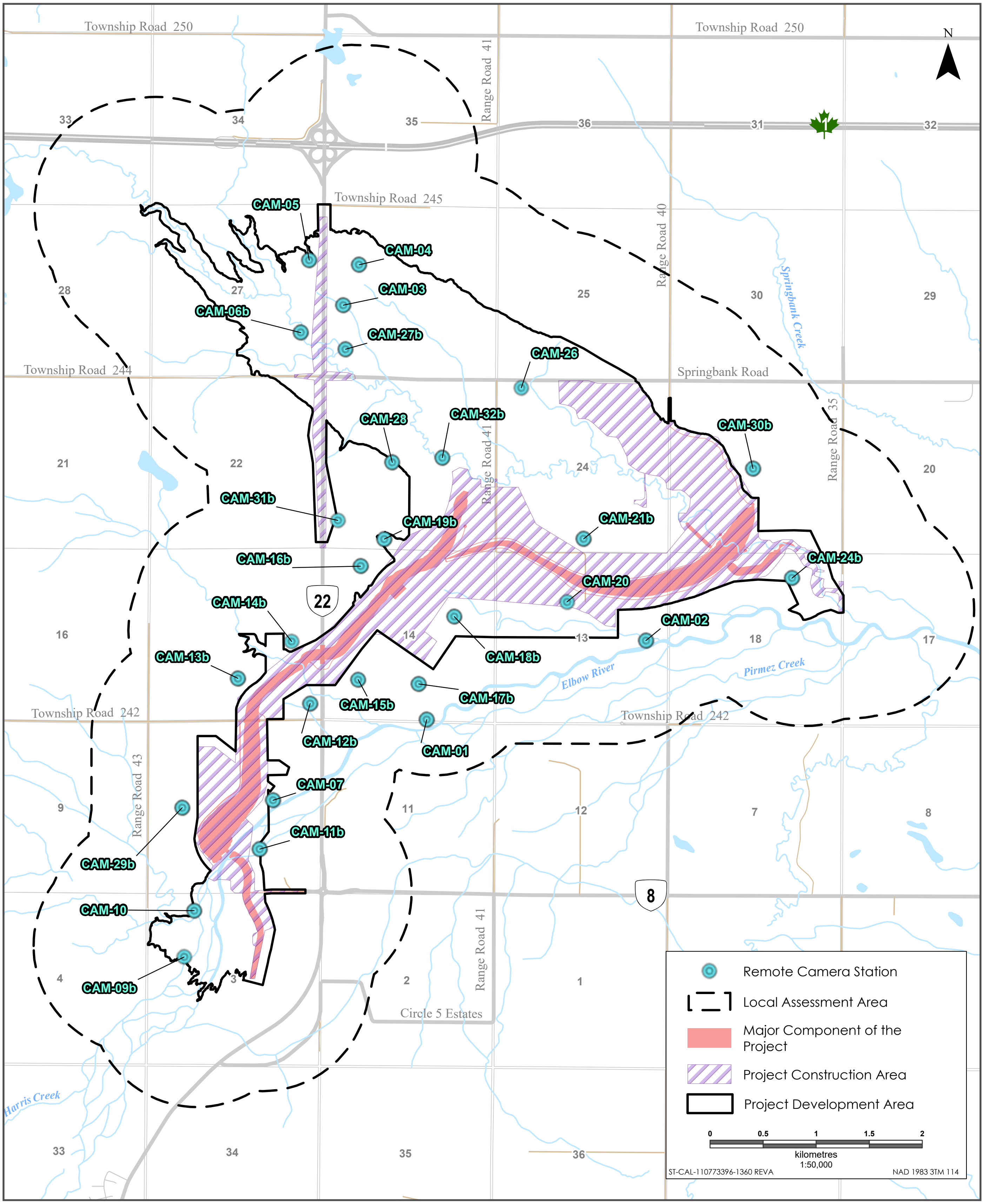
The remote cameras deployed during the 2021 pre-construction monitoring period that were placed within the Project Construction Area (i.e., permanent Project structure footprint and temporary workspaces) were moved during January 18 to 22, 2022 and on February 4, 2022, prior to the start of construction on February 8, 2022. Cameras were redeployed in similar habitat types outside the Project Construction Area where land access permitted (Figure 7). Two remote cameras (CAM-20 and CAM-25) were not relocated outside the Project Construction Area because there was no other suitable alternative location within similar habitat types.

8.2.2 DATA ANALYSIS

All images were reviewed and classified using MapView Professional software to determine wildlife presence. Individuals detected by remote cameras were identified to species as well as age and sex class, when possible. False triggers (events without an animal present) (e.g., wind moving a tree branch) and continuous images of vehicles (e.g., Highway 22) were removed prior to data analysis.

Wildlife observations were recorded by identifying independent events, which were defined as any image or series of images of each species (individual animal or group of animals) occurring greater than two minutes after the last image of the same species. Other domestic livestock (i.e., cows, horses) as well as humans (e.g., hiker, hunter, dog walkers) were recorded as events but not analyzed further.

A relative abundance index (i.e., photographic rate) was calculated by summing the count for each species over all independent events and dividing by the number of days the camera was active and calculated as the number of detections per 100 camera-days (Palmer et al. 2018, Burton et al. 2021). Photographic rates (detections/100 camera-days) were calculated for each season to account for potential seasonal differences in detection rates (Kays et al 2020). Specifically, this annual report includes an analysis of photographic rates for two seasons including fall (September 1 to November 30) and winter (December 1 to March 31) to coincide with this annual reporting period. Future annual reports will include results from all four seasons including spring (April 1 to May 31) and summer (June 1 to August 31). Only medium to large terrestrial mammals were included in the relative abundance analysis. All other wildlife observations observed by remote cameras were recorded as incidentals (e.g., birds, raptors, skunk) and not included in the analysis of relative abundance.



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
10/25/2022

Remote Camera Survey Locations
2022 Construction

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Figure 7

8.3 Results and Discussion

8.3.1 PRE-CONSTRUCTION

Four Stantec biologists and two Indigenous assistants installed 22 remote cameras in the LAA on September 16-17, 2021 and another eight cameras on December 9-10, 2021. One remote camera deployment was delayed due to landowner access constraints but was eventually installed on January 20, 2022. One remote camera previously deployed in 2016 along Elbow River (CAM-08) was not installed due to landowner access constraints. In total, 31 remote cameras were installed in 2021 prior to construction activities (Figure 6). However, four remote cameras malfunctioned during the monitoring period including one due to elk damage, one due to suspected elk damage and/or vandalism and two due to faulty camera settings. The cameras damaged due to elk were not replaced at these locations. Of the 10 remote cameras deployed during 2016, nine were re-deployed in 2021-2022 at the same survey station location. Remote camera data were retrieved from all stations on January 18 to January 20, 2022 and February 4, 2022.

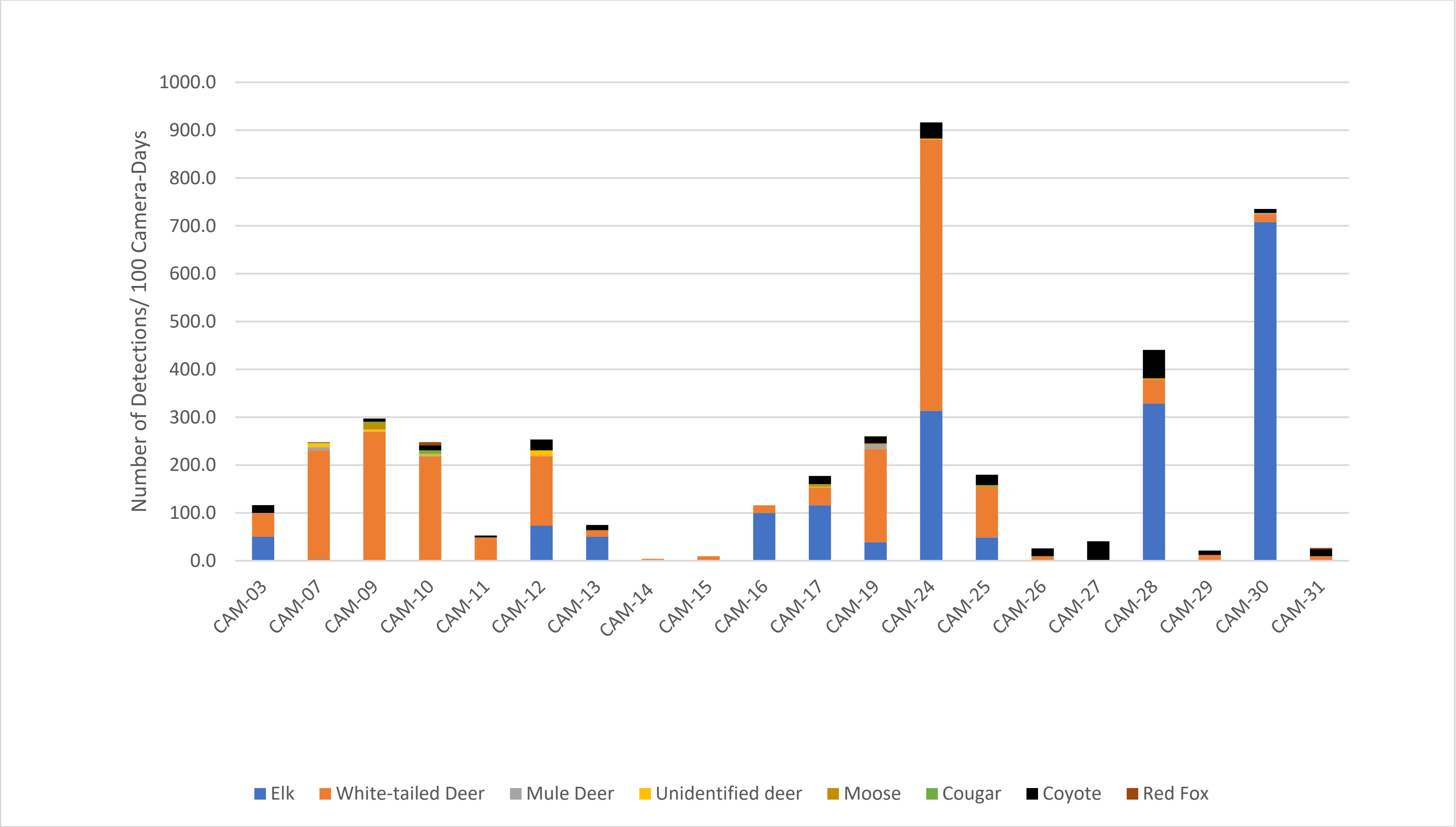
The total number of days each camera station was operational varied between 18-144 days (maximum number of monitoring days prior to construction). Twenty remote cameras (74%) were operational for the full monitoring period (144 days), five cameras for 60 days, one camera for 40 days and one camera for 18 days. The variation in the number of days each camera was deployed was related to delayed installation due to landowner access constraints, which resulted in 20 cameras operational during fall but the total number of cameras deployed (27) not operational until winter.

During fall pre-construction (September 16, 2021 to November 30, 2021), 20 remote cameras detected 1,755 independent events over 1,488 camera-days. Of those, the majority of independent events were white-tailed deer (60%) followed by elk (13.2%) and coyote (11.1%). The remainder of independent events included cows (7.3%), other wildlife species (5%; discussed below), horses (2.1%) and humans 1.6%). During winter pre-construction (December 12, 2021 to February 7, 2022), 27 remote cameras detected 897 independent events over 1,733 camera-days. Of those, the majority of independent events were also white-tailed deer (47.9%), followed by coyote, which increased to 24.4% and elk (11.8%). The remainder of independent events included other wildlife species (12.5%, discussed below), horse (2.2%), cow (0.2%) and humans (0.1%).

8.3.1.1 Relative Abundance

Seven medium to large mammal species were detected during the 2021 pre-construction monitoring period (Figure 8). The wildlife species detected were similar to the species detected in 2016; however, there were no black bear (*Ursus americanus*) or grizzly bear detected during fall 2021. Three species of small mammals were detected including red squirrel (*Tamiasciurus hudsonicus*), white-tailed jackrabbit (*Lepus townsendii*) and striped skunk (*Mephitis mephitis*) as well as one semi-aquatic furbearer (mink [*Mustela vison*]). Six species of bird were also detected: American crow (*Corvus brachyrhynchos*), black-billed magpie (*Pica hudsonia*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), rough-legged hawk (*Buteo lagopus*) and great-horned owl (*Bubo virginianus*).

Figure 8 **Relative Abundance (Number of Detections/100 Camera-Days) of Wildlife Species at each Remote Camera Station during Fall – 2021 Preconstruction**



During the 2021 fall pre-construction monitoring period, white-tailed deer was the most frequently detected wildlife species followed by elk (Table 8.2; Figure 8). White-tailed deer were detected at 19 of 20 (95%) monitoring stations indicating they are widely distributed in the LAA whereas elk were detected at 11 of 20 (55%) monitoring stations. Coyote was also widely distributed in the LAA with detections at 16 of 20 cameras (80%).

During fall, CAM-24, deployed south of unnamed creek in tame pasture (agricultural land) recorded the highest photographic rates with over 900 detections/100 camera-days, followed by CAM-30, and CAM-28 (Figure 8). White-tailed deer had the highest photographic rates at CAM-24 whereas elk were more frequently detected at CAM-28 (willow shrub/aspen) and CAM-30 (tame pasture). Many of the elk detected at CAM-28 were resting or feeding whereas most of the elk detected at CAM-30 were travelling southwest or north across the open field in cow-calf pairs, bachelor groups and mixed groups (bulls, cows, juveniles). CAM-07, CAM-09 and CAM-10 deployed along Elbow River in mixed forest had moderate levels of activity with 251, 301 and 251 detections/100 camera-days, respectively. White-tailed deer were the most frequently detected species along Elbow River; however, moose (*Alces alces*) as well as cougar were also detected (Figure 8).

CAM-14 and CAM 15 deployed along Hwy 22 near the proposed bridge over the diversion channel had the lowest level of wildlife activity during fall (Figure 8). These two monitoring stations recorded very high numbers of cars and trucks. CAM-12 and CAM-13 deployed along Township Road 242 (Figure 6) also recorded relatively high traffic levels; however, CAM-12 still detected moderate levels of wildlife use, particularly deer and elk whereas wildlife detections at CAM-13 were relatively lower (Figure 8).

Overall, deer and elk were detected most frequently in agricultural fields and grassland habitats near the low-level outlet and unnamed creek (CAM-24, CAM-25) as well as north of the proposed off-stream dam (CAM-30). Mixed shrubland/forest/agricultural lands located east of Hwy 22 along the PDA boundary (CAM-28) were also frequently used for feeding and bedding as well as agricultural fields just north of the diversion channel (CAM-32) (Appendix B, Figure B.1).

During fall, elk were detected travelling southwest in mixed groups (1-67 individuals) during September/October (CAM 30; Appendix A, Photo A.1), and during mid-November (CAM-12; Appendix A, Photo A.2). CAM-16 detected a large group of elk (75) travelling northwest during late November (Appendix A, Photo A.3). Elk were also detected moving southwest across agricultural fields and tame pasture during December and shrubland in late January (CAM-30, CAM-15 [Appendix A, Photo A.4], CAM-18).

CAM-26 near Springbank Road and CAM-29 located west of the diversion channel in an agricultural field, detected relatively fewer deer and elk compared to other remote camera stations (Figure 8). In addition, all cameras adjacent to Hwy 22 (CAM-14, CAM-15, CAM-27, CAM-31) also detected relatively few deer and elk. Overall, coyote were well distributed throughout the LAA whereas cougar were detected most frequently along Elbow River (CAM-07, CAM-09, CAM-10) (Figure 8).

Table 8.2 Relative Abundance of Wildlife Species by Season during Pre-Construction 2021-2022

	Detections/100 Camera-Days									
Season [a]	**Cougar**	**Coyote**	**Red Fox**	**Black Bear[d]**	**Grizzly Bear[d]**	**Moose**	**Elk**	**Mule Deer**	**White-tailed Deer**	**Unidentified Deer**
Fall [b]	0.7	15.3	0.5	0.0	0.0	1.3	91.5	1.1	100.2	1.5
Winter [c]	0.4	14.7	1.4	▨	▨	1.3	47.3	1.0	48.8	0.2

NOTES:

[a] Fall: September to November; Winter: December to March

[b] Number of detections/100 camera-days pooled over 20 remote cameras

[c] Number of detections/100 camera-days pooled over 27 remote cameras

[d] Black and grizzly bear detections not applicable due to winter hibernation

During winter, white-tailed deer and elk remained the most frequently detected species, however, photographic rates were lower compared to fall for both species (Table 8.2). The number of elk detections increased in areas supporting grassland and tame pasture (CAM-18, CAM-19, CAM-28, CAM-30) as well as shrubland (CAM-32) (Figure 9; Table 8.1). Overall, white-tailed deer were detected at 24 of 27 (88.9%) camera stations and elk were detected at 14 of 27 monitoring stations (51.8%), which represented similar naïve occupancy rates compared to fall pre-construction. Coyote was detected at 24 of 27 camera stations (88.9%), which indicated they are well distributed in the LAA.

During winter, photographic rates decreased compared to the fall 2021 pre-construction monitoring period (Figure 8 and Figure 9). CAM-24 recorded the highest total photographic rate similar to fall 2021 with white-tailed deer detected most frequently (Figure 9). Elk continued to be detected at CAM-28 and CAM-30 but were also frequently detected at CAM-18 (grassland/willow shrub) (grassland), CAM-19 (tame pasture/willow shrub) and CAM-32 (willow shrub) (Figure 9; Appendix B, Figure B.2). CAM-14 deployed along Hwy 22 only recorded traffic with no wildlife detections whereas CAM-15 detected primarily coyote (Figure 9).

Overall, these results are similar to 2016 when both white-tailed deer and elk were the most frequently detected and abundant wildlife species in the LAA. A comparison of relative abundance at remote camera stations monitored during both 2016-2017 and 2021-2022 indicate the total number of wildlife detections along Elbow River (CAM-1, CAM-2, CAM-7, CAM-9, CAM-10) during fall increased in 2021-2022 compared to 2016 but was relatively lower during winter (Figure 10). Most of the species detected at these cameras were white-tailed deer.

Figure 9 **Relative Abundance (Number of Detections/100 Camera-Days) of Wildlife Species at each Remote Camera Station during Winter – 2021/2022 Preconstruction**

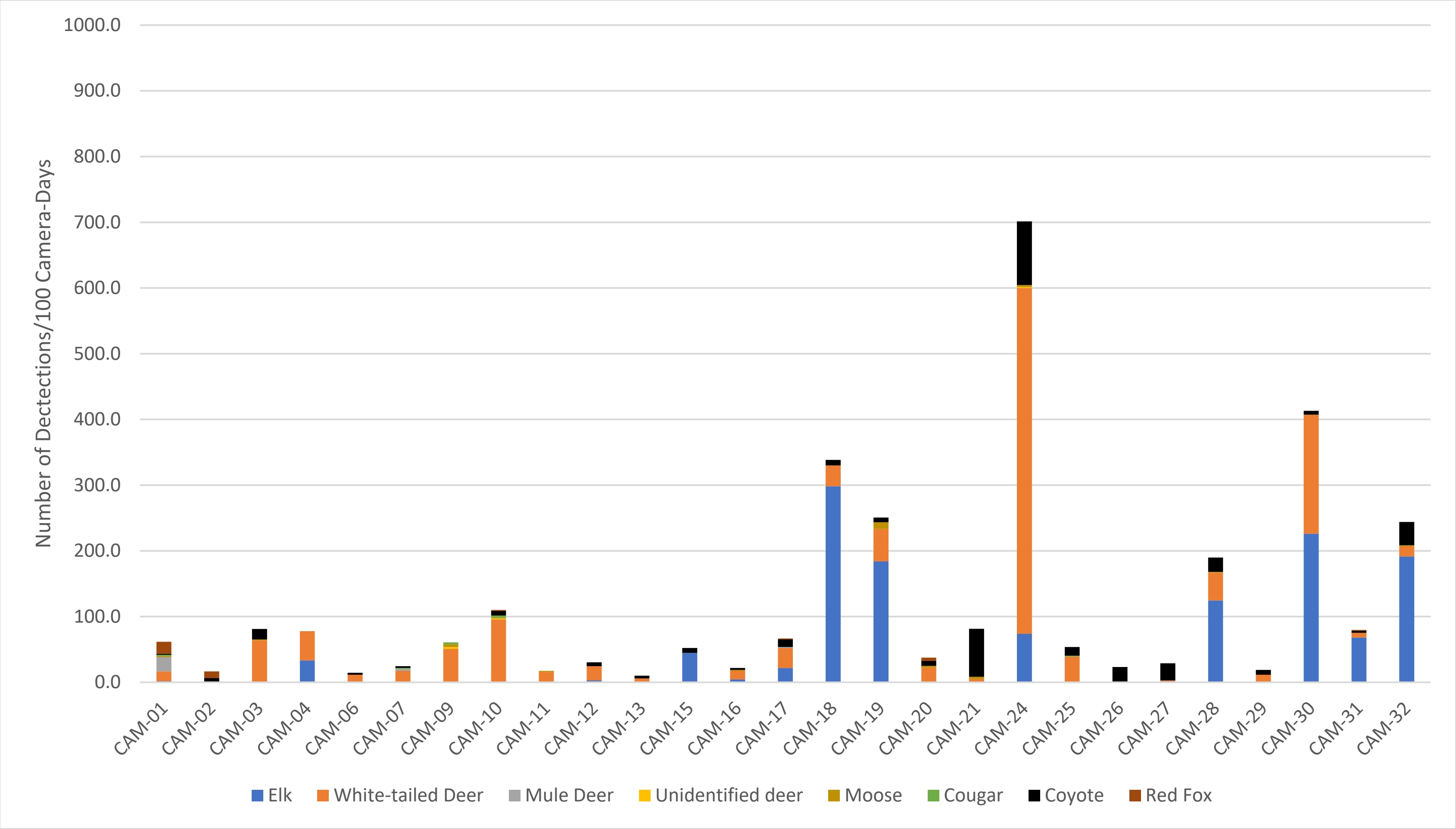
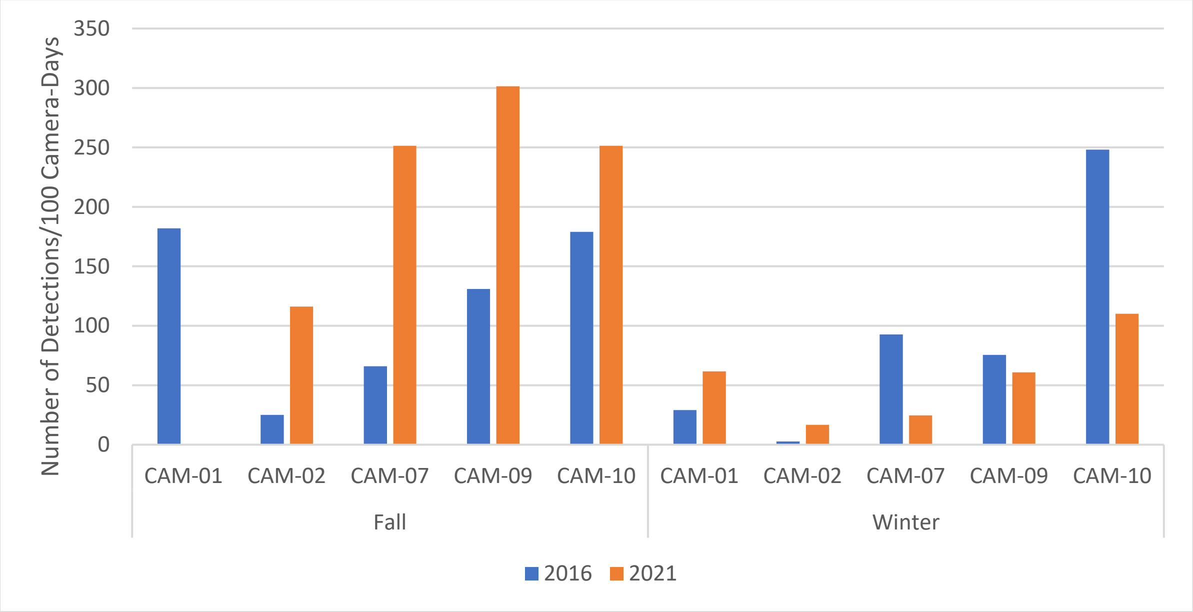


Figure 10 A Comparison of Relative Abundance (Number of Detections/100 Camera-Days) of Wildlife Species along Elbow River during 2016-2017 Baseline and 2021-2022 Pre-Construction



8.3.2 CONSTRUCTION

The remote cameras were operational from February 8, 2022 to April 13, 2022 during the initial stages of construction, which included tree removal using feller-bunchers and hand-fallers near the diversion structure, and floodplain berm as well as mulching of vegetation within the diversion channel construction area and low-level outlet near unnamed creek. The initial construction phase overlapped both winter and spring seasons. However, as previously mentioned, there was only two weeks of spring data (April 1 to April 13) collected during this reporting period; and therefore, only the remote camera data collected during winter construction (February 8 to March 31) are discussed in this Annual Report. The spring 2022 data will be analyzed when the remainder of the data are collected later this year and presented in the second Annual Report scheduled to be submitted in 2023.

CAM-5 malfunctioned due to a programming error and CAM-13b malfunctioned due to cows knocking the camera over and displacing the camera orientation on February 12, 2022. CAM-13b was only operational for 4 days during construction; and therefore, was not included in the analysis. However, it is worth noting 42 elk were detected at CAM 13b travelling southwest across the agricultural field north of Township Road 242 on February 9, 2022. The remaining 25 cameras were operational for 51 days during the initial construction monitoring period.

Twenty-five remote cameras detected 591 independent events over 1,275 camera-days during winter construction (February 8, 2022 to March 31, 2022). Of those, the majority of independent events were white-tailed deer (53.8%) followed by coyote (20.6%) and elk (10.3%).

8.3.2.1 Relative Abundance

Seven mammal species were detected during the winter 2022 construction period including one bobcat (*Lynx rufus*) at CAM-24b. White-tailed deer had the highest photographic rate followed by elk and coyote (Figure 11; Table 8.3). Three species of small mammals were detected including white-tailed jackrabbit, snowshoe hare and striped skunk as well as one semi-aquatic furbearer (mink). Six species of bird were also detected: American crow, black-billed magpie, European starling (*Sturnus vulgaris*), Canada goose, mallard, and great-horned owl.

Table 8.3 Relative Abundance of Wildlife Species during Winter 2022 Pre-Construction and Construction

Project Phase	Detections/100 Camera-Days							
	Bobcat	**Cougar**	**Coyote**	**Red Fox**	**Moose**	**Elk**	**Mule Deer**	**White-tailed Deer**
Pre-Construction [a]	0.0	0.4	14.7	1.4	1.3	47.3	1.0	48.8
Construction [b]	0.1	0.0	12.2	0.5	1.1	43.9	0.4	70.8

NOTES:

Winter: Defined as February 8 to March 31 for this reporting period. Otherwise, defined as December 1 to March 31

[a] Number of detections/100 camera-days across 27 remote cameras

[b] Number of detections/100 camera-days across 25 remote cameras

Overall, the wildlife species observed (richness) was similar to the wildlife species detected during the pre-construction period. Relative abundance (photographic rates) remained similar to winter pre-construction for most species (see Figure 9). Elk were detected at similar photographic rates during winter construction (43.9 detections/100 camera-days) compared to winter pre-construction (47.3 detections/100 camera-days) (Table 8.3). However, there were apparent shifts in elk use within the LAA during construction as photographic rates were lower at some remote camera stations (e.g., CAM 18, CAM 19, CAM-32b) but higher at others (CAM 04, CAM 24b; see Figure 12; Appendix B, Figure B.3).

Photographic rates for white-tailed deer increased during winter construction (70.8 detections/100 camera-days) compared to winter pre-construction (48.8 detections/100 camera-days) (Table 8.3). Although the remote cameras were relocated prior to construction in similar habitats, the relocation site(s) may have provided relatively higher suitability habitat (e.g., proximity of feeding habitat to tree/shrub cover) or better travel routes compared to the pre-construction monitoring location. For example, CAM-30b, which was relocated in tame pasture but closer to tree and shrub cover, resulted in a large increase in photographic rate for white-tailed deer compared to winter pre-construction (Figure 10 and Figure 12). Further monitoring across all sites will help clarify any trends in seasonal occurrence.

A comparison of white-tailed deer photographic rates during winter pre-construction and construction within the KWBZ identified along Elbow River varied with survey station. CAM-1 and CAM-11 recorded slight increases in photographic rates whereas CAM-2 had similar but low photographic rates. CAM-7, CAM-9 and CAM-10 all recorded lower photographic rates for white-tailed deer during construction. A comparison of species-specific photographic rates at each remote camera station during winter preconstruction and construction are provided in Figure 12.

Figure 11 **Relative Abundance (Number of Detections/100 Camera-Days) of Wildlife Species at each Remote Camera Station during Winter – 2022 Construction**

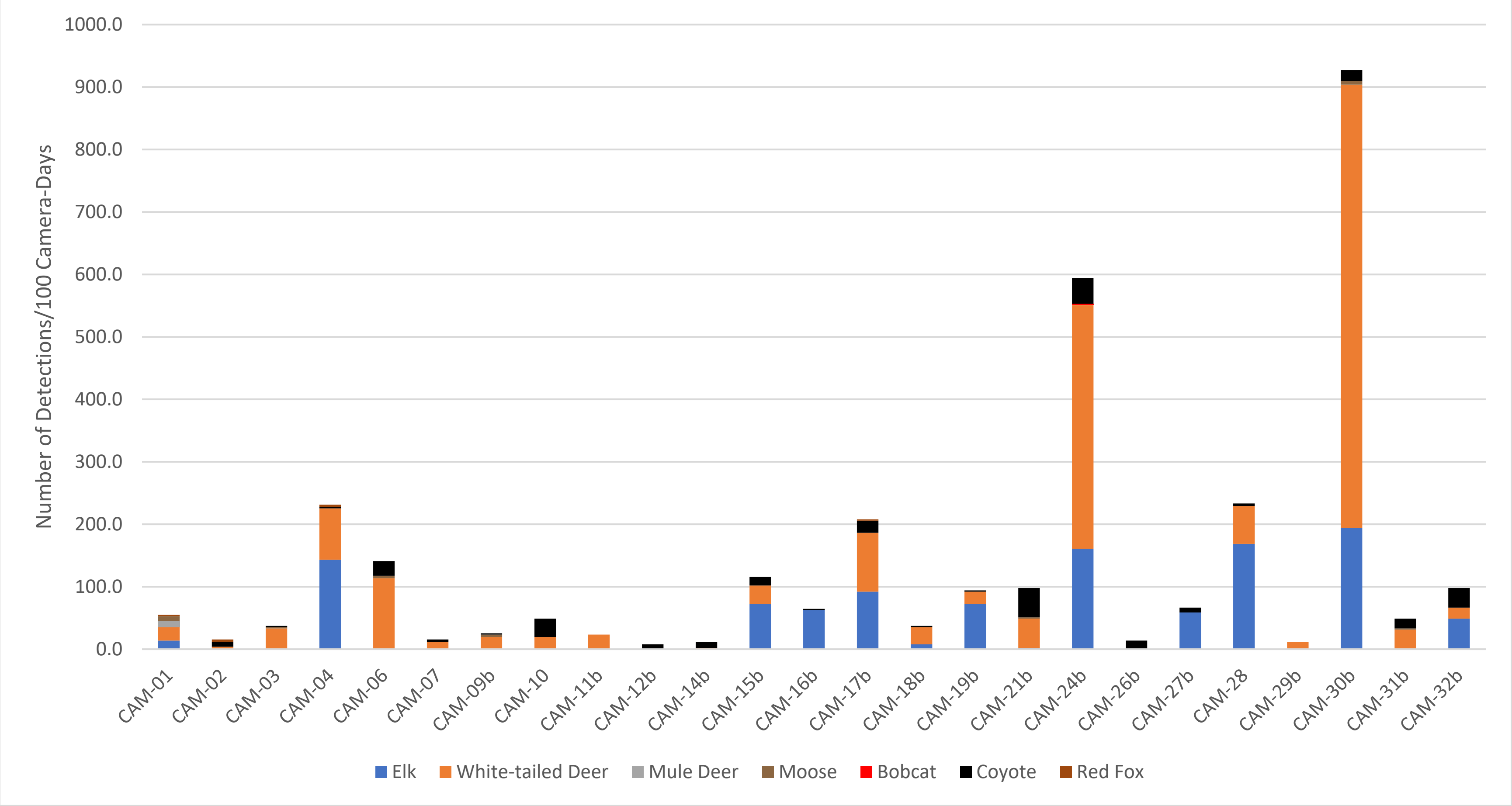
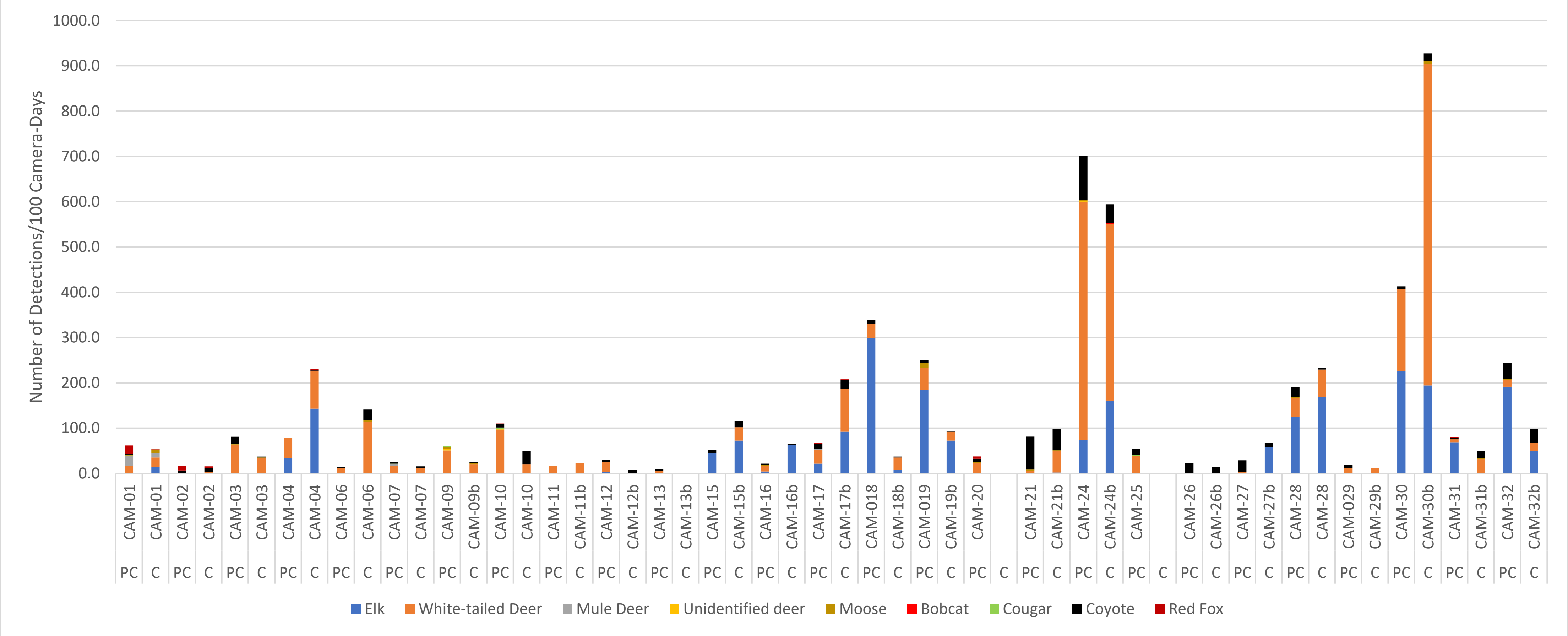


Figure 12 **Relative Abundance of Wildlife Species at each Remote Camera Station during Winter 2022 Pre-Construction (PC) and Construction (C) Periods**



8.4 Data Limitations

One of the primary objectives of the remote camera monitoring program is to determine if there is a measurable change in the relative abundance (photographic rate) of large and medium-sized mammals in the LAA during construction and dry operations compared to baseline/pre-construction. The results of the 2021-2022 remote camera program provided data to evaluate potential Project effects on wildlife habitat use and relative abundance in the LAA; however, the data collected were limited to two pre-construction seasons (fall, winter) and one construction season (winter). Further monitoring and analysis will be required to account for potential seasonal changes in photographic rates during spring, summer and fall 2022 as well as other subsequent monitoring years.

Although the number of cameras deployed varied over each project phase and season (fall pre-construction n=20; winter pre-construction n=27; winter construction n=25); the sampling effort was considered adequate based on recommended samples sizes reported in the literature (Shannon et al. 2014; Kays et al. 2020). In addition, the relatively high photographic and naïve occupancy rates for both white-tailed deer and elk during both pre-construction and initial construction phases also suggested sampling effort was adequate to detect common focal species (Shannon et al. 2014). As the monitoring program progresses, there will be opportunities to evaluate remote camera results each monitoring year and adjust the sample size, as necessary.

Many of the cameras were placed in locations that resulted in relatively high photographic rates; however, some of the cameras deployed adjacent to roads (e.g., Hwy 22) during pre-construction resulted in relatively few animal detections. This might reflect habitat avoidance (road effect) along certain sections of roadways/highways (Caravaggi et al. 2020), and/or wildlife (e.g., deer and elk) might be crossing Hwy 22 at different crossing locations. During construction, cameras that recorded high traffic volumes were moved away from roads including Project construction traffic as best as possible; however, there were other sources of construction traffic (i.e., third-party utility work) that confounded Project construction traffic at CAM-12b. Continued monitoring along Hwy 22 and Township Road 242 at future bridges over the diversion channel (i.e., underpass) will allow for further adjustments if required and provide additional data to eventually compare wildlife use during construction to dry operations.

Photographic rates of species should be interpreted with caution because they do not account for probability of detection (Burton et al. 2015, Caravaggi et al. 2020). However, the relatively open habitat conditions (agricultural land, grassland, open shrub) and camera placement along trails provided relatively consistent conditions across the majority of camera stations, which would reduce potential bias in detectability. Nonetheless, it is recognized there are species-specific differences in home range sizes, behaviour and movement patterns that can affect relative abundance indices (Burton et al. 2015). Overall, photographic rates were considered adequate to determine species occurrence at multiple cameras sites during the same monitoring period and study area (Muhly et al. 2011). In addition, one of the primary objectives of the remote camera monitoring program will be focused on evaluating wildlife crossing success or crossing rate for Project permanent structures, which will rely less on whether there are biases in detectability. This is because the purpose of monitoring during dry operations will be to evaluate whether an individual crosses or uses a Project structure (e.g., diversion channel) once they are detected by the remote camera (i.e., behavioural response).

8.5 Future Monitoring

Overall, in combination with the baseline data collected in 2016-2017, the remote camera data collected in 2021-2022 provided additional pre-construction data that demonstrated spatial variation in wildlife species occurrence and relative abundance in the LAA. The remote camera monitoring program will continue to use the existing camera stations to provide monitoring results during construction. However, cameras deployed adjacent to Hwy 22 and Township Road 242 will be evaluated and adjusted as necessary to reduce the amount of traffic recorded (e.g., moved farther back from the right-of-way) and sensitivity reduced (e.g., headlights). Future construction monitoring and 2023 reporting will include additional seasonal data collected during spring, summer, and fall 2022. In addition, future monitoring results will consider grouping remote camera stations into respective Project component categories (e.g., diversion channel, wildlife friendly fence, underpass) to better clarify spatial variation in wildlife use/movement in the LAA. As monitoring continues and sample sizes increase, more robust statistical analysis will be completed to quantitatively compare potential changes in photographic rates during pre-construction, construction, and eventually dry operations. Image recognition and classification software (e.g., MegaDetector [Microsoft Inc], Timelapse [Greenberg 2021) are being explored to increase data processing efficiency.

9 Incidental Wildlife Observations

Incidental wildlife species of management concern (SOMC) including their sign (e.g., tracks, scats), as well as wildlife habitat features (e.g., dens, nests, mineral licks, potential bat roosts and hibernacula) were recorded during pre-construction surveys as well as wildlife sweeps completed by Stantec. SOMC are defined as:

- listed federally as *endangered*, *threatened*, or *special concern* under Schedule 1 of the *Species at Risk Act* (GOC 2022)
- listed federally as *endangered*, *threatened*, or *special concern* by the Committee on the Status of Endangered Wildlife in Canada (GOC 2022)
- listed provincially as *endangered* or *threatened* under the Alberta *Wildlife Act* or *special concern* by the Alberta Endangered Species Conservation Committee (GOA 2022)
- listed provincially as *at risk*, *may be at risk*, or *sensitive* according to the General Status of Alberta Wild Species (AEP 2020)

Thirteen incidental wildlife SOMC were observed during the 2021 pre-construction wildlife surveys including 10 birds, one mammal, one amphibian and one reptile (Table 9.1).

Table 9.1 Incidental Observations of Wildlife Species of Management Concern

Common Name	Scientific Name	SARA Status[1]	COSEWIC Status[1]	Alberta Wildlife Act[2]	General Status Rank[3]
Birds					
sora	*Porzana Carolina*	---	---	---	Sensitive
great blue heron	*Ardea herodias*	---	---	---	Sensitive
golden eagle	*Aquila chrysaetos*	No Status	Not At Risk	---	Sensitive
bald eagle	*Haliaeetus leucocephalus*	---	Not at risk	---	Sensitive
American kestrel	*Falco sparverius*	---	---	---	Sensitive
eastern kingbird	*Tyrannus tyrannus*	---	---	---	Sensitive
bank swallow	*Riparia riparia*	Threatened	Threatened	---	Sensitive
barn swallow	*Hirundo rustica*	Threatened	Special Concern	---	Sensitive
Baird’s sparrow	*Ammodramus bairdii*	Special Concern	Special Concern	---	Sensitive
Baltimore Oriole	*Icterus galbula*	---	---	---	Sensitive

Table 9.1 Incidental Observations of Wildlife Species of Management Concern

Common Name	Scientific Name	SARA Status[1]	COSEWIC Status[1]	Alberta Wildlife Act[2]	General Status Rank[3]
Mammals					
Water Vole	*Microtus richardsoni*	---	---	---	Sensitive
Amphibians					
western tiger salamander	*Ambystoma mavortium*	Special Concern	--	---	Secure
Reptiles					
plains garter snake	*Thamnophis radix*	---	---	---	Sensitive

NOTES:

[1] GOC 2022

[2] GOA 2022

[3] AEP 2020

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APPENDICES

Appendix A Photos

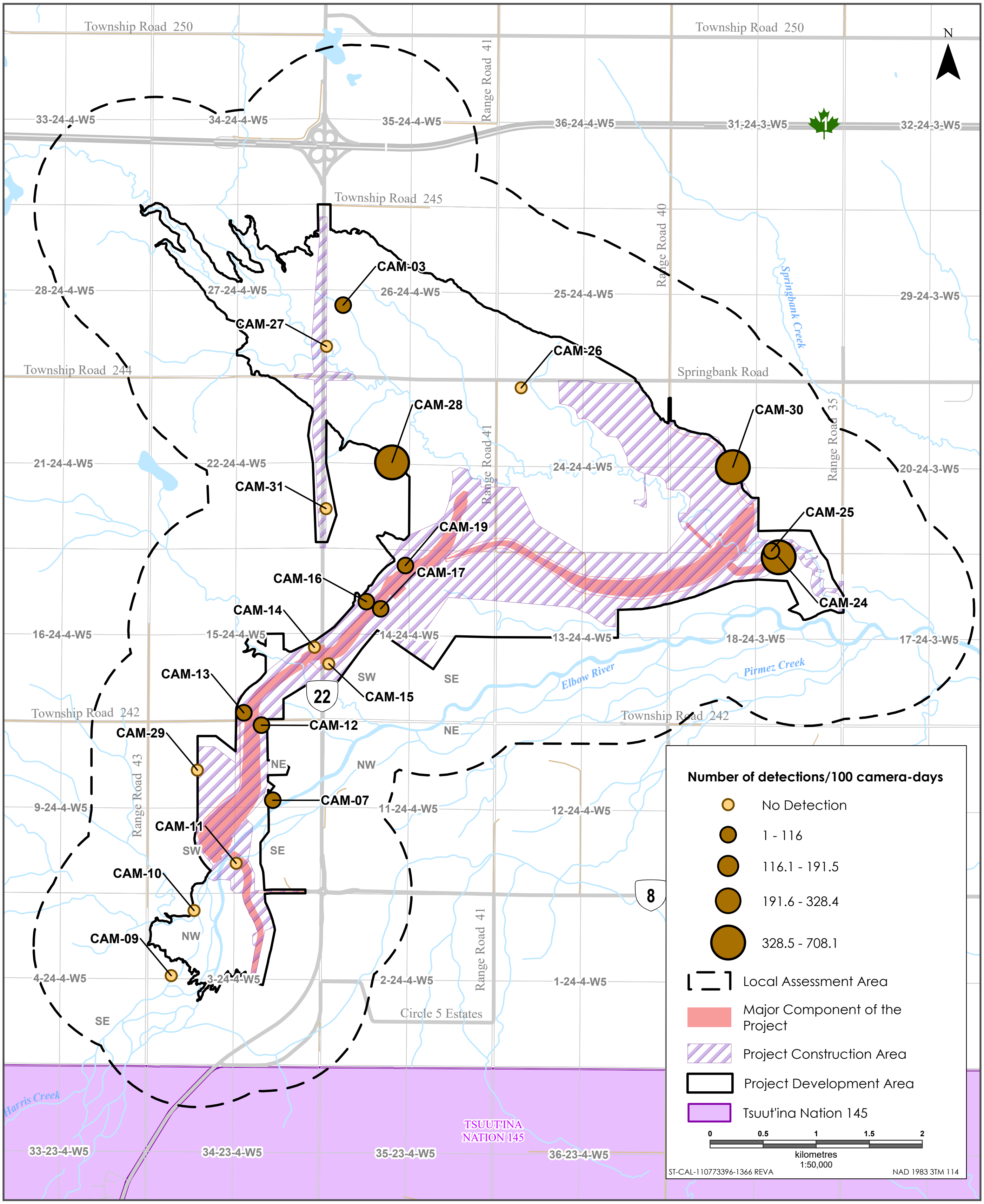
Photo A.1 **Elk herd travelling south across agricultural field on east side of Project Development Area (PDA) boundary during fall (September) 2021**

Photo A.2 **Elk herd travelling west across agricultural field near Township Road 242 during fall 2021**

Photo A.3 Elk herd travelling northwest near proposed diversion channel during fall 2021

Photo A.4 **Elk herd travelling west towards Hwy 22 near proposed diversion channel during winter 2022**

Appendix B Elk Relative Abundance (Photographic Rates) by Remote Camera Station in the LAA



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

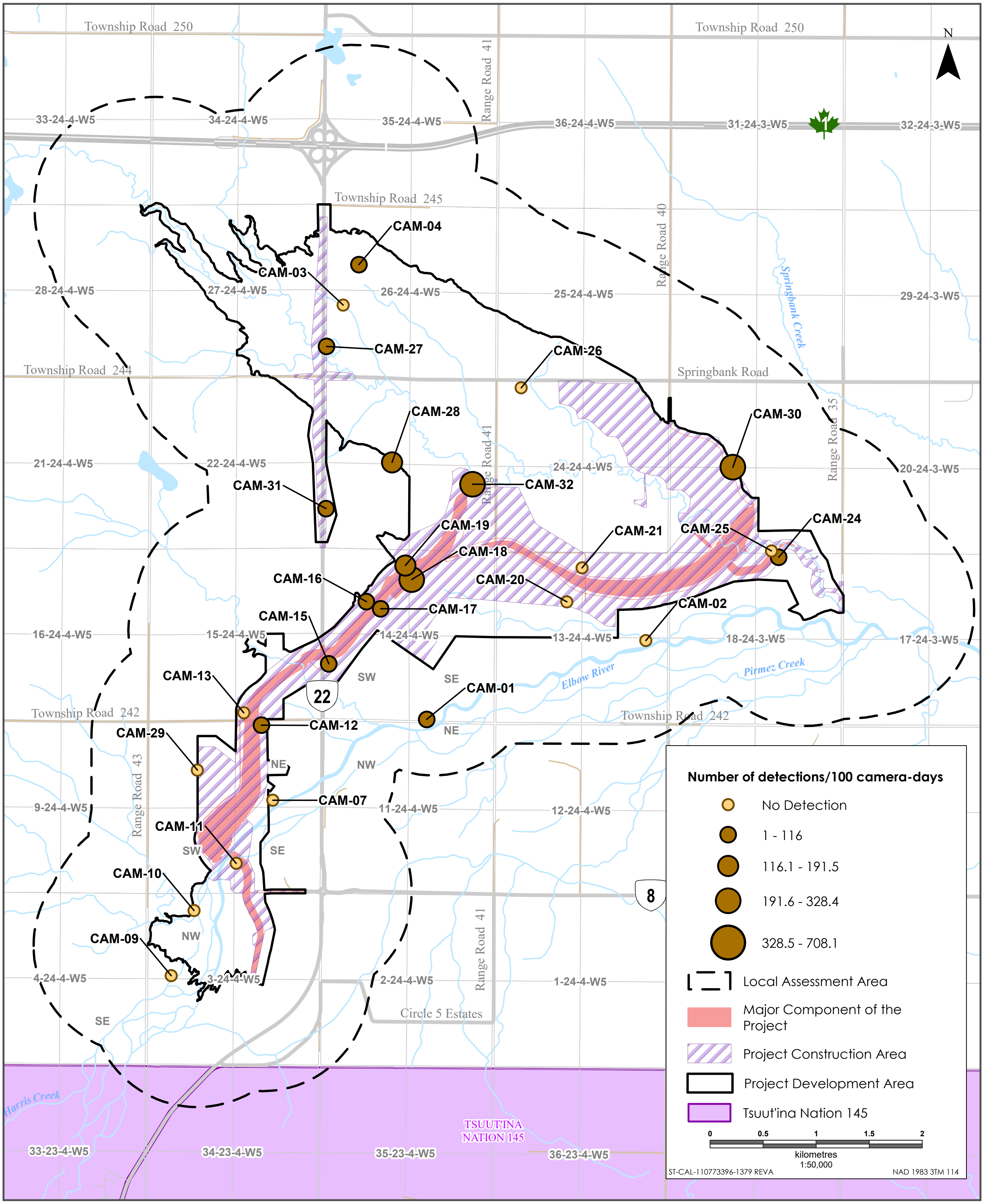
Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
10/25/2022

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Number of Elk Detections/100 Camera Days by Remote Camera Station
Fall 2021 Pre-construction

Figure B.1



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
10/25/2022

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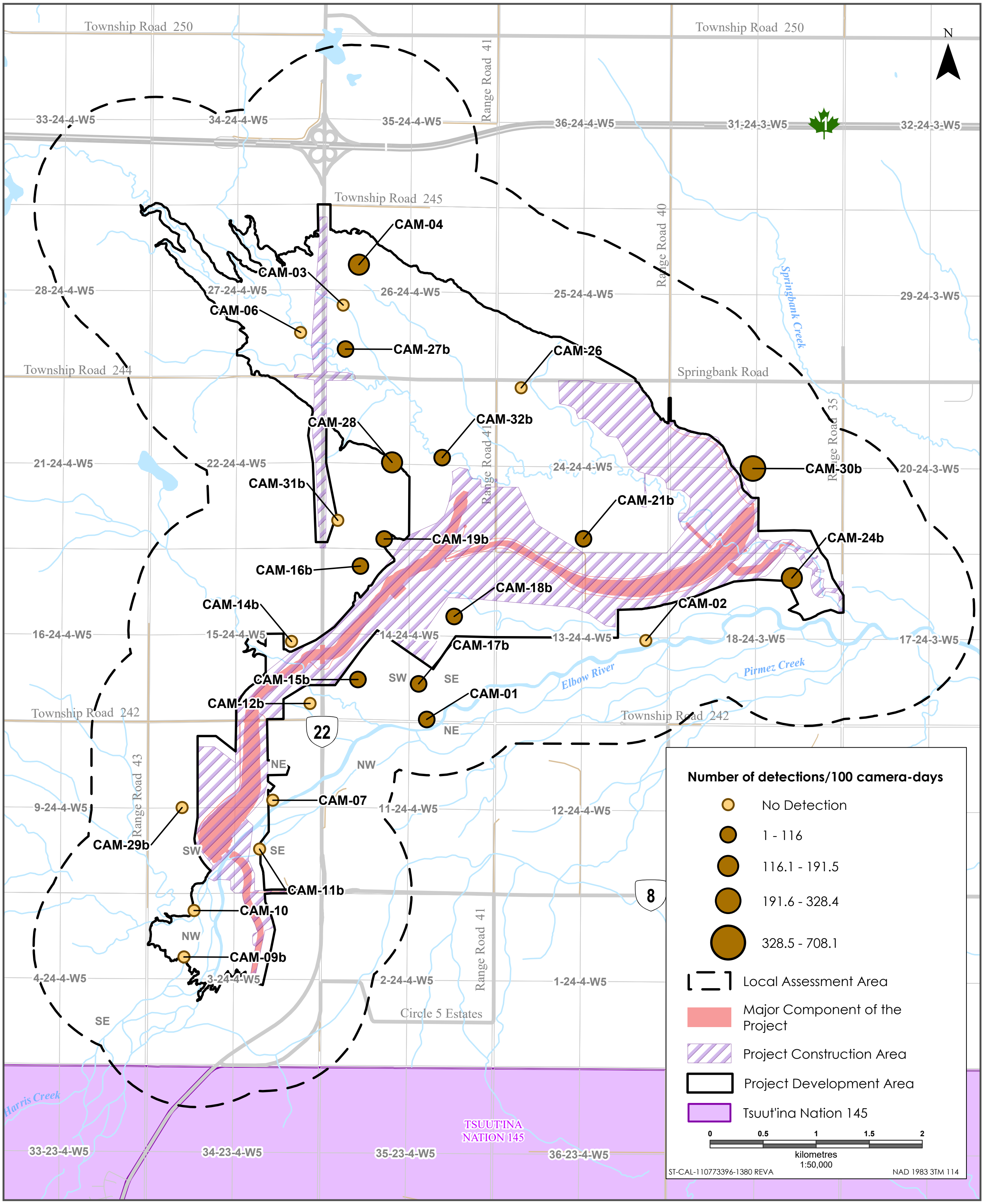
ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Number of Elk Detections/100 Camera Days by Remote Camera Station
Winter 2021/2022 Pre-construction

Figure B.2



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.
10/25/2022

Number of Elk Detections/100 Camera Days by Remote Camera Station Winter 2022 Construction

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Figure B.3

B.2

Fisheries

Stantec

Memo

To: Mark Svenson
Alberta Transportation
Project/File: 110773396

From: Lacey AuCoin
Stantec Consulting Ltd.
Date: October 31, 2022

Reference: Springbank Off-stream Reservoir Project Fish Passage Baseline Study

1 Introduction

This memorandum provides a summary of fish passage data results for the Springbank Offstream Reservoir Project (the Project) completed by Stantec staff between June and October 2021.

2 Methods

Stantec completed fish passage baseline data collection in the Elbow River on June 11, August 20 to 23, and October 12, 2021. The sampling periods aligned with the biologically significant periods (BSPs) that have been previously identified for fish passage evaluation as it pertains to the Project (Stantec 2021).

Field data was collected upstream of the Project and at the Project location during June, August, and October. Sites downstream of the Project were measured in June and August. Three transects were established at each monitoring site, and additional transects were measured at side channels and flood plain channels in June and August to account for high water levels. Figure 2.1, Figure 2.2, Figure 2.3, and Figure 2.4 demonstrate the locations where data was collected. A FlowTracker® Handheld Acoustic Doppler Velocimeter (ADV®) was used to collect flow and velocity data in the Elbow River. Wetted width and average wetted depth were measured using survey tape and a meter stick, respectively. Field crews recorded habitat observations at each transect as it relates to refuge, holding areas and fish passage.

Baseline fish passage data was evaluated for fish swimming performance as it pertains to three size categories of fish under the salmon and walleye swimming database: 25 mm, 250 mm, and 1,000 mm (Katapodis and Gervais 2016). Because the baseline data does not evaluate fish passage structures, distance (i.e., distance between two fish passage structures and burst speed between v-weirs) was not incorporated into the baseline analysis. Future iterations of the fish passage analysis will evaluate velocity and distance for fish size categories at the fish passage structures and comparisons will be made to the baseline data contained herein in the future. For the purpose of this baseline evaluation, the following maximum velocities are assumed for fish passage at cruising speeds that can be maintained for distances of at least 1 km (i.e., pools, deep runs):

- 25 mm: 1 m/s
- 250 mm: 1.3 m/s
- 1,000 mm: 2.5 m/s

The maximum velocities described above align with the velocities that were used to evaluate fish passage in the Environmental Impact Assessment (EIA) and will be carried forward in future evaluations of the fish passage structures. Additional velocity thresholds will be considered for burst speeds between the fish passage structures following construction to align with the methods described in the EIA.

3 Results

Flow in the Elbow River at Bragg Creek hydrometric station (05BJ004) at the time of the survey was recorded as follows (Water Survey of Canada 2022):

- June 11, 2021: 13.88 m^3/s
- August 20 to 23, 2021: flow ranged from 10.04 m^3/s to 9.93 m^3/s
- October 12, 2021: 4.96 m^3/s

Fish passage results at each BSP are provided in Table 1, Table 2, and Table 3.

Fish habitat potential was considered moderate to excellent at the monitoring stations. Floodplain habitat was identified in June and August that provides rearing and refuge habitat; lower water levels in October limited fish habitat to the mainstem and side channels of the Elbow River. The mainstem of the Elbow River provides refuge habitat along the margins of the channel, and occasional boulders in the mainstem of the Elbow River also offers velocity refugia in run habitat. The Elbow River is frequently braided and side channels offer good resting and refuge habitat for all size classes of fish.

4 Discussion

Baseline average velocities were all within an acceptable range for fish swimming capabilities at each size class of the Elbow River fish population. Future monitoring programs will evaluate post-construction Elbow River velocities in the context of the baseline results presented herein.

Sincerely,

STANTEC CONSULTING LTD.

Original Signed by

Lacey AuCoin
Environmental Planner
Phone: (403) 207-7541
lacey.aucoin@stantec.com

5 References

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Attachment A Tables

Table 1 Fish Passage Analysis in June 2021

Location	Monitoring Station	Data Collection Point	Coordinates (latitude, longitude)	Channel Type	Average Depth (m)	Average Velocity (m/s)	Does velocity meet fish passage requirements? (Y/N)		
							25 mm	250 mm	1,000 mm
Upstream of Project	FP1	FP1-XS1	50.992921 -114.502809	Main channel	0.4	0.9	Y	Y	Y
		FP1-XS2 A	50.997269 -114.501823	Main channel	0.5	0.8	Y	Y	Y
		FP1-XS2 B	50.99722 -114.501481	Side channel	0.2	0.5	Y	Y	Y
		FP1-XS2-SC	50.996799 -114.499685	Floodplain channel	0.1	0.2	Y	Y	Y
		FP1-XS3	51.000596 -114.497983	Main channel	0.4	0.7	Y	Y	Y
Fish Passage Structure	FP2	FP2-XS1	51.022198 -114.481814	Main channel	0.3	0.5	Y	Y	Y
		FP2-XS2	51.02801 -114.478	Main channel	0.4	0.8	Y	Y	Y
		FP3-XS3	51.03293 -114.466	Main channel	0.4	0.8	Y	Y	Y

Table 1 Fish Passage Analysis in June 2021

Location	Monitoring Station	Data Collection Point	Coordinates (latitude, longitude)	Channel Type	Average Depth (m)	Average Velocity (m/s)	Does velocity meet fish passage requirements? (Y/N)		
							25 mm	250 mm	1,000 mm
Confluence with Outlet	FP3	FP3-XS1-A	51.04432 -114.417	Main channel	0.3	0.9	Y	Y	Y
		FP3-XS1-B	51.04415 -114.417	Side channel	0.3	0.4	Y	Y	Y
		FP3-XS2-A	51.04774 -114.412	Section of braided mainstem channel	0.3	0.8	Y	Y	Y
		FP3-XS2-B	51.04731 -114.411	Section of braided mainstem channel	0.6	0.4	Y	Y	Y
		FP3-XS2-C	51.04674 -114.411	Section of braided mainstem channel	0.4	0.6	Y	Y	Y
		FP3 – XS3A	51.04717 -114.405	Main channel	0.4	0.8	Y	Y	Y
		FP3 – SX3B	51.04711 -114.405	Side channel	0.2	negligible	Y	Y	Y
		FP3 – Flood Plain 1	51.0462 -114.408	Floodplain channel	0.3	negligible	Y	Y	Y
		FP3 – Flood Plain 2	51.04553 -114.41	Floodplain channel	0.1	0.1	Y	Y	Y
		FP3- Flood Plain 3A	51.04419 -114.411	Floodplain channel	0.3	negligible	Y	Y	Y
		FP3 – Flood Plain 3B	51.04413 -114.41	Floodplain channel	0.2	0.1	Y	Y	Y

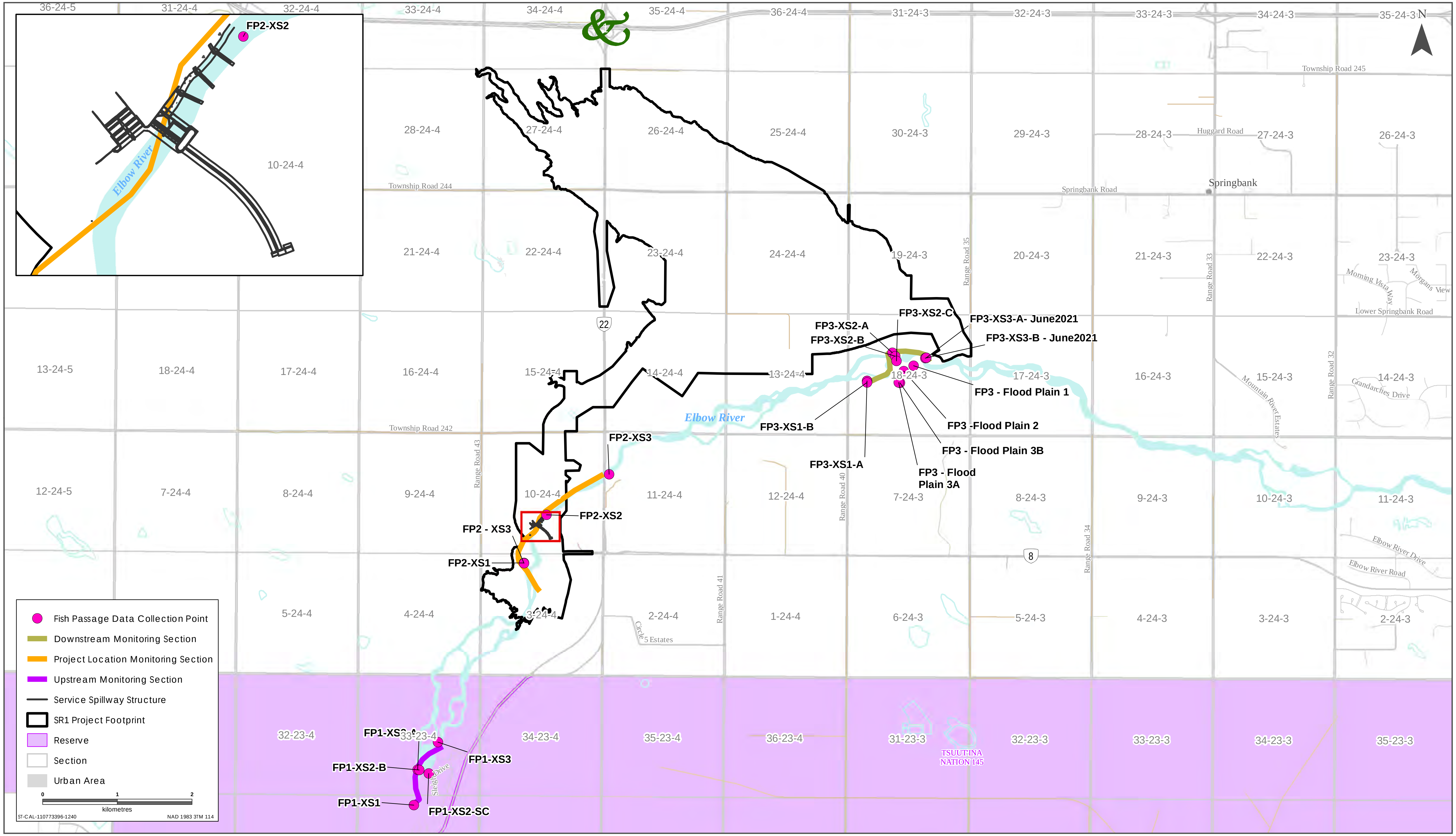
Table 2 **Fish Passage Analysis in August 2021**

Location	Monitoring Station	Data Collection Point	Coordinates (latitude, longitude)	Channel Type	Average Depth (m)	Average Velocity (m/s)	Does velocity meet fish passage requirements? (Y/N)		
							25 mm	250 mm	1,000 mm
Upstream of Project	FP1	FP1-XS1	50.992921 -114.502809	Main channel	0.4	0.6	Y	Y	Y
		FP1-XS2 A	50.997269 -114.501823	Main channel	0.8	0.6	Y	Y	Y
		FP1-XS3	51.000596 -114.497983	Main channel	0.4	0.4	Y	Y	Y
Fish Passage Structure	FP2	FP2-XS1	51.022198 -114.481814	Main channel	0.3	0.6	Y	Y	Y
		FP2-XS2	51.02801 -114.478	Main channel	0.4	0.8	Y	Y	Y
		FP3-XS3	51.03293 -114.466	Main channel	0.4	0.8	Y	Y	Y
Confluence with Outlet	FP3	FP3-XS1-A	51.04432 -114.417	Main channel	0.3	0.6	Y	Y	Y
		FP3-XS1-B	51.04415 -114.417	Side channel	0.1	0.2	Y	Y	Y
		FP3 – XS3A	51.04717 -114.405	Main channel	0.4	0.5	Y	Y	Y

Table 3 Fish passage analysis in October 2021

Location	Monitoring Station	Data Collection Point	Coordinates (latitude, longitude)	Channel Type	Average Depth (m)	Average Velocity (m/s)	Does velocity meet fish passage requirements? (Y/N)		
							25 mm	250 mm	1000 mm
Upstream of Project	FP1	FP1-XS1	50.992921 -114.502809	Main channel	0.3	0.5	Y	Y	Y
		FP1-XS2 A	50.997269 -114.501823	Main channel	0.5	0.7	Y	Y	Y
		FP1-XS3	51.000596 -114.497983	Main channel	0.4	0.6	Y	Y	Y
Fish Passage Structure	FP2	FP2-XS1	51.022198 -114.481814	Main channel	0.5	0.4	Y	Y	Y
		FP2-XS2	51.02801 -114.478	Main channel	0.2	0.7	Y	Y	Y
		FP3-XS3	51.03293 -114.466	Main channel	0.4	0.6	Y	Y	Y
Confluence with Outlet	FP3	Data not recorded							

Attachment B Figures



Sources: Base Data - Governments of Alberta and Canada. Thematic Data - Stantec

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Location of Fish Passage Monitoring Sections

Figure 2.1

W:\Clients\Alberta_Transportation\Springbank_Offstream_Storage\Figures\Aquatics\110773396_1374_Upstream_Monitoring_Section_updated.mxd 10/25/2022 2:51:02 PM rmeyers

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.
Imagery: ESRI basemap

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESEVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Fish Passage Monitoring Section 1

Figure 2.2

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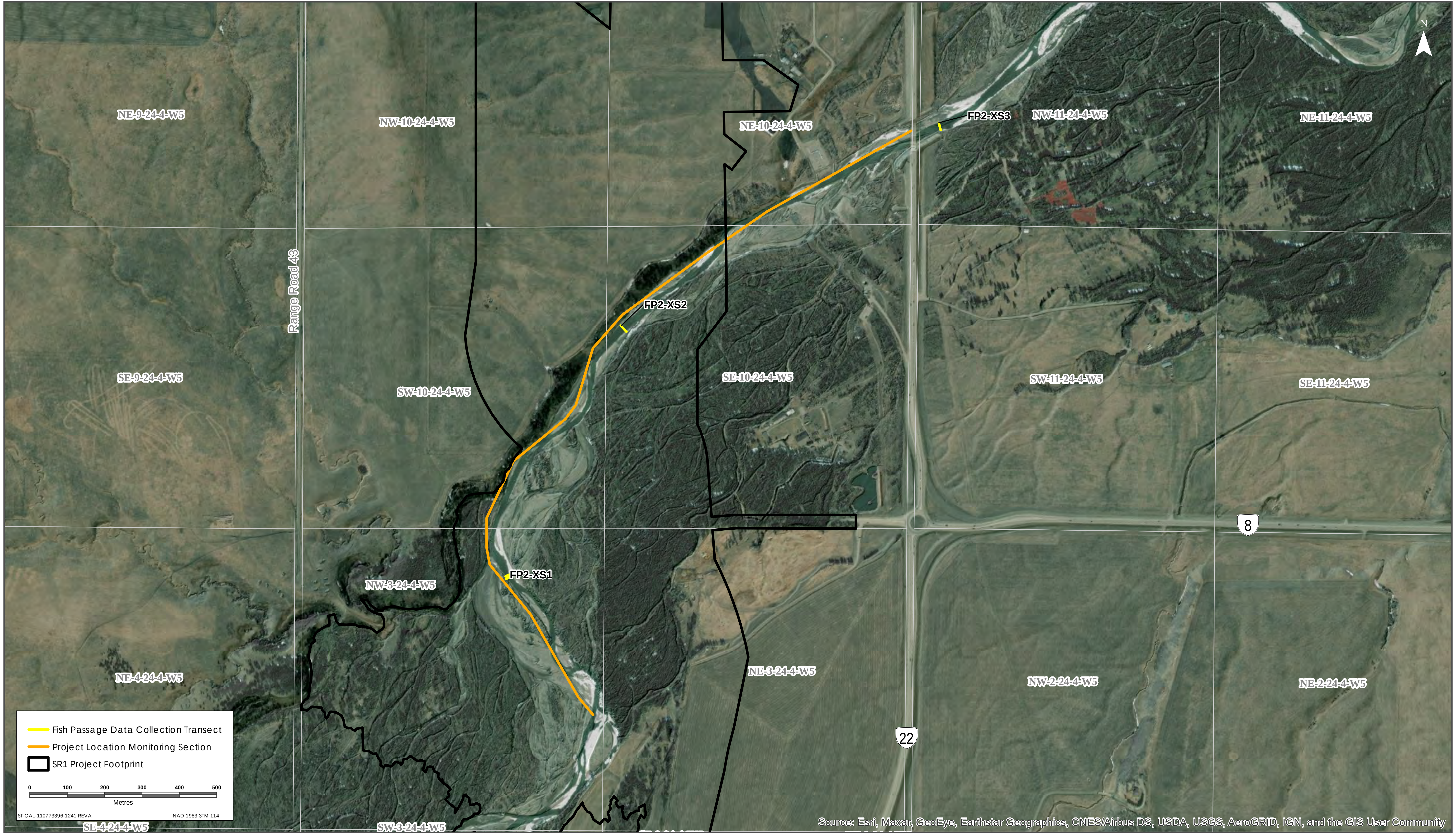

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.
Imagery: ESRI basemap

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESEVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Fish Passage Monitoring Section 2

Figure 2.3

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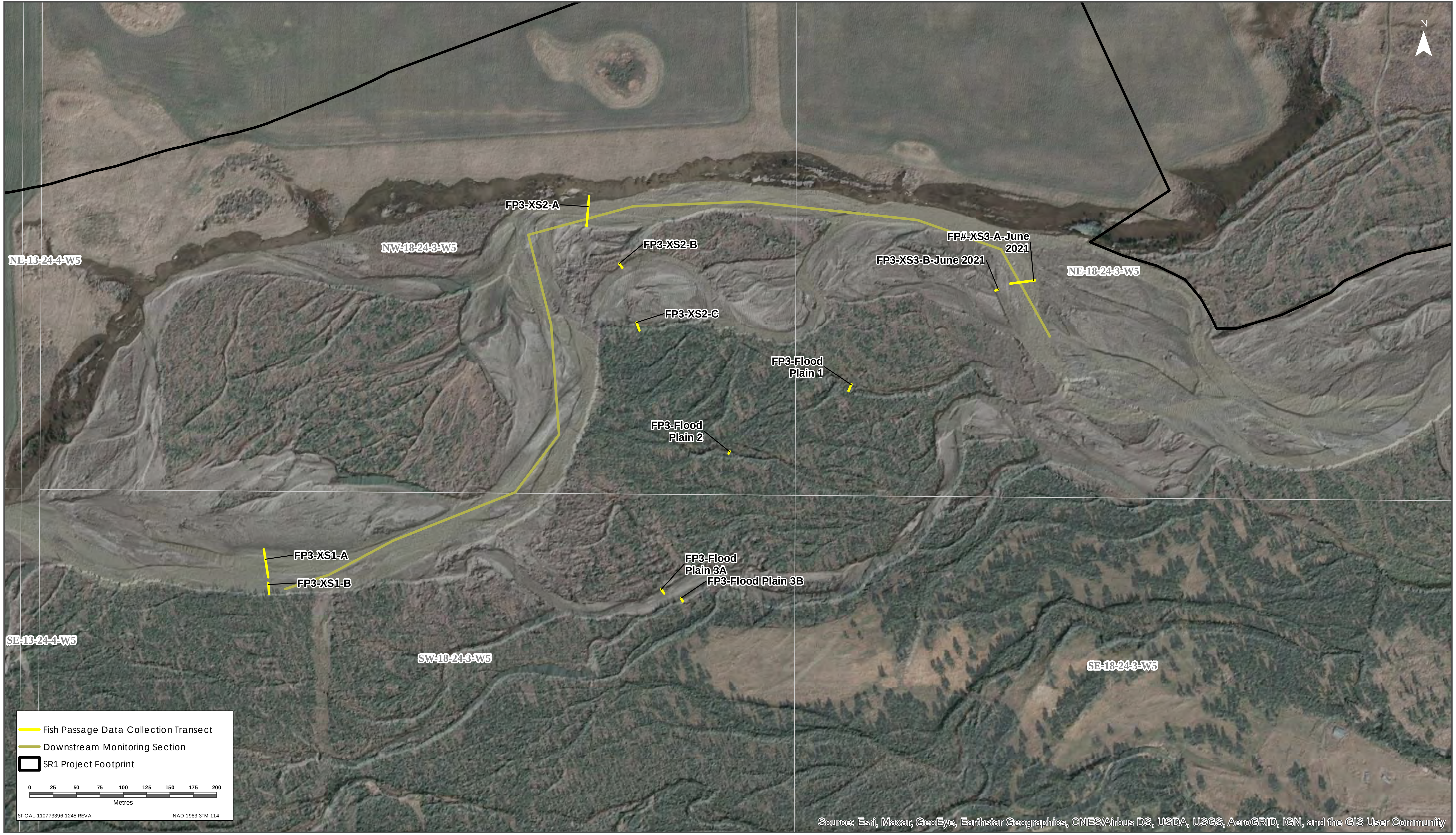

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.
Imagery: ESRI basemap

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESEVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Fish Passage Monitoring Section 3

Figure 2.4

Memo

To:	Mark Svenson Alberta Transportation	From:	Lacey AuCoin Stantec Consulting Ltd.
Project/File:	110773396	Date:	October 31, 2022

Reference: Fish Tissue Sampling Program Summary

1 Introduction

Alberta Transportation has begun construction of the Springbank Off-stream Reservoir Project (the Project), located approximately 15 km west of Calgary in Rocky View County. Construction began shortly after receipt of relevant regulatory approvals, which include the Decision Statement under the *Canadian Environmental Assessment Act*, 2012.

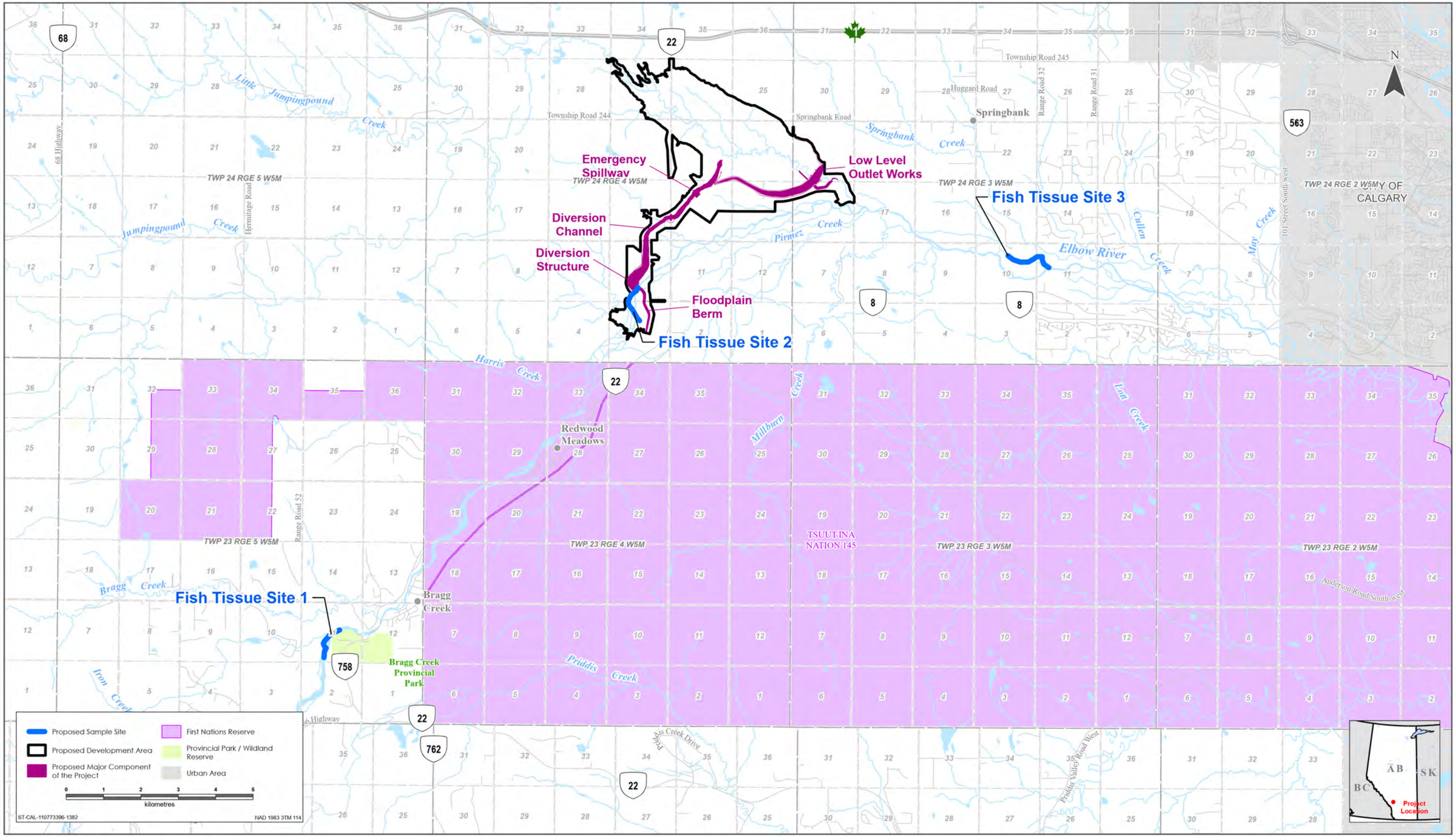
IAAC lists conditions for Project construction and operation, which include Condition 7.8, which specifies that Alberta Transportation will undertake a food web study to evaluate mercury concentrations of the aquatic food web near the Project relative to the predicted effects presented in the EIA (herein referred to as ‘the Program’).

The results of the Program will be presented in Alberta Transportation’s forthcoming annual report to IAAC. An interim summary is presented herein to demonstrate the efforts undertaken to collect baseline data in 2021 prior to construction.

2 Summary of Field Methods

Baseline (pre-construction) fish tissue and benthic invertebrate samples were collected between July 29, 2021 and August 7, 2021. Samples were obtained from three sites along the Elbow River; locations are presented in Figure 2.1.

Fish tissue was obtained from longnose dace for a prey indicator species, and brook trout as a predator indicator species. Laboratory testing required a minimum weight of 5 g per sample of fish tissue. Fish captures (both prey and predator species) yielded smaller amounts of tissue per individual fish than the minimum laboratory standards; therefore, composite samples were prepared for laboratory testing for both fish species. Twelve composite samples of each fish species were collected from each of the three sites. A minimum weight of 1 to 2 g per sample of invertebrates was required for laboratory testing and three samples were collected at each of the three sites. Fish muscle and invertebrate samples were submitted to ALS Environmental in Calgary, AB, for mercury and methylmercury analysis, and the University of Alberta in Edmonton, AB for isotope analysis; fish otoliths were submitted to North Shore Environmental Services in Thunder Bay, ON for ageing.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

Site Locations for Fish Tissue and Invertebrate Monitoring

Figure 2.1

Water samples and *in situ* data were collected on August 23, 2021, and November 12, 2021. Grab samples were submitted to ALS Environmental in Calgary, AB, for analysis of mercury and methylmercury.

The parameters that were analyzed included:

- water quality concentration values for total mercury (THg) and methylmercury (MeHg), results discussed under a separate cover.
- fish tissue concentration values for THg, MeHg
- fish tissue carbon-13 (C-13) and nitrogen-15 (N-15) stable isotopes
- fish tissue carbon (C) content and nitrogen (N) content
- fish age and morphometric data (fork length and weight)
- invertebrate concentration values for THg and MeHg
- invertebrate C-13 and N-15 stable isotopes
- invertebrate C content and N content

3 Results

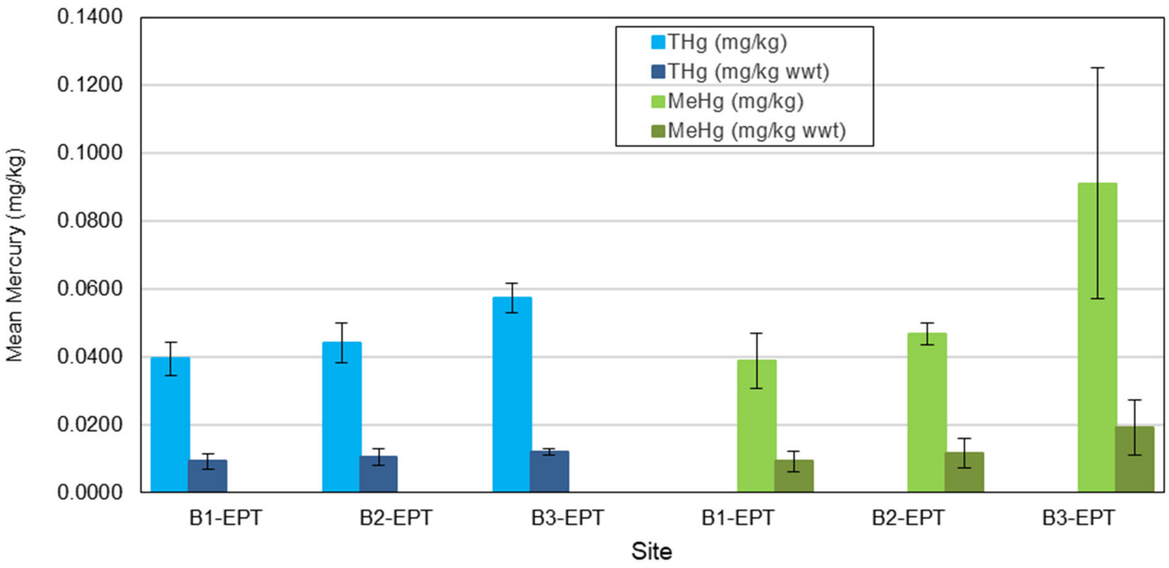
3.1 Benthic Invertebrates

Three benthic invertebrate samples were collected at each of the three sites on the Elbow River (B1-EPT, B2-EPT, B3-EPT). Sample collections consisted of insects of the orders Ephemeroptera, Plecoptera and Trichoptera (EPT) which are a common food source for fish. At least 1 g of EPT tissue was collected for each sample for isotope analysis. Collecting sufficient sample for mercury analysis (2 g) was challenging in the field due to the small size of invertebrates; therefore, a micro-digestion method was used for mercury analysis. The mean and standard deviation (SD) for mercury and isotope values were calculated for each site and graphed for this summary.

3.1.1 MERCURY AND METHYLMERCURY

Mean THg concentrations in invertebrate tissue at the three sites ranged from 0.0393 to 0.0573 mg/kg and from 0.0091 to 0.0120 mg/kg wet weight (wwt) (Figure 3.1). MeHg concentrations at the three sites ranged from 0.0387 to 0.0910 mg/kg and from 0.0091 to 0.0191 mg/kg wwt (Figure 3.1). There was a slight increase in both THg and MeHg in invertebrates in a downstream direction on the Elbow River.

Figure 3.1 Mean THg and MeHg concentrations with SD in benthic invertebrates at Elbow River sites, 2021



3.1.2 ISOTOPES

Mean C-13 in invertebrate tissue at the three sites ranged from -29.7 to -30.8% and N-15 from 2.9 to 4.7% (Figure 3.2). C-13 values in invertebrates were similar between sites, while N-15 increased slightly in a downstream direction on the Elbow River. Mean C content at the three sites ranged from 48.1 to 53.8% and N content from 10.3 to 11.8% (Figure 3.3). N content in invertebrates was similar between sites, while C content was slightly lower at site B2-EPT compared to the other two sites.

Overall, THg and MeHg concentrations in invertebrate tissue increased from the upper most sampling site (B1) on the Elbow River to the most downstream sampling site (B3), with a larger increase in MeHg at Site B3 compared to upstream sites. The percentage of N-15 and N content showed a minimal increase from the upper most sampling site to the most downstream sampling site and the percentage of C-13 and C content remained consistent across the 3 sites.

Figure 3.2 **Mean C-13 and N-15 with SD in benthic invertebrates at Elbow River sites, 2021**

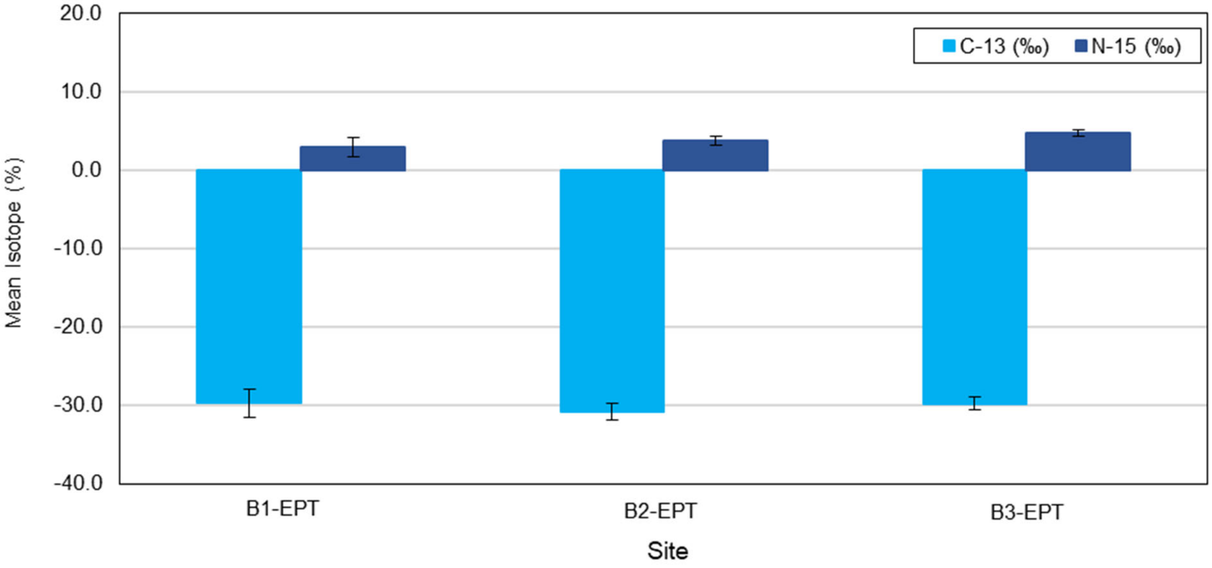
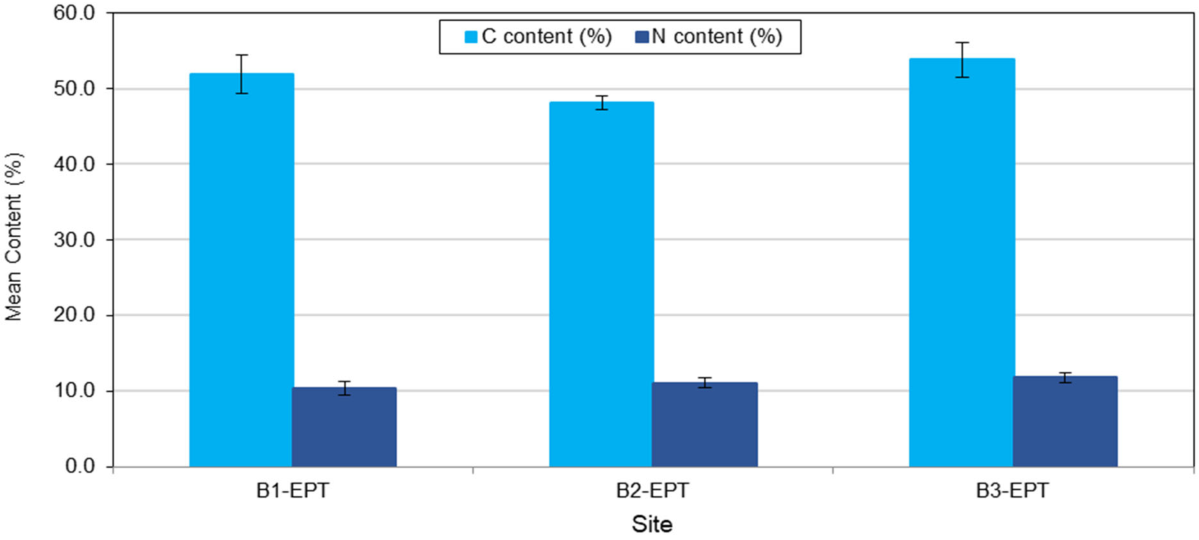


Figure 3.3 **Mean C content and N content with SD in benthic invertebrates at Elbow River sites, 2021**



3.2 Fish Tissue

3.2.1 FISH AGEING

The fish ageing based on otoliths indicated that the longnose dace ages ranged from 0 to 6, with one fish aged at 7 years. Older ages of longnose dace are often seen when ages are assessed using otoliths rather than scale ageing. The older ages observed in this study are generally beyond the lifespan reported in the literature of 5 years (Scott and Crossman 1973) which has likely been based on scale ageing.

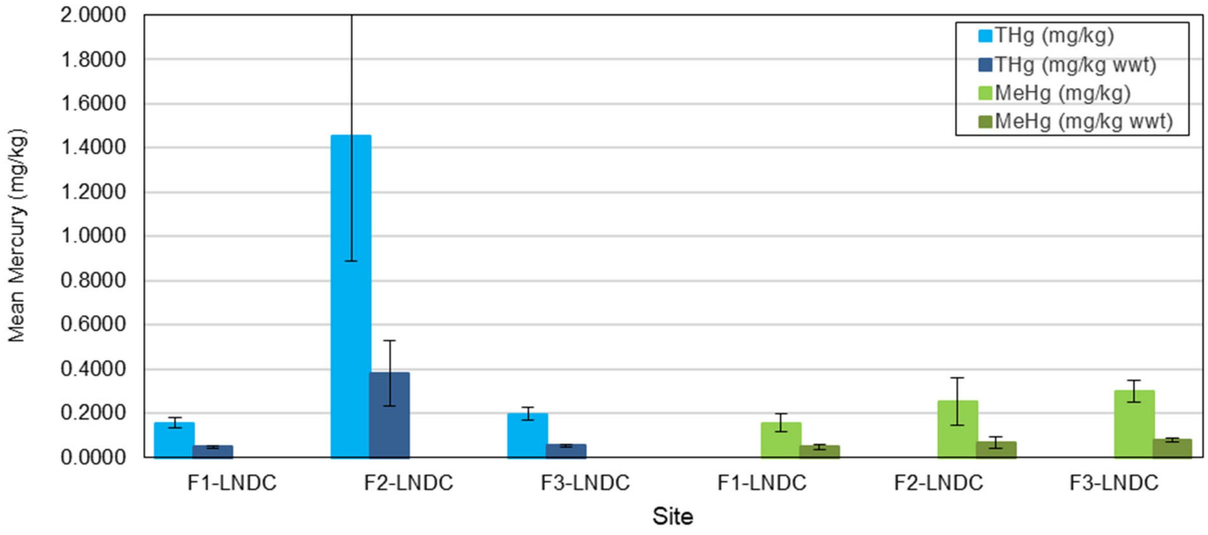
The brook trout ages ranged from 1 to 4. Brook trout are a short-lived fish species with a typical lifespan of 5 years (Scott and Crossman 1973).

3.2.2 MERCURY AND METHYLMERCURY

Twelve composite fish tissue samples were collected at each of the three sites on the Elbow River for longnose dace (LNDC) (F1-LNDC, F2-LNDC, F3-LNDC) and brook trout (BKTR) (F1-BKTR, F2-BKTR, F3-BLTR).

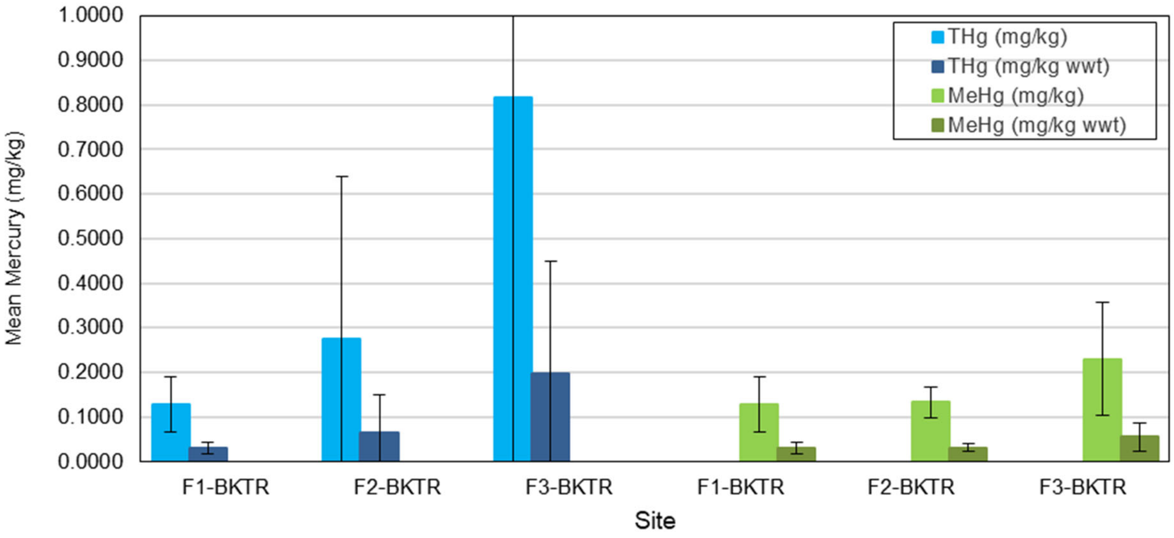
Mean THg concentrations in longnose dace at the three sites ranged from 0.1561 to 1.4517 mg/kg and from 0.0469 to 0.3825 mg/kg wet weight (wwt) (Figure 3.4). MeHg concentrations at the three sites ranged from 0.1559 to 0.2988 mg/kg and from 0.0468 to 0.0807 mg/kg wwt (Figure 3.4). There was a slight increase in MeHg in longnose dace in a downstream direction on the Elbow River, while THg was considerably higher at site F2-LNDC compared to the other two sites.

Figure 3.4 Mean THg and MeHg concentrations with SD in longnose dace at Elbow River sites, 2021



Mean THg concentrations in brook trout at the three sites ranged from 0.1274 to 0.8167 mg/kg and from 0.0302 to 0.1983 mg/kg wet weight (wwt) (Figure 3.5). MeHg concentrations at the three sites ranged from 0.1292 to 0.2302 mg/kg and from 0.0306 to 0.0552 mg/kg wwt (Figure 3.5). There was an increase in both THg and MeHg in brook trout in a downstream direction on the Elbow River.

Figure 3.5 Mean THg and MeHg concentrations with SD in brook trout at Elbow River sites, 2021



3.2.3 ISOTOPES

Mean C-13 in longnose dace tissue at the three sites ranged from -28.9 to -30.4% and N-15 from 6.2 to 7.1% (Figure 3.6). C-13 values in longnose dace decreased slightly in a downstream direction on the Elbow River, while N-15 was slightly lower at site F2-LNDC compared to the other two sites. Mean C content at the three sites ranged from 47.8 to 50.4% and N content from 12.2 to 13.7% (Figure 3.7). N content in longnose dace increased slightly in a downstream direction on the Elbow River, while C content was slightly lower at site F2-LNDC compared to the other two sites.

Figure 3.6 Mean C-13 and N-15 with SD in longnose dace at Elbow River sites, 2021

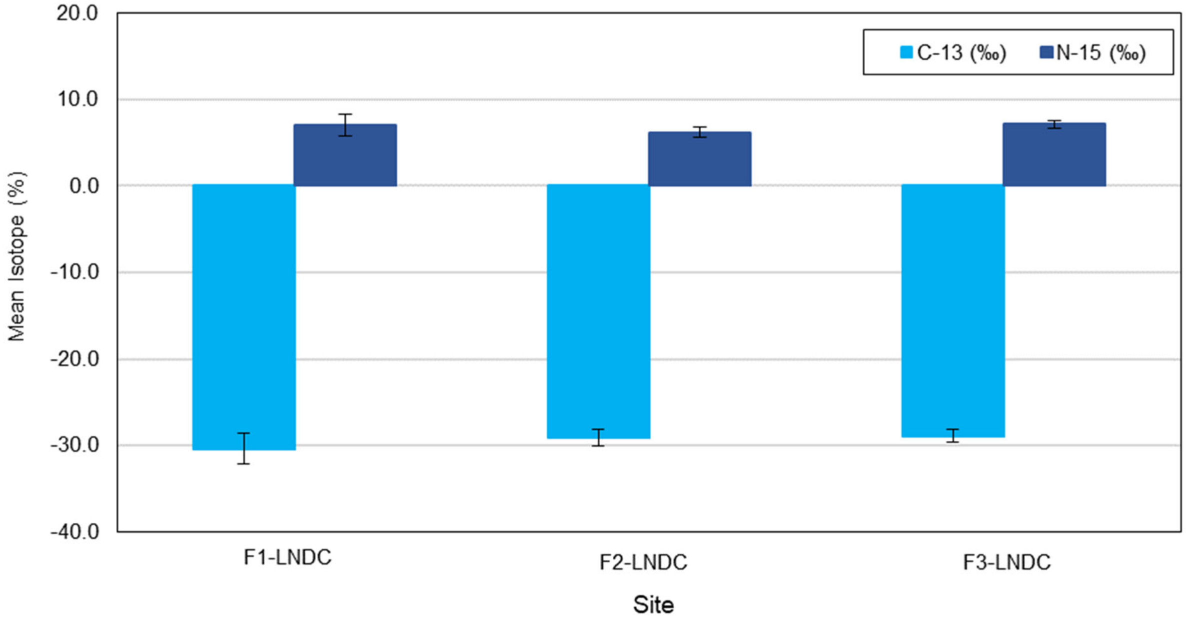
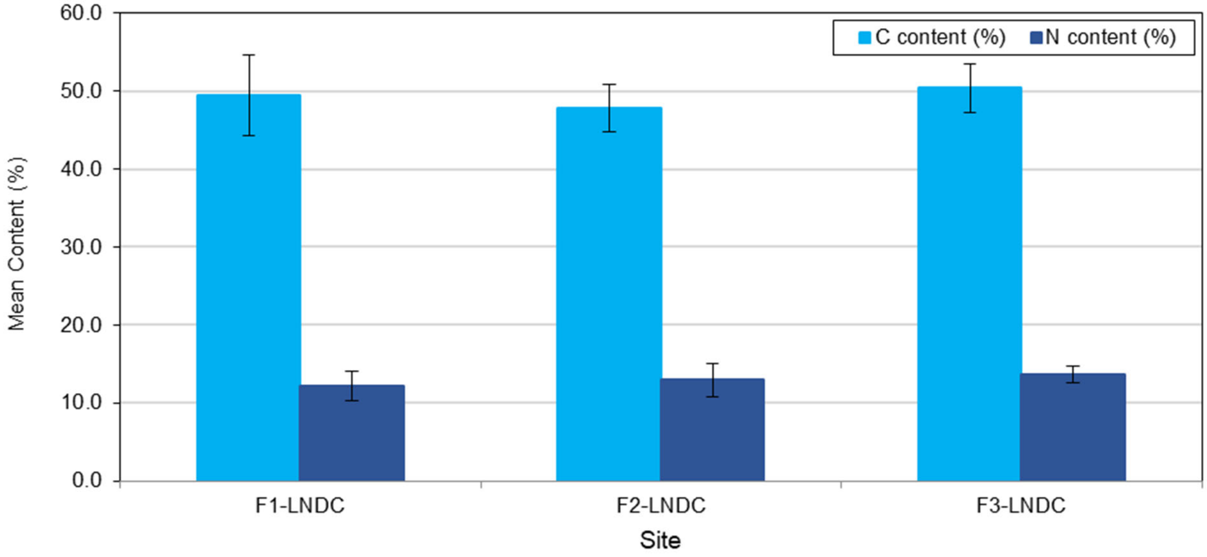


Figure 3.7 Mean C content and N content with SD in longnose dace at Elbow River sites, 2021



Mean C-13 in brook trout tissue at the three sites ranged from -27.8 to -30.7% and N-15 from 6.8 to 8.3% (Figure 3.8). C-13 and N-15 values in brook trout increased slightly in a downstream direction on the Elbow River. Mean C content at the three sites ranged from 47.6 to 48.8% and N content from 14.6 to 15.3% (Figure 3.9). C content and N content in brook trout decreased slightly in a downstream direction on the Elbow River.

Figure 3.8 Mean C-13 and N-15 with SD in brook trout at Elbow River sites, 2021

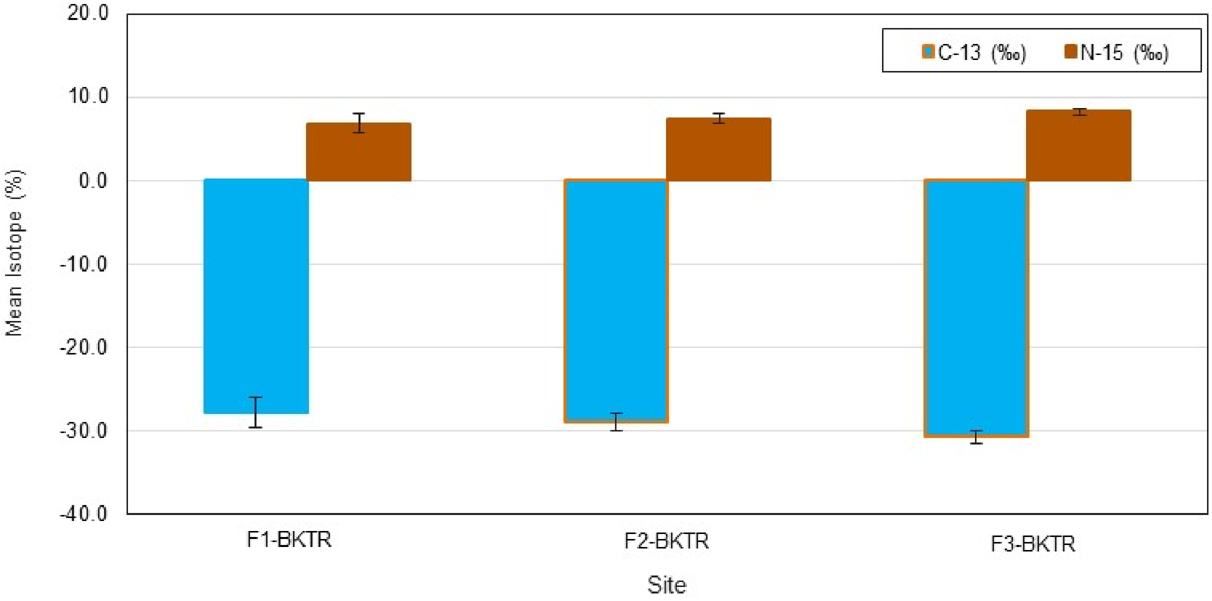
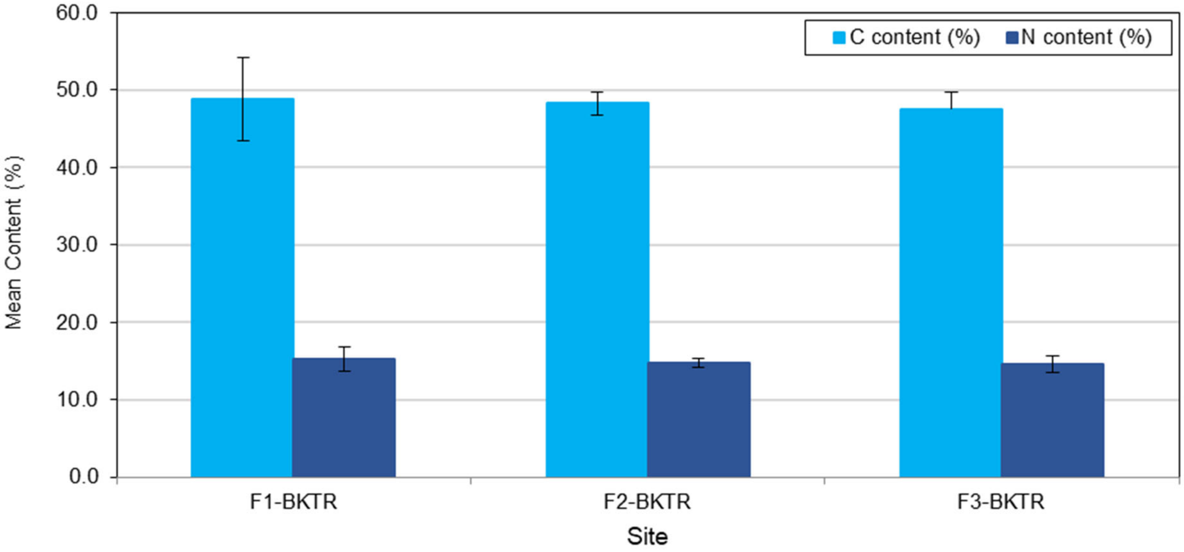


Figure 3.9 Mean C content and N content with SD in brook trout at Elbow River sites, 2021



4 Summary

THg and MeHg concentrations in brook trout tissue and MeHg in longnose dace increased from the upper most sampling site (F1) on the Elbow River to the most downstream sampling site (F3), while THg concentrations in longnose dace were the highest at Site F2 compared to other sites. THg and MeHg concentrations in longnose dace were higher than in brook trout tissue except at Site F3 where THg was lower. The percentage of C-13 and N-15 in brook trout increased slightly in the downstream direction, while C content and N content decreased slightly in the downstream direction. The percentage of C-13 and N-15 and C and N content in longnose dace was similar between sites.

THg and MeHg concentrations in invertebrate tissue increased from the upper most sampling site (F1) to the most downstream sampling site (F3). These concentrations were lower in invertebrate tissue than in fish tissue. C-13 and C content were similar between both fish species and the invertebrates, while N-15 and N content were higher in both fish species compared to the invertebrates.

Sincerely,

STANTEC CONSULTING LTD.

Original Signed by

Lacey AuCoin
Environmental Planner
Phone: (403) 207-7541
lacey.aucoin@stantec.com

5 References

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada, Ottawa, Ontario, Canada.

B.3

Groundwater

SPRINGBANK OFF-STREAM RESERVOIR PROJECT 2022 GROUNDWATER MONITORING REPORT

October 2022

Prepared for:
Alberta Transportation

Prepared by:
Stantec Consulting Ltd.

Project Number:
110773396

Table of Contents

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Acronyms / Abbreviations

%	percent
<	less than
>	greater than
°C	degrees celsius
3D CSM	three-dimensional conceptual site model
AD	Absolute difference
AEP	Alberta Environment and Parks
Alberta Tier 1 Guidelines	Alberta Tier 1 Soil and Groundwater Remediation Guidelines
AWWID	Alberta Water Well Information Database
BGP	base of groundwater protection
BTEX	benzene, toluene, ethylbenzene, xylenes
CALA	Canadian Association for Laboratory Accreditation
CCME	Canadian Council of Ministers of the Environment
cfu	colony forming unit
CGDWQ	Guidelines for Canadian Drinking Water Quality
Cv	coefficient of variation
DEM	digital elevation model
DO	dissolved oxygen
DOC	dissolved organic carbon
E. Coli	Escherichia coli
EC	electrical conductivity
EIA	environmental impact assessment
GCDWQ	Guidelines for Canadian Drinking Water Quality

GWMP	Groundwater Monitoring Plan
HPC	heterotrophic plate counts
IAAC	Impact Assessment Agency of Canada
LAA	local assessment area
LTC	level, temperature and conductivity
m	metre
m ASL	metres above sea level
m BGL	metres below ground level
m/s	metres per second
m/year	metres per year
m^3/day	cubic metres per day
mg/L	milligrams per litre
mL	millilitre
mpn	most probable number
NRCB	Natural Resources Conservation Board
ORP	oxidation-reduction potential
PDA	Project development area
PS1	Parameter Suite 1
PS2	Parameter Suite 2
PS3	Parameter Suite 3
Q2	second quarter
QA/QC	quality assurance/quality control
RAA	regional assessment area
RPD	relative percent difference
SR1; the Project	Springbank Off-stream Reservoir Project

Stantec	Stantec Consulting Ltd.
TDR	Technical Data Report
TDS	total dissolved solids
TSS	total suspended solids
UCL	upper confidence limit
US EPA	United States Environmental Protection Agency

1 Introduction

This document describes the activities completed and results of the Groundwater Monitoring Program for the Springbank Off-stream Reservoir Project (SR1; the Project) in 2021 and 2022. This report is based on the Stantec Consulting Ltd. (Stantec 2021) Groundwater Monitoring Plan (GWMP) for the Project and covers the monitoring period ending June 30, 2022.

The GWMP provides a summary of the project, the hydrogeological framework, the potential interactions between groundwater and the Project and mitigation measures identified to provide context for the plan. A summary of the hydrogeological setting is provided in Appendix A of this report for reference. The GWMP was developed using a tiered approach that considers the potential project interactions that could lead to effects on groundwater resources, which vary depending upon the specific location within the Project area and the project lifecycle phase. The timing and level of comprehensiveness involved in the GWMP varies accordingly. Monitoring results are compared to relevant water quality guidelines and trigger values set out in the plan. Once sufficient data are gathered, data will also be compared to quantitative control limits and temporal trend analyses will be completed to identify potential project effects.

Should the GWMP results exceed groundwater quantity or quality triggers, a conceptual groundwater response plan is also included in the GWMP that describes the actions that would be taken.

2 Background

The Project consists of the construction and operation of an off-stream reservoir to divert and retain a portion of Elbow River flows during a flood. The diverted water will be released back to Elbow River in a controlled manner after the flows in Elbow River decrease sufficiently to accommodate the release of water from the reservoir. The off-stream reservoir will not hold a permanent pool of water. The hydrogeological setting of the Project is presented in Appendix A to provide context for the GWMP.

2.1 Project Components

The primary Project components are:

- a diversion structure on the main channel and floodplain of Elbow River
- a diversion channel to transport diverted floodwater into the reservoir
- an off-stream dam to temporarily retain the diverted floodwater
- a low-level outlet in the dam to return retained water through the existing unnamed creek and back to the Elbow River when Alberta Environment and Parks (AEP) staff determines conditions are appropriate

2.2 Construction and Groundwater Effects Mitigation

Limited dewatering of surface water resulting from periods of heavy precipitation and overland flow occurred in June 2022, however, no dewatering of groundwater was required during the current reporting period.

The primary Project components are being constructed and operated under four lifecycle phases. The groundwater monitoring program results presented in this report covers a portion of the pre-construction baseline period and the early stages of construction.

The Project is scheduled to be functionally operational (able to accommodate a 1:100-year flood event) for floods after two years of construction and be completely constructed (able to accommodate the design flood) after three years of construction.

Construction dewatering of groundwater, where/when required, will be done locally and according to the terms and conditions of licences issued by AEP (where applicable and if required) and best management practices. Best management practices will include, but are not limited to, the following:

- Water will be discharged in a manner to avoid erosion using turbidity barriers, containment berms and settling ponds. Construction dewatering, if required, will be in accordance with the terms and conditions of *Water Act* approval and the federal *Fisheries Act* and *Canadian Navigable Waters Act*.

- Total suspended solids (TSS) levels will be controlled using silt fences and turbidity barriers. TSS levels will be monitored by carrying out frequent water quality testing.
- Construction dewatering will be limited through construction planning.
- Existing water wells within the off-stream reservoir footprint will be decommissioned and plugged off to prevent groundwater contamination.
- Regional-scale effects on groundwater quantity can be mitigated by allowing seepage in the diversion channel (when it is dry) to infiltrate back into the subsurface, or flow back into Elbow River through surface water drainage pathways.

Effects on groundwater quantity as a result of construction dewatering will not be entirely mitigated at a local scale because dewatering deliberately seeks to temporarily lower the groundwater table in the Project development area (PDA) in order to facilitate construction. The amount of time required for construction dewatering can be minimized through diligent construction planning. Groundwater that is collected during dewatering will be returned to the local watershed to mitigate regional-scale effects on groundwater quantity.

Groundwater that seeps into the diversion channel (when dry) would remain within the watershed, although potentially travelling through a more tortuous route. Regional-scale effects on groundwater quantity can be mitigated by allowing seepage in the diversion channel to infiltrate back into the subsurface, or flow back into Elbow River through surface water drainage pathways.

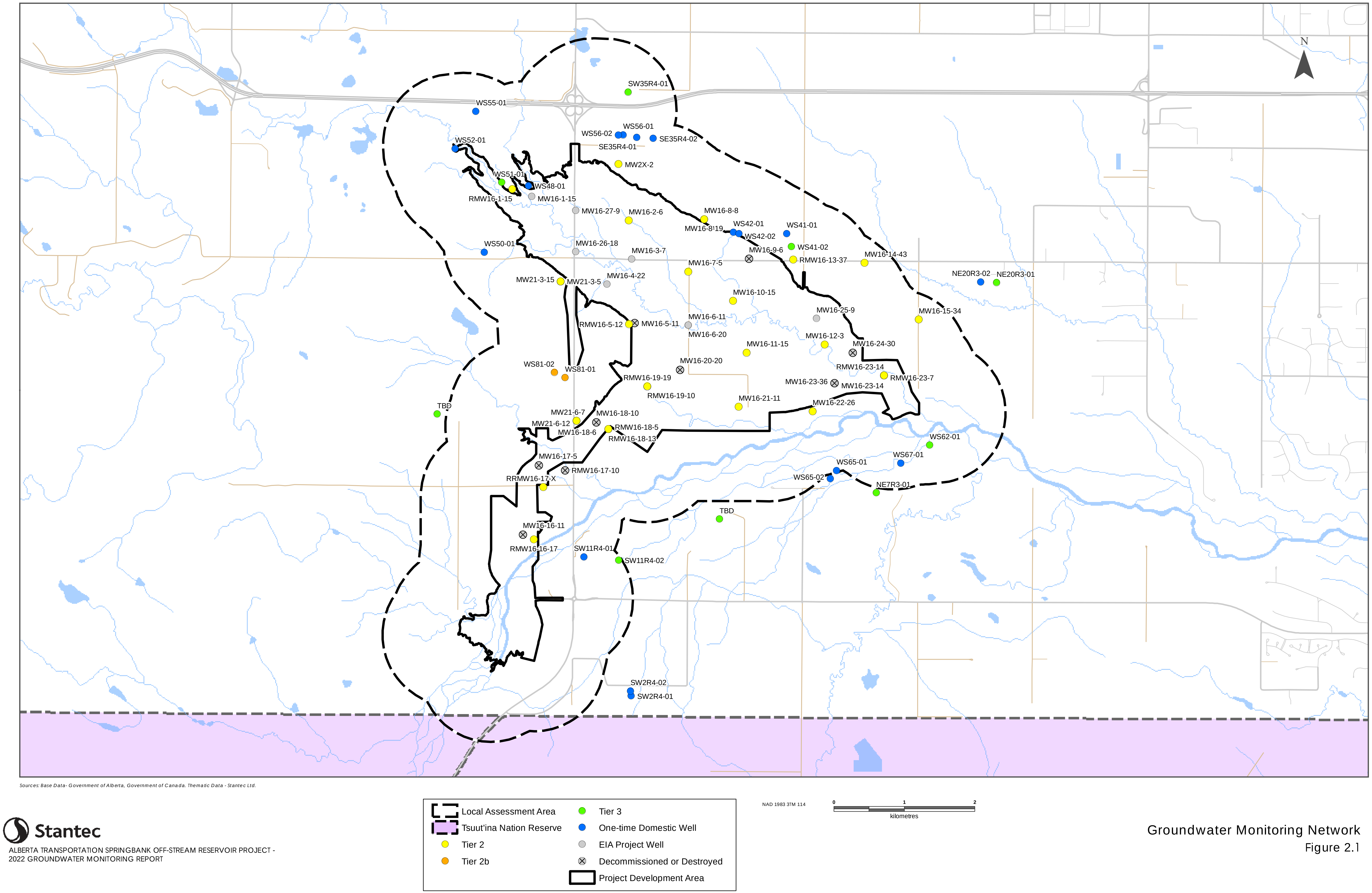
The secondary effects on groundwater quality related to changes in groundwater flow patterns will not be entirely mitigated because dewatering activities deliberately seek to lower the water table (and in turn affect groundwater flowpaths, potentially resulting in changes in groundwater quality). The amount of time required for construction dewatering can be minimized through construction planning which in turn would limit the duration of the residual effects. Other mitigation measures are in place as follows:

- at locations where flows from construction operations are discharged into waterbodies, water quality will be tested at discharge locations and TSS monitored
- construction dewatering may be reduced through construction planning

2.3 Groundwater Monitoring Well Network

2.3.1 TIERED GROUNDWATER MONITORING LOCATIONS

Figure 2.1 presents the layout of the current groundwater monitoring network. The density and distribution of groundwater monitoring wells is based on the need to detect potential changes to groundwater levels and quality that could arise from interactions between the Project and groundwater resources. The siting of monitoring wells considered the expected extent of effects on groundwater for construction as well as dry and flood operations.



Sources: Base Data- Government of Alberta, Government of Canada. Thematic Data - Stantec Ltd.

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ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT - 2022 GROUNDWATER MONITORING REPORT

Groundwater Monitoring Network

Figure 2.1

Simulation results from the numerical groundwater modeling completed as part of the environmental impact assessment (EIA) were reviewed to understand the potential areas over which effects on groundwater could be expected. Under dry operations, the simulated extent of potential effects will be limited to areas near the diversion channel, due to drawdown caused by incision of the channel through the water table. Under flood operations, effects on groundwater are expected to be limited to areas near the diversion channel and off-stream reservoir. In the case of both dry and flood operations, potential effects on groundwater will be limited to within the EIA local assessment area (LAA), with the potential exception of the area west of the diversion channel. Thus, monitoring wells sited within the LAA and west of the diversion channel will be able to detect change related to potential Project effects.

Groundwater monitoring well locations were also selected to allow for characterization of “background” water quality in areas anticipated to be unaffected by Project interactions depending on the stage of project. For example, Tier 2 and Tier 3 wells that are far removed from construction activities will continue to provide background data during the construction phase and operation phase up until the first operational flood event. Monitoring well locations will be selected based on the location of existing users of groundwater, such that some locations are able to provide “early warning” for changes in groundwater prior to those effects reaching existing groundwater users.

Three monitoring tiers have been established, based loosely around the associated geographic coverage:

- Tier 1 monitoring wells or piezometers will be shallow and located within or immediately adjacent to Project infrastructure (dam, diversion intake and channel). Piezometers or vibrating wire piezometers (for pore pressure monitoring) will be used for geotechnical monitoring within the Project components; however, this data will also be used to support the monitoring of potential effects to groundwater. Shallow monitoring wells will also be installed in this area in consultation with the dam engineering team prior to operations.
- Tier 2 monitoring wells are shallow and within or very near the wetted perimeter of the off-stream reservoir and diversion channel. They are installed in both the unconsolidated and shallow bedrock deposits. The Tier 2 wells also include nested pairs completed at different depths to monitor changes in vertical hydraulic gradients. Note that Tier 2 wells installed in bedrock will only be situated outside of the wetted perimeter to prevent potential vertical pathways for floodwater to enter bedrock aquifers. Nested monitoring well locations are indicated in Figure 2.1. A subset of Tier 2a wells are also included specifically to monitor drawdown near the diversion channel during construction and dry operations to address Natural Resources Conservation Board (NRCB) approval condition 11.5 a[1]).

---

[1] “monitor water levels in domestic water wells west of the diversion channel to the boundary of the local assessment area that may be impacted by dewatering during the Project construction. During flood and dryland operation, monitoring of the wells should be continued by the Operator for a minimum of five years or until it can be demonstrated that permanent lowering of the water level does not significantly impact yields from the water wells,“

- Tier 3 monitoring wells are situated beyond the area of predicted project effects at locations of some of the closest potential receptors to the Project. These monitoring wells are, or will be, installed within unconsolidated or bedrock units depending upon local groundwater use and potential aquifers of interest. The main purpose of these monitoring wells is to provide early detection of potential effects on groundwater that are propagating outward from the LAA. These monitoring wells will also be potentially used as background monitoring to discriminate between changes to groundwater levels arising from a flood or precipitation event, versus those which can be attributed to operation of the Project.

Tier 1 locations will be finalized toward the end of the construction phase once the Project infrastructure is built. Tier 2 monitoring well locations have been finalized (pending land access in some cases) and the network is nearing completion. The current network includes 25 of 28 proposed Tier 2 wells in their final locations. Two additional wells (MW16-15-34 and RMW16-17-10) require replacement which is planned for November 2022 and one well (labelled MW2X-2 on Figure 2.1) is pending land access. All domestic water well owners within the modelled drawdown area west of the diversion channel were invited to be included in the Tier 2a monitoring well network, however, only one landowner (with two wells) chose to participate. A total of seven Tier 3 monitoring well locations have been established with land access pending for the remaining 2.

In addition to the monitoring network, the locations of monitoring wells used in the EIA (herein referred to as “EIA Project Wells”) that will not be part of the long-term network are also presented. These monitoring wells have been decommissioned, or will be decommissioned prior to construction or operation, due to their location relative to the construction footprint or their completion relative to future operational flooding of the reservoir. The remaining EIA Project Wells continued to be monitored and sampled in 2021 and 2022 to gather additional baseline data. The data from these wells, along with previously collected data from the decommissioned monitoring wells, will also be included in the baseline dataset.

In addition to the monitoring tiers noted above, all landowners within the LAA and north of the Elbow River were invited to participate in one-time baseline testing of their domestic water wells based on a commitment made during the NRCB EIA Hearing.

In Figure 2.1, the Tier 1 monitoring wells will be within the dam structure. These wells would be expected to fall within an area where Project effects are expected (during dry and flood operations). Additional Tier 1 monitoring wells may be included near the diversion inlet and along the diversion channel. The locations will be finalized based on geotechnical and dam safety requirements.

In Figure 2.1, the Tier 2 monitoring wells are shown across much of the LAA, including some wells within the wetted area of the reservoir (i.e., the area of the reservoir that would be inundated during a design flood). These wells would be expected to fall within or very near to areas where Project effects are expected (during dry and flood operations). Previous wells installed to support the EIA that were completed in bedrock within the wetted perimeter will be decommissioned prior to dry operations. The remaining Tier 2 wells within the wetted perimeter are shallow and completed in the unconsolidated deposits and will remain in place during flood operations to monitor effects.

Tier 2a wells shown in Figure 2.1 fall within the potential construction and dry operations drawdown area near the diversion channel. Monitoring of the Tier 2a wells is voluntary and based on landowner participation.

In Figure 2.1, the Tier 3 monitoring wells are shown both north and south of Elbow River. These wells are situated in areas outside of the expected areas where Project effects could occur (however they could still detect effects from a flood or precipitation). Tier 3 wells near Elbow River (NE7-R3-01 and WS62-01) are screened within the alluvial deposits and thus are directly connected to Elbow River, and they would be expected to experience changes in levels or quality during and after a flood in response to changes in river stage. Changes in these wells would be associated with natural effects of a flood and could be used to help differentiate flood-related effects from those attributable to the Project. Other wells south of the Project are situated in upland areas outside the alluvial deposits, and they would not be in direct communication with Elbow River.

The plan for the Tier 3 network was to use as many existing domestic wells as possible, however, because they require appropriate construction and are dependent on long-term access agreements, there are a few gaps remaining in the network and there is a need to find or install additional wells. Tier 3 wells will provide the ability to detect changes that could potentially propagate outward from the LAA in the direction of domestic and agricultural well users.

Existing domestic water wells for inclusion as Tier 3 monitoring wells were evaluated to verify that they were in appropriate locations, are screened at appropriate depths, are in good condition, and have good surface seal integrity. Ideally these wells would not be in use or near other wells in use such that water levels are not influenced by pumping, however, that is not the case for the current set of wells, but data logging pressure transducers have been installed in the Tier 3 wells to monitor water level variation due to pumping as well as potential interference from the Project.

2.3.2 MONITORING WELL DEVELOPMENT

All monitoring wells installed specifically for the project to be included in the GWMP have been developed following completion. Development is conducted to remove drilling fluids (if used) and fine-grained materials from around the filter pack to improve the hydraulic efficiency of the filter pack and improve hydraulic communication between the filter pack and geologic formation. The objective of the well development is to provide more representative groundwater samples and improved hydraulic conductivity estimates.

2.4 Groundwater Monitoring Program

2.4.1 ANALYTICAL PARAMETER SUITES

Analytical parameter suites were developed for the GWMP to enable characterization of potential changes in groundwater quality through both general measures of groundwater quality (e.g., electrical conductivity [EC]), and through measures of groundwater quality specific to a given chemical compound (e.g., nitrate).

Interactions between the Project and groundwater can include changes to groundwater quantity or flow patterns that can in turn affect groundwater quality. There is also potential for groundwater contamination related to construction activities or the quality of the water in the reservoir during flood operations. The parameter suites were chosen to include a broad range of analytes as well as general indicators of water quality such as pH, electrical conductivity and dissolved organic carbon. Other parameters such as hydrocarbons are aimed at accidental releases during construction or in presence in floodwater. Similarly bacteriological parameters are intended to address potential impacts from human or animal waste in the floodwater.

The parameter suite applied during the monitoring program varies depending upon the Project phase and monitoring tier. Three parameter suites have been defined for the GWMP:

- Parameter Suite 1 (PS1) includes temperature and electrical conductivity (measured insitu).
- Parameter Suite 2 (PS2) includes general potability parameters, major ions, bacteriological parameters, dissolved organic carbon (DOC).
- Parameter Suite 3 (PS3) includes those listed in PS2 as well as dissolved metals, nutrients, benzene, toluene, ethylbenzene, xylenes (BTEX), and F1 to F2 fraction hydrocarbons.

Parameter Suite PS3 is being used for the baseline period and into the construction period to gather detailed water quality data. The parameter suites to be measured on an ongoing, scheduled basis will reduced to PS2 and PS1 as described in Section 2.4.2. Escalation to a higher parameter suite would still occur during a flood event or if the results from the lower, scheduled parameter suite suggest that further analysis is required. For example, should electrical conductivity (as part of PS1) exhibit an unexpectedly elevated reading, then analysis of PS2 could then be implemented to provide further information regarding which specific chemical parameter is contributing to the elevated electrical conductivity.

2.4.2 FREQUENCY OF MONITORING

The frequency of monitoring for measurement of groundwater levels and collection of groundwater samples for water quality analysis is dependent on:

- the phase of the Project under consideration. Project Phases requiring higher levels of monitoring comprehensiveness (e.g., baseline and flood operations) will have a higher frequency of monitoring events.

- the tier of monitoring well under examination. In general, monitoring wells within the Tier 1 category will have a higher frequency of monitoring relative to the Tier 3 monitoring wells.
- the parameter suite that is under examination. General or bulk parameters (PS1) will have a higher frequency of monitoring than PS2 or PS3.

The planned frequency of monitoring for groundwater levels and quality has been defined at three levels:

- near-continuous measurement (C) of levels and quality through data logging probes that automatically collect and record at high frequency intervals.
- intermittent (I) measurement of routine, scheduled monitoring at set frequency (e.g., semi-annually)
- event (E) based measurement in response to a flood or other operational event (e.g., maintenance) where groundwater could be affected. Monitoring frequency during operational flood events will be assessed based on accessibility, safety and other constraints.

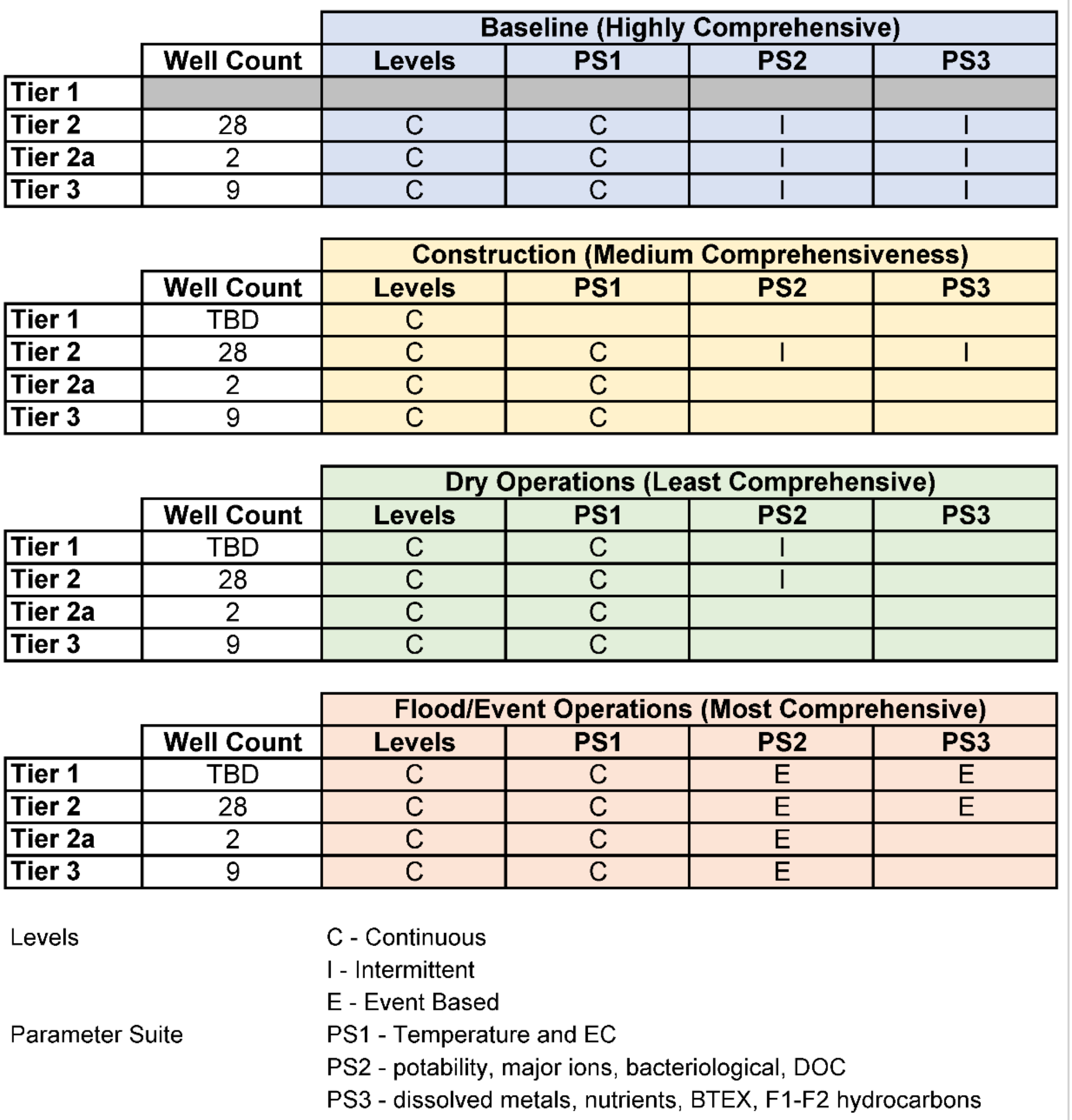
2.4.3 OVERVIEW OF GROUNDWATER MONITORING PROGRAM

Figure 2.2 illustrates the implementation of Monitoring Tiers, Parameter Suites, and Monitoring Frequency into an overall program that provides varying levels of monitoring comprehensiveness over the Project Phases.

In general, the level of monitoring comprehensiveness varies as follows (highest to lowest):

- Flood and post-flood operations requires of the most comprehensive monitoring because this is when the most Project interactions are applicable and when effects on groundwater are most likely to be observable.
- Baseline monitoring requires a highly comprehensive monitoring that starts prior to construction of the Project. The comprehensive baseline monitoring is being extended for some monitoring locations to assess the natural variability of groundwater quantity and quality. For example, baseline monitoring at monitoring wells not situated near construction areas could extend at least until construction is completed or even further until flood operations occur, if necessary
- Construction monitoring requires medium comprehensive monitoring. This monitoring is more focused on Project interactions that could potentially arise in a localized area due to construction activities (e.g., monitoring around a particular location undergoing construction dewatering).
- Dry operations monitoring has less comprehensive monitoring and occurs during dry operations between floods. This lower level of monitoring reflects the fewer Project interactions that are applicable when the Project is not in operation and flood water is not being retained within the off-stream reservoir.

Figure 2.2 Overview Summary of Groundwater Monitoring Program



		Baseline (Highly Comprehensive)			
	Well Count	**Levels**	**PS1**	**PS2**	**PS3**
Tier 1					
Tier 2	28	C	C	I	I
Tier 2a	2	C	C	I	I
Tier 3	9	C	C	I	I

		Construction (Medium Comprehensiveness)			
	Well Count	**Levels**	**PS1**	**PS2**	**PS3**
Tier 1	TBD	C			
Tier 2	28	C	C	I	I
Tier 2a	2	C	C		
Tier 3	9	C	C		

		Dry Operations (Least Comprehensive)			
	Well Count	**Levels**	**PS1**	**PS2**	**PS3**
Tier 1	TBD	C	C	I	
Tier 2	28	C	C	I	
Tier 2a	2	C	C		
Tier 3	9	C	C		

		Flood/Event Operations (Most Comprehensive)			
	Well Count	**Levels**	**PS1**	**PS2**	**PS3**
Tier 1	TBD	C	C	E	E
Tier 2	28	C	C	E	E
Tier 2a	2	C	C	E	
Tier 3	9	C	C	E	

Levels	C - Continuous
	I - Intermittent
	E - Event Based
Parameter Suite	PS1 - Temperature and EC
	PS2 - potability, major ions, bacteriological, DOC
	PS3 - dissolved metals, nutrients, BTEX, F1-F2 hydrocarbons

As the monitoring program progresses through construction, dry operation and flood operation it will be adapted as necessary to address observed effects on groundwater levels and groundwater quality. Adaptations may include augmentation of the monitoring network and/or changes to the monitoring frequency or analytical parameters in these areas.

2.4.4 GROUNDWATER MONITORING AND SAMPLING PROTOCOLS

Data logging pressure transducers and multi parameter sondes are installed in Tier 2 and Tier 3 monitoring wells. This equipment measures and record near continuous water level (pressure), temperature, and electrical conductivity (LTC loggers). Data logging pressure transducers (no electrical conductivity) were also installed at the Tier 2a monitoring wells. Near continuous pressure measurement will also be measured in Tier 1 wells using either pressure transducers or vibrating wire piezometers.

The following field procedures are used during monitoring to measure groundwater levels and to collect the groundwater samples:

- The depth to water at each monitoring well is measured and recorded.
- Each Tier 2 monitoring well is purged using its own dedicated inertial pump system or bailer until three well volumes are removed or until they are dry. Tier 3 domestic wells will be purged using existing well pumps for a minimum of 15 minutes and until stabilization of field parameters (dissolved oxygen [DO], oxidation-reduction potential [ORP], pH, EC) is achieved.
- Water samples are collected into laboratory supplied containers within a day of purging (unless additional time is required for water level recovery) following laboratory instructions for filtering, preservation/treatment, and temperature moderation. Samples are labeled at the time of collection with the site number, the date of collection, and the analysis required.
- Field measurements of combustible headspace vapours, DO, ORP, pH, EC and temperature are made at the time of sample collection.
- Quality assurance/quality control (QA/QC) samples are collected at a rate of approximately 10% of the total samples. Duplicate samples for quality control will be obtained by rinsing a clean container with formation water, discarding the rinse water and then collecting the required sample volume. The sample is split into two aliquots and placed into two different bottles with one bottle identified under a different sample name and the second bottle under the regular sample number. The laboratory is not informed of the nature of the sample. Demineralized water blanks are also collected during the sampling periods to determine bottle cleanliness and the effects of sample transport, handling, and collection techniques. All QA/QC water samples are given realistic sample numbers and submitted as groundwater samples.

The samples are delivered to a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory using standard chain of custody protocols. Chain of custody documents are included along with the laboratory reports in Appendix D.

3 2021-2022 Groundwater Monitoring Programs

The potential interactions that could lead to effects on groundwater resources vary depending upon the specific location and Project phase. The following are the potential interactions for the baseline and construction phases included in this reporting period

During baseline data collection there is comprehensive baseline monitoring ongoing prior to Project disturbances. Note that the baseline period will continue through construction and up until operation in areas in and around the reservoir where no construction activities will take place. The intent of baseline monitoring is to understand a wide range of hydrochemical parameters and their potential natural variability in location and time. The baseline monitoring program would seek to understand local seasonal variation in water levels and hydrochemistry. The baseline is intended to establish a point of comparison that can be used to assess changes that could be attributable to the Project in the future.

During construction, medium comprehensive monitoring is continuing to gather baseline data in some areas as noted above, as well as to monitor potential effects of construction activities that could lead to disturbances to the groundwater system such as construction dewatering or deep excavation along the diversion channel.

The following sections describe the groundwater monitoring network development and the monitoring that was completed during the 2021-2022 reporting period. The scopes of work for drilling and well installation and for groundwater monitoring were highly dependent on land access constraints.

3.1 May 2021 Monitoring

The Tier 2 well network was monitored and sampled between May 12 and May 14, 2021. The monitoring event included:

- 14 - Tier 2 wells
- 8 - EIA Project Wells

The EIA Project Wells continue to be monitored and sampled for baseline purpose as summarized in Table 1 and as discussed in Section 2.3.1. Access restrictions, damaged or destroyed wells or inability to locate wells prevented monitoring and sampling of the remaining wells as noted in the table. Monitoring and laboratory analysis was completed as described in the sampling protocols in Section 2.4.4.

The Tier 2a and Tier 3 monitoring network had not yet been established at the time of the May 2021 monitoring event and, as such, no monitoring or sampling of these wells occurred in May 2021.

3.2 August 2021 Monitoring Well Decommissioning and Installation

The following Tier 2 monitoring well decommissioning and installation activities were completed in August 2021 to continue to relocate monitoring wells outside of the construction footprint and to continue to establish the permanent monitoring network:

- installation of monitoring well MW21-3-5 and MW21-3-15 (nested pair)
- installation of monitoring well MW21-6-7 and MW21-6-12 (nested pair)
- installation of monitoring well RMW16-13-37 to replace damaged well MW16-13-37
- decommissioning of monitoring well MW16-16-11 and replacement installation of RMW16-16-17 adjacent to the diversion channel
- decommissioning of monitoring well MW16-17-5 and replacement installation of RMW16-17-10 adjacent to the diversion channel
- decommissioning of nested monitoring well pair MW16-18-6 and MW16-18-10 and replacement with RMW16-18-5 and RMW16-18-13 adjacent to the diversion channel

The new and replacement monitoring well locations are presented in Figure 2.1. Borehole logs including lithological descriptions and monitoring well completion details are included in Appendix B.

3.3 November 2021 Monitoring Well Decommissioning, Installation, and Monitoring

The following Tier 2 monitoring well decommissioning and installation activities were completed in November 2021 to continue to relocate monitoring wells outside of the construction footprint and to establish the permanent monitoring network:

- installation of replacement monitoring wells RWM16-19-10 and RMW16-19-19 following removal of the original wells (MW16-19-8 and MW16-19-19) by the landowner
- decommissioning of monitoring well MW16-5-11 and replacement installation of RMW15-5-12 outside of the design flood wetted perimeter of the reservoir

The locations of the well installations are presented in Figure 2.1. Borehole logs are presented in Appendix B.

The Tier 2 well network was monitored and sampled between November 22 and December 1, 2021. The monitoring and sampling program included:

- 18 - Tier 2 wells
- 8 - EIA Project Wells

LTC loggers were installed in the Tier 2 wells that were accessed in November 2021. Wells with existing temperature and pressure logging transducers installed in 2016 were downloaded and replaced with LTC loggers as required. Time-series charts presenting the logger data are included in Appendix C.

3.4 January 2022 Monitoring

Domestic water well owners were invited to participate in monitoring program in the fall of 2021 and the first monitoring event at the domestic water well locations was completed between January 10 and 14, 2022. The January 2022 monitoring and sampling program included:

- 3 - Tier 2 monitoring wells
- 2 - Tier 2a monitoring wells
- 3 - Tier 3 monitoring wells
- 8 - one-time wells were monitored and sampled for baseline purposes

In addition to the domestic wells, three Tier 2 wells that could not be accessed during the previous monitoring event (in November 2021) were monitored and sampled and LTC transducers were installed.

3.5 May 2022 Monitoring Well Decommissioning, Installation, and Monitoring

Tier 2 monitoring well decommissioning and installation activities were completed in May 2022 to continue to move monitoring wells outside of the construction footprint and to continue to establish the permanent monitoring network. The May 2022 work included:

- decommissioning of nested monitoring wells MW16-23-14 and RMW16-23-36 and installation of monitoring wells RMW16-23-7, RMW16-23-13 and RMW16-23-32 on the downstream side of the eventual dam footprint
- decommissioning of EIA Project Well MW16-24-30 in the dam footprint (not part of the Tier 2 network)

Locations of the decommissioning and installation work are presented in Figure 2.1. Borehole logs are included in Appendix B.

The May 2022 monitoring and sampling program was completed between May 4 and 27, 2022 and included:

- 25 - Tier 2 monitoring wells and
- 8 - EIA Project Wells
- 2 - Tier 2a monitoring wells
- 4 - Tier 3 monitoring wells
- 5 - one-time wells

Access to the Tier 2a wells, which are both located in pits, required confined space entry to measure water levels and deploy data loggers. Measurements were also taken so that direct read cables could be ordered for the data loggers to avoid the need for confined space entry in the future.

All deployed loggers were downloaded and calibrated in May 2022. Data logger pressure, temperature and electrical conductivity data are presented in Appendix C.

4 Results

4.1 Groundwater Levels

Data logger data are presented in Appendix C. Loggers had been installed in a number of wells in 2016 with continuous hourly measurements of pressure (head above logger) and temperature recorded from 2016 to 2022. The data from these monitoring wells (MW16-1-15, MW16-6-11, MW16-6-20, MW16-8-19 and MW16-18-10) show the natural water level fluctuation over the medium term (i.e., seasonal variation over 6 years). Groundwater levels varied between approximately 1.3 m and 3.2 m over the 2016-2022 period and showed similar ranges in variation between wells installed in shallow unconsolidated deposits and those installed deeper in bedrock. The lowest groundwater levels are generally observed between February and April and the highest levels are generally observed between May and July.

Groundwater temperatures fluctuate in a regular pattern maintaining temperatures between approximately 3 and 7 °C throughout the year. A lag in temperature change is observed with the lowest temperatures observed in the summertime and the highest temperatures observed in the winter.

Electrical conductivity measured by the data loggers in 2021 and 2022 indicated relatively stable or decreasing EC values between the fall of 2021 when the LTC loggers were installed and when they were downloaded during the May 2022 monitoring event. Water levels and temperatures also generally decreased over the same period with the beginning of the seasonal increase in water levels observed in some monitoring wells in April and May, 2022.

4.1.1 GROUNDWATER LEVEL TRIGGERS

Triggers for groundwater levels will be established based upon the expected variability defined during the baseline monitoring program for each individual monitoring well. As mentioned in previous sections, the baseline period is not strictly limited to pre-construction but is continuing through the construction period for some monitoring wells as discussed in Section 2.2. For example, some monitoring wells that are distal to the construction footprint will continue to gather baseline data up until the first flood event to account for longer term natural variability.

It is expected that some monitoring well locations will naturally have a higher variability than others. Monitoring wells that are installed near Elbow River and within the alluvial deposits would exhibit a seasonal trend similar to surface water, with additional precipitation event-based “spikes”. Monitoring wells that are installed in low permeability unconsolidated deposits or deeper into bedrock would exhibit a more muted seasonal variability since they are not directly influenced by the surface water flow regime. Considering construction of the channel or dewatering of areas near the Tier 2 monitoring network have not yet occurred, the current reporting period is still considered part of the baseline with respect to groundwater levels.

Groundwater level triggers will include:

- potential development of flowing artesian conditions during flooding or reservoir retention
- a decrease in water level in a well(s) resulting from construction dewatering or permanent drawdown near the diversion channel to the point where the well(s) are no longer useable

Neither of the trigger conditions were observed at any of the project or domestic monitoring wells in 2021 or 2022.

4.2 Groundwater Quality

4.2.1 TIER 2 AND EIA PROJECT WELLS

Analytical data for the 2021 and 2022 monitoring events for the Tier 2 and EIA Project wells are presented in Table 2 and laboratory analytical reports are included in Appendix D for reference. Historical data are also presented in Table D.1 in Appendix D for reference.

The full analytical suite of parameters (PS3) described in Section 2.4.1 was analyzed for each monitoring well. Table 2 includes the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Alberta Tier 1 Guidelines) (AEP 2019) for fine grained soils in an agricultural land use setting and the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2022). Guidelines are provided only for comparison purposes and discussion.

A total of 18 groundwater Tier 2 and EIA project monitoring wells completed in the unconsolidated deposits were sampled in 2021 and 2022. The TDS concentrations in the unconsolidated deposits were similar to the previous (2016) results and ranged from 560 to 6,140 mg/L with and average concentration of 2,112 mg/L. These TDS concentrations naturally exceed both referenced guidelines and are considered slightly to moderately saline. At two locations (MW16-2-6, MW16-16-11) the TDS concentrations exceeded the definition of “non-saline water” (TDS <4,000 mg/L) under the Alberta’s Water (Ministerial) Regulation. The elevated TDS at these two monitoring wells is consistent with historical observations.

A total of 18 Tier 2 and EIA project monitoring wells completed in bedrock were sampled in 2021 and 2022. The TDS concentrations in the bedrock deposits were similar to the previous (2016) results and ranged from 410 to 4,460 mg/L with an average concentration of 1,519 mg/L. The bedrock TDS concentrations remain lower than in the surficial deposits but still exceed both referenced guidelines in 16 of the 18 monitoring wells sampled and are considered slightly saline. The dominant cations contributing to the TDS is sodium (calcium and magnesium to a lesser extent) and the dominant anions are sulphate and bicarbonate. Chloride concentrations are generally low however exceedances of the 100 mg/L Alberta Tier 1 Guideline have been noted at MW16-8-19, MW16-18-10, and RMW16-13-37. A single exceedance of the Alberta Tier 1 and GCDWQ was noted in the May 2021 sample at MW16-27-9 with a reported chloride concentration of 370 mg/L; however, the concentration appears to be anomalous and potentially due to laboratory error considering the chloride concentration was <1 mg/L during the subsequent November 2021 and May 2022 monitoring events.

Nutrient concentrations including ammonia, nitrate, nitrite, phosphate and total Kjeldahl nitrogen are analyzed because they are contaminants of potential concern in agricultural settings. Nitrate and nitrite concentrations were low and below guidelines in all samples in 2021 and 2022. Ammonia nitrogen concentration exceed the Alberta Tier 1 Guideline in the majority of samples with concentrations of up to 2.04 mg/L (MW16-6-20 in December 2021). Ammonia concentrations were similar in wells completed in unconsolidated and bedrock deposits and the 2021 and 2022 concentrations were similar to historical results. Phosphate concentrations were low and below the laboratory detection limit in the majority of samples.

Dissolved metals concentrations were generally within the range of expected concentrations for monitoring wells completed in glacial deposits and shallow bedrock in southern Alberta. Iron concentrations exceeded the 0.3 mg/L guideline at seven locations with a maximum concentration 3.1 mg/L. Manganese concentrations exceeded the referenced guidelines (0.05 mg/L) at all locations except MW16-8-8, MW16-8-19 and MW16-18-6 with values ranging from <0.004 to 3.4 mg/L. Selenium concentrations exceeded the 0.001 mg/L Alberta Tier 1 Guideline in 10 monitoring wells. Uranium concentrations exceeded the 0.01 mg/L guidelines at 12 monitoring wells. All but one of the monitoring wells with uranium exceedances was completed in unconsolidated deposits which is not unexpected given the prevalence of uranium in the glacial material. Sporadic Alberta Tier 1 Guideline exceedances of aluminum, arsenic and copper along with a single exceedance of zinc (MW16-10-15 in November 2021) were also noted in the 2021 and 2022 analytical data.

Mercury is a contaminant of potential concern for dam reservoir areas due to the potential for methylmercury to form during the decomposition of organic matter. Dissolved mercury was below the laboratory detection limit in the majority of samples but exceeded the 0.000005 mg/L Alberta Tier 1 guideline during single sampling events at RMW16-17-10, MW16-22-26, MW16-23-14, and MW21-6-7 with a maximum concentration of 0.0000081 mg/L (MW16-23-14 in November 2021). Total mercury was also analysed in all samples with concentrations ranging from <0.0000019 to 0.00446 mg/L. However, it should be noted that given the amount of sediment entrained in many of the samples as a result of the fine-grained aquifer material, the laboratory detection limits had to be raised for many samples.

Hydrocarbon concentrations were below their respective guideline concentrations at all monitoring wells except for MW16-2-6. The F2 (C10-C16) hydrocarbon fraction concentration exceeded the Alberta Tier 1 Guideline in May 2021 with a concentration of 5.9 mg/L. The subsequent November 2021 sample concentration was below the laboratory detection limit of 0.1 mg/L and the May 2022 concentration rebounded to 0.28 mg/L but remained below the guideline. The May 2022 concentration is consistent with the 2016 sampling event at this location which reported a concentration of 0.47 mg/L.

Bacteriological parameters including Escherichia coli (E. Coli), fecal coliform, total coliforms and heterotrophic plate counts (HPC) were enumerated for all samples. As with the mercury analyses described above, sediment in the samples also affected the detection limits for the bacteriological parameters. While the detection limits were not low enough to determine if the water is safe for human consumption in the majority of samples, it does provide general information on the bacteriological levels and potential for pre-existing impacts in the shallow groundwater.

HPC's were included in the analytical suite to provide information on the level of bacteriological activity. HPC concentrations varied significantly from 35 cfu/100 mL at RMW16-23-13 to 150,000 cfu/100 mL at RMW16-13-37. No spatial or depth correlation was evident in the HPC data. E. coli were counted in at a number of locations with concentrations of up to 411 mpn/100 mL at RMW16-5-12. Total coliform bacteria ranged from <1 to 2,424 mpn/100 mL. Fecal coliform bacteria also exceeded guidelines at a number of locations with concentrations of up to 579 mpn/100 mL at RMW16-5-12.

4.2.2 TIER 2A, TIER 3 AND ONE-TIME DOMESTIC WELLS

The Tier 2a, Tier 3 and One-Time Domestic Wells are grouped together for the purposes of discussion considering they are all domestic and or stock watering wells as opposed to monitoring wells installed specifically for the project. Analytical data for the 2021 and 2021 monitoring events are presented Table 3 and laboratory analytical reports are included in Appendix D for reference.

TDS concentrations were lower in the domestic and livestock wells, averaging 740 mg/L in wells known to be completed in bedrock (some completion details are unknown) and 312 mg/L in wells completed in shallow alluvial deposits. The bedrock wells had similar major ion chemistry to the project wells in the previous section. The dominant cations contributing to the TDS in the bedrock wells are sodium (calcium and magnesium to a lesser extent) and the dominant anions are sulphate and bicarbonate. In contrast, the groundwater in the alluvial deposits is calcium and magnesium bicarbonate type water.

Nutrient concentrations including ammonia, nitrate, nitrite, phosphate and total Kjeldahl nitrogen were generally low. Nitrate concentrations were below CGDWQ at all locations and below Alberta Tier 1 Guidelines at all locations except two.

Dissolved metals concentrations were generally lower than in the project monitoring wells in Section 4.2.1, however, there were still exceedances of Alberta Tier 1 Guidelines for copper, iron, manganese, selenium, sodium and zinc in some samples. The only exceedances of the CGDWQ were for iron (2 locations) manganese (9 locations) and sodium 6 locations). Total and dissolved mercury concentrations were below laboratory detection limits in all samples.

Hydrocarbon concentrations were below their respective guideline concentrations at all Tier 2a, Tier 3 and One-Time Domestic Wells.

Bacteriological parameters including E. Coli, fecal coliform, total coliforms and HPC were enumerated for all samples. HPC concentrations varied widely from 1 cfu/100 ml at RMW16-23-13 to >6,000 cfu/100 mL. Total coliform bacteria ranged from <1 to 240 mpn/100 mL. E. coli and fecal coliforms were reported to be below laboratory detection limits in all samples.

4.2.3 GROUNDWATER QUALITY TRIGGERS

After a sufficient baseline dataset has been established at a monitoring well (approximately eight monitoring events where possible), trigger values will be determined for parameters that are naturally present at detectible concentrations (e.g., chlorides) to identify changes in groundwater quality that fall outside of the baseline conditions for a given well. Triggers will be developed for each individual monitoring well and will be based on a calculated upper confidence limit (UCL). The baseline historical groundwater monitoring data for each well will be screened and outliers removed prior to the calculation of each UCL. Results that are more than two standard deviations above or below the mean of the historical data will be considered outliers. The UCL will be calculated as follows:

$$UCL = x + Z*s$$

Where:

x = sample mean

Z = multiplier (a value of 4.5 is considered appropriate for groundwater monitoring [Gibbons 1999])

s = sample standard deviation

United States Environmental Protection Agency (US EPA 1989) indicated that the overall confidence levels for the control limits calculated using $Z=4.5$ is 95% based on a minimum of eight historical monitoring events.

Where the standard deviation is very large or very small, the coefficient of variation (Cv) will be calculated for the UCL as follows:

Where $Cv < 0.05$ $UCL = 1.225*x$

Where $Cv > 0.5$ $UCL = 3.25*x$

UCL values for parameters that are not naturally present in groundwater (e.g., BTEX, F1-F3 hydrocarbons) will be considered to be equal to the lesser of five times the laboratory reportable detection limit or the referenced guideline for that parameter.

UCL trigger values will not be determined for monitoring wells where impacts are currently above the relevant guidelines. Instead, triggers at monitoring wells in the affected areas will be based on increasing temporal trends in groundwater quality over four monitoring events. However, sampling frequency in relation to seasonal variation may also need to be taken into consideration.

Once the baseline data set has been established, non-parametric trend analysis will be conducted for each groundwater monitoring well to determine changes in groundwater quality that may be due to Project operations. Trend analysis will be conducted for select analytes that are most indicative of potential changes in groundwater quality related to Project operations. The results of the trend analysis will be included in the annual groundwater monitoring reports for the Project.

The current maximum number of baseline events at any of the monitors is four, therefore UCL values have not yet been established and there are too few data points for non-parametric trend analysis. Development of UCL values and trend analysis will be completed after eight monitoring events (anticipated to occur in Q2 2024).

4.2.4 QA/QC ANALYTICAL RESULTS

Four field duplicate sample sets were collected during the 2021 and 2022 monitoring events as part of the QA/QC program to evaluate the precision or reproducibility of the analytical data between samples. The relative percent difference (RPD) between the sample and duplicate results was calculated for each sample or, when the parameter result was within five times the detection limit, the Absolute difference (AD) between the sample and duplicate was calculated. An RPD of 40% or less, or an AD of less than two times the detection limit, is considered acceptable for duplicate groundwater samples (CCME 2016).

The duplicate QA/QC analytical results are presented in Table D.2 in Appendix D. A comparison of the duplicate sample results indicated that 99% (507 of 512 results) of the duplicate sample results meet the criteria referenced above. Overall, the reproducibility of the data is good and the analytical results are considered valid.

Laboratory QA/QC procedures and analysis are included with the analytical results in Appendix D. The quality assurance reports include analysis of matrix spikes, QC standards, blanks and calibration checks.

5 Conclusions and Recommendations

Groundwater monitoring network development and groundwater monitoring activities were completed between May 2021 and May 2022.To address IAAC Condition 7.6, eight monitoring wells were decommissioned and replaced (where required) outside of the construction footprint or wetted perimeter of the design flood. An additional seven monitoring wells were installed to further develop the monitoring network.

Groundwater monitoring and sampling was completed in May 2021, November 2021, January 2022 and May 2022. The monitoring and sampling included the Tier 2 monitoring wells, Tier 2a monitoring wells, Tier 3 domestic wells, one-time domestic wells (NRCB EIA hearing commitment) and the legacy EIA Project wells.

The monitoring programs included measurement of groundwater levels, field parameters (DO, ORP, pH, EC) and installation of data logging pressure transducers. The transducers were deployed to measure and record near continuous water level (pressure), temperature, and electrical conductivity at the Tier 2, Tier 2a and Tier 3 monitoring wells. Groundwater samples were collected and submitted to the laboratory for routine potability parameters, major ions, bacteriological parameters, DOC, dissolved metals, nutrients, BTEX, and F1 to F2 fraction hydrocarbons.

No Project related changes to groundwater levels were noted, nor were they expected considering there was no construction dewatering of groundwater during the reporting period. Groundwater quality in 2021 and 2022 was consistent with historical results and, while there are numerous exceedances of the Alberta Tier 1 Guidelines (AEP 2019) and the Guidelines for Canadian Drinking Water Quality (Health Canada 2022), no exceedances were attributed to Project effects. Project effects on groundwater quality are not expected at this point during the construction phase considering there has been limited interaction between construction activities and groundwater resources (i.e., no groundwater dewatering, no excavation into the water table and no spills reported that had the potential to impact groundwater).

The following recommendations are made for the next monitoring period:

- continue semi-annual groundwater monitoring over 2022 and 2023 for potential construction related effects as additional baseline data gathering away from construction areas
- establish the final two Tier 3 monitoring locations shown as “TBD” on Figure 2.1
- replace Tier 2 monitoring well MW16-15-34 which could not be located, this well was installed in the shoulder of an approach off Range Road 35 and is presumed to have been damaged or destroyed
- replace RMW16-17-10 for the second time to move off private property to Alberta Transportation owned property as requested by the landowner
- the next groundwater monitoring report should cover the period between July 1, 2022 and June 30, 2023

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TABLES

Table 1 Groundwater Monitoring Summary

Monitoring Well	Monitoring Tier	Unit	2021-2022 Sampling Events			
			May-21	Nov-21	Jan-22	May-22
MW16-1-15	Tier 2	Bedrock	X		X	X
MW16-2-6	Tier 2	Unconsolidated	X	X		X
MW16-5-11	Tier 2 (original)	Bedrock	X	Decommissioned		
RMW16-5-12	Tier 2 (replacement)	Bedrock		X		X
MW16-7-5	Tier 2	Unconsolidated	X	X		X
MW16-8-8	Tier 2	Unconsolidated	X		X	X
MW16-8-19	Tier 2	Bedrock	X		X	X
MW16-10-15	Tier 2	Unconsolidated	X	X		X
MW16-11-15	Tier 2	Unconsolidated	X	X		X
MW16-12-3	Tier 2	Unconsolidated	DRY	DRY		DRY
RMW16-13-37	Tier 2	Bedrock		X		X
MW16-14-33	Tier 2	Bedrock	NA			
MW16-15-34	Tier 2	Bedrock	NA			CNL
MW16-16-11	Tier 2 (original)	Unconsolidated	X	Decommissioned		
RMW16-16-17	Tier 2 (replacement)	Bedrock		X		X
MW16-17-5	Tier 2 (original)	Unconsolidated	Decommissioned			
RMW16-17-10	Tier 2 (replacement)	Unconsolidated		X		X
MW16-18-6	Tier 2 (original)	Unconsolidated		X	Decommissioned	
RMW16-18-5	Tier 2 (replacement)	Unconsolidated				X
MW16-18-10	Tier 2 (original)	Bedrock		X	Decommissioned	
RMW16-18-13	Tier 2 (replacement)	Bedrock				X
MW16-19-8	Tier 2 (original)	Unconsolidated	CNL	Decommissioned		
RMW16-19-10	Tier 2 (replacement)	Unconsolidated		X		X
MW16-19-19	Tier 2 (original)	Bedrock	CNL	Decommissioned		
RMW16-19-19	Tier 2 (replacement)	Bedrock		X		X
MW16-21-11	Tier 2	Bedrock	ISV			ISV
MW16-22-26	Tier 2	Unconsolidated	X	X		X
MW16-23-14	Tier 2 (original)	Unconsolidated	X	X	Decommissioned	
RMW16-23-7	Tier 2 (replacement)	Unconsolidated				X
RMW16-23-13	Tier 2 (replacement)	Bedrock				X
MW16-23-36	Tier 2 (original)	Bedrock	X	X	Decommissioned	
RMW16-23-32	Tier 2 (replacement)	Bedrock				X
MW21-3-5	Tier 2	Unconsolidated				DRY
MW21-3-15	Tier 2	Bedrock				X
MW21-6-7	Tier 2	Unconsolidated		X		X
MW21-6-12	Tier 2	Bedrock		X		X
WS81-01	Tier 2b	Bedrock			X	X
WS81-02	Tier 2b	Bedrock			X	X
NE20-R3-01	Tier 3	Bedrock			X	NA
SW35-R4-01	Tier 3	Bedrock				NA
NE7-R3-01	Tier 3	Unconsolidated (alluvial)				X
SW11-R4-02	Tier 3	Bedrock			X	X
WS41-02	Tier 3	Bedrock				X
WS51-01	Tier 3	Bedrock			X	NA
WS62-01	Tier 3	Unconsolidated (alluvial)			X	X
MW16-3-7	EIA Project Well	Unconsolidated	X	X		X
MW16-4-22	EIA Project Well	Bedrock	X	X		X

Table 1 Groundwater Monitoring Summary (continued)

Monitoring Well	Monitoring Tier	Unit	2021-2022 Sampling Events			
MW16-6-11	EIA Project Well	Unconsolidated	X	X		X
MW16-6-20	EIA Project Well	Bedrock	X	X		X
MW16-9-6	EIA Project Well	Unconsolidated	Decommissioned			
MW16-20-21	EIA Project Well	Bedrock	Decommissioned			
MW16-24-30	EIA Project Well	Bedrock	X	X		X
MW16-25-9	EIA Project Well	Unconsolidated	X	X		X
MW16-26-18	EIA Project Well	Bedrock	X	X		X
MW16-27-9	EIA Project Well	Unconsolidated	X	X		X
SE35-R4-01	One Time	Bedrock			X	NR
SE35-R4-02	One Time	Bedrock				X
SW2-R4-01	One Time	Unknown			X	NR
SW2-R4-02	One Time	Unknown				X
SW11-R4-01	One Time	Bedrock			X	NR
WS42-01	One Time	Bedrock				X
WS42-02	One Time	Bedrock				X
WS48-01	One Time	Bedrock			X	NR
WS56-01	One Time	Bedrock			X	NR
WS56-02	One Time	Bedrock			X	NR
WS65-01	One Time	Bedrock			X	NR
WS65-02	One Time	Unknown			X	NR
WS67-01	One Time	Unconsolidated (alluvial)				X

▨ decomissioned monitoring wells

X - monitored and sampled (where sufficient volume)

CNL - could not locate

NA - no access

NR - not required (one-time sampling completed)

ISV - insufficient volume for sample collection

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells

Sample Location				MW16-1-15			MW16-2-6			MW16-5-11	RMW16-5-12		MW16-7-5			MW16-8-8			MW16-8-19		
Completion Lithology				Bedrock			Unconsolidated			Bedrock	Bedrock		Unconsolidated			Unconsolidated			Bedrock		
Sample Date				12-May-21	13-Jan-22	5-May-22	12-May-21	24-Nov-21	4-May-22	14-May-21	1-Dec-21	4-May-22	13-May-21	1-Dec-21	5-May-22	13-May-21	13-Jan-22	6-May-22	13-May-21	13-Jan-22	6-May-22
Monitoring Tier	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2
Field Parameters																					
Dissolved oxygen, Field	mg/L	n/v	n/v	1.43	2.83	3.18	3.79	3.92	2.33	12.81	8.3	5.12	13.59	8.14	2.9	14.49	3.65	4.15	2.75	4.81	3.3
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**2,187^{A}**	**2,134^{A}**	**2,192^{A}**	**6,179^{A}**	**6,105^{A}**	**6,392^{A}**	707.5	776	818	**3,246^{A}**	**3,318^{A}**	**3,271^{A}**	**1,081^{A}**	**1,410^{A}**	**1,157^{A}**	**1,246^{A}**	**1,282^{A}**	**1,292^{A}**
Oxidation Reduction Potential, field	mV	n/v	n/v	60.2	44.7	68.2	92.4	95.3	-21.3	73.6	-17.3	-45.2	63.0	95.7	5.8	88.7	73.6	68.1	88.4	84.1	84.5
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.23	7.64	7.16	**6.86^{B}**	**6.93^{B}**	**6.38^{AB}**	7.40	7.73	**6.96^{B}**	7.26	7.28	7.09	7.38	7.59	7.43	7.09	7.4	**6.97^{B}**
Temperature, Field	deg C	n/v	≤15^{B}	8.8	5.6	7.7	7.4	5.09	9	7.4	5.1	8.9	6.5	5.94	7.4	7.1	6	9.5	6.9	4.8	7.5
Calculated Parameters																					
Anion Sum	meq/L	n/v	n/v	27	29	29	97	-	94	8.3	-	9.2	36	-	38	12	13	14	14	14	13
Cation Sum	meq/L	n/v	n/v	26	27	29	96	-	96	8.1	-	9.6	44	-	43	13	14	16	15	16	16
Hardness (as CaCO3)	mg/L	n/v	n/v	990	1,000	1,100	3,100	3,390	3,100	320	329	310	1,400	1,440	1,300	590	620	710	640	670	680
Ion Balance	%	n/v	n/v	2.4	2.2	0.84	0.61	114	1.3	1.2	120	2.2	9.8	120	6.8	3.3	1.7	5.8	3.1	5.7	9.3
Nitrate	mg/L	13$_{f}^{A}$	45^{C}	<0.22	<0.22	<0.22	<0.22	<0.5	<0.44	2.7	0.8	<0.044	0.062	2.2	0.088	3.6	3.6	3.3	3.8	4.1	3.9
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	<0.050 MI	<0.050 AT	<0.050 AT	<0.050 MI	<0.02	<0.10 DB	0.62	0.18	<0.010	0.014	0.50	0.020	0.81 MI	0.81	0.74	0.87 MI	0.92	0.88
Nitrite	mg/L	0.197/1.97$_{n4,e,g}^{A}$	3^{C}	<0.033	<0.033	<0.033	<0.033	<0.10	<0.033	<0.033	<0.05	<0.033	<0.033	<0.10	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**1,700^{AB}**	**1,800^{AB}**	**1,800^{AB}**	**6,100^{AB}**	**6140^{AB}**	**6,000^{AB}**	410	426	480	**2,400^{AB}**	**2,560^{AB}**	**2,500^{AB}**	**660^{AB}**	**720^{AB}**	**770^{AB}**	**750^{AB}**	**760^{AB}**	**740^{AB}**
BTEX and Petroleum Hydrocarbons																					
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.00089	<0.00089	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.10	<0.10	**5.9^{A}**	<0.1	0.28	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics																					
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	2.4	2.1	2.4	4.2	4.774	4.1	3.6	3	2.5	3.6	4	3.8	1.6	1.8	2.8	0.63	0.95	1.8
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**2,200^{A}**	**2,200^{A}**	**2,200^{A}**	**6,400^{A}**	**6,550^{A}**	**6,500^{A}**	720	729	780	**3,400^{A}**	**3,470^{A}**	**3,200^{A}**	**1,100^{A}**	**1,100^{A}**	**1,100^{A}**	**1,300^{A}**	**1,300^{A}**	**1,200^{A}**
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.63	7.56	7.74	7.31	7.82	7.41	7.96	8.26	8.04	7.91	8.19	7.82	7.81	7.50	7.78	7.69	7.43	7.65
Anions																					
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	320	320	300	650	615	650	370	334	410	440	415	400	370	400	430	440	450	420
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	390	400	370	790	751	800	450	408	500	540	507	490	460	490	520	530	540	510
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulfate	mg/L	429$_{n5,e}^{A}$	≤500$_{i}^{B}$	**990 CD^{AB}**	**1,000^{AB}**	**1,100^{AB}**	**4,000 CD^{AB}**	**3,880^{AB}**	**3,900^{AB}**	36	46.1	48	**1,300 CD^{AB}**	**1,450^{AB}**	**1,400^{AB}**	180 CD	210	210	82	85	84
Chloride	mg/L	100^{A}	≤250^{B}	9.3	11	11	2.9	1.2	1.8	3.3	3.3	2.7	8.8	6.9	5.8	27	28	28	**130^{A}**	**120^{A}**	**120 AT^{A}**
Nutrients																					
Ammonia (as N)	mg/L	0.737$_{n2}^{A}$	n/v	0.045	0.036	0.036	0.2	0.15	0.16	0.14	0.28	0.29	0.11	0.06	0.029	<0.015	<0.015	<0.015	0.018	<0.015	<0.015
Nitrite (as N)	mg/L	0.06/0.6$_{n4,e}^{A}$	1^{C}	<0.010	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Orthophosphate (as P)	mg/L	n/v	n/v	<0.0030	0.0041	<0.0030	0.0059	<0.15	<0.0030	<0.0030	<0.15	<0.0030	0.011	<0.15	0.011	0.0049	0.0043	<0.0030	<0.0030	<0.0030	<0.0030
Nitrate (as N)	mg/L	3^{A}	10^{C}	<0.050	<0.050	<0.050	<0.050	<0.02	<0.10	0.62	0.18	<0.010	0.014	0.50	0.020	0.81	0.81	0.74	0.87	0.92	0.88
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	<0.0030	0.52 DB	<0.0030	0.0060	-	0.0032	0.0059	-	0.058	0.012	-	0.010	0.0053	1.4 DB	<0.0030	<0.0030	0.11 DB	<0.0030
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	0.26	0.258	0.86	7.2	2.3	<2.0	2.4	8.00	4.7	<1.0	0.89	1.80	0.182	0.131	14.2	0.177	0.105	0.075
Nitrogen	mg/L	n/v	n/v	0.26 DB	0.26	0.86 DB	7.2 DB	-	<2.0 DB	3.0 DB	-	4.7 DB	<1.0 DB	-	1.8 DB	0.99	0.94	15 DB	1.0	1.0	0.95
Microbiological Parameters																					
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<10 MI***	***<10 VV***	***<10***	***<100 MI***	***<1***	***<2.0 AT***	***<100 MI***	**411^{D}**	**10 AT^{D}**	***<10 SVH MI***	**14^{D}**	***<100***	***<1.0***	***<10 VV***	***<100 DVM***	***<10 MI***	***<1.0***	***<1.0***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<10 MI***	***<10***	***<10***	***<100 MI***	**2^{D}**	***<10 AT***	***<100 MI***	**579^{D}**	**10 AT^{D}**	**20 SVH MI^{D}**	**35^{D}**	***<100***	***<1.0***	***<10 VV***	***<100 DVM***	***<10 MI***	***<1.0***	***<1.0***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	5,500	10,000 VV	2,700	6,100 MI	8,700	6,200 DVM	18,000 MI	4,600	>6000 DVM	210	1,760	2,400	1,100	16,000 VV	470 AT	210	140	73
Total Coliforms	mpn/100mL	n/v	0^{D}	***<10 MI***	**680 VV^{D}**	**260^{D}**	***<100 MI***	**7^{D}**	***<2.0 AT***	***<100 MI***	**2,424^{D}**	**10 AT^{D}**	***<10 SVH MI***	**365^{D}**	***<100***	**>2400^{D}**	**200 VV^{D}**	**530 DVM^{D}**	***<10 MI***	***<1.0***	***<1.0***

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				**MW16-1-15**			**MW16-2-6**			**MW16-5-11**	**RMW16-5-12**		**MW16-7-5**			**MW16-8-8**			**MW16-8-19**		
Completion Lithology				**Bedrock**			**Unconsolidated**			**Bedrock**	**Bedrock**		**Unconsolidated**			**Unconsolidated**			**Bedrock**		
Sample Date				**12-May-21**	**13-Jan-22**	**5-May-22**	**12-May-21**	**24-Nov-21**	**4-May-22**	**14-May-21**	**1-Dec-21**	**4-May-22**	**13-May-21**	**1-Dec-21**	**5-May-22**	**13-May-21**	**13-Jan-22**	**6-May-22**	**13-May-21**	**13-Jan-22**	**6-May-22**
Monitoring Tier	**Units**	**2019 AEP Tier 1**	**GCDWQ**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**
Metals - Dissolved																					
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	<0.0030	<0.0030	<0.0030	0.0069	0.021	0.0036	0.018	**0.061**^{A}	0.0058	<0.0030	0.039	<0.0030	0.0096	0.0049	0.0033	<0.0030	<0.0030	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.00060	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	<0.00020	0.00036	0.00051	0.00035	<0.001	0.0010	0.00047	<0.001	0.00056	0.00046	<0.001	0.00063	0.00025	<0.00020	0.00030	<0.00020	<0.00020	<0.00020
Barium	mg/L	1^{A}	2.0^{C}	<0.010	0.012	0.012	<0.010	<0.05	<0.010	0.071	0.07	0.069	0.013	<0.05	0.019	0.044	0.045	0.046	0.062	0.063	0.067
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.078	0.077	0.080	0.10	0.11	0.11	0.043	0.09	0.12	0.10	0.11	0.10	0.052	0.042	0.047	0.053	0.047	0.052
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	<0.000020	0.00032	0.000066	0.000039	0.000124	0.00027	0.000022	0.000030	<0.00002	0.000021	0.000028	<0.00002	<0.000020	<0.00002	<0.00002	0.000020	0.000023	0.000028
Calcium	mg/L	n/v	n/v	220	230	250	400	451	410	69	74.9	68	210	234	200	130	130	150	150	150	150
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	0.00087	0.00098	0.00099	0.0021	0.0027	0.0029	0.00040	<0.0009	0.00042	0.00077	0.0018	0.00085	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Copper	mg/L	0.007^{A}	$\leq 1.0^{B}$ 2^{C}	0.00020	0.00097	<0.0010	0.00090	0.0034	0.0015	0.0013	<0.0008	<0.0010	0.00023	<0.0008	<0.0010	0.0020	0.00053	<0.0010	0.00022	0.00051	<0.0010
Iron	mg/L	0.3^{A}	$\leq 0.3^{B}$	0.069	<0.060	<0.060	<0.060	<0.1	<0.060	<0.060	<0.1	<0.060	<0.060	<0.1	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	<0.00020	<0.00020	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	0.0004	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	<0.020	<0.020	<0.020	0.099	-	0.11	0.022	-	<0.020	0.070	-	0.060	0.020	<0.020	<0.020	0.021	0.028	<0.020
Magnesium	mg/L	n/v	n/v	100	100	110	520 CD	549	490	37	34.5	34	210	209	190	67	70	82	67	70	72
Manganese	mg/L	0.05^{A}	$\leq 0.02^{B}$ 0.12^{C}	**0.82**^{ABC}	**0.83**^{ABC}	**0.82**^{ABC}	**1.3**^{ABC}	**1.31**^{ABC}	**1.3**^{ABC}	**0.11**^{AB}	**0.122**^{ABC}	**0.14**^{ABC}	**0.30**^{ABC}	**0.389**^{ABC}	**0.22**^{ABC}	0.013	**0.025**^{B}	0.019	0.0058	<0.0040	<0.0040
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000025	<0.0000019	<0.0000019	-	<0.0000019	<0.0000019	-	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	0.0000022	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.0017	0.0019	0.0019	0.00091	<0.001	0.00092	0.0056	0.006	0.0039	0.0011	0.002	0.0014	0.00073	0.00078	0.0010	0.0011	0.00068	0.00060
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	0.00083	0.0013	0.00099	0.0059	0.007	0.0071	0.001	0.003	0.0015	0.0035	0.006	0.0027	0.0011	0.0011	0.00082	<0.00050	<0.00050	<0.00050
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	3.6	3.8	4.2	7.5	8.8	8.3	3.7	8.1	8.2	4.5	5.0	5.5	5.7	6.1	6.8	6.1	6.5	6.8
Selenium	mg/L	0.002^{A}	0.05^{C}	<0.00020	<0.00020	<0.00020	<0.00020	<0.0005	0.00024	**0.0025**^{A}	<0.0005	0.00029	0.00021	<0.0005	0.00094	**0.0044**^{A}	**0.0038**^{A}	**0.0035**^{A}	**0.0061**^{A}	**0.0086**^{A}	**0.0077**^{A}
Silicon	mg/L	n/v	n/v	4.3	4.4	4.5	4.8	-	5.2	4.5	-	4.1	5.0	-	4.6	4.9	4.4	4.6	4.6	4.1	4.1
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	200^{A}	$\leq 200^{B}$	140	160	170	**750 CD**^{AB}	**882**^{AB}	**800**^{AB}	35	58.0	73	**370**^{AB}	**405**^{AB}	**400**^{AB}	24	25	28	51	56	56
Strontium	mg/L	n/v	7.0^{C}	1.4	1.6	1.6	5.8 CD	-	6.0	0.93	-	1.2	2.3	-	2.1	1.1	1.2	1.3	1.4	1.5	1.5
Sulfur	mg/L	n/v	n/v	330	310	310	1,400 CD	-	1,300	11	-	18	610 CD	-	530	73	62	68	31	27	27
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	-	0.0015	<0.0010	-	<0.0010	<0.0010	<0.0010	0.0021	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	0.002	<0.0010	<0.0010	0.002	0.0016	<0.0010	0.002	<0.0010	<0.0010	0.0012	0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.0043	0.0042	0.0048	**0.029**^{AC}	**0.031**^{AC}	**0.029**^{AC}	0.0067	0.002	0.0022	**0.014**^{A}	**0.018**^{A}	**0.016**^{A}	**0.011**^{A}	**0.012**^{A}	**0.013**^{A}	0.0044	0.0049	0.0050
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	0.0012	<0.0010	-	0.0013	<0.0010	-	0.0011	<0.0010	-	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	mg/L	0.03^{A}	$\leq 5.0^{B}$	<0.0030	<0.0030	<0.0030	0.0031	<0.005	<0.0030	<0.0030	<0.005	<0.0030	<0.0030	<0.005	<0.0030	0.0036	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Metals - Total																					
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.0000473**^{A}	**0.000038**^{A}	**0.000055**^{A}	**0.000277 DB**^{A}	**0.000032**^{A}	**0.00071**^{A}	**0.000383 DB**^{A}	**0.000055**^{A}	**0.000096**^{A}	**0.0000292**^{A}	**0.000013**^{A}	**0.000114**^{A}	**0.0000091**^{A}	**0.000146**^{A}	**0.00278**^{AC}	**0.0000262**^{A}	**0.0000104**^{A}	**0.0000058**^{A}

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-10-15			MW16-11-15			RMW16-13-37		MW16-16-11	RMW16-16-17		RMW16-17-10		MW16-18-6	RMW16-18-5		MW16-18-10
Completion Lithology				Unconsolidated			Unconsolidated			Bedrock		Unconsolidated	Bedrock		Unconsolidated		Unconsolidated	Unconsolidated		Bedrock
Sample Date				13-May-21	24-Nov-21	9-May-22	13-May-21	22-Nov-21	6-May-22	24-Nov-21	9-May-22	13-May-21	2-Dec-21	5-May-22	22-Nov-21	10-May-22	13-May-21	22-Nov-21	5-May-22	13-May-21
Monitoring Tier	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2
Field Parameters																				
Dissolved oxygen, Field	mg/L	n/v	n/v	20.18	3.1	5.02	1.52	4.7	2.77	6.07	5.11	14.91	6.62	3.98	7.13	3.61	23.79	41.26	3.71	5.11
Electrical Conductivity, Field	µS/cm	1,000^A	n/v	**3,992^A**	**3,930^A**	**4,422^A**	**3,012^A**	**2,842^A**	**2,921^A**	**3,344^A**	**3,027^A**	**5,210^A**	**5,160^A**	**5,086^A**	**2,077^A**	**2,143^A**	**1,060^A**	**1,073^A**	**1,143^A**	**1,211^A**
Oxidation Reduction Potential, field	mV	n/v	n/v	-54.3	60.5	-0.25	48.7	47.5	-8.3	-44.4	-101.7	84.2	5	-23.4	19.3	51.2	62.5	62.1	67	69.4
pH, Field	S.U.	6.5-8.5^A	7.0-10.5^B	**6.80^B**	**6.49^{AB}**	**6.86^B**	7.01	7.08	**6.94^B**	8.01	7.67	**6.76^B**	7.13	**6.9^B**	7.2	7.11	7.43	7.94	7.42	7.53
Temperature, Field	deg C	n/v	≤15^B	9.5	5.03	9	8.0	4.35	8.5	3.96	6.2	12.2	4.07	7.5	6.55	7.4	6.4	6.32	8.2	6.5
Calculated Parameters																				
Anion Sum	meq/L	n/v	n/v	61	-	64	41	-	36	-	35	81	-	59	-	26	12	-	12	13
Cation Sum	meq/L	n/v	n/v	62	-	63	42	-	38	-	34	80	-	66	-	27	13	-	13	13
Hardness (as CaCO3)	mg/L	n/v	n/v	2,300	2,510	2,500	1,400	1,240	1,200	155	110	2,700	1,520	1,400	826	850	490	265	260	200
Ion Balance	%	n/v	n/v	0.93	113	0.85	0.17	108	1.8	110	0.63	0.41	109	5.6	108	0.36	2.0	109	3.3	0.068
Nitrate	mg/L	13$_f^A$	45^C	<0.22	<0.5	<0.22	<0.22	<0.5	<0.044	0.7	<0.044	<0.22	<0.5	<0.22	<0.5	<0.22	4.1	4.3	4.1	1.6
Nitrate + Nitrite (as N)	mg/L	100^A	n/v	<0.050 MI	<0.02	<0.050 AT	<0.050 MI	<0.02	<0.010	0.16	<0.010	<0.050 MI	<0.02	<0.050 AT	<0.02	<0.050 AT	0.93 MI	0.97	0.95	0.35
Nitrite	mg/L	0.197/1.97$_{n4\ e\ g}^A$	3^C	<0.033	<0.10	<0.033	<0.033	<0.05	<0.033	<0.10	<0.033	<0.033	<0.10	<0.033	<0.05	<0.033	<0.033	<0.05	0.040	<0.033
Total Dissolved Solids	mg/L	500^A	≤500^B	**3,900^{AB}**	**3,960^{AB}**	**4,000^{AB}**	**2,600^{AB}**	**2,390^{AB}**	**2,300^{AB}**	**2,470^{AB}**	**2,200^{AB}**	**5,100^{AB}**	**4,460^{AB}**	**3,900^{AB}**	**1,530^{AB}**	**1,600^{AB}**	**620^{AB}**	**665^{AB}**	**650^{AB}**	**740^{AB}**
BTEX and Petroleum Hydrocarbons																				
Benzene	mg/L	0.005^A	0.005^C	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.0005	0.00051	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040
Toluene	mg/L	0.024^A	0.024^B 0.06^C	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^A	0.0016^B 0.14^C	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^A	0.02^B 0.09^C	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^A	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^A	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10
Miscellaneous Inorganics																				
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	2.3	4.391	2.6	2.4	6	3.0	58.28	41	3.4	4	2.6	6	3.3	3.8	6	2.2 DSM	1.6
Electrical Conductivity, Lab	µS/cm	1,000^A	n/v	**4,300^A**	**4,390^A**	**4,300^A**	**3,100^A**	**3,000^A**	**2,900^A**	**3,650^A**	**3,100^A**	**5,500^A**	**5,510^A**	**5,200^A**	**2,080^A**	**2,100^A**	**1,100^A**	**1,130^A**	**1,100^A**	**1,200^A**
pH, lab	S.U.	6.5-8.5^A	7.0-10.5^B	7.52	7.87	7.29	7.69	8.07	7.86	8.33	8.02	7.48	8.14	7.89	8.02	7.80	7.93	8.25	7.95	7.96
Anions																				
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	480	472	490	410	400	370	450	640	720	683	640	453	450	450	408	380	420
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	580	575	600	500	497	450	540	780	870	833	780	566	550	550	511	470	510
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0
Sulfate	mg/L	429$_{n5,e}^A$	≤500$_i^B$	**2,500 CD^{AB}**	**2,450^{AB}**	**2,600^{AB}**	**1,600 CD^{AB}**	**1,380^{AB}**	**1,400^{AB}**	**1,130^{AB}**	**950^{AB}**	**3,200 CD^{AB}**	**2,560^{AB}**	**2,200^{AB}**	**744^{AB}**	**830^{AB}**	82	62.2	70	94
Chloride	mg/L	100^A	≤250^B	3.7	2.3	2.6	1.5	<1.0	<1.0	**156^A**	84	5.9	4.1	5.3	<1.0	<1.0	45	80.2	92	**110^A**
Nutrients																				
Ammonia (as N)	mg/L	0.737$_{n2}^A$	n/v	0.43	0.46	0.46	0.39	0.53	0.46	**1.77^A**	**1.5^A**	0.33	**1.91^A**	**1.7^A**	0.05	0.066	<0.015	0.05	0.017	0.034
Nitrite (as N)	mg/L	0.06/0.6$_{n4,e}^A$	1^C	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.01	<0.010	<0.010	<0.01	0.012	<0.010
Orthophosphate (as P)	mg/L	n/v	n/v	<0.0030	<0.15	<0.0030	<0.0030	<0.15	<0.0030	<0.15	0.0078	0.0037	<0.15	0.0037	<0.15	0.0043	0.0032	<0.15	0.0049	<0.0030
Nitrate (as N)	mg/L	3^A	10^C	<0.050	<0.02	<0.050	<0.050	<0.02	<0.010	0.16	<0.010	<0.050	<0.02	<0.050	<0.02	<0.050	0.93	0.97	0.93	0.35
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	0.017	-	0.021	<0.0030	-	<0.0030	-	0.0048	<0.0030	-	<0.0030	-	0.0034	0.0031	-	0.0069	<0.0030
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.88	11.1	1.5	1.67	39.8	4.0	17.0	3.2	1.25	19.06	4.8	4.5	<2.0	0.72	1.7	0.63	0.89
Nitrogen	mg/L	n/v	n/v	1.9 DB	-	1.5 DB	1.7 DB	-	4.0 DB	-	3.2 DB	1.2 DB	-	4.8 DB	-	<2.0 DB	1.7 DB	-	1.6 DB	1.2 DB
Microbiological Parameters																				
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^D	***<10 MI***	**6^D**	***<10 AT***	***<10 MI***	**11^D**	***<100 DVM***	**3^D**	***<10 AT***	***<10 SVH MI***	**1^D**	***<10***	**3^D**	***<10 AT***	***<10 MI***	***<1***	***<100***	***<10 MI***
Fecal Coliforms	mpn/100mL	n/v	0^D	***<10 MI***	**23^D**	***<50 AT***	***<10 MI***	**11^D**	***<100 DVM***	**5^D**	**10 AT^D**	***<10 SVH MI***	**2^D**	***<100***	**8^D**	**10 AT^D**	***<10 MI***	***<1***	***<100***	***<10 MI***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	5,400 MI	91,500	1,200 AT	370	5,800	1,900 AT	111,000	150,000 AT	350	18,300	740	95,000	900 AT	140	89,500	79,000	450
Total Coliforms	mpn/100mL	n/v	0^D	**310 MI^D**	**154^D**	***<10 AT***	***<10 MI***	**205^D**	***<100 DVM***	**178^D**	**85 AT^D**	***<10 SVH MI***	**550^D**	**210^D**	**1,990^D**	**160 AT^D**	***<10 MI***	**85^D**	***<100***	***<10 MI***

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				**MW16-10-15**			**MW16-11-15**			**RMW16-13-37**		**MW16-16-11**	**RMW16-16-17**		**RMW16-17-10**		**MW16-18-6**	**RMW16-18-5**		**MW16-18-10**
Completion Lithology				**Unconsolidated**			**Unconsolidated**			**Bedrock**		**Unconsolidated**	**Bedrock**		**Unconsolidated**		**Unconsolidated**	**Unconsolidated**		**Bedrock**
Sample Date				**13-May-21**	**24-Nov-21**	**9-May-22**	**13-May-21**	**22-Nov-21**	**6-May-22**	**24-Nov-21**	**9-May-22**	**13-May-21**	**2-Dec-21**	**5-May-22**	**22-Nov-21**	**10-May-22**	**13-May-21**	**22-Nov-21**	**5-May-22**	**13-May-21**
Monitoring Tier				**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**
	Units	**2019 AEP Tier 1**	**GCDWQ**																	
Metals - Dissolved																				
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	<0.0030	**0.069^{A}**	<0.0030	0.0057	<0.004	<0.0030	**0.279^{AB}**	0.013	0.0050	0.005	<0.0030	0.011	<0.0030	0.0053	0.017	0.015	0.0032
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.001	<0.00060	<0.00060	<0.001	<0.00060	<0.001	0.00075	<0.00060	0.002	0.00096	<0.001	0.0014	<0.00060	<0.001	<0.00060	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	0.00053	<0.001	0.00034	0.0011	0.002	0.00060	0.003	0.0049	0.00056	**0.014^{AC}**	**0.012^{AC}**	0.001	0.00042	0.00026	0.001	0.00029	<0.00020
Barium	mg/L	1^{A}	2.0^{C}	0.015	<0.05	0.012	0.012	<0.05	0.012	0.09	0.049	0.013	<0.05	0.012	<0.05	0.022	0.080	<0.05	0.065	0.028
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.22	0.21	0.21	0.12	0.09	0.12	0.16	0.18	0.29	0.23	0.22	0.12	0.13	0.092	0.11	0.11	0.16
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	<0.000020	0.000262	0.000067	0.000052	0.000288	0.000078	0.000098	<0.00002	0.000098	0.000064	0.000087	0.000086	<0.00002	<0.000020	0.000047	<0.00002	<0.000020
Calcium	mg/L	n/v	n/v	470	514	460	330	297	280	47.6	32	460	346	300	189	190	85	54.7	52	47
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	0.0008	<0.0010	<0.0010	<0.0005	<0.0010	0.0006	<0.0010	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	0.0041	0.0050	0.0044	0.0014	0.0018	0.0013	<0.0009	0.00031	0.0036	0.0096	0.0054	0.0022	0.0014	<0.00030	<0.0009	0.00031	<0.00030
Copper	mg/L	0.007^{A}	$\leq 1.0^{B}$ 2^{C}	<0.00020	**0.0127^{A}**	<0.0010	0.00072	<0.0008	<0.0010	**0.0233^{A}**	<0.0010	0.00022	<0.0008	<0.0010	<0.0008	<0.0010	0.00080	0.0011	<0.0010	0.00041
Iron	mg/L	0.3^{A}	$\leq 0.3^{B}$	**0.35^{AB}**	<0.1	<0.060	**0.52^{AB}**	<0.1	<0.060	0.1	0.22	**0.51^{AB}**	<0.1	<0.060	<0.1	<0.060	<0.060	<0.1	<0.060	<0.060
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	<0.00020	0.0005	<0.00020	<0.00020	<0.0002	<0.00020	0.0006	<0.00020	<0.00020	<0.0002	<0.00020	<0.0002	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.050	-	0.025	0.055	-	0.044	-	0.085	0.15	-	0.24	-	0.022	0.027	-	<0.020	0.039
Magnesium	mg/L	n/v	n/v	280	299	310	140	122	120	8.8	6.7	370	159	150	86.0	92	67	31.1	32	21
Manganese	mg/L	0.05^{A}	$\leq 0.02^{B}$ 0.12^{C}	**3.0^{ABC}**	**2.80^{ABC}**	**2.8^{ABC}**	**1.2^{ABC}**	**0.721^{ABC}**	**0.84^{ABC}**	**0.187^{ABC}**	**0.16^{ABC}**	**3.4^{ABC}**	**0.902^{ABC}**	**0.69^{ABC}**	**0.648^{ABC}**	**0.72^{ABC}**	0.0047	**0.099^{AB}**	**0.099^{AB}**	**0.21^{ABC}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000019	<0.0000025	<0.0000019	<0.0000019	<0.0000025	<0.0000019	<0.0000025	<0.0000019	<0.0000019	-	<0.0000019	**0.0000052^{A}**	<0.0000019	<0.0000019	0.0000039	<0.0000019	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.00047	<0.001	0.00066	0.00057	0.001	0.0011	0.046	0.064	0.00041	0.025	0.0085	0.001	0.0010	0.0015	0.004	0.0032	0.0018
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	0.007	0.013	0.008	0.0025	<0.003	0.0022	0.003	0.0022	0.007	0.06	0.029	0.006	0.0018	0.0006	<0.003	0.0013	0.0025
Phosphorus	mg/L	n/v	n/v	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	0.08	<0.10	<0.10	<0.08	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	<0.10
Potassium	mg/L	n/v	n/v	10	11.2	10	5.9	6.9	6.3	5.6	5.1	13	14.0	12	5.4	5.6	2.2	2.6	2.2	1.3
Selenium	mg/L	0.002^{A}	0.05^{C}	0.00052	<0.0005	<0.00020	<0.00020	0.0010	0.0010	**0.0042^{A}**	0.00096	0.00030	<0.0005	0.0011	<0.0005	<0.00020	**0.0023^{A}**	<0.0005	0.00060	0.0013
Silicon	mg/L	n/v	n/v	6.0	-	5.4	5.3	-	4.2	-	5.0	7.1	-	5.0	-	4.5	4.3	-	3.8	4.0
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010
Sodium	mg/L	200^{A}	$\leq 200^{B}$	**350^{AB}**	**401^{AB}**	**320^{AB}**	**320^{AB}**	**343^{AB}**	**320^{AB}**	**860^{AB}**	**740^{AB}**	**590 CD^{AB}**	**972^{AB}**	**880^{AB}**	**232^{AB}**	**220^{AB}**	62	179	170	**210^{AB}**
Strontium	mg/L	n/v	7.0^{C}	6.6 CD	-	**7.1^{C}**	3.0	-	2.9	-	0.59	6.0 CD	-	7.0	-	2.7	0.80	-	0.41	0.36
Sulfur	mg/L	n/v	n/v	920 CD	-	890	590 CD	-	470	-	320	1,200 CD	-	830	-	250	31	-	22	36
Thallium	mg/L	n/v	n/v	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.0001	<0.00020	<0.00020	0.0001	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	-	0.0011	<0.0010	-	<0.0010	-	<0.0010	<0.0010	-	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	0.003	<0.0010	<0.0010	0.003	<0.0010	0.007	0.0019	<0.0010	0.002	<0.0010	0.002	<0.0010	<0.0010	0.001	<0.0010	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.0080	**0.011^{A}**	0.010	0.0054	0.006	0.0061	**0.029^{AC}**	**0.030^{AC}**	**0.019^{A}**	0.005	0.0014	0.007	0.0067	0.0076	0.008	0.0080	0.0049
Vanadium	mg/L	n/v	n/v	<0.0010	-	<0.0010	<0.0010	-	<0.0010	-	0.0011	<0.0010	-	0.0010	-	<0.0010	<0.0010	-	0.0016	<0.0010
Zinc	mg/L	0.03^{A}	$\leq 5.0^{B}$	<0.0030	**0.035^{A}**	<0.0030	<0.0030	<0.005	<0.0030	0.018	<0.0030	<0.0030	<0.005	<0.0030	<0.005	<0.0030	<0.0030	<0.005	<0.0030	<0.0030
Metals - Total																				
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.000195 DB^{A}**	**0.000092^{A}**	**0.000169^{A}**	**0.000215 DB^{A}**	**0.000052^{A}**	**0.0009^{A}**	***<0.0000125***	**0.000522^{A}**	**0.0000788^{A}**	**0.000035^{A}**	**0.000491^{A}**	***<0.0000125***	**0.000239^{A}**	**0.0000383^{A}**	**0.000069^{A}**	**0.000225^{A}**	***<0.00019 DB***

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				RMW16-18-13		RMW16-19-10		RMW16-19-19		MW16-22-26			RMW16-23-7	MW16-23-14		RMW16-23-13	MW16-23-36		RMW16-23-32	MW21-3-15
Completion Lithology				Bedrock		Unconsolidated		Bedrock		Unconsolidated			Unconsolidated	Unconsolidated		Unconsolidated	Bedrock		Bedrock	Bedrock
Sample Date				22-Nov-21	5-May-22	1-Dec-21	6-May-22	1-Dec-21	6-May-22	14-May-21	23-Nov-21	10-May-22	13-May-22	14-May-21	23-Nov-21	13-May-22	14-May-21	23-Nov-21	13-May-22	4-May-22
Monitoring Tier	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2
Field Parameters																				
Dissolved oxygen, Field	mg/L	n/v	n/v	3.19	2.56	5.19	5.09	2.75	2.04	4.71	4.89	5.34	5.87	9.22	4.31	4.73	13.11	2.8	3.6	4.76
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**1,011^{A}**	**1,098^{A}**	**3,024^{A}**	**3,057^{A}**	**2,642^{A}**	**2,642^{A}**	**1,897^{A}**	**1,922^{A}**	**2,120^{A}**	947	993	**1,016^{A}**	**1,257^{A}**	**1,298^{A}**	**1,281^{A}**	**1,169^{A}**	**1,145^{A}**
Oxidation Reduction Potential, field	mV	n/v	n/v	52.3	66.9	123.8	52.2	-4.7	-103	65.8	89.4	130.3	-6.5	0.1	31.9	81.2	-72.6	-38.1	27.1	88.2
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.64	7.45	7.07	7.09	7.23	7.05	7.37	7.68	7.25	7.46	**6.96^{B}**	**6.92^{B}**	7.49	7.64	7.71	7.71	7.56
Temperature, Field	deg C	n/v	≤15^{B}	5.04	7.5	4.28	10.6	3.89	6.8	14.0	3.56	4.8	6.4	10.4	2.17	6.9	7.8	3.88	5.5	8.4
Calculated Parameters																				
Anion Sum	meq/L	n/v	n/v	-	12	-	38	-	32	24	-	24	10	13	-	13	15	-	12	21
Cation Sum	meq/L	n/v	n/v	-	13	-	42	-	33	24	-	23	9.7	12	-	13	14	-	12	13
Hardness (as CaCO3)	mg/L	n/v	n/v	132	180	1,180	1,200	485	480	680	704	680	390	510	565	340	190	198	63	22
Ion Balance	%	n/v	n/v	103	5.3	117	4.4	108	1.3	0.53	116	4.1	2.0	1.7	111	1.1	1.8	112	1.3	22
Nitrate	mg/L	13$_{f}^{A}$	45^{C}	1.5	2.8	<0.5	<0.22	<0.5	<0.044	3.3	1.5	<0.044	0.37	<0.044	<0.5	0.24	<0.044	<0.5	0.051	0.062
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	0.34	0.63	<0.02	<0.050 AT	<0.02	<0.010	0.73	0.34	0.022	0.098 AT	<0.010	<0.02	0.054 AT	<0.010	<0.02	0.012	0.014
Nitrite	mg/L	0.197/1.97$_{n4,e,g}^{A}$	3^{C}	<0.05	<0.033	<0.10	<0.033	<0.05	<0.033	<0.033	<0.05	0.069	0.046	<0.033	<0.05	<0.033	<0.033	<0.05	<0.033	<0.033
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**640^{AB}**	**660^{AB}**	**2,330^{AB}**	**2,500^{AB}**	**1,850^{AB}**	**2,000^{AB}**	**1,600^{AB}**	**1,480^{AB}**	**1,500^{AB}**	**560^{AB}**	**620^{AB}**	**639^{AB}**	**750^{AB}**	**900^{AB}**	**858^{AB}**	**660^{AB}**	**990^{AB}**
BTEX and Petroleum Hydrocarbons																				
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.0003	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.0005	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10
Miscellaneous Inorganics																				
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	4	1.8	6	5.7	4	3.6	2.4	3	1.5	2.8	2.1	6	2.5	2.3	4	1.7	5.6
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**1,080^{A}**	**1,100^{A}**	**3,110^{A}**	**3,100^{A}**	**2,760^{A}**	**2,600^{A}**	**2,000^{A}**	**2,000^{A}**	**2,000^{A}**	900	**1,100^{A}**	**1,040^{A}**	**1,200^{A}**	**1,400^{A}**	**1,380^{A}**	**1,200^{A}**	**1,100^{A}**
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	8.40	8.20	8.12	7.57	8.24	8.01	7.80	8.13	7.94	7.98	7.52	7.90	7.97	8.16	8.33	8.37	**8.59^{A}**
Anions																				
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	6	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<1.0	<5	<1.0	<1.0	<5	4.5	13
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	386	390	402	480	519	620	180	184	180	250	580	561	390	300	314	480	910
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	468	470	490	590	634	750	220	232	220	300	710	702	480	370	386	570	1,100
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	7	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<1.0	<5	<1.0	<1.0	<5	5.4	16
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<5	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0
Sulfate	mg/L	429$_{n5,e}^{A}$	≤500$_{i}^{B}$	82.4	80	**1,280^{AB}**	**1,400^{AB}**	**883^{AB}**	**940^{AB}**	**970 CD^{AB}**	**845^{AB}**	**1,000^{AB}**	170	45	35.7	240	410 CD	339	110	130
Chloride	mg/L	100^{A}	≤250^{B}	64.3	76	2.5	2.1	<1.0	1.2	3.5	12.8	3.1	54	<1.0	5.5	16	2.2	3.1	<1.0	3.7
Nutrients																				
Ammonia (as N)	mg/L	0.737$_{n2}^{A}$	n/v	0.04	<0.015	0.08	0.043	**1.14^{A}**	**1.0^{A}**	0.021	0.14	0.39	0.13	0.089	0.1	0.24	**1.1^{A}**	**1.11^{A}**	**0.80^{A}**	**0.90^{A}**
Nitrite (as N)	mg/L	0.06/0.6$_{n4,e}^{A}$	1^{C}	<0.01	<0.010	<0.01	<0.010	<0.01	<0.010	<0.010	<0.01	0.021	0.014	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010
Orthophosphate (as P)	mg/L	n/v	n/v	<0.15	<0.0030	<0.15	0.0035	<0.15	<0.0030	0.0068	<0.15	0.0092 DXE	<0.0030	0.0033	0.17	<0.0030	0.0043	<0.15	0.0076	0.12
Nitrate (as N)	mg/L	3^{A}	10^{C}	0.34	0.63	<0.02	<0.050	<0.02	<0.010	0.73	0.34	<0.010	0.084	<0.010	<0.02	0.054	<0.010	<0.02	0.012	0.014
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	-	<0.0030	-	<0.0030	-	<0.0030	0.0081	-	<0.0030	0.0066	0.0045	-	<0.0030	0.016	-	0.0078	0.13
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.1	0.30	10.58	1.45	5.66	1.27	<0.020	0.3	0.788	1.52	0.149	1.0	0.37	1.86	4.3	0.989	14.4
Nitrogen	mg/L	n/v	n/v	-	0.93 DB	-	1.5 DB	-	1.3	0.62	-	0.81	1.6 DB	0.15	-	0.42 DB	1.9 DB	-	1.0	14 DB
Microbiological Parameters																				
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	**1^{D}**	***<1.0***	**13^{D}**	***<100 DVM***	**1^{D}**	***<1.0***	***<1.0***	***<1***	***<1.0***	***<1.0***	***<10 MI***	**1^{D}**	***<1.0***	***<20 MI***	***<1***	***<1.0***	***<100 AT***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	**1^{D}**	***<10***	**26^{D}**	***<100 DVM***	**2^{D}**	***<1.0***	***<1.0***	**1^{D}**	**3.1^{D}**	***<1.0***	***<10 MI***	**1^{D}**	***<1.0***	***<20 MI***	***<1***	***<1.0***	***<100 AT***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	6,200	2,500	8,900	1,100 AT	1,350	140	510	3,800	1,200	2,000	6,100 MI	2,660	35	1,100 MI	2,450	110	100,000 DVM
Total Coliforms	mpn/100mL	n/v	0^{D}	**770^{D}**	**12^{D}**	**194^{D}**	**410 DVM^{D}**	**86^{D}**	**5.2^{D}**	**1,200^{D}**	**488^{D}**	**460^{D}**	**3.1^{D}**	***<10 MI***	**17^{D}**	**8.6^{D}**	***<20 MI***	**81^{D}**	**20^{D}**	***<100 AT***

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				**RMW16-18-13**		**RMW16-19-10**		**RMW16-19-19**		**MW16-22-26**			**RMW16-23-7**	**MW16-23-14**		**RMW16-23-13**	**MW16-23-36**		**RMW16-23-32**	**MW21-3-15**
Completion Lithology				**Bedrock**		**Unconsolidated**		**Bedrock**		**Unconsolidated**			**Unconsolidated**	**Unconsolidated**		**Unconsolidated**	**Bedrock**		**Bedrock**	**Bedrock**
Sample Date				**22-Nov-21**	**5-May-22**	**1-Dec-21**	**6-May-22**	**1-Dec-21**	**6-May-22**	**14-May-21**	**23-Nov-21**	**10-May-22**	**13-May-22**	**14-May-21**	**23-Nov-21**	**13-May-22**	**14-May-21**	**23-Nov-21**	**13-May-22**	**4-May-22**
Monitoring Tier	**Units**	**2019 AEP Tier 1**	**GCDWQ**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**
Metals - Dissolved																				
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	0.017	<0.0030	**0.072**^{A}	<0.0030	**0.102**^{AB}	<0.0030	0.0057	0.015	<0.0030	0.0060	<0.0030	<0.004	<0.0030	<0.0030	0.004	0.0033	**3.9**^{ABC}
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.001	<0.00060	<0.001	<0.00060	<0.001	<0.00060	<0.00060	<0.001	0.0020	0.0028	<0.00060	<0.001	0.00061	<0.00060	<0.001	<0.00060	0.0016
Arsenic	mg/L	0.005^{A}	0.010^{C}	<0.001	0.00035	0.002	0.00035	<0.001	<0.00020	<0.00020	0.002	0.00048	0.00039	0.0013	0.002	0.00021	0.00029	0.002	0.00056	**0.0065**^{A}
Barium	mg/L	1^{A}	2.0^{C}	<0.05	0.041	<0.05	0.015	<0.05	<0.010	0.020	<0.05	0.016	0.11	0.090	<0.05	0.030	0.053	<0.05	0.019	0.041
Beryllium	mg/L	n/v	n/v	<0.0005	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.13	0.14	0.12	0.13	0.15	0.15	0.14	0.14	0.12	0.027	0.13	0.12	0.070	0.095	0.09	0.087	0.19
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	0.000082	<0.00002	0.000096	0.000051	0.000035	<0.00002	0.000042	0.000052	<0.00002	<0.00002	<0.000020	0.000029	0.000030	<0.000020	0.000017	<0.00002	0.000029
Calcium	mg/L	n/v	n/v	29.5	38	309	290	119	110	170	184	160	99	130	146	79	51	54.4	17	6.6
Chromium	mg/L	0.05^{A}	0.05^{C}	0.0005	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	0.0036
Cobalt	mg/L	n/v	n/v	<0.0009	<0.00030	0.0012	0.00068	<0.0009	<0.00030	<0.00030	<0.0009	0.00050	0.00036	0.00079	<0.0009	0.00047	<0.00030	<0.0009	<0.00030	0.0010
Copper	mg/L	0.007^{A}	≤1.0^{B} 2^{C}	0.0016	<0.0010	0.0011	<0.0010	<0.0008	<0.0010	0.00026	<0.0008	<0.0010	<0.0010	0.0056	<0.0008	<0.0010	0.00025	<0.0008	<0.0010	**0.0080**^{A}
Iron	mg/L	0.3^{A}	≤0.3^{B}	<0.1	<0.060	<0.1	<0.060	<0.1	<0.060	<0.060	<0.1	<0.060	<0.060	**0.91**^{AB}	<0.1	<0.060	**0.77**^{AB}	<0.1	<0.060	**0.95**^{AB}
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	0.0002	<0.00020	0.0006	<0.00020	0.0002	<0.00020	<0.00020	0.0003	<0.00020	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	<0.0002	<0.00020	0.0016
Lithium	mg/L	n/v	n/v	-	<0.020	-	0.024	-	0.053	0.064	-	0.032	<0.020	0.033	-	0.030	0.075	-	0.037	<0.020
Magnesium	mg/L	n/v	n/v	14.1	21	100	110	45.6	49	58	59.3	66	34	45	48.6	35	15	15.2	5.1	1.4
Manganese	mg/L	0.05^{A}	≤0.02^{B} 0.12^{C}	**0.078**^{AB}	**0.12**^{AB}	**0.537**^{ABC}	**0.61**^{ABC}	**0.248**^{ABC}	**0.28**^{ABC}	**0.27**^{ABC}	**0.400**^{ABC}	**0.46**^{ABC}	**0.074**^{AB}	**0.37**^{ABC}	**0.368**^{ABC}	**0.42**^{ABC}	**0.10**^{AB}	**0.073**^{AB}	**0.027**^{B}	**0.034**^{B}
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000025	<0.0000019	-	<0.0000019	-	<0.0000019	<0.0000019	**0.0000056**^{A}	<0.0000019	<0.0000019	<0.0000019	**0.0000081**^{A}	<0.0000019	<0.0000019	<0.0000025	<0.0000019	0.000002
Molybdenum	mg/L	n/v	n/v	0.005	0.0036	<0.001	0.00081	0.002	0.0015	0.0032	0.003	0.0028	0.0076	0.00052	<0.001	0.0066	0.0023	0.005	0.0022	0.023
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	<0.003	<0.00050	0.004	0.0026	<0.003	<0.00050	0.0014	<0.003	0.0008	0.0016	0.00088	<0.003	0.00085	<0.00050	<0.003	<0.00050	0.0067
Phosphorus	mg/L	n/v	n/v	<0.08	<0.10	<0.08	<0.10	<0.08	<0.10	<0.10	0.10	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	0.11
Potassium	mg/L	n/v	n/v	1.3	1.4	6.5	6.8	5.3	5.7	6.7	6.8	6.6	7.6	4.5	5.0	4.9	4.0	4.3	2.5	1.2
Selenium	mg/L	0.002^{A}	0.05^{C}	<0.0005	0.00053	<0.0005	**0.0030**^{A}	<0.0005	<0.00020	0.00048	0.0010	<0.00020	**0.0023**^{A}	<0.00020	0.0011	0.00039	<0.00020	0.0020	0.00029	**0.0022**^{A}
Silicon	mg/L	n/v	n/v	-	3.0	-	3.9	-	3.6	4.4	-	4.0	3.4	5.9	-	4.2	3.8	-	3.5	4.5
Silver	mg/L	0.0001^{A}	n/v	<0.00005	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010
Sodium	mg/L	200^{A}	≤200^{B}	**210**^{AB}	**210**^{AB}	**388**^{AB}	**410**^{AB}	**486**^{AB}	**530**^{AB}	**230**^{AB}	**252**^{AB}	**200**^{B}	40	40	53.2	140	**230**^{AB}	**252**^{AB}	**240**^{AB}	**300**^{AB}
Strontium	mg/L	n/v	7.0^{C}	-	0.28	-	1.9	-	1.8	3.1	-	2.9	0.44	1.3	-	0.55	0.83	-	0.29	0.053
Sulfur	mg/L	n/v	n/v	-	24	-	450	-	320	330	-	340	48	15	-	79	140	-	38	46
Thallium	mg/L	n/v	n/v	<0.0001	<0.00020	<0.0001	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	-	<0.0010	-	<0.0010	-	<0.0010	<0.0010	-	0.011	0.0014	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.001	<0.0010	0.002	<0.0010	0.002	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	0.002	<0.0010	<0.0010	0.001	<0.0010	0.15
Uranium	mg/L	0.01^{A}	0.02^{C}	0.005	0.0056	**0.013**^{A}	**0.012**^{A}	0.002	0.00088	0.0026	0.003	0.0022	**0.011**^{A}	0.0026	0.003	0.0023	<0.00010	<0.001	0.00024	0.0072
Vanadium	mg/L	n/v	n/v	-	0.0018	-	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	0.011
Zinc	mg/L	0.03^{A}	≤5.0^{B}	<0.005	<0.0030	<0.005	<0.0030	<0.005	<0.0030	0.016	<0.005	0.015	<0.0030	<0.0030	<0.005	<0.0030	<0.0030	<0.005	<0.0030	0.0065
Metals - Total																				
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.000049**^{A}	**0.0000083**^{A}	**0.000081**^{A}	**0.00072**^{A}	**0.000041**^{A}	**0.0000099**^{A}	<0.0000019	**0.0000056**^{A}	<0.0000019	**0.000377**^{A}	**0.0000234**^{A}	**0.000013**^{A}	**0.0000211**^{A}	**0.0000699**^{A}	**0.000025**^{A}	0.0000024	**0.00446**^{AC}

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW21-6-7		MW21-6-12		MW16-3-7			MW16-4-22			MW16-6-11			MW16-6-20		
Completion Lithology				Unconsolidated		Bedrock		Unconsolidated			Bedrock			Unconsolidated			Bedrock		
Sample Date				22-Nov-21	5-May-22	22-Nov-21	5-May-22	12-May-21	24-Nov-21	4-May-22	12-May-21	24-Nov-21	4-May-22	12-May-21	1-Dec-21	5-May-22	12-May-21	1-Dec-21	5-May-22
Monitoring Tier	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well
Field Parameters																			
Dissolved oxygen, Field	mg/L	n/v	n/v	17.92	3.55	7.91	2.24	8.41	6.99	4.05	6.51	3.59	2.73	3.72	14.78	2.59	3.26	10.78	5.24
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**1,306**^{A}	**1,427**^{A}	**1,425**^{A}	**1,592**^{A}	**1,307**^{A}	**1,845**^{A}	**2,566**^{A}	**2,857**^{A}	**4,143**^{A}	**4,362**^{A}	**3,269**^{A}	**3,104**^{A}	**3,157**^{A}	**2,104**^{A}	**2,079**^{A}	**2,255**^{A}
Oxidation Reduction Potential, field	mV	n/v	n/v	41.5	7.8	69	-53.6	51.9	104.4	85.6	11.9	37.2	-28.7	53.9	87.5	14.2	-52.6	48.8	12.1
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.4	7	7.83	7.01	7.30	7.1	**6.64**^{B}	**6.75**^{B}	**6.88**^{B}	**6.33**^{AB}	**6.95**^{B}	7.13	**6.97**^{B}	7.75	8.01	7.67
Temperature, Field	deg C	n/v	≤15^{B}	7.36	9	5.99	12.1	8.4	7.46	10.4	8.5	5.38	14.7	13.4	5.78	8	7.3	4.23	8.1
Calculated Parameters																			
Anion Sum	meq/L	n/v	n/v	-	15	-	16	29	-	33	61	-	60	46	-	43	28	-	49
Cation Sum	meq/L	n/v	n/v	-	19	-	20	28	-	35	57	-	59	43	-	45	22	-	26
Hardness (as CaCO3)	mg/L	n/v	n/v	351	390	336	380	770	823	1,000	1,900	1,660	2,000	1,400	1,530	1,400	250	234	210
Ion Balance	%	n/v	n/v	110	12	106	10	2.6	120	2.4	3.4	94	1.1	3.9	119	2.4	12	112	32
Nitrate	mg/L	13$_{f}^{A}$	45^{C}	<0.5	<0.044	<1.0	<0.044	1.1	0.8	<0.22	<0.22	<0.5	<0.22	<0.22	<0.5	<0.22	<0.044	<0.5	<0.044
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	<0.02	<0.010	<0.02	<0.010	0.26	0.18	<0.050 DB	<0.050 MI	<0.02	<0.050 DB	<0.050 MI	<0.02	<0.050 MSE AT	<0.010	<0.02	<0.010
Nitrite	mg/L	0.197/1.97$_{n4,e,g}^{A}$	3^{C}	<0.05	<0.033	<0.05	<0.033	<0.033	<0.05	<0.033	<0.033	<0.10	<0.033	<0.033	<0.10	<0.033	<0.033	<0.05	<0.033
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**957**^{AB}	**950**^{AB}	**968**^{AB}	**980**^{AB}	**1,800**^{AB}	**1,550**^{AB}	**2,000**^{AB}	**3,800**^{AB}	**3,600**^{AB}	**3,800**^{AB}	**2,900**^{AB}	**2,730**^{AB}	**2,800**^{AB}	**1,700**^{AB}	**1,500**^{AB}	**2,400**^{AB}
BTEX and Petroleum Hydrocarbons																			
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.0003	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.0005	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10
Miscellaneous Inorganics																			
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	14	3.5	8	2.5	5.1	6.396	3.7	6.5	5.386	5.6	3.3	3	2.8	3.0	4	3.0
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**1,480**^{A}	**1,400**^{A}	**1,510**^{A}	**1,500**^{A}	**2,400**^{A}	**2,140**^{A}	**2,500**^{A}	**4,200**^{A}	**4,310**^{A}	**4,300**^{A}	**3,400**^{A}	**3,320**^{A}	**3,200**^{A}	**2,300**^{A}	**2,290**^{A}	**2,200**^{A}
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	8.13	7.83	8.07	7.91	7.48	8.07	7.81	7.37	7.79	7.64	7.46	8.07	7.71	8.10	8.49	8.18
Anions																			
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	6	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	549	500	537	480	420	387	470	470	448	490	370	276	400	460	243	1,500
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	684	610	669	590	510	472	570	580	547	590	460	336	480	560	281	1,900
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	7	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0
Sulfate	mg/L	429$_{n5,e}^{A}$	≤500$_{i}^{B}$	223	230	221	240	**910 CD**^{AB}	**710**^{AB}	**1,100**^{AB}	**2,500 CD**^{AB}	**2,320**^{AB}	**2,400**^{AB}	**1,900 CD**^{AB}	**1,660**^{AB}	**1,700**^{AB}	**920 CD**^{AB}	**814**^{AB}	**890**^{AB}
Chloride	mg/L	100^{A}	≤250^{B}	19.0	18	44.7	48	62	63.7	41	2.1	<1.0	1.1	2.1	1.0	1.6	3.2	1.0	1.7
Nutrients																			
Ammonia (as N)	mg/L	0.737$_{n2}^{A}$	n/v	0.12	0.036	0.23	0.19	0.073	0.05	0.051	**0.97**^{A}	**0.93**^{A}	**1.0**^{A}	0.32	0.38	0.39	**1.1**^{A}	**2.04**^{A}	**1.3**^{A}
Nitrite (as N)	mg/L	0.06/0.6$_{n4,e}^{A}$	1^{C}	<0.01	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010
Orthophosphate (as P)	mg/L	n/v	n/v	<0.15	<0.0030	<0.15	<0.0030	0.013	<0.15	0.0046	<0.0030	<0.15	<0.0030	0.0040	<0.15	0.0034	0.0031	<0.15	<0.0030
Nitrate (as N)	mg/L	3^{A}	10^{C}	<0.02	<0.010	<0.02	<0.010	0.26	0.18	<0.050	<0.050	<0.02	<0.050	<0.050	<0.02	<0.050	<0.010	<0.02	<0.010
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	-	0.010	-	<0.0030	0.021	-	0.0089	0.017	-	0.0041	0.0032	-	0.0052	0.0087	-	0.019
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	166	4.7	1.4	0.47	1.11	2.0	0.72	1.46	2.8	1.57	0.92	17.92	12.5	1.25	16.64	4.3
Nitrogen	mg/L	n/v	n/v	-	4.7 DB	-	0.47 DB	1.4 DB	-	0.72 DB	1.5 DB	-	1.6 DB	0.92 DB	-	12 DB	1.2	-	4.3 DB
Microbiological Parameters																			
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	**4**^{D}	***<10***	***<1***	**10**^{D}	***<100 MI***	**24**^{D}	***<2.0 AT***	***<100 MI***	***<1***	***<2.0 AT***	***<100 MI***	**1**^{D}	***<100***	***<1.0***	**2**^{D}	***<100***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	**9**^{D}	***<100***	***<1***	***<10***	***<100 MI***	**40**^{D}	***<10 AT***	***<100 MI***	**3**^{D}	***<10 AT***	***<100 MI***	**9**^{D}	***<100***	***<100 MI***	**5**^{D}	***<100***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	73,000	1,200	5,650	210	5,700 MI	10,900	2,600	4,100 MI	500	3,300	7,100 MI	12,100	22,000	4,000	13,800	26,000
Total Coliforms	mpn/100mL	n/v	0^{D}	**830**^{D}	**30**^{D}	**548**^{D}	**10**^{D}	***<100 MI***	**238**^{D}	***<2.0 AT***	***<100 MI***	**7**^{D}	***<2.0 AT***	***<100 MI***	**113**^{D}	***<100***	**4.1**^{D}	**204**^{D}	***<100***

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW21-6-7		MW21-6-12		MW16-3-7			MW16-4-22			MW16-6-11			MW16-6-20		
Completion Lithology				Unconsolidated		Bedrock		Unconsolidated			Bedrock			Unconsolidated			Bedrock		
Sample Date				22-Nov-21	5-May-22	22-Nov-21	5-May-22	12-May-21	24-Nov-21	4-May-22	12-May-21	24-Nov-21	4-May-22	12-May-21	1-Dec-21	5-May-22	12-May-21	1-Dec-21	5-May-22
Monitoring Tier	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well
Metals - Dissolved																			
Aluminum	mg/L	0.05$_{n1,e}^{A}$	0.1$_{a}^{B}$ 2.9^{C}	0.009	<0.0030	0.005	<0.0030	<0.0030	0.045	0.0089	**0.14^{AB}**	0.005	<0.0030	<0.0030	**0.117^{AB}**	<0.0030	<0.0030	**0.397^{AB}**	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.001	<0.00060	<0.001	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.001	0.00065
Arsenic	mg/L	0.005^{A}	0.010^{C}	0.001	0.00023	0.001	0.00072	<0.00020	<0.001	0.00045	0.0020	0.001	0.00075	0.00039	0.002	0.00054	0.00041	<0.001	0.00081
Barium	mg/L	1^{A}	2.0^{C}	<0.05	0.025	<0.05	0.015	0.025	<0.05	0.025	<0.010	<0.05	<0.010	0.011	<0.05	0.017	0.014	<0.05	0.023
Beryllium	mg/L	n/v	n/v	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.19	0.20	0.21	0.23	0.088	0.08	0.10	0.12	0.12	0.13	0.13	0.13	0.14	0.11	0.11	0.12
Cadmium	mg/L	0.00037$_{n3,e}^{A}$	0.007^{C}	0.000037	0.000023	0.000077	<0.00002	0.000020	0.000058	0.000054	<0.000020	<0.000016	0.000026	0.000030	0.000096	0.000037	<0.000020	<0.000016	0.000069
Calcium	mg/L	n/v	n/v	91.2	100	88.7	98	140	130	160	440	340	450	320	361	320	63	63.2	55
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	0.0018	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	0.0008	<0.0010
Cobalt	mg/L	n/v	n/v	<0.0009	0.00037	<0.0009	0.00058	0.00087	<0.0009	0.00063	0.00055	0.0013	0.00033	0.0023	0.0018	0.0013	0.00049	<0.0009	0.00069
Copper	mg/L	0.007^{A}	≤1.0^{B} 2^{C}	<0.0008	<0.0010	0.0012	<0.0010	0.00029	0.0042	<0.0010	0.00026	<0.0008	<0.0010	0.00038	0.0009	<0.0010	**0.013^{A}**	0.0011	<0.0010
Iron	mg/L	0.3^{A}	≤0.3^{B}	<0.1	<0.060	<0.1	<0.060	<0.060	<0.1	<0.060	**3.1^{AB}**	**1.7^{AB}**	<0.060	0.16	<0.1	<0.060	0.25	0.2	<0.060
Lead	mg/L	0.007$_{n3,e}^{A}$	0.005^{C}	<0.0002	<0.00020	<0.0002	<0.00020	<0.00020	0.0012	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	<0.0002	<0.00020	0.00045	0.0006	0.00027
Lithium	mg/L	n/v	n/v	-	0.032	-	0.045	0.041	-	0.055	0.082	-	0.078	0.044	-	0.047	0.048	-	0.070
Magnesium	mg/L	n/v	n/v	30.0	34	27.7	33	110	121	150	200	197	210	140	152	150	22	18.5	17
Manganese	mg/L	0.05^{A}	≤0.02^{B} 0.12^{C}	0.009	**0.17^{ABC}**	**0.149^{ABC}**	**0.18^{ABC}**	**0.26^{ABC}**	**0.201^{ABC}**	**0.23^{ABC}**	**0.90^{ABC}**	**0.803^{ABC}**	**0.78^{ABC}**	**1.2^{ABC}**	**1.10^{ABC}**	**0.68^{ABC}**	**0.22^{ABC}**	**0.119^{AB}**	**0.17^{ABC}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.0000054^{A}**	<0.0000019	***<0.0000125***	<0.0000019	<0.0000019	<0.0000025	<0.0000019	<0.0000019	<0.0000025	<0.0000019	<0.0000019	-	<0.0000019	<0.0000019	-	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.002	0.0016	0.002	0.0012	0.0011	0.002	0.0011	0.00090	0.004	0.00095	0.00065	0.001	0.0018	0.0026	0.004	0.0043
Nickel	mg/L	0.17$_{n3,e}^{A}$	n/v	<0.003	0.0019	0.005	0.0016	0.0028	0.005	0.003	0.0013	0.004	0.00083	0.0046	0.004	0.0032	0.0013	<0.003	0.0013
Phosphorus	mg/L	n/v	n/v	<0.14	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10
Potassium	mg/L	n/v	n/v	6.2	5.2	4.3	5.1	4.1	4.7	4.8	8.5	8.9	9.4	6.4	7.5	8.1	4.2	4.8	5.5
Selenium	mg/L	0.002^{A}	0.05^{C}	<0.0005	0.00023	<0.0005	<0.00020	<0.00020	<0.0005	<0.00020	<0.00020	0.0011	<0.00020	<0.00020	<0.0005	0.00069	<0.00020	<0.0005	0.00022
Silicon	mg/L	n/v	n/v	-	4.9	-	4.5	4.2	-	4.9	5.4	-	4.8	4.8	-	4.1	3.5	-	2.7
Silver	mg/L	0.0001^{A}	n/v	<0.00005	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010
Sodium	mg/L	200^{A}	≤200^{B}	**251^{AB}**	**260^{AB}**	**253^{AB}**	**270^{AB}**	**280^{AB}**	**289^{AB}**	**330^{AB}**	**400^{AB}**	**466^{AB}**	**430^{AB}**	**350^{AB}**	**388^{AB}**	**380^{AB}**	**390^{AB}**	**452^{AB}**	**490^{AB}**
Strontium	mg/L	n/v	7.0^{C}	-	1.0	-	1.8	1.5	-	1.7	6.1 CD	-	6.7	2.9	-	3.0	1.1	-	1.0
Sulfur	mg/L	n/v	n/v	-	72	-	73	300	-	380	690 CD	-	850	530 CD	-	570	300	-	280
Thallium	mg/L	n/v	n/v	<0.0001	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	0.00025
Tin	mg/L	n/v	n/v	-	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010
Titanium	mg/L	n/v	n/v	0.005	<0.0010	0.001	<0.0010	<0.0010	0.002	0.0027	0.0029	0.002	0.0011	<0.0010	0.002	<0.0010	<0.0010	0.003	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.008	0.0070	0.004	0.0043	**0.012^{A}**	**0.012^{A}**	**0.014^{A}**	0.0023	0.002	0.0022	0.0067	0.008	0.0067	0.00071	<0.001	0.00092
Vanadium	mg/L	n/v	n/v	-	0.0014	-	0.0014	<0.0010	-	0.0013	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	0.0024
Zinc	mg/L	0.03^{A}	≤5.0^{B}	<0.005	<0.0030	<0.005	<0.0030	<0.0030	0.007	<0.0030	<0.0030	<0.005	<0.0030	<0.0030	<0.005	<0.0030	0.0036	0.007	<0.0030
Metals - Total																			
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.000060^{A}**	**0.00169^{AC}**	**0.000010^{A}**	**0.0000122^{A}**	**0.00117 DB^{AC}**	**0.000016^{A}**	**0.000047^{A}**	**0.000114 DB^{A}**	<0.0000025	***<0.000019***	**0.000361 DB^{A}**	**0.000080^{A}**	**0.00376^{AC}**	**0.0000064^{A}**	**0.000022^{A}**	**0.000208^{A}**

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-24-30			MW16-25-9			MW16-26-18			MW16-27-9		
Completion Lithology				Bedrock			Unconsolidated			Bedrock			Unconsolidated		
Sample Date				14-May-21	23-Nov-21	10-May-22	14-May-21	23-Nov-21	10-May-22	12-May-21	24-Nov-21	4-May-22	12-May-21	24-Nov-21	4-May-22
Monitoring Tier	Units	2019 AEP Tier 1	GCDWQ	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well
Field Parameters															
Dissolved oxygen, Field	mg/L	n/v	n/v	11.89	3.65	3.46	11.01	4.01	2.93	7.76	3.68	3.08	1.77	38.5	5.31
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**1,107^{A}**	**1,074^{A}**	**1,178^{A}**	**1,647^{A}**	**1,279^{A}**	**1,293^{A}**	**3,581^{A}**	**1,238^{A}**	**1,372^{A}**	**1,826^{A}**	**1,479^{A}**	**1,580^{A}**
Oxidation Reduction Potential, field	mV	n/v	n/v	-10.9	25.8	36.5	62.3	36.6	98.7	-32.5	80.1	-3.8	83.7	86.9	11.6
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.83	7.47	7.46	7.11	7.17	7.11	7.70	7.23	7.29	7.03	**6.85^{B}**	**6.52^{B}**
Temperature, Field	deg C	n/v	≤15^{B}	7.0	3.4	6.5	8.0	3.32	8.2	5.6	6.78	10.1	6.8	2.65	9.3
Calculated Parameters															
Anion Sum	meq/L	n/v	n/v	13	-	13	21	-	16	16	-	14	29	-	18
Cation Sum	meq/L	n/v	n/v	12	-	13	21	-	16	16	-	16	24	-	21
Hardness (as CaCO3)	mg/L	n/v	n/v	160	170	170	810	745	650	170	71	150	800	739	760
Ion Balance	%	n/v	n/v	2.8	113	1.8	0.40	115	0.77	0.57	100	6.0	9.9	113	7.6
Nitrate	mg/L	13$_{f}^{A}$	45^{C}	<0.044	<0.5	<0.044	<0.044	<0.5	<0.044	<0.044	<0.5	<0.044	0.079	<0.5	<0.044
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	<0.010	<0.02	<0.010	<0.010	<0.02	<0.010	<0.010	<0.02	<0.010	0.018	<0.02	<0.010
Nitrite	mg/L	0.197/1.97$_{n4,e,g}^{A}$	3^{C}	<0.033	<0.05	<0.033	<0.033	<0.05	<0.033	<0.033	<0.05	<0.033	<0.033	<0.05	<0.033
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**690^{AB}**	**691^{AB}**	**720^{AB}**	**1,200^{AB}**	**903^{AB}**	**830^{AB}**	**990^{AB}**	**780^{AB}**	**910^{AB}**	**1,600^{AB}**	**1,100^{AB}**	**1,100^{AB}**
BTEX and Petroleum Hydrocarbons															
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10
Miscellaneous Inorganics															
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	2.8	4	1.1	4.8	7	4.1	2.3	3.274	1.8	4.0	3.069	2.1
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**1,100^{A}**	**1,150^{A}**	**1,100^{A}**	**1,700^{A}**	**1,350^{A}**	**1,200^{A}**	**1,500^{A}**	**1,310^{A}**	**1,300^{A}**	**2,600^{A}**	**1,600^{A}**	**1,500^{A}**
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	8.05	8.34	8.18	7.74	8.07	7.73	8.21	8.32	8.26	7.71	7.92	7.63
Anions															
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	470	456	480	530	532	560	280	265	290	420	482	510
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	570	567	590	650	660	690	340	319	350	510	588	620
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0	<1.0	<5	<1.0
Sulfate	mg/L	429$_{n5,e}^{A}$	≤500$_{i}^{B}$	150	120	150	**500 CD^{AB}**	253	210	380 CD	344	370	**490 CD^{A}**	420	380
Chloride	mg/L	100^{A}	≤250^{B}	2.5	2.0	1.0	3.8	1.6	<1.0	84	1.2	19	**370 CD^{AB}**	<1.0	<1.0
Nutrients															
Ammonia (as N)	mg/L	0.737$_{n2}^{A}$	n/v	**0.81^{A}**	**0.77^{A}**	**0.83^{A}**	0.029	<0.02	<0.015	**0.76^{A}**	0.62	**0.79^{A}**	0.35	0.35	0.33
Nitrite (as N)	mg/L	0.06/0.6$_{n4,e}^{A}$	1^{C}	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010
Orthophosphate (as P)	mg/L	n/v	n/v	0.0034	<0.15	<0.0030	0.0079	<0.15	0.012	0.0065	<0.15	<0.0030	0.034	<0.15	<0.0030
Nitrate (as N)	mg/L	3^{A}	10^{C}	<0.010	<0.02	<0.010	<0.010	<0.02	<0.010	<0.010	<0.02	<0.010	0.018	<0.02	<0.010
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	<0.0030	-	<0.0030	0.018	-	0.0064	0.013	-	0.0031	0.20	-	<0.0030
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.10	0.9	1.03	0.69	1.4	2.26	1.42	1.7	<2.0	2.29	4.6	<2.0
Nitrogen	mg/L	n/v	n/v	1.1	-	1.0	0.69 DB	-	2.3 DB	1.4 DB	-	<2.0 DB	2.3 DB	-	<2.0 DB
Microbiological Parameters															
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<1.0***	***<1***	***<1.0***	***<10 MI***	**9^{D}**	***<10 AT***	***<10 MI***	***<1***	***<5.0 AT***	***<100 MI***	**6^{D}**	***<2.0 AT***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<1.0***	***<1***	***<1.0***	***<10 MI***	**26^{D}**	***<10 AT***	***<10 MI***	***<1***	***<10 AT***	***<100 MI***	**27^{D}**	***<10 AT***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	750	925	100	5,300 MI	21,100	2,700 AT	4,500	850	510	1,300 MI	2,400	430
Total Coliforms	mpn/100mL	n/v	0^{D}	***<1.0***	**43^{D}**	**19^{D}**	***<10 MI***	**70^{D}**	**30 AT^{D}**	**640 MI^{D}**	**649^{D}**	**26 AT^{D}**	**410 MI^{D}**	**173^{D}**	**8.2 AT^{D}**

See notes on last page

Table 2
Groundwater Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-24-30			MW16-25-9			MW16-26-18			MW16-27-9		
Completion Lithology				Bedrock			Unconsolidated			Bedrock			Unconsolidated		
Sample Date				14-May-21	23-Nov-21	10-May-22	14-May-21	23-Nov-21	10-May-22	12-May-21	24-Nov-21	4-May-22	12-May-21	24-Nov-21	4-May-22
Monitoring Tier	Units	2019 AEP Tier 1	GCDWQ	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well
Metals - Dissolved															
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	0.0032	0.013	<0.0030	<0.0030	0.033	<0.0030	<0.0030	**0.109^{AB}**	0.0049	**0.94^{AB}**	<0.004	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.001	<0.00060	<0.00060	<0.001	0.0014	<0.00060	<0.001	<0.00060	<0.00060	<0.001	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	0.0025	0.005	0.0025	0.00041	0.001	0.00060	<0.00020	<0.001	0.0010	0.0011	<0.001	0.00033
Barium	mg/L	1^{A}	2.0^{C}	0.037	<0.05	0.018	0.063	<0.05	0.050	0.053	<0.05	0.018	0.023	<0.05	0.013
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.093	0.09	0.088	0.070	0.06	0.071	0.12	0.13	0.14	0.12	0.13	0.14
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	<0.000020	0.000021	<0.00002	0.000077	0.000023	0.000046	<0.000020	<0.000016	<0.00002	0.000035	0.000017	0.000047
Calcium	mg/L	n/v	n/v	38	41.2	41	160	148	120	47	16.0	41	180	186	180
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	0.0007	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	0.0013	<0.0005	<0.0010
Cobalt	mg/L	n/v	n/v	<0.00030	<0.0009	<0.00030	0.00067	<0.0009	0.00069	<0.00030	<0.0009	<0.00030	0.0020	<0.0009	0.0010
Copper	mg/L	0.007^{A}	$\leq1.0^{B}$ 2^{C}	<0.00020	0.0016	<0.0010	0.0016	0.0026	<0.0010	0.00021	0.0015	<0.0010	0.0017	<0.0008	<0.0010
Iron	mg/L	0.3^{A}	$\leq0.3^{B}$	0.10	<0.1	<0.060	<0.060	<0.1	<0.060	0.14	<0.1	<0.060	<0.060	<0.1	<0.060
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	<0.00020	0.0010	<0.00020	<0.00020	0.0007	<0.00020	<0.00020	0.0011	<0.00020	0.00047	<0.0002	<0.00020
Lithium	mg/L	n/v	n/v	0.056	-	0.075	0.071	-	0.043	0.028	-	0.038	0.050	-	0.033
Magnesium	mg/L	n/v	n/v	15	16.2	17	100	91.2	82	13	7.5	12	85	66.7	73
Manganese	mg/L	0.05^{A}	$\leq0.02^{B}$ 0.12^{C}	**0.076^{AB}**	**0.065^{AB}**	**0.067^{AB}**	**0.22^{ABC}**	**0.170^{ABC}**	**0.14^{ABC}**	**0.10^{AB}**	**0.066^{AB}**	**0.071^{AB}**	**0.65^{ABC}**	**0.362^{ABC}**	**0.32^{ABC}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000019	<0.0000025	<0.0000019	<0.0000019	<0.0000025	<0.0000019	<0.0000019	<0.0000025	<0.0000019	<0.0000019	<0.0000025	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.0035	0.001	0.0013	0.0017	0.001	0.0014	0.0045	0.005	0.0051	0.0035	0.004	0.00053
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	<0.00050	<0.003	<0.00050	0.0036	0.004	0.0028	<0.00050	<0.003	0.0006	0.0047	<0.003	0.00093
Phosphorus	mg/L	n/v	n/v	<0.10	<0.08	<0.10	<0.10	0.09	<0.10	<0.10	<0.08	<0.10	<0.10	0.10	<0.10
Potassium	mg/L	n/v	n/v	3.6	3.9	4.0	5.9	5.7	5.8	2.8	1.9	2.7	6.3	4.7	5.1
Selenium	mg/L	0.002^{A}	0.05^{C}	<0.00020	0.0008	<0.00020	<0.00020	0.0007	0.00045	<0.00020	0.0012	<0.00020	<0.00020	**0.0025^{A}**	<0.00020
Silicon	mg/L	n/v	n/v	3.6	-	3.3	6.0	-	5.3	4.1	-	4.4	7.1	-	5.7
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010
Sodium	mg/L	200^{A}	$\leq200^{B}$	**200^{B}**	**229^{AB}**	**220^{AB}**	110	79.3	63	**290^{AB}**	**253^{AB}**	**290^{AB}**	170	135	130
Strontium	mg/L	n/v	7.0^{C}	0.63	-	0.66	1.7	-	1.3	0.65	-	0.67	1.4	-	1.4
Sulfur	mg/L	n/v	n/v	51	-	44	180	-	66	110	-	140	210	-	150
Thallium	mg/L	n/v	n/v	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	0.0001	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	0.001	<0.0010	<0.0010	0.002	<0.0010	<0.0010	0.004	<0.0010	0.097	0.002	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.00029	<0.001	0.00021	**0.035^{AC}**	**0.028^{AC}**	**0.025^{AC}**	0.00029	<0.001	0.00016	**0.017^{A}**	0.006	0.0050
Vanadium	mg/L	n/v	n/v	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	0.0026	-	<0.0010
Zinc	mg/L	0.03^{A}	$\leq5.0^{B}$	<0.0030	0.019	<0.0030	<0.0030	0.011	<0.0030	<0.0030	<0.005	<0.0030	0.0042	<0.005	<0.0030
Metals - Total															
Mercury	mg/L	0.000005^{A}	0.001^{C}	0.0000042	**0.0000052^{A}**	<0.0000019	**0.0000683^{A}**	**0.000097^{A}**	**0.000077^{A}**	**0.0000096^{A}**	**0.000016^{A}**	**0.000131^{A}**	**0.000306 DB^{A}**	**0.000072^{A}**	**0.000177^{A}**

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Notes:

2019 AEP Tier 1	Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division 199 pp.
^{A}	Table 2. Alberta Tier 1 Groundwater Remediation Guidelines - Agricultural - Fine
GCDWQ	Health Canada (June 2022). Guidelines for Canadian Drinking Water Quality—Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.
^{B}	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives/ Operational Guidelines
^{C}	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentration
^{D}	Guidelines for Canadian Drinking Water Quality - Microbiological Parameters
6.5^{A}	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
^{a}	This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum found in groundwater. The operational guidance values of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
^{c,n}	NGA - no guideline available. Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
^{f}	Guidelines only provided for Nitrate (as N). Nitrate guideline (as NO3) is calculated by multiplying the Nitrate (as N) guideline by 4.43.
^{i}	High levels (above 500 mg/L) can cause physiological effects such as diarrhea or dehydration.
^{n1,e}	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.1 for further guidance on aquatic life pathway, standard varies with pH, long term guideline shown (see Table 1.1 for short term guideline). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
^{n2}	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.2 for further guidance on aquatic life pathway, standard varies with pH and temperature (see Table 1.2 for guideline and is for total ammonia (NH3 as N).
^{n3,e}	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.3 for further guidance on aquatic life pathway, standard varies with hardness, long term is shown (see Table 1.3 for short term). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
^{n4,e}	Overall guideline value for ecological receptors only. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.4 for further guidance on aquatic life pathway, standard varies with chloride, maximum nitrite-N is shown (see Table 1.4 for 30-day average). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
$^{n4,e, g}$	Overall guideline value for ecological receptors only. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.4 for further guidance on aquatic life pathway, standard varies with chloride, maximum nitrite-N is shown (see Table 1.4 for 30-day average). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines. Guidelines only provided for Nitrite (as N). Nitrite guideline (as NO2) is calculated by multiplying the Nitrite (as N) guideline by 3.29.
^{n5,e}	Guideline for protection of aquatic life is below detection limit, groundwater monitoring is required. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.7 for further guidance on aquatic life pathway, standard varies with hardness. Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
AT	Detection limit raised due to interference.
CD	Detection limits raised due to dilution to bring analyte within the calibrated range.
DB	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
DSM	Detection limits raised due to sample matrix
DVM	Detection limit raised based on sample volume used and sample matrix
DXE	Dissolved greater than total. Unable to re-analyze due to insufficient sample.
MI	Detection limit was raised due to matrix interferences.
MSE	Matrix spike exceeds acceptance limits due to probable matrix interference.
SVH	Sample analyzed over hold time. Sample analysis is recommended within 24 hours of sampling.
VV	Detection limit raised based on sample volume used for analysis.
RPD	Relative Percent Difference.
61%	RPD exceeds data quality objective of 30%.
nc	RPD is not calculated if one or more values is non detect or if one or more values is less than five times the reportable detection limit.

Table 3
Groundwater Analytical Results - Tier 2a, Tier 3 and One-Time Domestic Monitoring Wells

Sample Location				**WS81-01**		**WS81-02**		**WS41-02**	**WS51-01**	**WS62-01**		**NE7-R3-01**	**NE20-R3-01**	**SW11-R4-02**		**SE35-R4-01**	**SE35-R4-02**	**SW2-R4-01**
Completion Lithology				**Bedrock**		**Bedrock**		**Bedrock**	**Bedrock**	**Unconsolidated (Alluvial)**		**Unconsolidated (Alluvial)**	**Bedrock**	**Bedrock**		**Bedrock**	**Bedrock**	**Unknown**
Sample Date				**11-Jan-22**	**25-May-22**	**11-Jan-22**	**25-May-22**	**26-May-22**	**13-Jan-22**	**14-Jan-22**	**25-May-22**	**25-May-22**	**11-Jan-22**	**12-Jan-22**	**27-May-22**	**10-Jan-22**	**25-May-22**	**11-Jan-22**
Monitoring Tier				**Tier 2a**		**Tier 2a**		**Tier 3**	**Tier 3**	**Tier 3**		**Tier 3**	**Tier 3**	**Tier 3**		**One Time**	**One Time**	**One Time**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**															
Field Parameters																		
Dissolved oxygen, Field	mg/L	n/v	n/v	2.18	7.93	1.96	1.73	4.37	1.75	6.76	5.81	11.48	9.25	1.12	1.88	5.05	2.32	3.65
Electrical Conductivity, Field	µS/cm	$1,000^{A}$	n/v	**$1,201^{A}$**	**$1,209^{A}$**	**$1,350^{A}$**	**$1,443^{A}$**	**$1,182^{A}$**	793	582	625	496	**$1,600^{A}$**	460	477	**$1,307^{A}$**	**$1,265^{A}$**	**$1,923^{A}$**
Oxidation Reduction Potential, field	mV	n/v	n/v	158.9	63.9	-53.7	-46	91.7	-129.9	108.2	88.4	107.6	147.47	-1.33	3	52.4	-43	125.1
pH, Field	S.U.	$6.5\text{-}8.5^{A}$	$7.0\text{-}10.5^{B}$	7.45	7.66	7.48	7.35	7.21	7.86	7.67	7.5	7.67	7.78	8.38	7.84	7.19	7.28	7.33
Temperature, Field	deg C	n/v	$\leq 15^{B}$	5.8	8	5.2	6.9	7.6	6.9	3.4	4.3	3.8	11.5	5.7	8.6	5.4	8.3	5.9
Calculated Parameters																		
Anion Sum	meq/L	n/v	n/v	14	14	15	16	13	8.8	6.5	6.9	5.3	18	4.9	5.2	15	14	27
Cation Sum	meq/L	n/v	n/v	15	15	17	18	14	9.6	7.0	7.3	5.8	20	5.3	5.1	16	15	26
Hardness (as CaCO3)	mg/L	n/v	n/v	450	440	220	250	250	190	330	340	270	690	46	55	590	610	810
Ion Balance	%	n/v	n/v	5.7	3.5	5.9	5.4	3.3	4.2	3.5	3.0	4.7	4.9	3.8	0.52	3.7	4.6	0.51
Nitrate	mg/L	13_{f}^{A}	45^{C}	**15^{A}**	**19^{A}**	0.92	0.73	8.4	<0.044	0.13	0.28	1.7	3.2	<0.044	<0.044	3.5	<0.044	**26^{A}**
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	3.3	4.4	0.26	0.21	1.9	<0.010	0.030	0.063	0.39	0.72	<0.010	<0.010	0.78	<0.010	5.8
Nitrite	mg/L	$0.197/1.97_{n4.e.\ a}^{A}$	3^{C}	<0.033	<0.033	0.16	0.14	0.036	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	0.038
Total Dissolved Solids	mg/L	500^{A}	$\leq 500^{B}$	**790^{AB}**	**790^{AB}**	**890^{AB}**	**940^{AB}**	**730^{AB}**	**510^{AB}**	350	370	290	**$1,100^{AB}$**	280	290	**820^{AB}**	**720^{AB}**	**$1,600^{AB}$**
BTEX and Petroleum Hydrocarbons																		
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics																		
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	2.0	1.9	2.8	3.3	2.2	0.64	1.1	0.93	<0.50	2.2	0.57	<0.50	1.6	1.5	3.4
Electrical Conductivity, Lab	µS/cm	$1,000^{A}$	n/v	**$1,200^{A}$**	**$1,200^{A}$**	**$1,300^{A}$**	**$1,500^{A}$**	**$1,200^{A}$**	810	590	630	500	**$1,600^{A}$**	460	490	**$1,300^{A}$**	**$1,300^{A}$**	**$2,200^{A}$**
pH, lab	S.U.	$6.5\text{-}8.5^{A}$	$7.0\text{-}10.5^{B}$	7.47	7.80	7.82	7.59	7.75	7.84	7.47	7.37	7.60	7.77	8.08	8.35	7.41	7.36	7.56
Anions																		
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.5	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	440	420	550	550	530	310	240	240	180	440	190	190	490	430	480
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	530	520	670	670	640	380	290	290	220	530	230	230	590	520	590
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.8	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulfate	mg/L	$429_{n5,e}^{A}$	$\leq 500_{j}^{B}$	190	190	190	220	80	120	76	91	67	320	51	60	160	74	**720^{AB}**
Chloride	mg/L	100^{A}	$\leq 250^{B}$	26	42	9.0	14	34	<1.0	5.8	6.6	6.0	**110^{A}**	5.2	4.6	63	**120^{A}**	54
Nutrients																		
Nitrite (as N)	mg/L	$0.06/0.6_{n4.e}^{A}$	1^{C}	<0.010	<0.010	0.047	0.041	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012
Orthophosphate (as P)	mg/L	n/v	n/v	0.0036	0.0031	<0.0030	<0.0030	<0.0030	0.0032	0.0077	<0.0030	<0.0030	<0.0030	0.0040	0.0043	<0.0030	<0.0030	0.0032
Ammonia (as N)	mg/L	0.737_{n2}^{A}	n/v	<0.015	<0.015	0.031	0.038	0.2	0.26	<0.015	<0.015	<0.015	0.14	0.16	0.19	0.058	0.26	0.21
Nitrate (as N)	mg/L	3^{A}	10^{C}	**3.3^{A}**	**4.4^{A}**	0.21	0.16	1.9	<0.010	0.030	0.063	0.39	0.72	<0.010	<0.010	0.78	<0.010	**5.8^{A}**
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0057	<0.0030	<0.0030	<0.0030	0.0031
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.56	0.23	0.123	0.239	0.20	0.269	0.053	0.123	0.409	0.356	0.157	0.188	0.076	0.382	0.71
Nitrogen	mg/L	n/v	n/v	4.9	4.6	0.38	0.45	2.1	0.27	0.083	0.19	0.80	1.1	0.16	0.19	0.86	0.38	6.5
See notes on last page																		
Microbiological Parameters																		
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<2.0 AT***	***<1.0***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	82	41	3.0	22	240	1.0	16	7.0	1.0	68	340	72	370	300	33
Total Coliforms	mpn/100mL	n/v	0^{D}	**2.0^{D}**	**28^{D}**	***<1.0***	**1.0^{D}**	***<1.0***	***<1.0***	***<1.0***	**1.0^{D}**	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<3,500 AT***	**1.0^{D}**

Table 3

Groundwater Analytical Results - Tier 2a, Tier 3 and One-Time Domestic Monitoring Wells (continued)

Sample Location				**WS81-01**		**WS81-02**		**WS41-02**	**WS51-01**	**WS62-01**		**NE7-R3-01**	**NE20-R3-01**	**SW11-R4-02**		**SE35-R4-01**	**SE35-R4-02**	**SW2-R4-01**
Completion Lithology				**Bedrock**		**Bedrock**		**Bedrock**	**Bedrock**	**Unconsolidated (Alluvial)**		**Unconsolidated (Alluvial)**	**Bedrock**	**Bedrock**		**Bedrock**	**Bedrock**	**Unknown**
Sample Date				**11-Jan-22**	**25-May-22**	**11-Jan-22**	**25-May-22**	**26-May-22**	**13-Jan-22**	**14-Jan-22**	**25-May-22**	**25-May-22**	**11-Jan-22**	**12-Jan-22**	**27-May-22**	**10-Jan-22**	**25-May-22**	**11-Jan-22**
Monitoring Tier				**Tier 2a**		**Tier 2a**		**Tier 3**	**Tier 3**	**Tier 3**		**Tier 3**	**Tier 3**	**Tier 3**		**One Time**	**One Time**	**One Time**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**															
Metals - Dissolved																		
Aluminum	mg/L	$0.05_{n1.e}^{A}$	0.1_{a}^{B} 2.9^{C}	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0050	<0.0030	<0.0030	<0.0030	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00054	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Barium	mg/L	1^{A}	2.0^{C}	0.023	0.023	0.041	0.045	0.055	0.015	0.063	0.066	0.11	0.022	0.069	0.088	0.025	0.030	0.034
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.16	0.16	0.15	0.16	0.059	0.10	<0.020	<0.020	<0.020	0.059	0.031	0.045	0.074	0.058	0.089
Cadmium	mg/L	$0.00037_{n3.e}^{A}$	0.007^{C}	<0.00002	<0.00002	<0.00002	<0.00002	0.000023	<0.00002	<0.00002	<0.00002	<0.00002	0.000039	<0.00002	<0.00002	0.000026	<0.00002	<0.00002
Calcium	mg/L	n/v	n/v	95	91	47	53	57	57	92	96	74	150	12	15	130	140	180
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Copper	mg/L	0.007^{A}	$\leq1.0^{B}$ 2^{C}	0.0028 NH	0.0044	0.00032	<0.0010	0.0018	<0.00020	**0.013^{A}**	**0.017^{A}**	**0.017^{A}**	0.0041	0.00094	0.0013	0.0045	<0.0010	0.0034
Iron	mg/L	0.3^{A}	$\leq0.3^{B}$	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	**0.47^{AB}**	<0.060
Lead	mg/L	$0.007_{n3.e}^{A}$	0.005^{C}	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.0012	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.039	0.031	0.042	0.037	0.035	0.023	<0.020	<0.020	<0.020	0.044	0.024	<0.020	0.026	<0.020	0.071
Magnesium	mg/L	n/v	n/v	52	51	25	27	27	11	24	25	20	78	4.0	4.5	66	65	88
Manganese	mg/L	0.05^{A}	$\leq0.02^{B}$ 0.12^{C}	<0.0040	<0.0040	0.013	**0.022^{B}**	0.013	**0.13^{ABC}**	0.0063	0.0062	<0.0040	0.0088	**0.039^{B}**	**0.048^{B}**	0.0040	**0.071^{AB}**	**0.062^{AB}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.0048	0.0052	0.0017	0.0015	0.0076	0.0051	0.00041	0.00040	0.00061	0.0011	0.0019	0.0016	0.0012	0.00023	0.00066
Nickel	mg/L	$0.17_{n3.e}^{A}$	n/v	<0.00050	0.00052	<0.00050	<0.00050	0.0012	<0.00050	<0.00050	<0.00050	<0.00050	0.0021	<0.00050	0.001	0.00054	<0.00050	0.00062
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	2.4	2.2	1.6	1.6	5.1	1.1	2.0	2.0	3.8	8.0	0.80	0.76	6.4	6.2	4.0
Selenium	mg/L	0.002^{A}	0.05^{C}	**0.0032^{A}**	**0.0038^{A}**	0.0013	0.0013	**0.0037^{A}**	<0.00020	0.00061	0.0011	0.00061	0.00038	<0.00020	<0.00020	**0.0039^{A}**	**0.012^{A}**	0.0014
Silicon	mg/L	n/v	n/v	3.3	3.4	3.1	3.3	3.0	5.0	2.7	2.9	2.8	3.8	3.5	3.9	3.8	4.0	4.4
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	200^{A}	$\leq200^{B}$	140	140	**290^{AB}**	**300^{AB}**	**210^{AB}**	130	8.8	8.6	6.8	140	100	92	97	59	**230^{AB}**
Strontium	mg/L	n/v	7.0^{C}	1.1	1.1	0.76	0.88	0.79	0.56	0.46	0.47	0.35	1.8	0.25	0.32	1.4	1.7	1.8
Sulfur	mg/L	n/v	n/v	57	65	61	78	28	39	25	33	25	97	16	20	53	29	200
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.0041	0.0038	0.0052	0.0051	0.0031	0.00015	0.00067	0.0010	0.00070	0.0055	<0.00010	<0.00010	0.0050	0.0033	0.010
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	mg/L	0.03^{A}	$\leq5.0^{B}$	<0.0030	0.0061	0.0042	0.0033	0.0072	<0.0030	0.0057	0.028	0.018	0.018	0.0039	**0.052^{A}**	0.0096	<0.0030	0.024
Metals - Total																		
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019

See notes on last page

Table 3

Groundwater Analytical Results - Tier 2a, Tier 3 and One-Time Domestic Monitoring Wells (continued)

Sample Location				**SW2-R4-02**	**SW11-R4-01**	**WS42-01**	**WS42-02**	**WS48-01**	**WS56-01**	**WS56-02**	**WS65-01**	**WS65-02**	**WS67-01**
Completion Lithology				**Unknown**	**Bedrock**	**Bedrock**	**Bedrock**	**Bedrock**	**Bedrock**	**Bedrock**	**Bedrock**	**Unknown**	**Unconsolidated (alluvial)**
Sample Date				**26-May-22**	**12-Jan-22**	**26-May-22**	**26-May-22**	**13-Jan-22**	**10-Jan-22**	**10-Jan-22**	**12-Jan-22**	**12-Jan-22**	**25-May-22**
Monitoring Tier				**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**										
Field Parameters													
Dissolved oxygen, Field	mg/L	n/v	n/v	6.77	1.97	6.07	4.78	3.49	6.59	1.75	10.13	1.16	3.76
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**2,999**^{A}	408	**1,102**^{A}	**1,070**^{A}	**1,823**^{A}	**1,341**^{A}	**2,009**^{A}	448	549	520
Oxidation Reduction Potential, field	mV	n/v	n/v	142	-163.4	101.3	112.3	-102.9	-35.8	122	63.2	-25.8	-94.4
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.23	**8.71**^{A}	**6.99**^{B}	7.04	7.7	7.01	7.19	7.73	8.29	7.47
Temperature, Field	deg C	n/v	≤15^{B}	12.5	5.5	6.3	7.7	4.4	6.3	7.8	5.5	4.4	8
Calculated Parameters													
Anion Sum	meq/L	n/v	n/v	39	4.6	12	11	22	15	19	4.9	5.7	5.5
Cation Sum	meq/L	n/v	n/v	38	4.9	13	12	21	16	21	5.2	6.4	5.6
Hardness (as CaCO3)	mg/L	n/v	n/v	860	58	560	550	600	670	11	250	21	260
Ion Balance	%	n/v	n/v	0.34	3.3	4.2	4.2	3.0	3.6	3.2	3.0	5.5	1.2
Nitrate	mg/L	13$_{f}^{A}$	45^{C}	1.4	0.13	1.5	4.4	<0.044	0.054	0.77	0.96	0.097	0.28
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	0.32	0.030	0.34	1.0	<0.010	0.012	0.17	0.22	0.022	0.063
Nitrite	mg/L	0.197/1.97$_{n4.e.\ a}^{A}$	3^{C}	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**2,500**^{AB}	250	**610**^{AB}	**600**^{AB}	**1,400**^{AB}	**760**^{AB}	**1,100**^{AB}	270	340	280
BTEX and Petroleum Hydrocarbons													
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics													
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	3.1	0.52	2.1	1.8	1.2	1.2	11	0.86	1.3	3.3
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**3,000**^{A}	410	**1,100**^{A}	**1,100**^{A}	**1,800**^{A}	**1,300**^{A}	**2,000**^{A}	450	550	500
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.55	8.21	7.38	7.44	7.65	7.40	7.35	7.55	8.05	7.38
Anions													
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	460	210	380	380	210	430	380	160	220	230
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	570	260	460	460	260	530	460	200	260	280
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulfate	mg/L	429$_{n5,e}^{A}$	≤500$_{j}^{B}$	**1,400**^{AB}	14	64	58	**870**^{AB}	86	56	74	69	43
Chloride	mg/L	100^{A}	≤250^{B}	3.3	2.0	95	94	2.2	**140**^{A}	**380**^{AB}	2.8	<1.0	1.9
Nutrients													
Nitrite (as N)	mg/L	0.06/0.6$_{n4.e}^{A}$	1^{C}	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Orthophosphate (as P)	mg/L	n/v	n/v	<0.0030	0.012	<0.0030	<0.0030	0.0032	<0.0030	<0.0030	0.0033	0.0038	<0.0030
Ammonia (as N)	mg/L	0.737$_{n2}^{A}$	n/v	0.38	0.14	<0.015	<0.015	0.58	0.34	<0.015	<0.015	0.58	**1.0**^{A}
Nitrate (as N)	mg/L	3^{A}	10^{C}	0.32	0.030	0.34	1.0	<0.010	0.012	0.17	0.22	0.022	0.063
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	<0.0030	0.0087	<0.0030	<0.0030	0.026	0.056	<0.0030	<0.0030	0.41 DB	<0.0030
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	0.929	0.260	0.784	0.092	0.724	0.522	0.046	0.082	<2.0	2.78
Nitrogen	mg/L	n/v	n/v	1.3	0.29	1.1	1.1	0.72	0.53	0.22	0.30	<2.0 DB	2.8 DB
See notes on last page													
Microbiological Parameters													
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<10 VV***	***<2.0 AT***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<1.0***	***<10 VV HX***	***<2.0 AT***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	>6000	470	15	2.0	600	2.0	<1.0	29	>6000 DSM	220
Total Coliforms	mpn/100mL	n/v	0^{D}	***<1.0***	***<1.0***	***<1.0***	**1.0**^{D}	***<1.0***	***<1.0***	***<1.0***	**6.3**^{D}	**240 VV**^{D}	***<30 AT***

Table 3
Groundwater Analytical Results - Tier 2a, Tier 3 and One-Time Domestic Monitoring Wells (continued)

Sample Location				**SW2-R4-02**	**SW11-R4-01**	**WS42-01**	**WS42-02**	**WS48-01**	**WS56-01**	**WS56-02**	**WS65-01**	**WS65-02**	**WS67-01**
Completion Lithology				**Unknown**	**Bedrock**	**Bedrock**	**Bedrock**	**Bedrock**	**Bedrock**	**Bedrock**	**Bedrock**	**Unknown**	**Unconsolidated (alluvial)**
Sample Date				**26-May-22**	**12-Jan-22**	**26-May-22**	**26-May-22**	**13-Jan-22**	**10-Jan-22**	**10-Jan-22**	**12-Jan-22**	**12-Jan-22**	**25-May-22**
Monitoring Tier				**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**	**One Time**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**										
Metals - Dissolved													
Aluminum	mg/L	$0.05_{n1.e}{}^{A}$	$0.1_{a}{}^{B}$ 2.9^{C}	<0.0030	0.0043	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0081	0.0066	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	<0.00020	0.0023	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00048	0.00033
Barium	mg/L	1^{A}	2.0^{C}	<0.010	0.28	0.049	0.050	<0.010	0.039	<0.010	0.082	0.025	0.17
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.16	0.061	0.036	0.036	0.081	0.11	0.063	<0.020	0.075	<0.020
Cadmium	mg/L	$0.00037_{n3.e}{}^{A}$	0.007^{C}	<0.00002	<0.00002	0.000030	<0.00002	<0.00002	0.000022	<0.00002	<0.00002	<0.00002	<0.00002
Calcium	mg/L	n/v	n/v	210	14	130	120	170	150	1.7	70	6.4	76
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	0.00038	<0.00030	<0.00030	<0.00030	<0.00030
Copper	mg/L	0.007^{A}	$\leq 1.0^{B}$ 2^{C}	**0.013**^{A}	0.00045	<0.0010	0.0011	0.0025	<0.00020	**0.011**^{A}	0.0035	0.00052	<0.0010
Iron	mg/L	0.3^{A}	$\leq 0.3^{B}$	<0.060	<0.060	<0.060	<0.060	<0.060	**0.41**^{AB}	<0.060	<0.060	0.11	0.072
Lead	mg/L	$0.007_{n3.e}{}^{A}$	0.005^{C}	0.00024	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.11	<0.020	<0.020	<0.020	0.030	0.043	0.036	<0.020	0.032	<0.020
Magnesium	mg/L	n/v	n/v	83	5.4	60	60	43	74	1.5	18	1.3	18
Manganese	mg/L	0.05^{A}	$\leq 0.02^{B}$ 0.12^{C}	**0.15**^{ABC}	0.015	<0.0040	<0.0040	**0.40**^{ABC}	**0.20**^{ABC}	<0.0040	<0.0040	0.0064	**0.42**^{ABC}
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.00036	0.0012	0.0011	0.00068	0.0022	0.00028	0.00067	0.00068	0.0074	0.00052
Nickel	mg/L	$0.17_{n3.e}{}^{A}$	n/v	0.0078	<0.00050	<0.00050	<0.00050	<0.00050	0.0007	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	4.9	0.91	5.4	5.5	5.5	7.4	1.3	0.88	1.7	3.3
Selenium	mg/L	0.002^{A}	0.05^{C}	<0.00020	<0.00020	**0.0073**^{A}	**0.0071**^{A}	<0.00020	0.0014	**0.0063**^{A}	0.00078	<0.00020	<0.00020
Silicon	mg/L	n/v	n/v	5.3	4.0	4.3	4.3	4.8	3.2	3.9	2.1	2.6	3.7
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	200^{A}	$\leq 200^{B}$	**480**^{AB}	85	29	29	**210**^{AB}	43	**470**^{AB}	3.9	140	4.2
Strontium	mg/L	n/v	7.0^{C}	3.5	0.22	1.1	1.1	1.6	2.3	<0.020	0.40	0.080	0.31
Sulfur	mg/L	n/v	n/v	490	6.0	22	20	250	28	18	23	22	15
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.00019	<0.00010	0.0046	0.0042	<0.00010	0.0022	0.0057	0.00048	0.00018	<0.00010
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010
Zinc	mg/L	0.03^{A}	$\leq 5.0^{B}$	**0.053**^{A}	<0.0030	<0.0030	<0.0030	**0.036**^{A}	**0.058**^{A}	<0.0030	0.011	<0.0030	**1.2**^{A}
Metals - Total													
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000019	<0.0000019	<0.0000019	<0.0000019	0.0000021	<0.0000019	<0.0000019	<0.0000019	***<0.000019***	<0.0000019

See notes on last page

Table 3
Groundwater Analytical Results - Tier 3 and One-Time Domestic Monitoring Wells (continued)

Notes:

2019 AEP Tier 1	Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division 199 pp.
A	Table 2. Alberta Tier 1 Groundwater Remediation Guidelines - Agricultural - Fine
GCDWQ	Health Canada (June 2022). Guidelines for Canadian Drinking Water Quality—Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.
B	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives/ Operational Guidelines
C	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentration
D	Guidelines for Canadian Drinking Water Quality - Microbiological Parameters
6.5^{A}	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
a	This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum found in groundwater. The operational guidance values of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
c,n	NGA - no guideline available. Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
f	Guidelines only provided for Nitrate (as N). Nitrate guideline (as NO3) is calculated by multiplying the Nitrate (as N) guideline by 4.43.
i	High levels (above 500 mg/L) can cause physiological effects such as diarrhea or dehydration.
n1,e	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.1 for further guidance on aquatic life pathway, standard varies with pH, long term guideline shown (see Table 1.1 for short term guideline). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
n2	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.2 for further guidance on aquatic life pathway, standard varies with pH and temperature (see Table 1.2 for guideline and is for total ammonia (NH3 as N).
n3,e	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.3 for further guidance on aquatic life pathway, standard varies with hardness, long term is shown (see Table 1.3 for short term). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
n4,e	Overall guideline value for ecological receptors only. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.4 for further guidance on aquatic life pathway, standard varies with chloride, maximum nitrite-N is shown (see Table 1.4 for 30-day average). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
n4,e, g	Overall guideline value for ecological receptors only. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.4 for further guidance on aquatic life pathway, standard varies with chloride, maximum nitrite-N is shown (see Table 1.4 for 30-day average). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines. Guidelines only provided for Nitrite (as N). Nitrite guideline (as NO2) is calculated by multiplying the Nitrite (as N) guideline by 3.29.
n5,e	Guideline for protection of aquatic life is below detection limit, groundwater monitoring is required. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.7 for further guidance on aquatic life pathway, standard varies with hardness. Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
AT	Detection limit raised due to interference.
DB	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
DSM	Detection limits raised due to sample matrix
HX	Holding time had been exceeded upon sample receipt.
NH	Duplicate exceeds acceptance criteria due to sample non homogeneity. Reanalysis yields similar results.
VV	Detection limit raised based on sample volume used for analysis.
RPD	Relative Percent Difference.
<u>61%</u>	RPD exceeds data quality objective of 30%.
nc	RPD is not calculated if one or more values is non detect or if one or more values is less than five times the reportable detection limit.

Monitoring Tier

APPENDICES

Appendix A Hydrogeological Setting

The hydrogeologic setting of the regional assessment area (RAA) is summarized below in order to provide context for the GWMP.

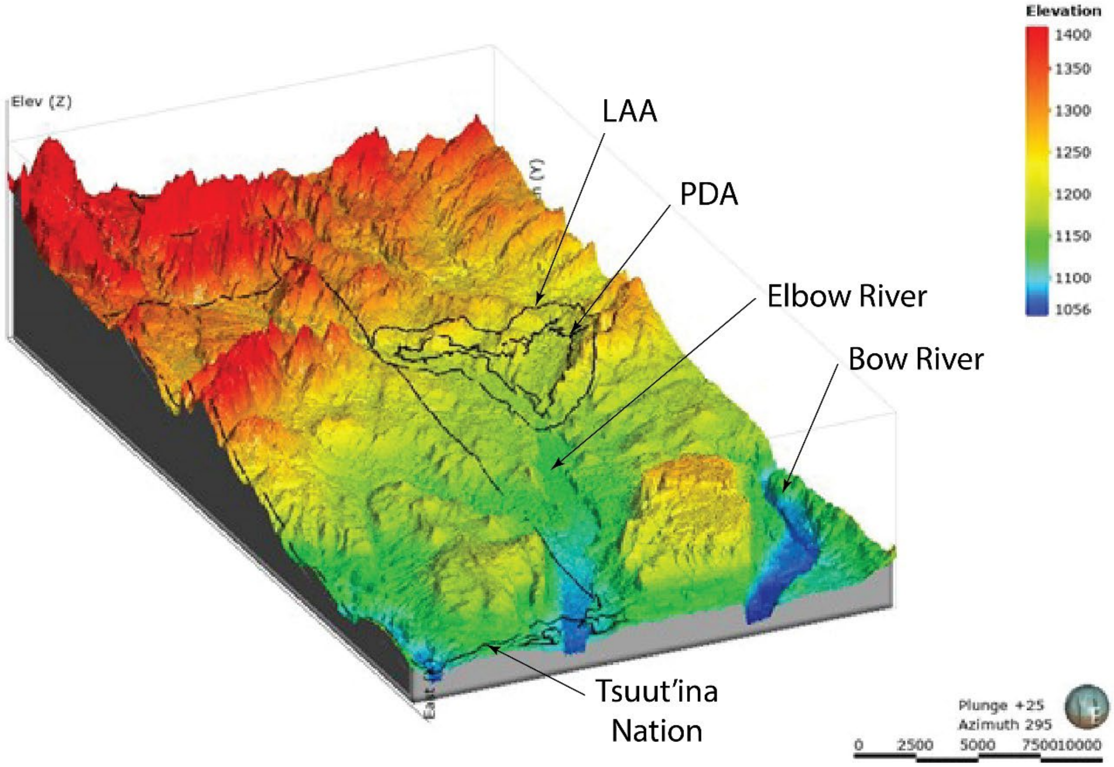
A.1 Regional Topography and Drainage

The ground surface topography of the RAA is depicted by the digital elevation model (DEM) in Figure A.1. Outlines of the Hydrogeology PDA/LAA used in the EIA and Tsuut'ina Nation Reserve are also shown as overlays for reference. Areas of higher elevation are denoted by red, and they grade down to areas of low elevation, denoted by blue as shown on the colour scale. The topographic elevation ranges from approximately 1,365 m ASL on the bedrock ridges in the southwest corner of the RAA to approximately 1,125 m ASL along Elbow River at the eastern boundary.

The topography on the north side of the RAA consists of a series of ridges and valleys that are oriented northwest to southeast. The topography of most of the RAA is generally controlled by the bedrock structure, particularly in the southwest, and to a lesser extent, the patterns of glacial sediment deposition modifying the topography in lower areas. Prominent ridges through the assessment area are a result of formations that are more resistive to weathering; the valleys in between the ridges are more easily weathered or recessive.

Near the modern river channels, fluvial erosion and deposition is the primary control agent. Near Elbow River and Jumpingpound Creek, the terrain is incised with one or more fluvial terraces within the river valleys. Hummocky regions have low to moderate relief, with gentle slopes that vary between 2% and 15%. Areas with low relief are underlain by till or glaciolacustrine sediments, while areas of moderate relief are underlain by till and glaciofluvial sediments. Outcrops of bedrock occur along ridges in the lower areas of the RAA and are moderately weathered and fractured, but they are covered by a thick sequence of unconsolidated sediment.

Figure A.1 Topography of the Regional Assessment Area



A.2 Regional Hydrogeologic Setting

A.2.1 CONCEPTUAL HYDROSTRATIGRAPHIC FRAMEWORK

The conceptual hydrostratigraphic framework for the LAA and RAA is based on the three-dimensional conceptual site model (3D CSM) developed for the baseline groundwater assessment. Figure A.2 presents an oblique view of the 3D CSM looking from the east with the RAA boundary shown overlain on the model and air photograph for reference.

A regional stratigraphic column that shows the generalized stratigraphy beneath the RAA is depicted in Figure A.3. Brief descriptions of each stratigraphic unit, and a discussion of the additional salient features of the area are presented in the following subsections.

Figure A.2 Oblique Angle Overview of 3D CSM

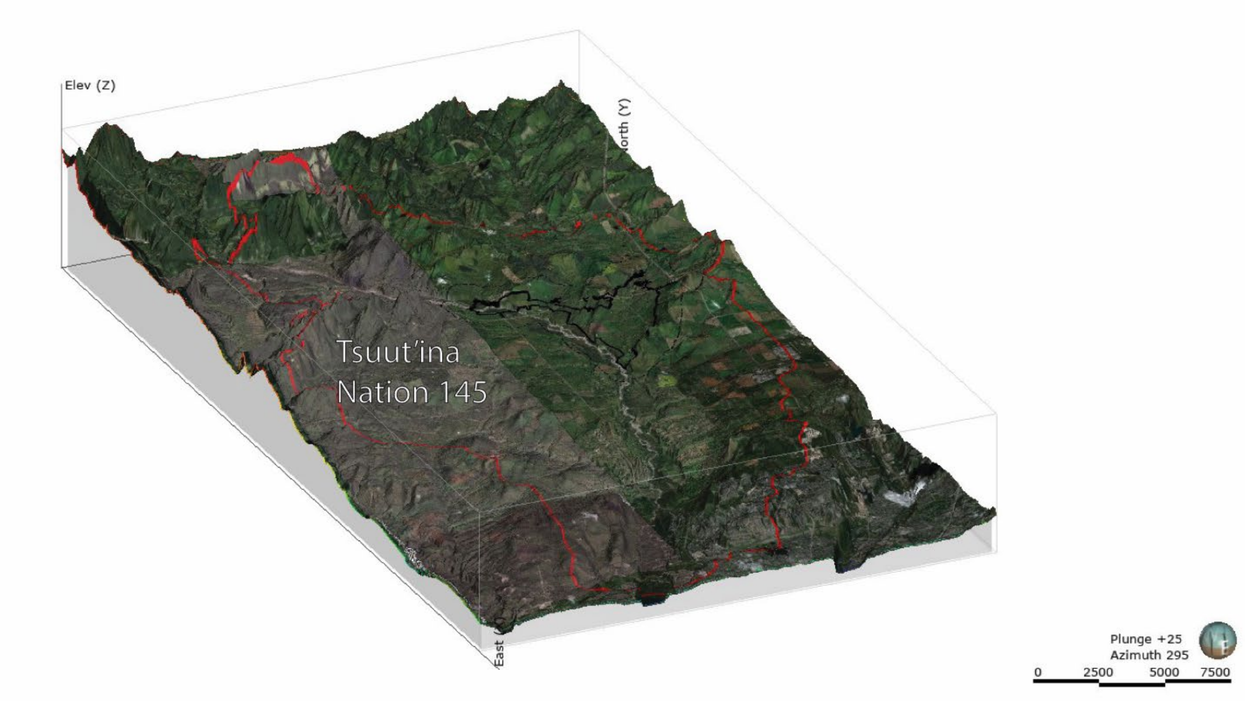
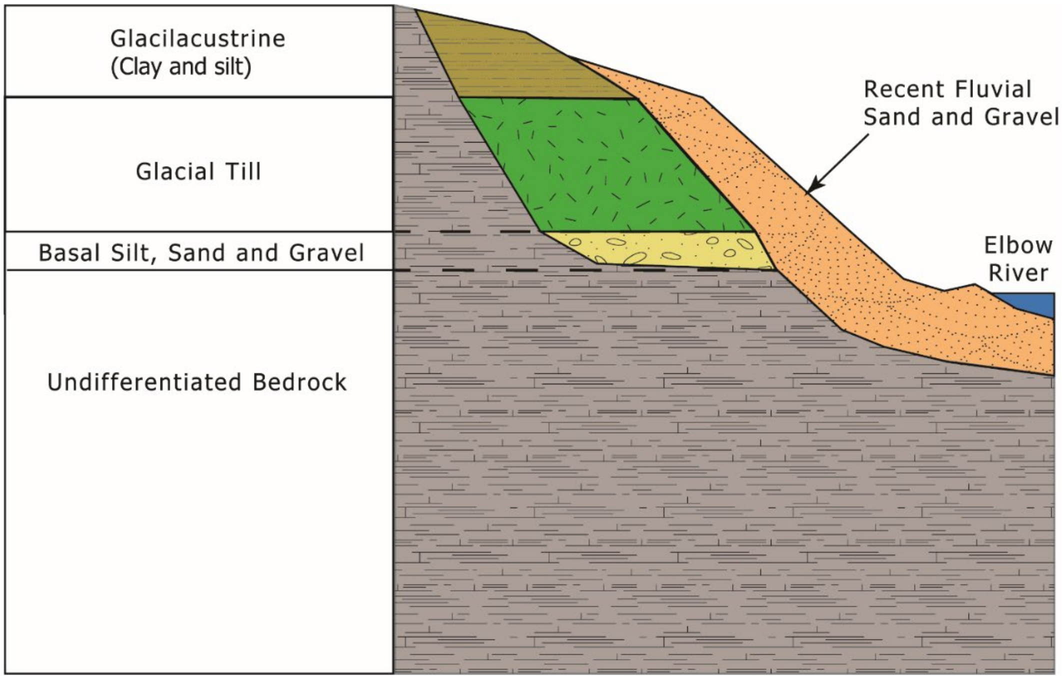


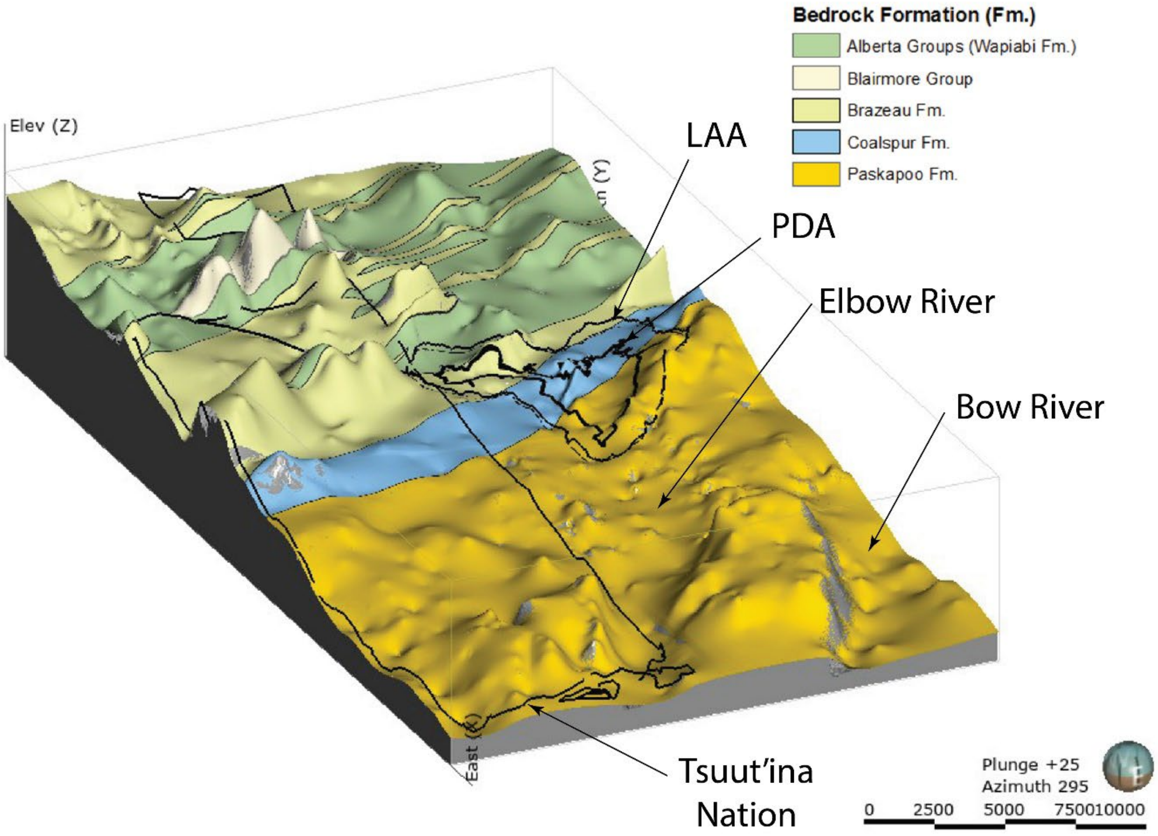
Figure A.3 Conceptual Regional Stratigraphic Column



A.2.2 BEDROCK

The bedrock surface within the RAA was shaped by tectonism and associated formation of the Rocky Mountains to the west, glacial erosion/deposition, and erosional incision of modern-day river channels. The RAA is in the disturbed belt which forms a transitional zone (foothills) between the Rocky Mountains to the west and prairie to the east. Bedrock topography is depicted in Figure A.4.

Figure A.4 Bedrock Topography and Subcrop Formations



The bedrock units encountered beneath the quaternary deposits are presented below from oldest to youngest. This generally coincides with how they appear from west to east across the RAA except for the Blairmore Group:

- The lower Cretaceous Blairmore Group dominantly composed of fluvial sediments. The two fluvial formations belonging to the upper Blairmore Group include the Beaver Mines and Mill Creek formations (Langenberg et al. 2000). This unit subcrops over a small topographically elevated area in the southwest of the RAA.
- The upper Cretaceous-aged Wapiabi Formation of the Alberta Group is generally composed of shale and mudstone with minor siltstone, except for the Chungo and Marshybank Members, which are sandstone dominated (Pana and Elgr 2013).
- The upper Cretaceous-aged Brazeau Formation is composed primarily of sandstone and laminated siltstone, along with olive green mudstone and granule to pebble conglomerate in the lower part. The upper part is composed of greenish-grey to dark grey mudstone, siltstone and greenish-grey sandstone. Thin coal and coaly shale beds and thin bentonite layers also occur in the upper part (Prior et al. 2013).
- The Upper Cretaceous-to-Tertiary aged Coalspur Formation formed as a marginal marine fluvial infill of the foreland basin. The Coalspur Formation is composed of thinly bedded to massive sandstone, siltstone, light grey to olive green mudstone, shale, coaly shale, coal seams and minor volcanic tuff in the lower portions (Pana and Elgr 2013).
- The Tertiary-aged Paskapoo Formation is made up of thick tabular sandstone, siltstone and mudstone (Glass 1990). The sandstones are fine to coarse grained and are cliff forming. The Paskapoo Formation also contains a substantial amount of shale, carbonaceous shale, siltstone, rare coals seams and shell beds (Pana and Elgr 2013). In the central Rocky Mountains and foothills, the Paskapoo Formation is dominated by recessively weathering, grey to greenish-grey mudstone and siltstone with subordinate pale grey, thick- to thin-bedded, sandstone; minor conglomerate; mollusc coquina; and coal (Prior et al. 2013). The Paskapoo Formation is the primary bedrock aquifer in the Elbow River watershed. Due to the stratigraphy of the layers of sandstone and shale within this formation, multiple aquifers occur at various depths in the rock (Waterline 2011).

The approximate subcrop boundaries of the bedrock units are presented in Figure A.4 and are based on regional mapping by Pana and Elgr (2013), except for the contact between the Coalspur and Brazeau Formations. This contact was reinterpreted by Jerzykiewicz (1997) based on observation and description of the entrance conglomerate in outcrop along Highway 22. The entrance conglomerate marks the boundary between these two formations, and its presence was confirmed in the field Project-specific data gathering.

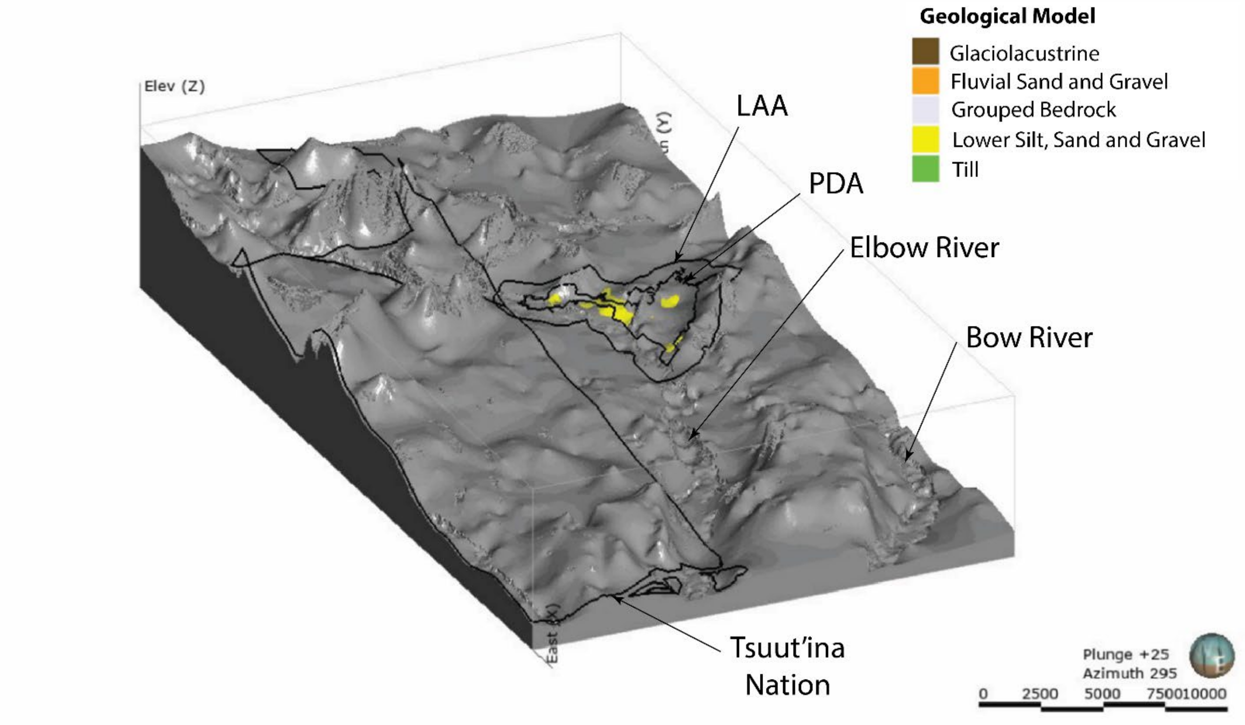
The bedrock descriptions from boreholes drilled to support the Project consist of varying thicknesses of alternating siltstone, sandstone mudstone and claystone. Descriptions of each of these lithological units are as follows:

- Grey to brown, fine to medium-grained sandstone ranges from completely unlithified to well cemented and dry. Significant fracturing was noted in many intervals, with oxidation common along fracture planes. The upper sandstone beds beneath the unconsolidated deposits are highly weathered. Thicknesses of individual sandstone beds range from thin, centimetre-scale beds to a maximum of 15.3 m and an average thickness of 2.5 m.
- Grey to brown and, in some intervals, greenish-grey siltstone occurs and is extremely weak and friable to well cemented. It is highly fractured in some intervals, with oxidation along fracture planes. The average thickness of the interbedded siltstone beds is 2.5 m.
- Medium grey to brown claystone, generally blocky and not fissile-like shale, dry except where fractures are saturated occurs. Fracturing varies from completely unfractured to, more often, highly fractured with oxidation and alteration of clay along fractures. Claystone is interbedded with the other lithologies described above, with an average thickness of 1.9 m for each of the interbedded layers.

A.2.3 BASAL SILT, SAND AND GRAVEL

In some portions of the LAA, a coarser grained unit occurs above the bedrock at the base of the till. This unit is most prominent near the Elbow River valley and consists of a mixture of brown sand, silt and gravel with variable fines. The unit ranges in thickness from 0.9 to 4.2 m with an average of 2.4 m in the boreholes where it was encountered. The distribution of the basal silt, sand and gravel deposits is shown in yellow in Figure A.5. While this unit may be more widespread within the RAA than the distribution shown, the data density in the LAA was sufficient based on Project-specific data to allow correlation and mapping of this unit.

Figure A.5 Distribution of Basal Silt, Sand and Gravel



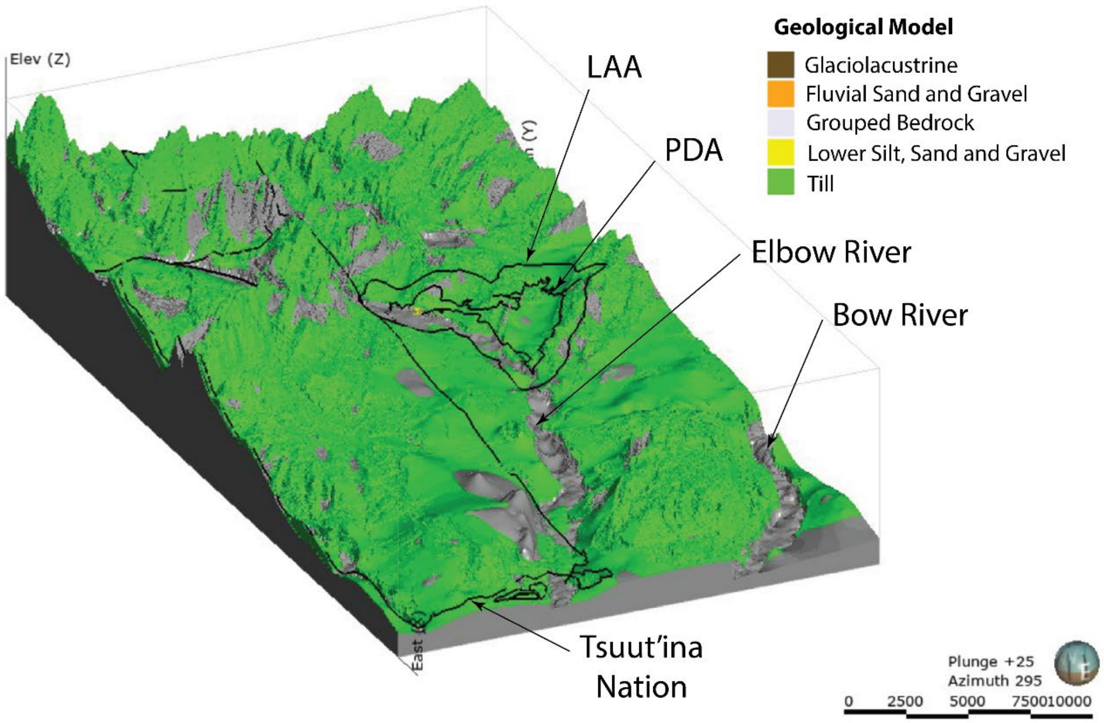
A.2.4 TILL

The unconsolidated deposits present beneath the majority of the RAA consist of Pleistocene Age glaciolacustrine clay and till (Fenton et al. 2013; Moran 1986). In the RAA, the till material was deposited by glacial ice as basal or lateral moraines. Based on the field observations and laboratory grain size analyses completed as part of the geotechnical drilling program, the till in the LAA is composed of a heterogeneous mixture of approximately equal parts clay and silt, a lower proportion of sand, and minor gravel. Silt and sand lenses are also present within the heterogeneous matrix. The till is described as generally stiff to very stiff or hard, medium to high plastic clay with silt and more minor sand. Where present, the till ranges in thickness from 0.2 m to greater than 50 m with an average thickness of 10 m across the RAA.

Two main till sub-units are summarized as follows:

- Brown-grey subglacial till is dark brown to grey sandy, silty, clay with variable gravel. The till is hard with low to medium plasticity. The brown-grey subglacial till was encountered throughout the dam and diversion footprint. Cobble-sized clasts within the matrix were rounded to sub-rounded sandstones and carbonates.
- Upper brown till occurs above the subglacial till and is a massive, matrix-supported, olive brown to brown, medium plastic clay, clay and silt with sand content increasing with depth. This unit was encountered in boreholes in the dam footprint and eastern portion of the diversion channel.

Figure A.6 Distribution of Till



A.2.5 GLACIOLACUSTRINE DEPOSITS

Glaciolacustrine clay overlies the till in the low-lying areas of the LAA. The silty clay was deposited in Glacial Lake Calgary, a proglacial lake formed by ice damming during the last deglaciation. The glaciolacustrine deposits have been named the Calgary Formation (Moran 1986).

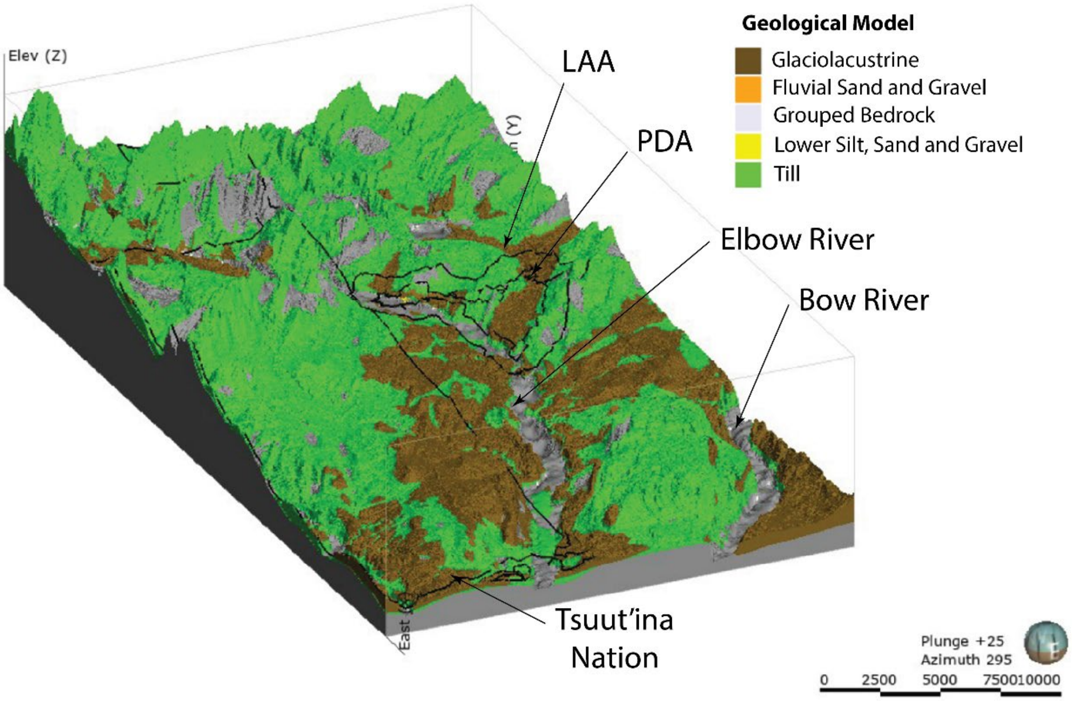
The distribution of this unit is presented in blue in Figure A.7. Outlines of the Tsuut'ina Nation Reserve and the Hydrogeology PDA/LAA are also shown as overlays for reference. Within the LAA, the glaciolacustrine clay averaged 5.3 m thick in the boreholes where it was encountered.

Based on the field observations and laboratory grain size analyses, the glaciolacustrine clay in the LAA is composed of 50-70% clay, 30-40% silt and a minor proportion of sand. Typical of a lacustrine deposit, the clay was found to be laminated with silt and fine sand. This layering has resulted in the following:

- relatively high hydraulic conductivities for silty clays (measured at $1.4x10^{-7}$ m/s and model calibrated at $5.1x10^{-6}$ m/s) and anisotropy ratios (horizontal hydraulic conductivity: vertical hydraulic conductivity) compared to the underlying till
- groundwater preferentially flows through the silt

The laminations and rhythmic bedding of the glaciolacustrine deposits can be observed along the banks of Elbow River in the RAA.

Figure A.7 Distribution of Glaciolacustrine Deposits



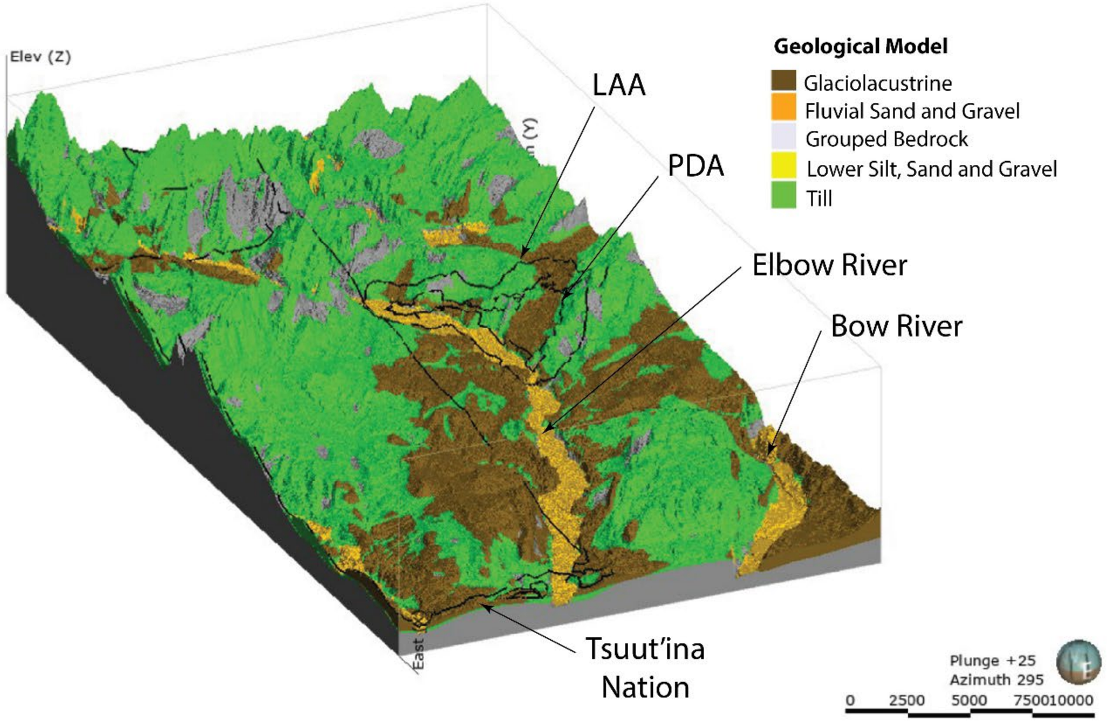
A.2.6 RECENT FLUVIAL DEPOSITS

Post-glacial fluvial channel sediments are in the Elbow River valley that extends across the RAA and in the Jumpingpound Creek channel in the western portion of the RAA. These sediments developed as the high-energy rivers, eroded and exported material from upstream areas and deposited coarse alluvium (sand and gravel) in the river channel. Localized areas of overbank deposits consisting of fluvial silt are also present (Moran 1986). The deposition of alluvium over Quaternary deposits or bedrock in the valleys resulted in the formation of alluvial aquifers, which are an important source of groundwater for the river and residents.

The alluvial aquifers provide temporary storage for water from Elbow River and Jumpingpound Creek during floods; the water is naturally released back into the rivers from bank storage after a flood recedes. Groundwater from the alluvial aquifer of Elbow River is essential in maintaining baseflow. Yields for the Elbow River alluvial aquifer range from 175 m^3/day to 2,500 m^3/day (Waterline 2011).

Recent fluvial deposits are depicted in orange in Figure A.8. Outlines of the Tsuut'ina Nation Reserve and the Hydrogeology PDA/LAA are also shown as overlays for reference. The fluvial deposits in this area are brown and grey silty gravel with more minor sand, cobbles and boulders.

Figure A.8 Distribution of Recent Fluvial Deposits



A.3 Groundwater Flow

A.3.1 GROUNDWATER FLOW IN THE UNCONSOLIDATED GLACIAL DEPOSITS

Groundwater levels within the surficial deposits generally follow the topography and range from 0 m BGL, where the water table intersects ground surface at springs and along stream and river banks, to approximately 8.0 m BGL. The corresponding groundwater elevations range from approximately 1,380 m ASL in the topographically elevated areas in the of the RAA southwest to 1,080 m ASL along the eastern boundary of the RAA.

There is high potential for perched water table development within the RAA because of the following landscape and geological controls:

- permeability contrast created by an unconsolidated sediment veneer over the bedrock
- steep land surface gradients and erosional unconformities that truncate hydrostratigraphic units within the RAA
- mapped contact springs that indicate perched conditions in topographically elevated areas.

Groundwater flow direction is interpreted to be toward Elbow River across the majority of the RAA, except for areas 1) northwest where shallow groundwater flows west toward Jumpingpound Creek, 2) areas along the north side of the RAA across the flow divide, and 3) in the Bow River watershed where groundwater flows north. Horizontal gradients beneath the LAA range from 0.003 in the central portion of the reservoir to 0.1 in the southern portion of the LAA that is adjacent to the Elbow River near the diversion structure.

As noted above, the unconsolidated sediment above bedrock is also thought to host-perched water tables in which groundwater flow is typically dictated by local-scale topography where the permeability contrast exists to support development of perched groundwater.

The average linear groundwater velocity in the unconsolidated glaciolacustrine deposits and till is estimated to range from less than 0.01 m/year to approximately 2.3 m/year. However, it should be noted that flow velocities through sand lenses within, or at the base of, the till could be higher.

A.3.2 GROUNDWATER FLOW IN THE UPPER BEDROCK AQUIFERS

The potentiometric surface elevation in the upper bedrock ranges from approximately 1,400 m ASL in the southwest to 1,080 m ASL at the base of the Elbow River valley along the eastern boundary of the RAA. The potentiometric surface elevation in the mountainous southwest area of the RAA is predicted above land surface between topographically elevated areas. This suggests the presence of locally perched bedrock aquifers in this area that are poorly hydraulically connected to the underlying regional bedrock aquifer.

Groundwater flow direction in the bedrock is dominantly controlled by the bedrock surface-topography. On the north side of Elbow River, the bedrock generally slopes towards the river, while being influenced by variation in the bedrock surface topography. There are some topographic low areas in the bedrock on the north side of the river that focus groundwater flow in the bedrock beneath the PDA and LAA before trending towards Elbow River. The bedrock topography is significantly more complex on the south side of Elbow River and the flow patterns in the bedrock demonstrate radial flow away from elevated bedrock features. Correspondingly, the surface water drainage features to Elbow River on the south side appear to act as groundwater discharge features that focus flow between topographically-elevated bedrock features.

Horizontal gradients in the upper-bedrock aquifers beneath the LAA range from 0.005 in the central portion of the proposed reservoir to 0.02 in the southern portion of the LAA adjacent to Elbow River near the diversion structure.

The average linear groundwater velocity in the shallow bedrock is estimated to range from less than 0.01 cm/year in the unfractured portions of the claystone bedrock to approximately 30 m/year in the more permeable sandstone in the areas of higher hydraulic gradient near the Elbow River.

A.4 Existing Groundwater and Surface Water Use

Groundwater use in the RAA is primarily from shallow bedrock aquifers with some wells also completed in the recent fluvial deposits along Elbow River. Regional mapping by HCL (2002) indicate yields from the bedrock aquifers in the disturbed belt range from 10 m^3/day to 75 m^3/day. Yields from wells completed in the recent fluvial deposits along Elbow River are expected to range from 175 m^3/day to 2,500 m^3/day (Waterline 2011).

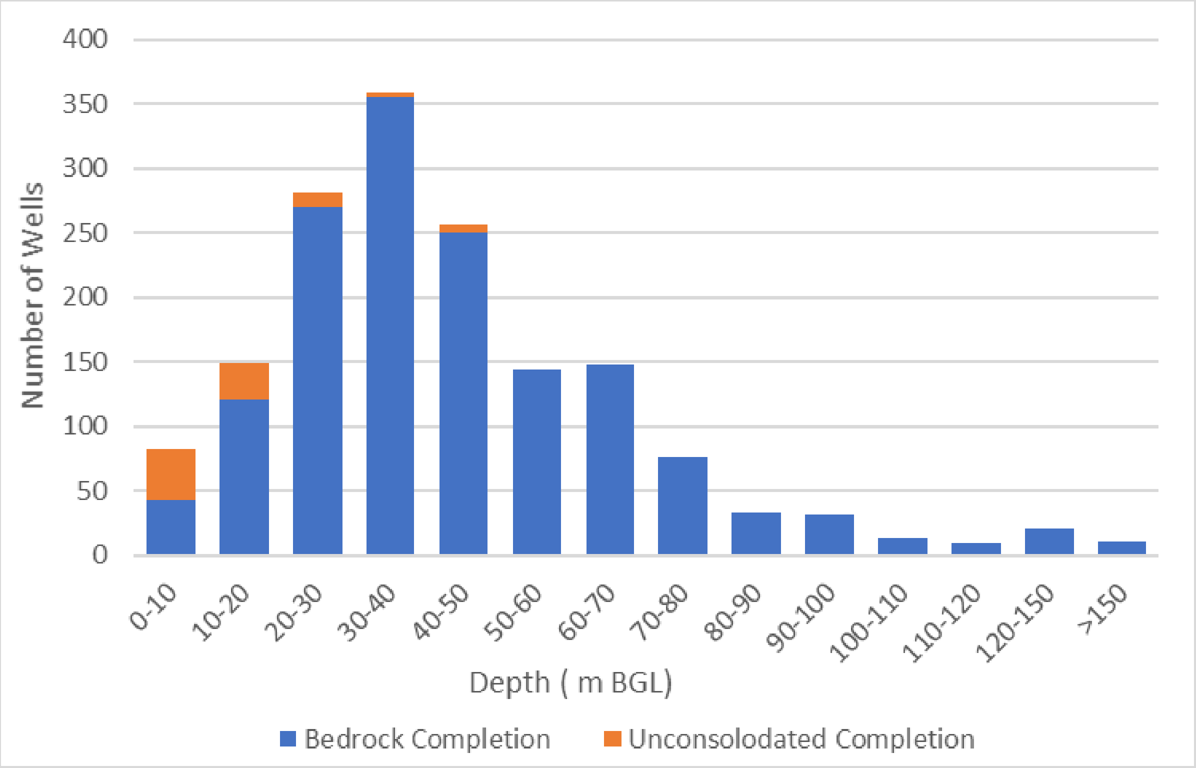
The base of groundwater protection (BGP) is an estimate of the elevation of the base of the geological formation in which the groundwater is deemed useable with a total dissolved solids (TDS) concentration of less than 4,000 mg/L. West of the RAA, the BGP is defined as the base of the Paskapoo Formation; however, because the RAA lies within the disturbed belt of the Rocky Mountains, the AGS has set an arbitrary BGP of 600 m BGL.

Water well drillers records for groundwater wells completed in the RAA were queried from the Alberta Water Well Information Database (AWWID). A total of 2,140 unique well records were identified within the RAA. A number of well record types were removed from the raw data such as abandoned test holes, dry holes, piezometers, and seismic test holes, which are not reflective of groundwater use. A total of 1,708 water well drilling records remained after removing irrelevant data. The proposed use of the wells associated with the AWWID drilling records within the expanded were as follows:

- 1,458 for domestic use
- 71 for stock use
- 75 for domestic and stock use
- 15 for commercial purposes
- 16 for industrial purposes
- 5 for irrigation purposes
- 9 for municipal use
- 59 for unknown use

Water well depths ranged from 1.5 m to 246 m BGL. Figure A.9 presents a histogram of the total depth recorded on the drilling records. The number of wells completed in bedrock and unconsolidated units are also summarized in the figure. A total of 83 well records were for wells installed in unconsolidated deposits with completion depths ranging from 0 to 50 m BGL. It is worth noting that many of the wells will not currently be in use considering the average age of the records is 33 years and some are as old as 80 years. Additional detail and mapping regarding groundwater use are presented in the Hydrogeology Technical Data Report (TDR) Update (Stantec 2019).

Figure A.9 Histogram of Water Well Depth in the RAA



A.5 Implications for the Groundwater Monitoring Plan

The following factors were considered during development of the GWMP based on the hydrostratigraphic framework and summary of groundwater use presented above:

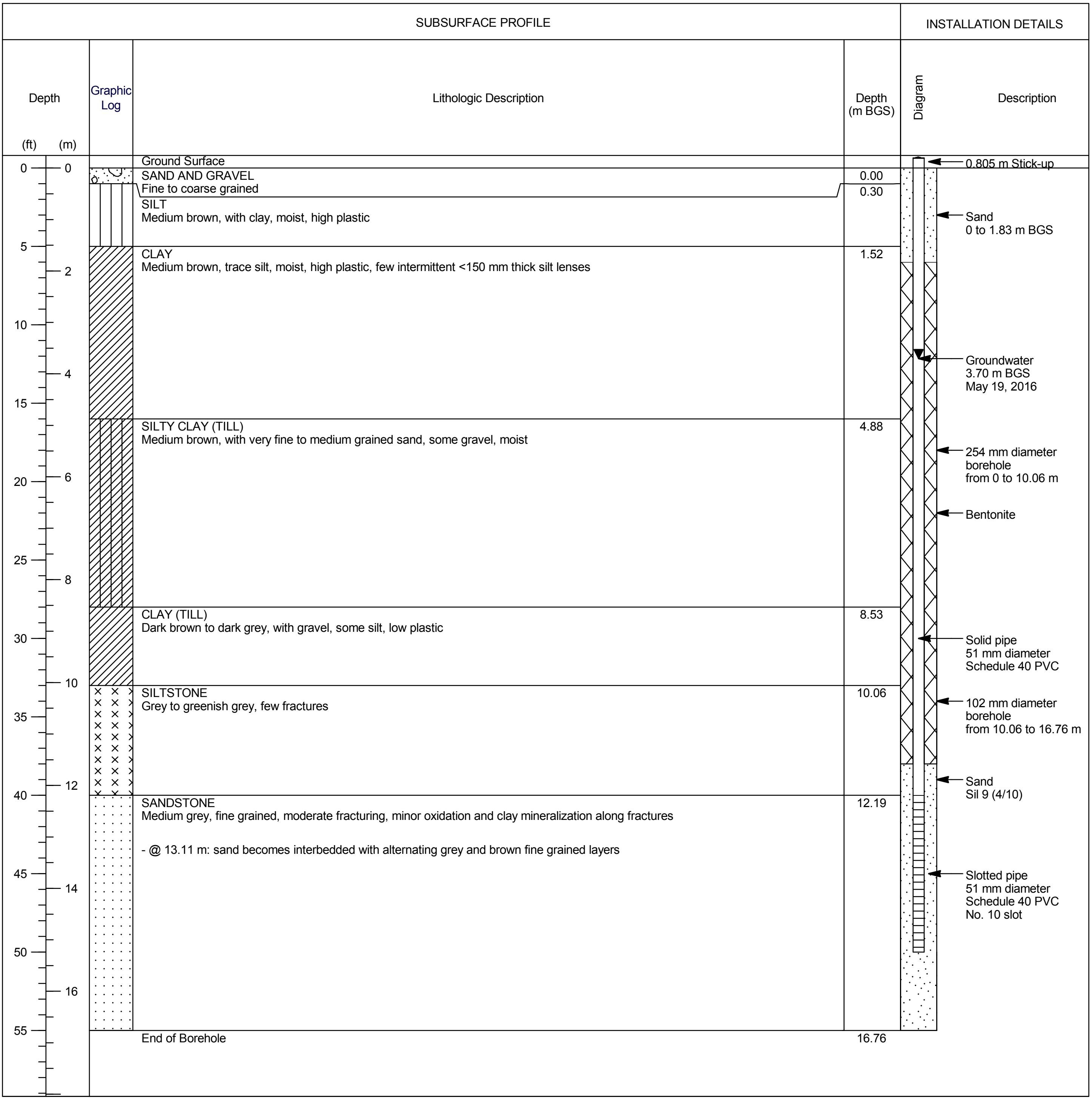
- The hydrogeologic setting in the RAA is complex and consists of a series of unconsolidated deposits overlying bedrock. The GWMP describes monitoring of both unconsolidated and bedrock hydrostratigraphic units.
- The distribution of the unconsolidated units is highly variable across the RAA, but generally consist of low permeability (10^{-10} to 10^{-6} m/s) deposits in areas outside of river valleys. Higher permeability deposits are generally confined to the Elbow River valley and within some of the smaller tributary valleys. The GWMP considers the variable distribution of the unconsolidated deposits and describes monitoring in both permeable units (potential aquifers) and low permeability units (aquitards).

- Bedrock in the RAA is also variable and heterolithic, generally consisting of interbedded sequences of fine-and-coarse grained deposits varying from mudstones to sandstones. When the position of monitoring wells is better constrained, the completion interval for the monitoring well will need to carefully consider the lithology encountered during drilling/installation to reflect the uppermost interval most likely to be used domestic/agricultural use.
- Groundwater use for domestic and agricultural purposes in the RAA is sourced from both unconsolidated and bedrock units. However, use from the bedrock units dominates, particularly for wells with depths greater than 10 m. As such, the draft GWMP considers monitoring of the deeper bedrock units, particularly in areas distant from Project infrastructure, such that unexpected change in groundwater levels can be detected in hydrostratigraphic units currently being used for domestic and agricultural purposes.

Appendix B Borehole Logs

Monitoring Well: MW16-1-15 (GW1)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	19-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-33327.478
Contractor:	All Service Drilling Inc.	**Northing:**	5659967.274



Lithologic Description	Depth (m BGS)
Ground Surface	
SAND AND GRAVEL Fine to coarse grained	0.00
SILT Medium brown, with clay, moist, high plastic	0.30
CLAY Medium brown, trace silt, moist, high plastic, few intermittent <150 mm thick silt lenses	1.52
SILTY CLAY (TILL) Medium brown, with very fine to medium grained sand, some gravel, moist	4.88
CLAY (TILL) Dark brown to dark grey, with gravel, some silt, low plastic	8.53
SILTSTONE Grey to greenish grey, few fractures	10.06
SANDSTONE Medium grey, fine grained, moderate fracturing, minor oxidation and clay mineralization along fractures - @ 13.11 m: sand becomes interbedded with alternating grey and brown fine grained layers	12.19
End of Borehole	16.76

Installation details – Description:

0.805 m Stick-up

Sand
0 to 1.83 m BGS

Groundwater
3.70 m BGS
May 19, 2016

254 mm diameter
borehole
from 0 to 10.06 m

Bentonite

Solid pipe
51 mm diameter
Schedule 40 PVC

102 mm diameter
borehole
from 10.06 to 16.76 m

Sand
Sil 9 (4/10)

Slotted pipe
51 mm diameter
Schedule 40 PVC
No. 10 slot

Screen Interval:	12.19 - 15.24 m BGS
Sand Pack Interval:	11.58 - 16.76 m BGS
Well Seal Interval:	1.83 - 11.58 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-1-15

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-2-6 (GW2)

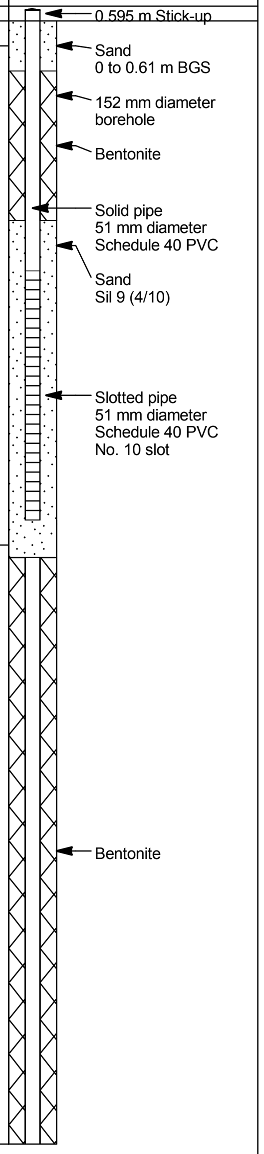
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	26-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31947.274
Contractor:	All Service Drilling Inc.	**Northing:**	5659623.886

SUBSURFACE PROFILE

Lithologic Description	Depth (m BGS)
Ground Surface	
SOIL Black to dark brown, moist	0.00
CLAY Brown to beige, some silt, moist, high plastic - @ 2.13 m: becomes mottled beige and grey, silt content increases to 15-30% - @ 3.66 m: trace gravel and coal present	0.30
SILT (TILL) Light brown, some fine grained sand stringers, with gravel and clay, moist, low plastic - @ 10.67 m: grades to gravelly silt	6.40
End of Borehole	13.72

Depth (ft) (m): 0, 5, 10, 15, 20, 25, 30, 35, 40, 45 ft; 0, 2, 4, 6, 8, 10, 12, 14 m

INSTALLATION DETAILS



Screen Interval: 3.05 - 6.10 m BGS
Sand Pack Interval: 2.44 - 6.55 m BGS
Well Seal Interval: 6.55 - 13.72 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-2-6

Stantec

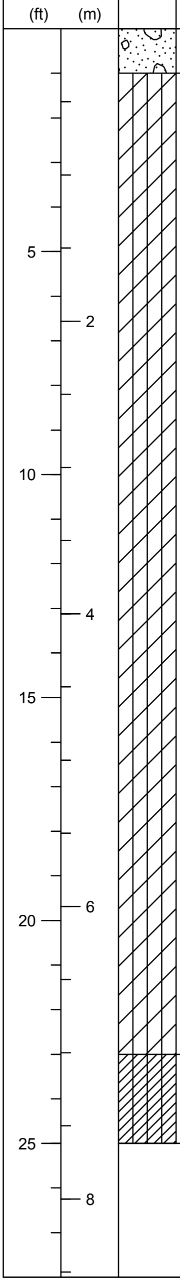
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-3-7 (GW3)

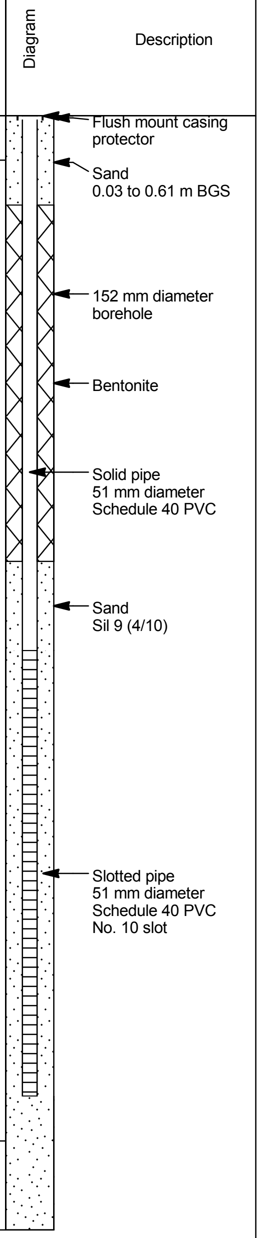
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31904.435
Contractor:	All Service Drilling Inc.	**Northing:**	5659073.461

SUBSURFACE PROFILE

INSTALLATION DETAILS



Lithologic Description	Depth (m BGS)
Ground Surface	
SAND AND GRAVEL (FILL)	0.00
CLAY AND SILT Medium brown, moist, medium plastic - @ 1.83 m: silt content decreases to 30-40%, high plastic - from 5.18 to 6.10 m: layer of silt with clay, wet	0.30
SILTY CLAY (TILL) Medium brown, some very fine grained sand, with gravel, dry to moist, low to medium plastic	7.01
End of Borehole	7.62



Screen Interval: 3.66 - 6.71 m BGS
Sand Pack Interval: 3.05 - 7.62 m BGS
Well Seal Interval: 0.61 - 3.05 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-3-7

Drawn By/Checked By: M. Kuhl / D. King

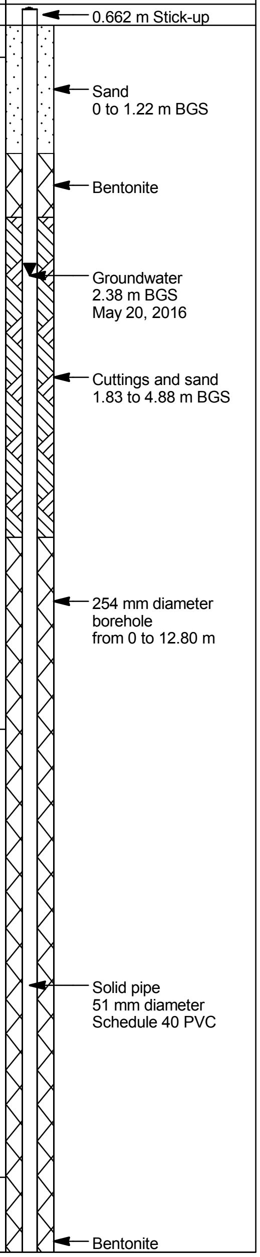
Monitoring Well: MW16-4-22 (GW4)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	20-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32259.324
Contractor:	All Service Drilling Inc.	**Northing:**	5658717.399

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Lithologic Description	Depth (m BGS)
0	0	Ground Surface TOPSOIL	0.00
		CLAY Light to medium brown, with silt, moist, high plastic	0.30
5	2		
10	4		
15			
20	6		
		SILTY CLAY (TILL) Medium brown, some very fine to fine sand, with gravel, moist, high plastic	6.71
25	8	- @ 8.23 m: trace coal present	
30		- @ 9.45 m: sand component increases to 15-30% very fine to fine sand	
35	10		
		SILT AND CLAY (TILL) With very fine to fine sand, with gravel, dry to slighly moist, friable	10.97

INSTALLATION DETAILS



Screen Interval: 18.59 - 21.64 m BGS
Sand Pack Interval: 18.29 - 21.95 m BGS
Well Seal Interval: 21.95 - 22.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

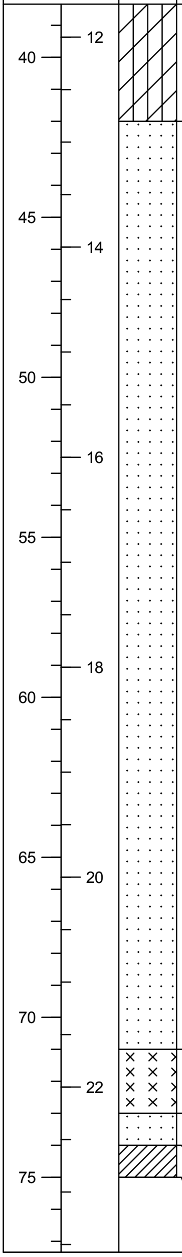
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-4-22

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-4-22 (GW4)

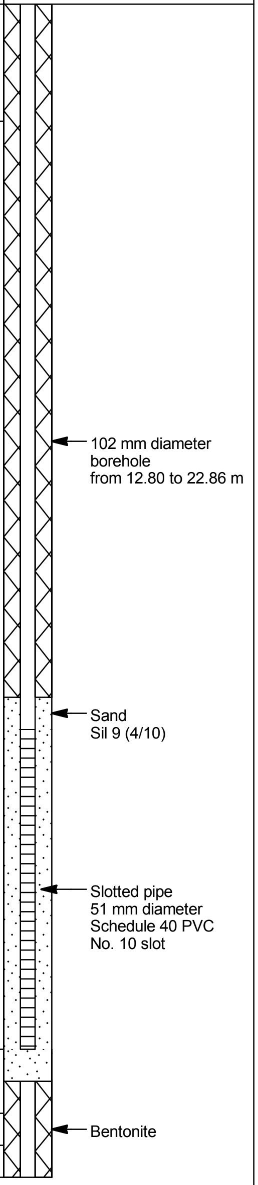
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	20-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32259.324
Contractor:	All Service Drilling Inc.	**Northing:**	5658717.399

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
SILT AND CLAY (TILL) With very fine to fine sand, with gravel, dry to slighly moist, friable	
SANDSTONE Medium grey, very fine to fine grained, few fractures, some oxidation on fracture surfaces, no structure, massive - @ 14.94 m: sandstone becomes slightly banded with alternating light grey and dark grey layers, no oxidation present - @ 17.98 m: medium grained layers interbedded with finer grained layers become present - @ 20.12 m: sand begins to coarsen to medium grained sandstone, some clay along fractures	12.80
SILTSTONE Dark grey, highly fractured and altered - @ 21.95 m: clay mineralization along fractures	21.64
SANDSTONE Medium grey, very fine grained	22.25
CLAYSTONE Dark grey to black, few fractures	22.56
End of Borehole	22.86

INSTALLATION DETAILS



Screen Interval: 18.59 - 21.64 m BGS
Sand Pack Interval: 18.29 - 21.95 m BGS
Well Seal Interval: 21.95 - 22.86 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

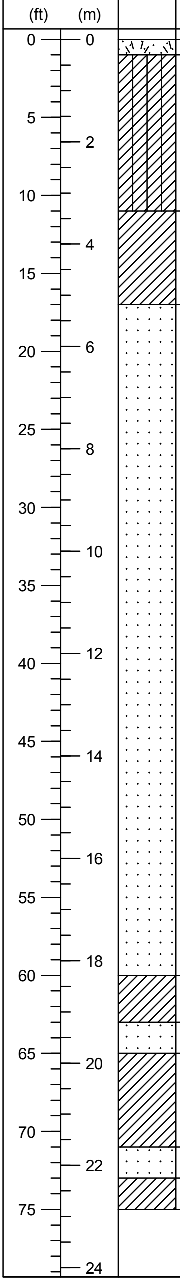
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-4-22

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-5-11 (GW5)

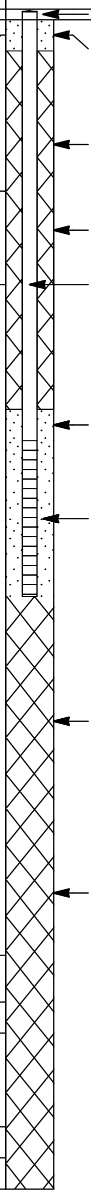
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	09-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31863.152
Contractor:	All Service Drilling Inc.	**Northing:**	5658164.716

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILTY CLAY (TILL) Medium brown, some very fine grained sand, with gravel, moist, low plastic	0.30
CLAY Mottled brown and grey, some gravel, some silt, moist, high plastic	3.35
SANDSTONE brown, very fine to fine grained, few fractures with minor oxidation, massive - @ 5.49 : oxidized clay infill in 50 mm fracture - @ 7.01 m: becomes silty, finer grained, with dark and light brown cross-bedding - @ 8.23 m: 50 mm coal seam, sandstone becomes massive again, few irregular coal stringers - @ 8.84 m: coarsens to a fine grained sandstone, very few fractures, weakly bedded - @ 15.24 m: exhibits black and brown fine planar laminated beds, becomes very fine grained - @ 16.15 m: beds become irregular and highly deformed, exhibits minor displacement along fractures, microfolds in some bedding	5.18
CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle - from 18.90 to 19.20 m: few 13 to 38 mm thick coal seams	18.29
SANDSTONE Grey, fine grained, becomes finer towards bottom of unit, weakly bedded	19.20
CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle	19.81
SANDSTONE Green to greyish green, very fine grained, some shell fragments	21.64
CLAYSTONE Dark grey, highly fractured, altered to clay along fractures, brittle	22.25
End of Borehole	22.86

INSTALLATION DETAILS



Description

- 0.671 m Stick-up
- Sand
0 to 0.61 m BGS
- 152 mm diameter borehole from 0 to 5.18 m
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- 102 mm diameter borehole from 5.18 to 22.86 m
- Bentonite

Screen Interval:	8.23 - 11.28 m BGS
Sand Pack Interval:	7.62 - 11.28 m BGS
Well Seal Interval:	0.61 - 7.62 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

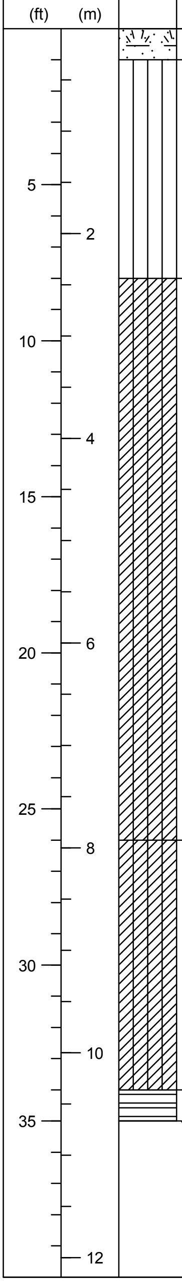
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-5-11

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-6-11 (GW6S)

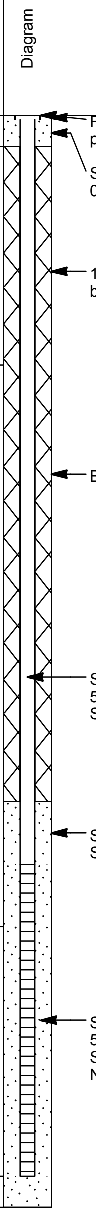
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	26-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31100.486
Contractor:	All Service Drilling Inc.	**Northing:**	5658135.293

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILT Light brown, some clay, moist to wet - @ 1.22 m: clay content begins to increase	0.30
SILTY CLAY Light brown to light grey, medium to high plastic, mottled - @ 4.88 m: clay content decreases to 15-30%, high plastic	2.44
SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic - @ 9.14 m: silt content increases to > 40%	7.92
CLAYSTONE Light to medium grey, dry, medium to high plastic when wetted	10.36
End of Borehole	10.67

INSTALLATION DETAILS



Description

- Flush mount casing protector
- Sand 0.04 to 0.30 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval:	7.32 - 10.36 m BGS
Sand Pack Interval:	6.71 - 10.67 m BGS
Well Seal Interval:	0.30 - 6.71 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-6-11

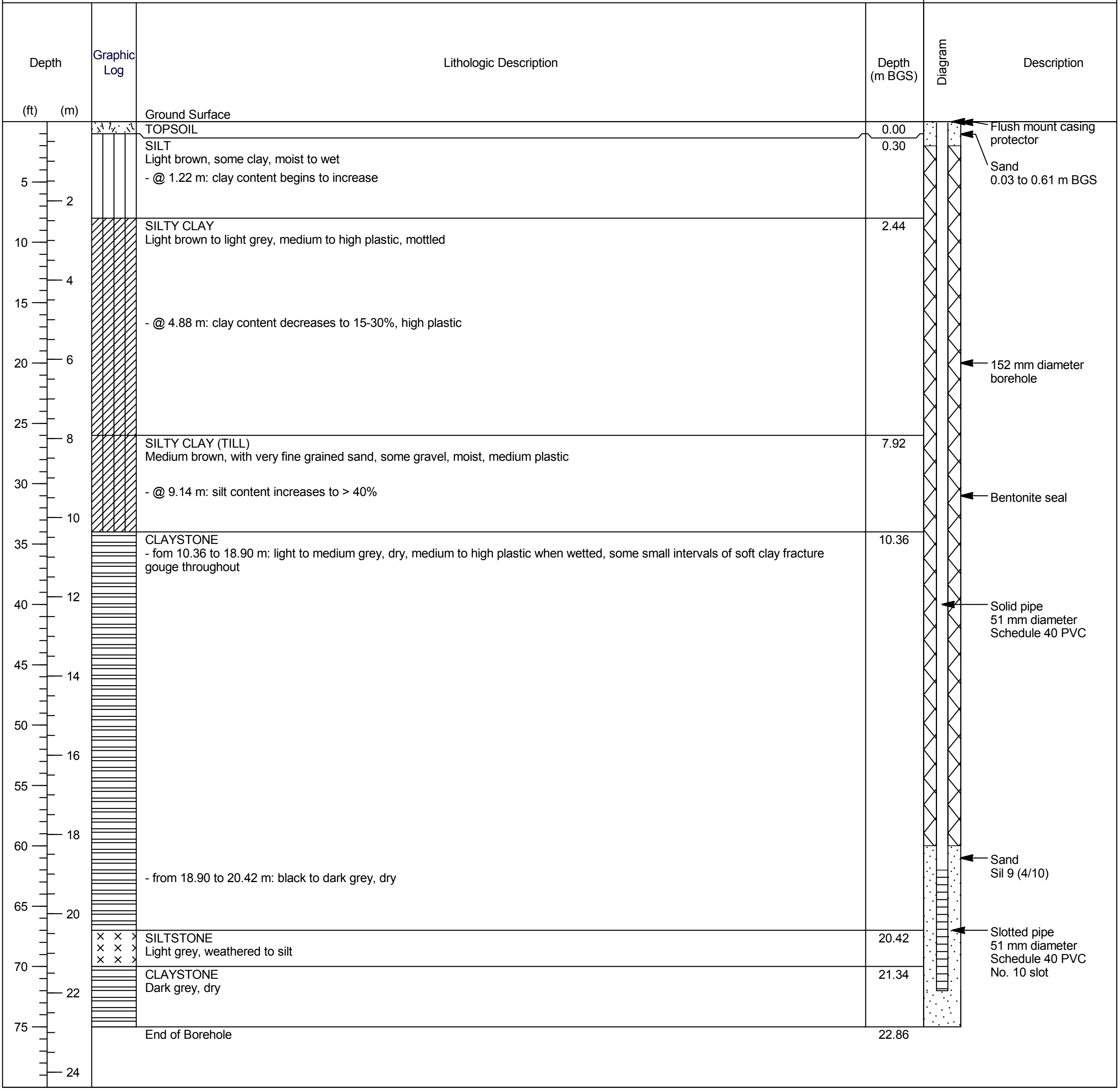
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-6-20 (GW6D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	26-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31100.423
Contractor:	All Service Drilling Inc.	**Northing:**	5658133.938

SUBSURFACE PROFILE

INSTALLATION DETAILS



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILT Light brown, some clay, moist to wet - @ 1.22 m: clay content begins to increase	0.30
SILTY CLAY Light brown to light grey, medium to high plastic, mottled - @ 4.88 m: clay content decreases to 15-30%, high plastic	2.44
SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic - @ 9.14 m: silt content increases to > 40%	7.92
CLAYSTONE - fom 10.36 to 18.90 m: light to medium grey, dry, medium to high plastic when wetted, some small intervals of soft clay fracture gouge throughout - from 18.90 to 20.42 m: black to dark grey, dry	10.36
SILTSTONE Light grey, weathered to silt	20.42
CLAYSTONE Dark grey, dry	21.34
End of Borehole	22.86

Description

- Flush mount casing protector
- Sand
0.03 to 0.61 m BGS
- 152 mm diameter borehole
- Bentonite seal
- Solid pipe
51 mm diameter
Schedule 40 PVC
- Sand
Sil 9 (4/10)
- Slotted pipe
51 mm diameter
Schedule 40 PVC
No. 10 slot

Screen Interval:	18.90 - 21.95 m BGS
Sand Pack Interval:	18.29 - 22.86 m BGS
Well Seal Interval:	0.61 - 18.29 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-6-20

Stantec

Drawn By/Checked By: M. Kuhl / D. King

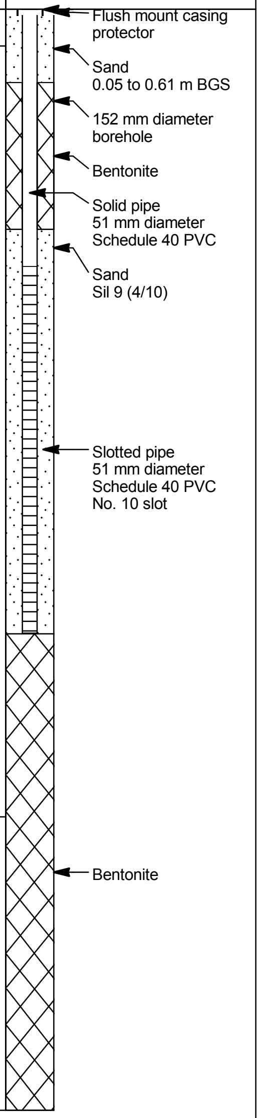
Monitoring Well: MW16-7-5 (GW7)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	28-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31098.792
Contractor:	All Service Drilling Inc.	**Northing:**	5658895.242

SUBSURFACE PROFILE

Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILTY CLAY Light to medium brown, moist, medium plastic - from 4.57 to 5.18 m: trace fine grained sand, some gravel	0.30
SILTY CLAY (TILL) With very fine to fine grained sand (oxidized), with gravel, dry to moist, low plastic	6.71
End of Borehole	9.14

INSTALLATION DETAILS



Screen Interval: 2.13 - 5.18 m BGS
Sand Pack Interval: 1.83 - 5.19 m BGS
Well Seal Interval: 0.61 - 1.83 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-7-5

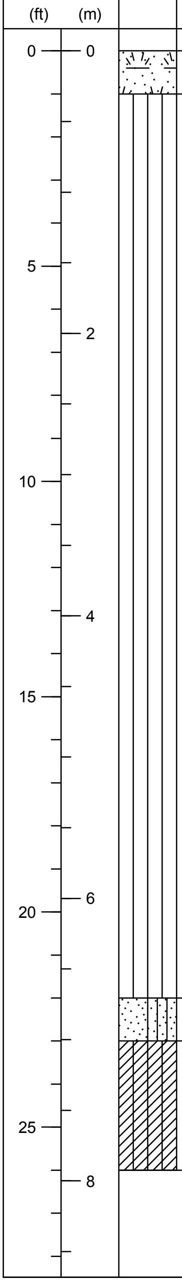
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-8-8 (GW8S)

Project: Springbank Off-Stream Reservoir Project (SR1)
Client: Alberta Transportation
Location: Rocky View County, Alberta
Number: 110773396
Field investigator: D. Nisbet
Contractor: All Service Drilling Inc.

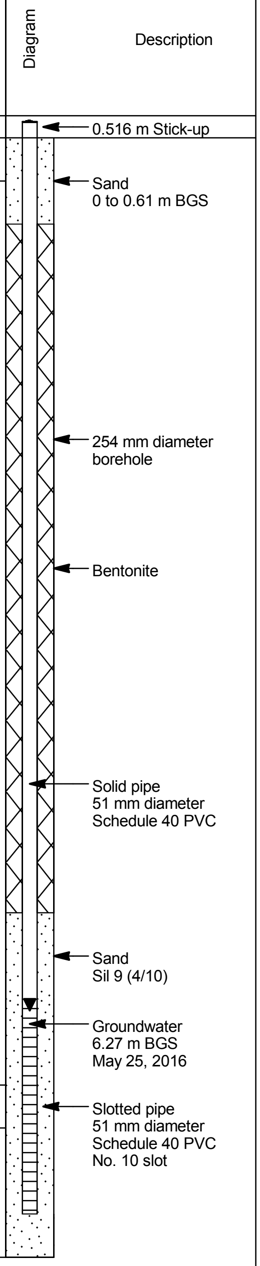
Drilling method: Hollow-stem auger (Track mounted)
Date started/completed: 25-May-2016
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: -30875.717
Northing: 5659641.119

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
SOIL Black, dry	0.00
SILT (TILL) Brown to light brown, some gravel, with clay, dry, low plastic, friable - @ 2.44 m: some very fine grained sand seams become present - @ 3.35 m: becomes moist - @ 5.79 m: red to orange, trace oxidized silt stringers	0.30
SILT AND SAND Brown, very fine grained, saturated	6.71
SILTY CLAY (TILL) Light to medium brown, with gravel, dry, low plastic	7.01
End of Borehole	7.92

INSTALLATION DETAILS



Screen Interval:	6.10 - 7.62 m BGS
Sand Pack Interval:	5.49 - 7.92 m BGS
Well Seal Interval:	0.61 - 5.49 m BGS

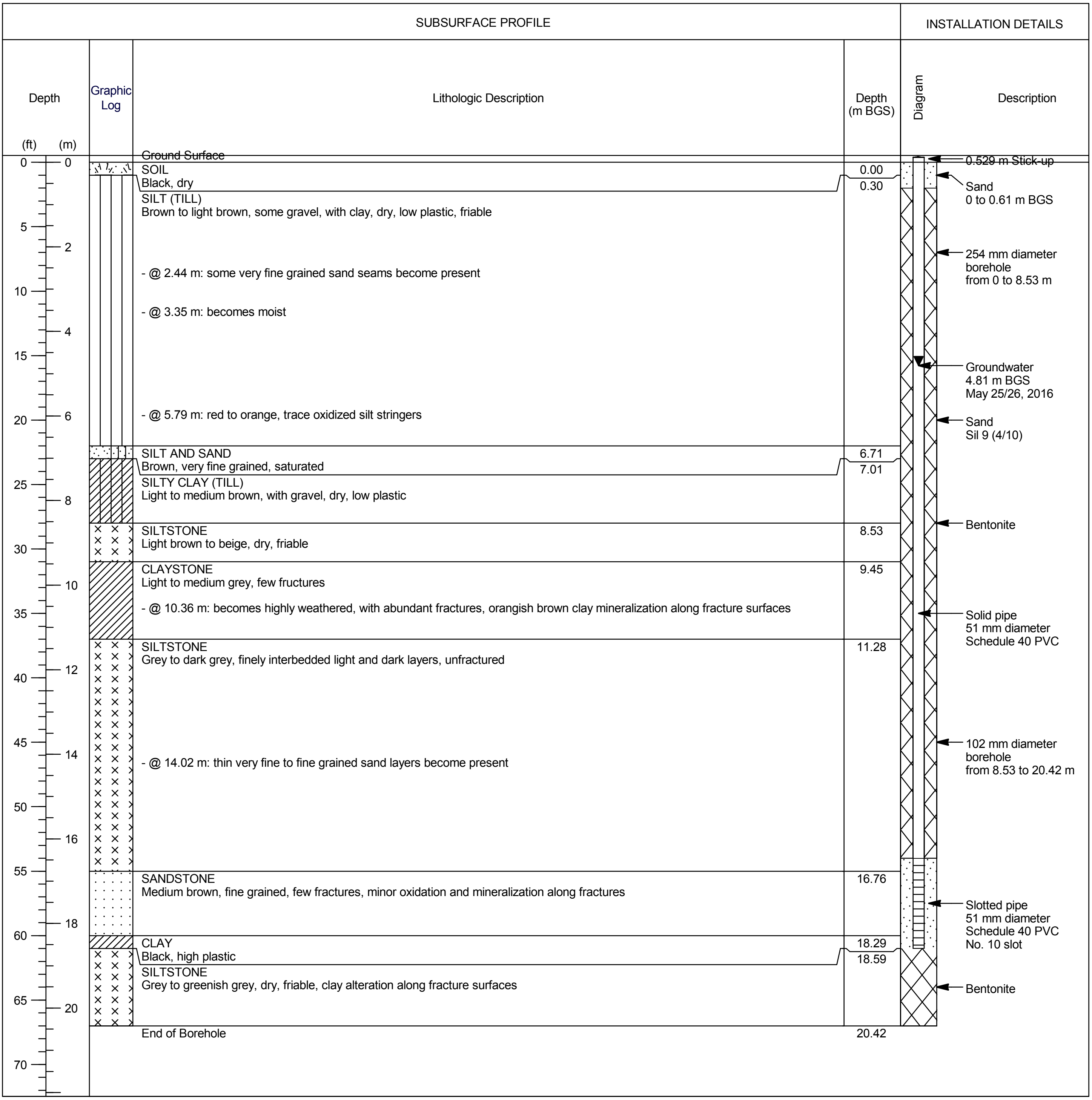
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-8-8

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-8-19 (GW8D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	25-May-2016 / 26-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30877.454
Contractor:	All Service Drilling Inc.	**Northing:**	5659641.18



Lithologic Description	Depth (m BGS)
Ground Surface	
SOIL Black, dry	0.00
SILT (TILL) Brown to light brown, some gravel, with clay, dry, low plastic, friable - @ 2.44 m: some very fine grained sand seams become present - @ 3.35 m: becomes moist - @ 5.79 m: red to orange, trace oxidized silt stringers	0.30
SILT AND SAND Brown, very fine grained, saturated	6.71
SILTY CLAY (TILL) Light to medium brown, with gravel, dry, low plastic	7.01
SILTSTONE Light brown to beige, dry, friable	8.53
CLAYSTONE Light to medium grey, few fructures - @ 10.36 m: becomes highly weathered, with abundant fractures, orangish brown clay mineralization along fracture surfaces	9.45
SILTSTONE Grey to dark grey, finely interbedded light and dark layers, unfractured - @ 14.02 m: thin very fine to fine grained sand layers become present	11.28
SANDSTONE Medium brown, fine grained, few fractures, minor oxidation and mineralization along fractures	16.76
CLAY Black, high plastic	18.29
SILTSTONE Grey to greenish grey, dry, friable, clay alteration along fracture surfaces	18.59
End of Borehole	20.42

Installation Details – Description:

- 0.529 m Stick-up
- Sand
0 to 0.61 m BGS
- 254 mm diameter borehole from 0 to 8.53 m
- Groundwater 4.81 m BGS May 25/26, 2016
- Sand Sil 9 (4/10)
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- 102 mm diameter borehole from 8.53 to 20.42 m
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot
- Bentonite

Screen Interval: 16.46 - 18.59 m BGS
Sand Pack Interval: 16.46 - 18.59 m BGS
Well Seal Interval: 0.61 - 16.46 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

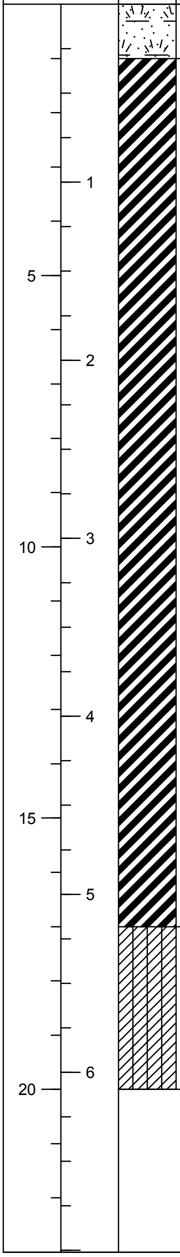
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-8-19

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-9-6 (GW9)

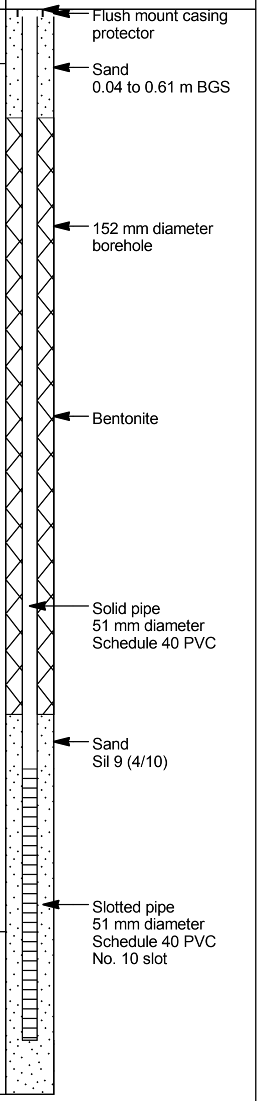
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	02-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30236.405
Contractor:	All Service Drilling Inc.	**Northing:**	5659076.781

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
CLAY Light to medium brown, with silt, moist, high plastic, mottled - below 3.66 m: some seams of very fine grained sand (oxidized) - from 4.57 to 5.18 m: silt content increases to > 40%	0.30
SILTY CLAY (TILL) with very fine to fine grained sand, with gravel	5.18
End of Borehole	6.10

INSTALLATION DETAILS



Screen Interval: 4.27 - 5.79 m BGS
Sand Pack Interval: 3.96 - 6.10 m BGS
Well Seal Interval: 0.61 - 3.96 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-9-6

Stantec

Drawn By/Checked By: M. Kuhl / D. King

Sheet 1 of 1

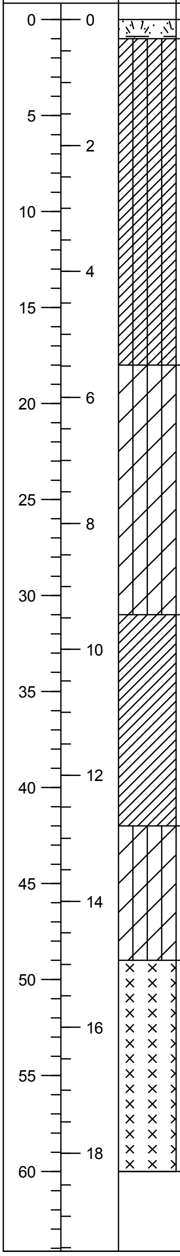
STANTEC BOREHOLE AND WELL V2 110773396_NEW.GPJ STANTEC - DATA TEMPLATE.GDT 17/1/16 MKUHL

Monitoring Well: MW16-10-15 (GW10)

Project: Springbank Off-Stream Reservoir Project (SR1)
Client: Alberta Transportation
Location: Rocky View County, Alberta
Number: 110773396
Field investigator: D. Nisbet
Contractor: All Service Drilling Inc.

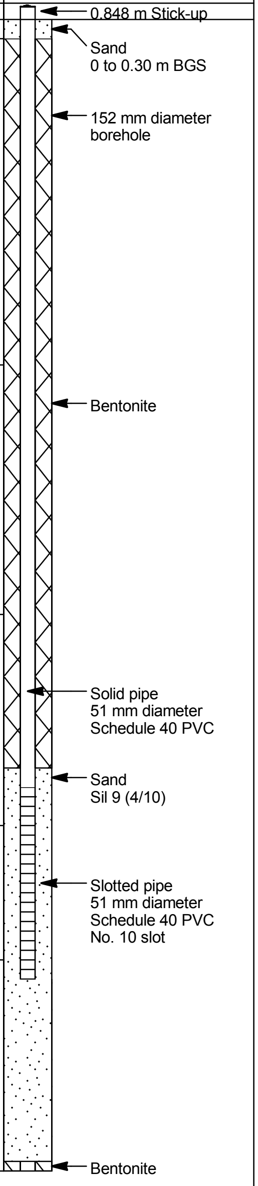
Drilling method: Solid-stem auger (Track mounted)
Date started/completed: 10-Aug-2016
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: -30461.405
Northing: 5658478.167

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILTY CLAY Light to medium brown, moist, medium to high plastic, mottled - below 3.66 m: some very fine grained sand, some gravel	0.30
CLAYEY SILT Light grey to medium brown, moist, high plastic, mottled	5.49
CLAY (TILL) Medium brown, some very fine grained sand, some gravel, with silt, dry to moist, medium plastic - @ 10.97 m: gravel content increases to 15-30%	9.45
CLAYEY SILT (TILL) Medium to dark grey, with very fine grained sand, some gravel, dry, low plastic	12.80
SILTSTONE Light to medium grey, dry	14.94
End of Borehole	18.29

INSTALLATION DETAILS



Screen Interval: 12.19 - 15.24 m BGS
Sand Pack Interval: 11.89 - 18.14 m BGS
Well Seal Interval: 18.14 - 18.29 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-10-15

Drawn By/Checked By: M. Kuhl / D. King

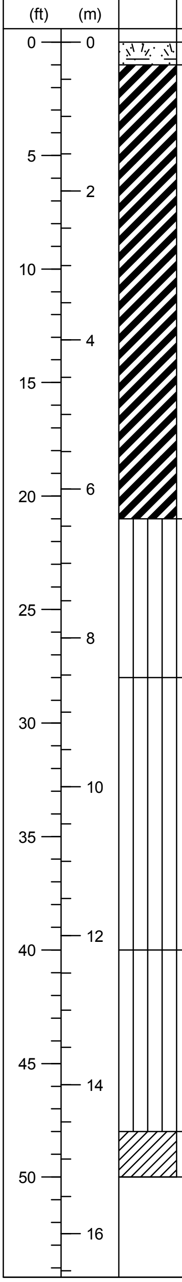
Monitoring Well: MW16-11-15 (GW11)

Project: Springbank Off-Stream Reservoir Project (SR1)
Client: Alberta Transportation
Location: Rocky View County, Alberta
Number: 110773396
Field investigator: D. Nisbet
Contractor: All Service Drilling Inc.

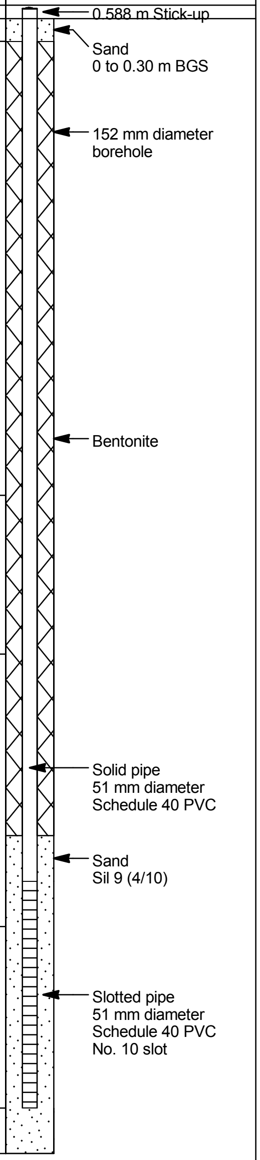
Drilling method: Solid-stem auger (Track mounted)
Date started/completed: 30-Jun-2016
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: -30269.84
Northing: 5657742.889

SUBSURFACE PROFILE

Depth (m BGS)	Lithologic Description
	Ground Surface
0.00	TOPSOIL
0.30	CLAY Light to medium brown, with silt, moist, high plastic, mottled - @ 2.13 m: silt content increases to 30-40%, mottled brown and grey - @ 2.74 m: silt content decreases back to 15-30% - @ 5.79 m: clay content begins to decrease towards bottom of interval
6.40	SILT Medium brown, some clay, moist
8.53	SILT (TILL) Medium brown, with fine to medium grained sand, with gravel, some clay, moist
12.19	SILT Medium brown, some very fine grained sand, moist to wet
14.63	CLAY (TILL) Medium to dark grey, some very fine grained sand, some gravel, with silt, low plastic
15.24	End of Borehole



INSTALLATION DETAILS



Screen Interval:	11.58 - 14.63 m BGS
Sand Pack Interval:	10.97 - 15.24 m BGS
Well Seal Interval:	0.30 - 10.97 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-11-15

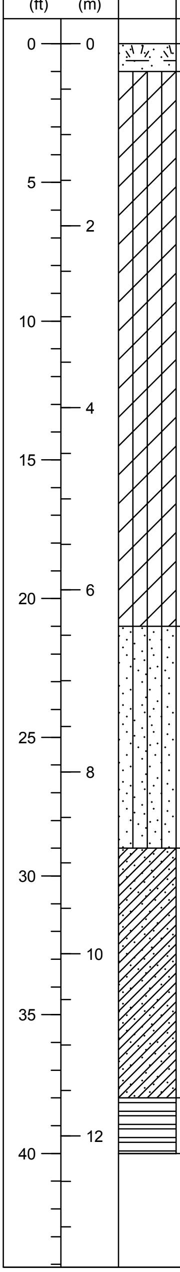
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-12-3 (GW12)

Project: Springbank Off-Stream Reservoir Project (SR1)
Client: Alberta Transportation
Location: Rocky View County, Alberta
Number: 110773396
Field investigator: D. Nisbet
Contractor: All Service Drilling Inc.

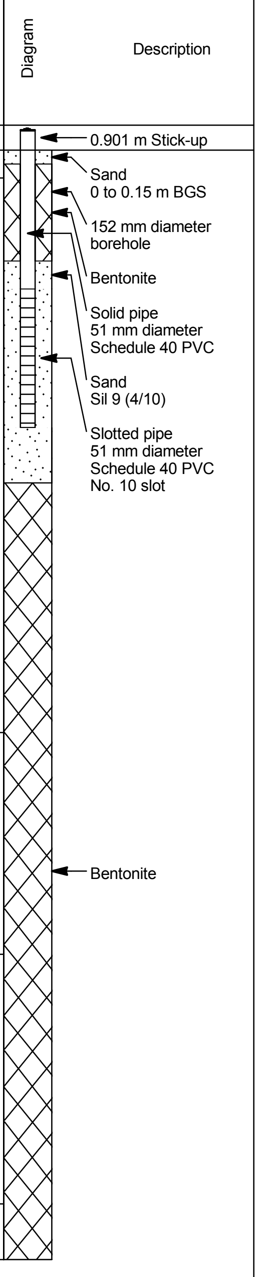
Drilling method: Solid-stem auger (Track mounted)
Date started/completed: 19-Aug-2016
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: -29160.284
Northing: 5657858.348

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
CLAYEY SILT (TILL) Medium brown, moist, high plastic - @ 1.83 m: sand content increases to 30-40%, fine to medium grained sand, some gravel - @ 2.74 m: sand content decreases to 15-30%	0.30
SANDY SILT (TILL) Medium brown, some gravel, with clay, dry to moist, crumbly	6.40
SANDY CLAY (TILL) Medium to dark grey, some silt, dry to moist	8.84
CLAYSTONE Light grey to brown, dry	11.58
End of Borehole	12.19

INSTALLATION DETAILS



Screen Interval: 1.52 - 3.05 m BGS
Sand Pack Interval: 1.22 - 3.66 m BGS
Well Seal Interval: 0.15 - 1.22 m BGS

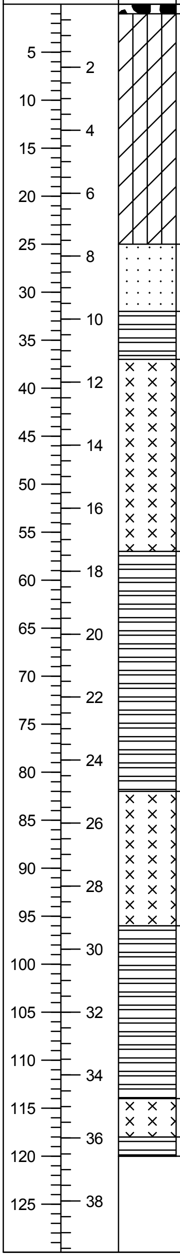
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-12-3

Monitoring Well: MW16-13-37 (GW13)

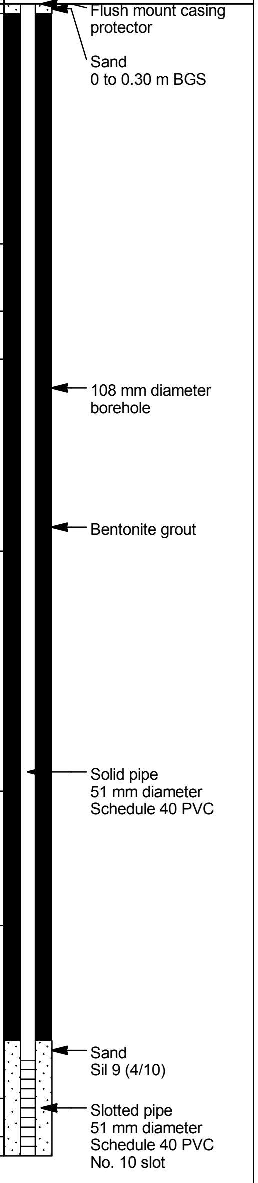
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	08-Aug-2016 / 09-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	n/a
Contractor:	All Service Drilling Inc.	**Northing:**	n/a

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
GRAVEL (FILL)	0.00
CLAYEY SILT (TILL) Mottled light and medium brown, some very fine grained sand (slightly oxidized), dry to moist, medium plastic - @ 2.13 m: some gravel - @ 3.66 m: sand content increases to 15-30%	0.30
SANDSTONE Very fine to fine grained, dry - from 9.14 to 9.75 m: saturated	7.62
CLAYSTONE Medium brown, dry - below 10.36 m: few moist zones weathered to clay	9.75
SILTSTONE Light grey, dry, friable - @ 12.80 m: saturated	11.28
CLAYSTONE Medium grey to brown, some zones weathered to clay, other zones dry, friable - below 20.12 m: dry	17.37
SILTSTONE Light to medium grey, in some zones fractured and weathered to silt	24.99
CLAYSTONE Light to medium grey, dry, some fractured and weathered zones below 31.70 m: completely dry	29.26
SILTSTONE Light grey, saturated	34.75
CLAYSTONE Light to medium grey	35.97
End of Borehole	36.58

INSTALLATION DETAILS



Screen Interval: 33.53 - 36.58 m BGS
Sand Pack Interval: 32.92 - 36.58 m BGS
Well Seal Interval: 0.30 - 32.92 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

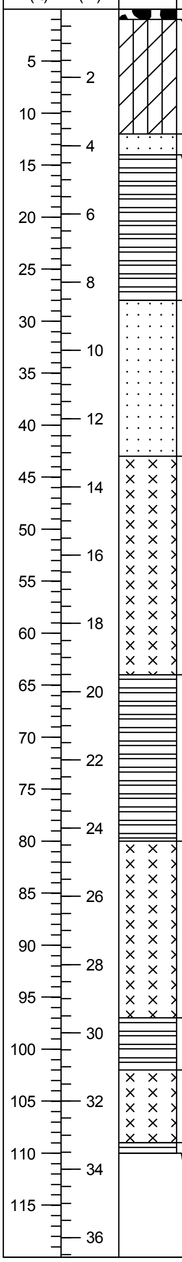
mm - millimetres
Coordinate System - NAD 1983 3TM 114

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-14-33 (GW14)

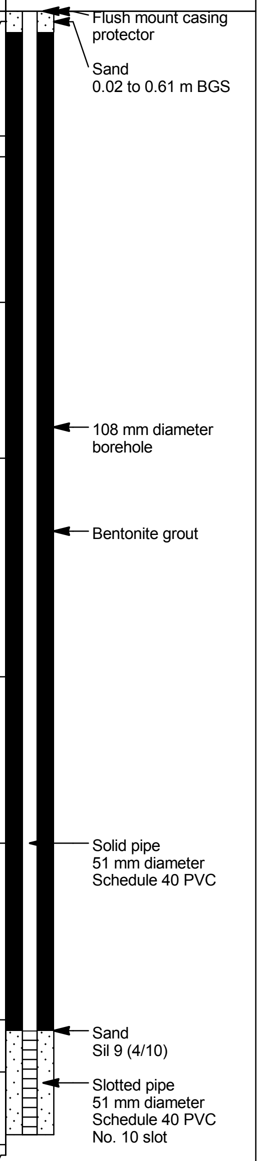
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	09-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-28592.189
Contractor:	All Service Drilling Inc.	**Northing:**	5659018.428

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
GRAVEL	0.00
CLAYEY SILT (TILL) Brown, some very fine grained sand, moist, medium plastic	0.30
SANDSTONE Light to medium brown, very fine grained sand, dry	3.66
CLAYSTONE Medium grey, dry	4.27
SANDSTONE Light to medium brown, very fine to fine grained	8.53
SILTSTONE Light grey, dry	13.11
CLAYSTONE Medium grey to brown, dry	19.51
SILTSTONE Medium brown, saturated	24.38
CLAYSTONE Light to medium grey	29.57
SILTSTONE Light to medium grey, saturated	31.09
CLAYSTONE Light to medium grey	33.22
End of Borehole	33.53

INSTALLATION DETAILS



Screen Interval:	29.88 - 32.93 m BGS
Sand Pack Interval:	29.87 - 32.93 m BGS
Well Seal Interval:	0.61 - 29.87 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

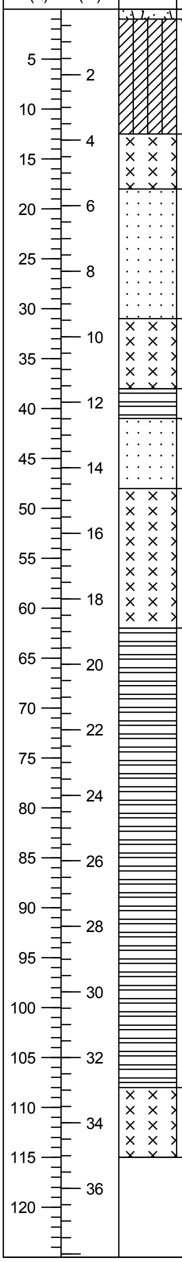
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-14-33

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-15-34 (GW15)

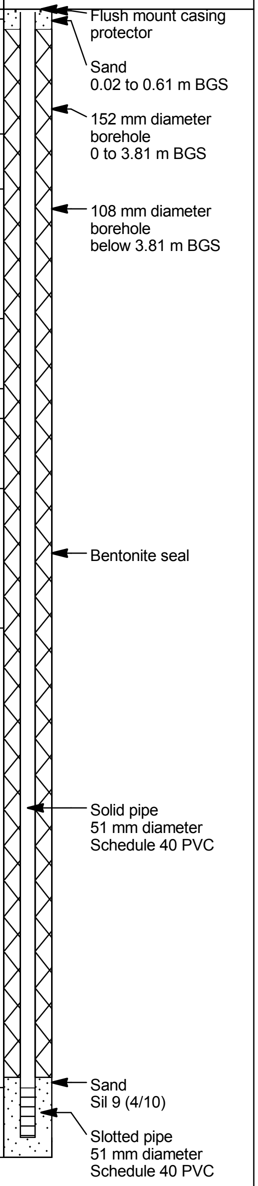
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem/ air rotary auger (Truck mounted)
Client:	Alberta Transportation	**Date started/completed:**	27-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-27818.819
Contractor:	All Service Drilling Inc.	**Northing:**	5658214.931

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILTY CLAY (TILL) Beige to light brown, moist, medium plastic - @ 1.83 m: some very fine grained sand stringers, some gravel	0.30
SILTSTONE Light beige, dry	3.81
SANDSTONE Light brown, very fine grained, dry	5.49
SILTSTONE Light beige, dry, few thin sandstone layers throughout	9.45
CLAYSTONE Medium grey, dry	11.58
SANDSTONE Light brown, very fine to fine grained, dry	12.50
SILTSTONE Light grey to light brown, dry - from 15.85 to 17.07 m: few seams of fine grained sand (oxidized)	14.63
CLAYSTONE Medium to dark grey, dry - below 26.82 m: some siltstone layers - @ 31.09 m: light grey	18.90
SILTSTONE Light to medium greenish grey - 32.92 m: saturated	32.92
End of Borehole	35.05

INSTALLATION DETAILS



Screen Interval: 32.92 - 34.44 m BGS
Sand Pack Interval: 32.61 - 35.05 m BGS
Well Seal Interval: 0.61 - 32.61 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-15-34

Stantec

Drawn By/Checked By: M. Kuhl / D. King

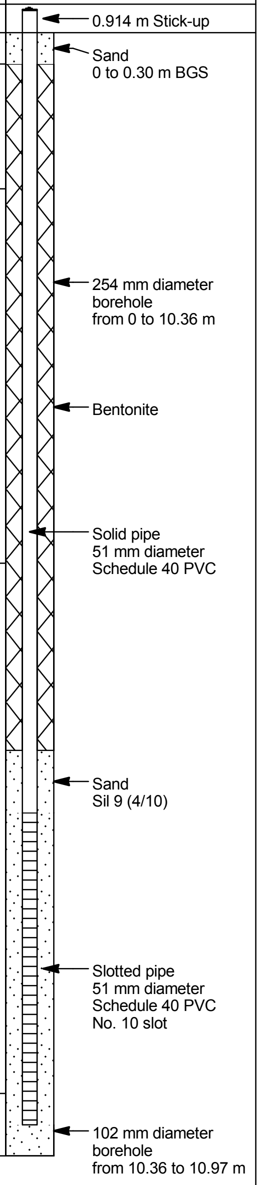
Monitoring Well: MW16-16-11 (DC-9)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	15-Apr-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-33453.625
Contractor:	All Service Drilling Inc.	**Northing:**	5655154.279

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			SOIL Some clay, organics	0.00
			SILT Brown to beige, minor very fine sand, some clay	0.30
5			CLAY Mottled beige to grey, minor silt, moist	1.52
17			CLAY (TILL) Some fine to very fine grained sand, some gravel, some silt, dry, friable	5.18
34			SANDSTONE Very fine grained, dry, weathered, crumbles under minor force	10.36
			End of Borehole	10.97

INSTALLATION DETAILS



Screen Interval: 7.62 - 10.67 m BGS
Sand Pack Interval: 7.01 - 10.97 m BGS
Well Seal Interval: 0.30 - 7.01 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

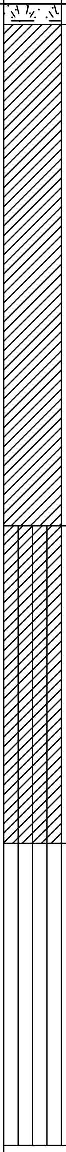
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-16-11

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-17-5 (DC-15)

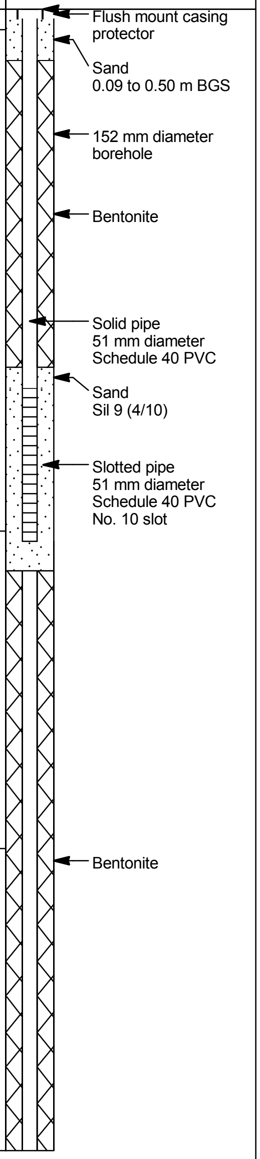
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-33226.452
Contractor:	All Service Drilling Inc.	**Northing:**	5656140.553

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
CLAY Mottled brown - from 0.2 to 2.5 m: minor silt, damp to moist, low to medium plastic - from 2.5 to 5.1 m: minor sand, some silt, moist, medium plastic	0.20
SILTY CLAY (TILL) Minor sand, trace gravel, damp, some oxidation	5.10
SILT Brown, minor fine grained sand, trace gravel, some clay, moist	8.20
End of Borehole	11.15

INSTALLATION DETAILS



Screen Interval: 3.70 - 5.20 m BGS
Sand Pack Interval: 3.50 - 5.49 m BGS
Well Seal Interval: 5.49 - 11.15 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-17-5

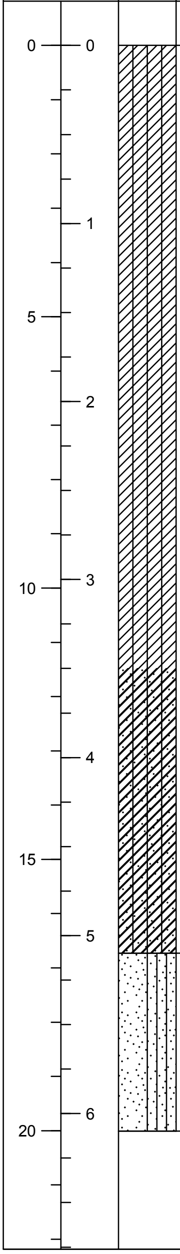
Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-18-6 (DC-21S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32406.586
Contractor:	All Service Drilling Inc.	**Northing:**	5656749.506

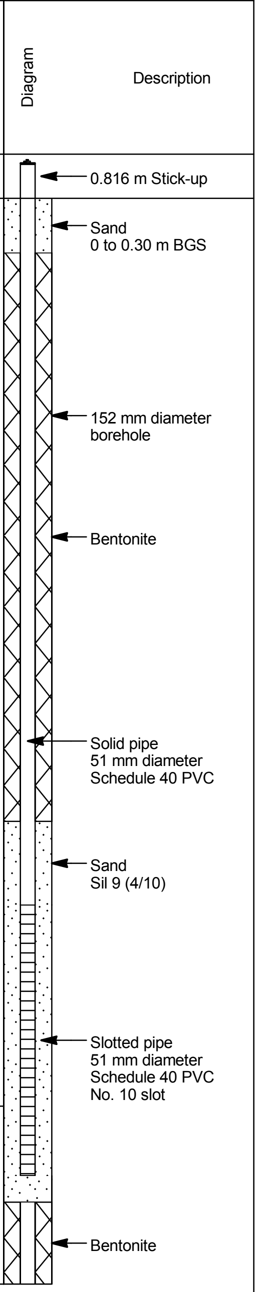
SUBSURFACE PROFILE

Depth (ft) (m)



Lithologic Description	Depth (m BGS)
Ground Surface	
SILTY CLAY (TILL) Brown, minor sand, moist, low plastic	0.00
SANDY CLAY - from 4.8 to 4.9 m: rafted bedrock	3.50
SAND AND SILT Light brown, medium grained, some gravel, moist	5.10
End of Borehole	6.10

INSTALLATION DETAILS



Screen Interval: 3.97 - 5.49 m BGS
Sand Pack Interval: 3.50 - 5.64 m BGS
Well Seal Interval: 5.64 - 6.10 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

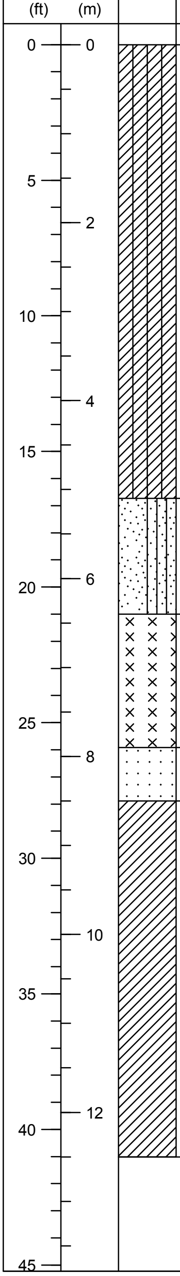
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-18-6

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-18-10 (DC-21D)

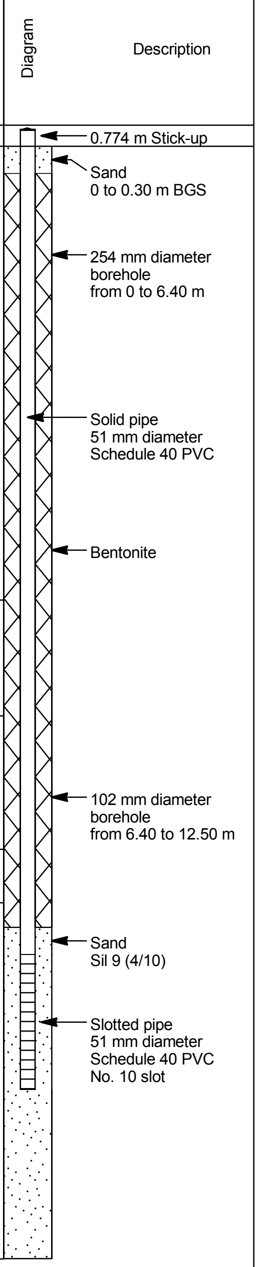
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	11-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32406.714
Contractor:	All Service Drilling Inc.	**Northing:**	5656750.577

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
SILTY CLAY (TILL) Brown, minor sand, moist, low plastic - beginning @ 3.5 m: becomes sandy clay - from 4.8 to 4.9 m: rafted bedrock	0.00
SAND AND SILT Light brown, medium grained, some gravel, moist	5.10
SILTSTONE Grey to greenish, some fractures, oxidation along fractures	6.40
SANDSTONE Grey to greenish, very fine grained, few fractures, oxidation on fratures surfaces	7.90
CLAYSTONE - from 8.5 to 8.63 m: brown, minor silt, moist, weathered to soft clay - from 8.63 to 12.5 m: grey, oxidized fractures - @ 9.24 m: fracture intensity increases - from 9.65 to 10.9 m: highly fractured, oxidation and some clay along fractures - from 10.36 to 10.63 m: altered to clay - @ 12.10 m: becomes hard/cemented	8.50
End of Borehole	12.50

INSTALLATION DETAILS



Screen Interval: 9.08 - 10.60 m BGS
Sand Pack Interval: 8.78 - 12.50 m BGS
Well Seal Interval: 0.30 - 8.78 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-18-10

Stantec

Drawn By/Checked By: M. Kuhl / D. King

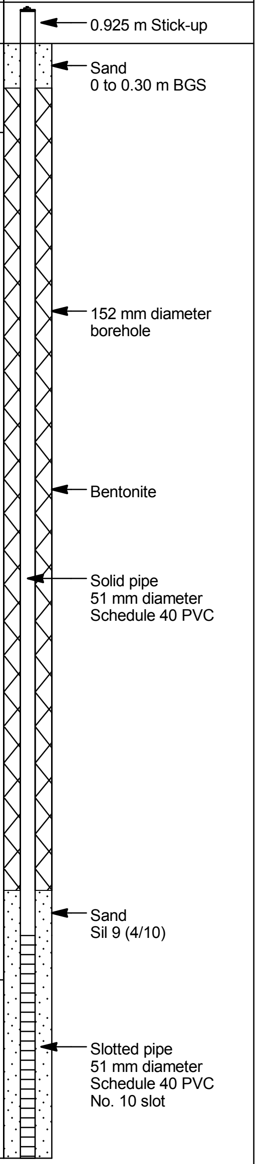
Monitoring Well: MW16-19-8 (DC-25S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger
Client:	Alberta Transportation	**Date started/completed:**	09-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31684.576
Contractor:	All Service Drilling Inc.	**Northing:**	5657262.245

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Lithologic Description	Depth (m BGS)
		Ground Surface	
0	0	TOPSOIL	0.00
		SILTY CLAY (TILL) Light to medium brown, some very fine grained sand, some gravel, few lenses of oxidized silt, moist, low plastic	0.61
		SANDY SILT Medium brown, very fine grained, wet	6.40
25		End of Borehole	7.62

INSTALLATION DETAILS



Screen Interval:	6.10 - 7.62 m BGS
Sand Pack Interval:	5.79 - 7.62 m BGS
Well Seal Interval:	0.30 - 5.79 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-19-8

Drawn By/Checked By: M. Kuhl / D. King

Sheet 1 of 1

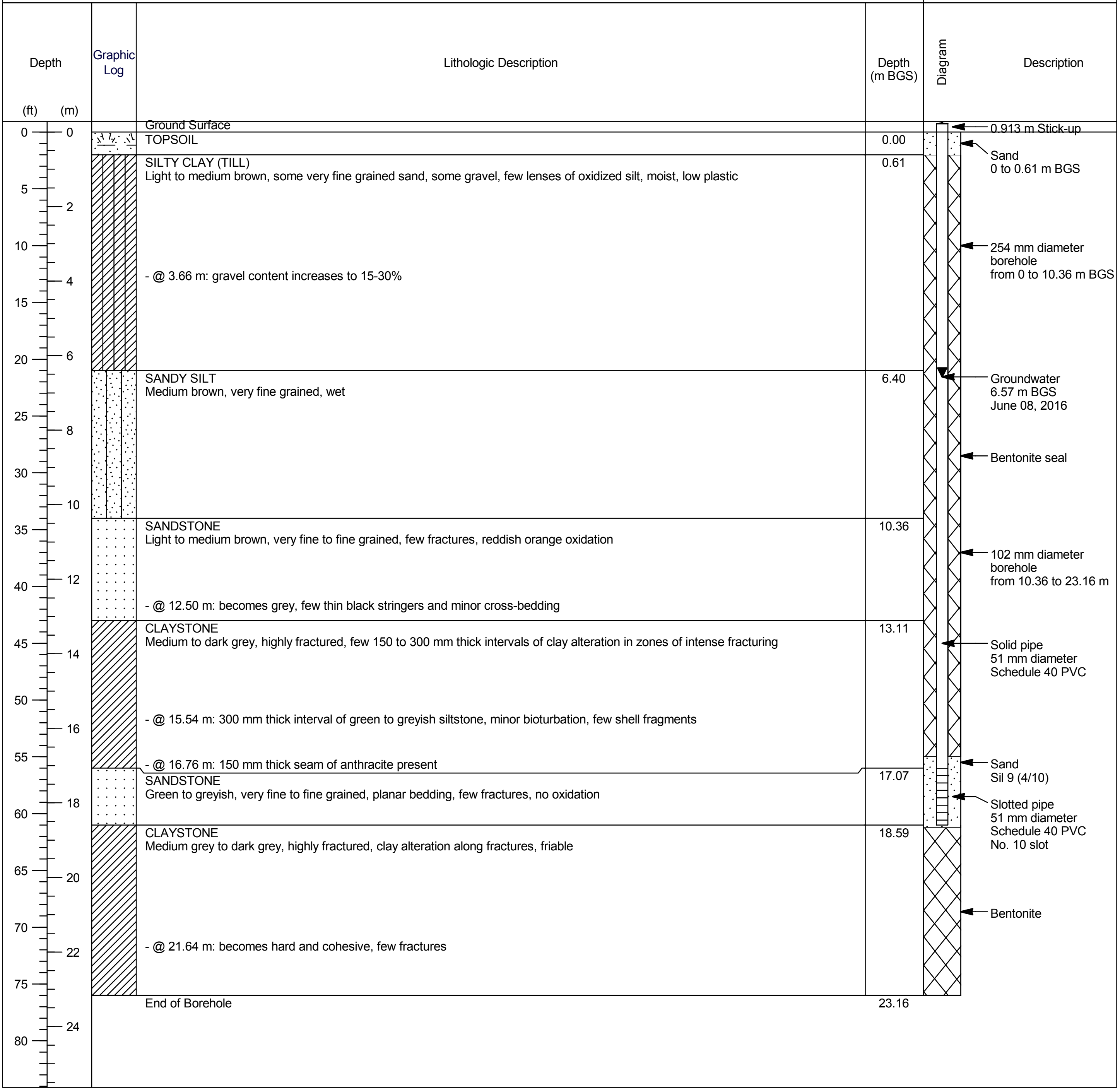
STANTEC BOREHOLE AND WELL V2 110773396_NEW.GPJ STANTEC - DATA TEMPLATE.GDT 17/1/16 MKUHL

Monitoring Well: MW16-19-19 (DC-25D)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	08-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31684.489
Contractor:	All Service Drilling Inc.	**Northing:**	5657263.177

SUBSURFACE PROFILE

INSTALLATION DETAILS



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILTY CLAY (TILL) Light to medium brown, some very fine grained sand, some gravel, few lenses of oxidized silt, moist, low plastic - @ 3.66 m: gravel content increases to 15-30%	0.61
SANDY SILT Medium brown, very fine grained, wet	6.40
SANDSTONE Light to medium brown, very fine to fine grained, few fractures, reddish orange oxidation - @ 12.50 m: becomes grey, few thin black stringers and minor cross-bedding	10.36
CLAYSTONE Medium to dark grey, highly fractured, few 150 to 300 mm thick intervals of clay alteration in zones of intense fracturing - @ 15.54 m: 300 mm thick interval of green to greyish siltstone, minor bioturbation, few shell fragments - @ 16.76 m: 150 mm thick seam of anthracite present	13.11
SANDSTONE Green to greyish, very fine to fine grained, planar bedding, few fractures, no oxidation	17.07
CLAYSTONE Medium grey to dark grey, highly fractured, clay alteration along fractures, friable - @ 21.64 m: becomes hard and cohesive, few fractures	18.59
End of Borehole	23.16

Description

0.913 m Stick-up

Sand
0 to 0.61 m BGS

254 mm diameter
borehole
from 0 to 10.36 m BGS

Groundwater
6.57 m BGS
June 08, 2016

Bentonite seal

102 mm diameter
borehole
from 10.36 to 23.16 m

Solid pipe
51 mm diameter
Schedule 40 PVC

Sand
Sil 9 (4/10)

Slotted pipe
51 mm diameter
Schedule 40 PVC
No. 10 slot

Bentonite

Screen Interval:	17.07 - 18.59 m BGS
Sand Pack Interval:	16.76 - 18.67 m BGS
Well Seal Interval:	0.61 - 16.76 m BGS

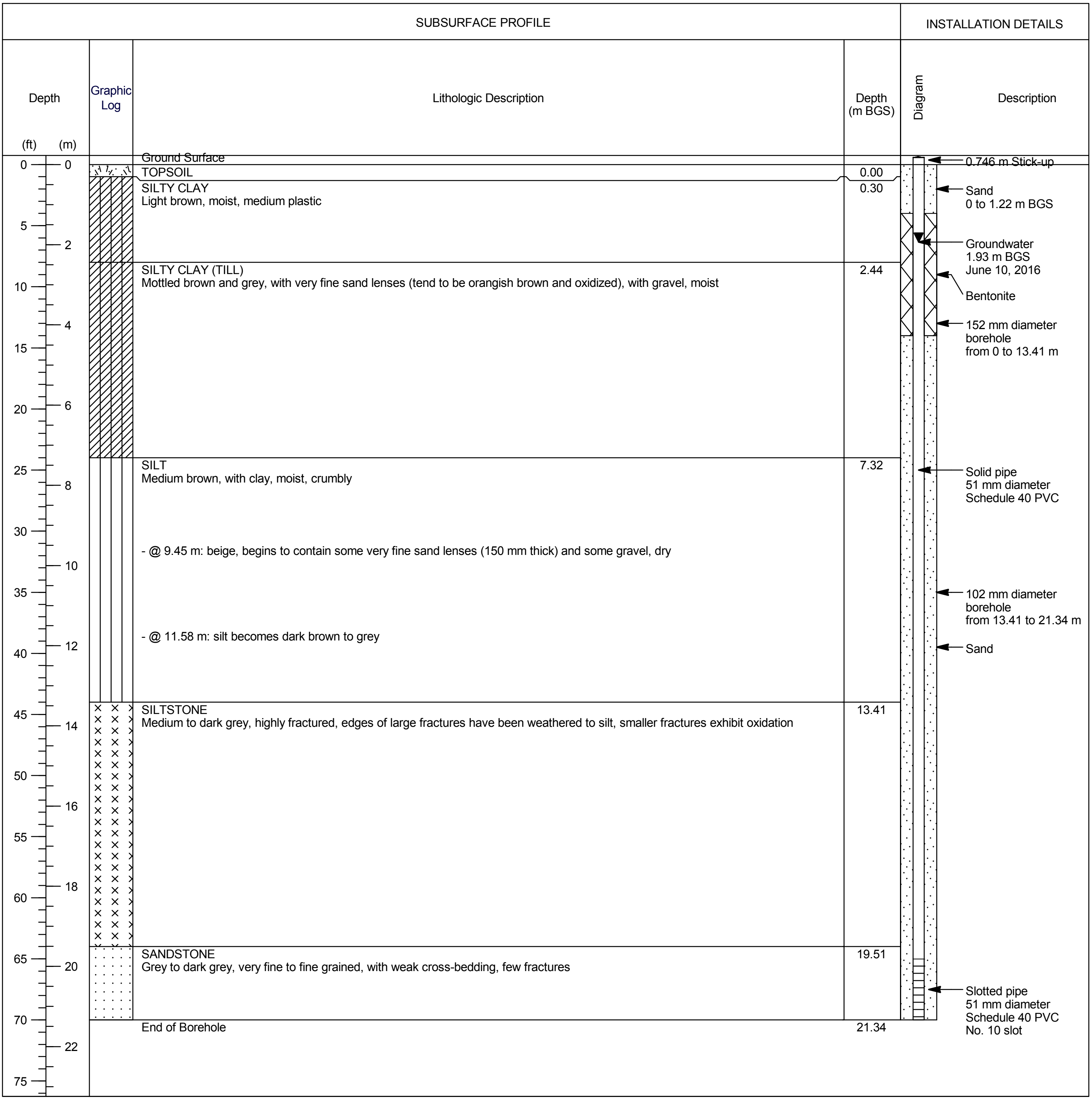
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-19-19

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-20-21 (D2)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger
Client:	Alberta Transportation	**Date started/completed:**	10-Jun-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-31218.384
Contractor:	All Service Drilling Inc.	**Northing:**	5657498.57



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILTY CLAY Light brown, moist, medium plastic	0.30
SILTY CLAY (TILL) Mottled brown and grey, with very fine sand lenses (tend to be orangish brown and oxidized), with gravel, moist	2.44
SILT Medium brown, with clay, moist, crumbly - @ 9.45 m: beige, begins to contain some very fine sand lenses (150 mm thick) and some gravel, dry - @ 11.58 m: silt becomes dark brown to grey	7.32
SILTSTONE Medium to dark grey, highly fractured, edges of large fractures have been weathered to silt, smaller fractures exhibit oxidation	13.41
SANDSTONE Grey to dark grey, very fine to fine grained, with weak cross-bedding, few fractures	19.51
End of Borehole	21.34

Screen Interval:	19.81 - 21.34 m BGS
Sand Pack Interval:	4.27 - 21.34 m BGS
Well Seal Interval:	1.22 - 4.27 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

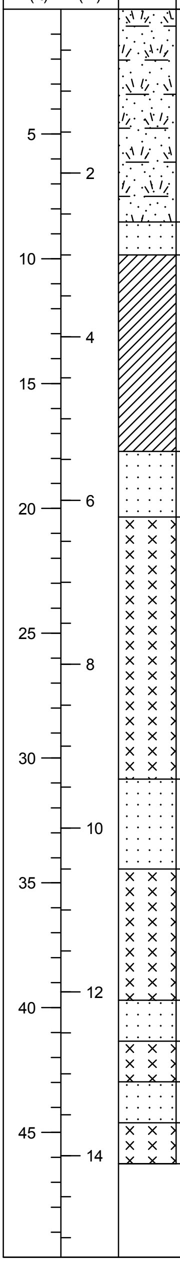
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-20-20

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-21-11 (D9)

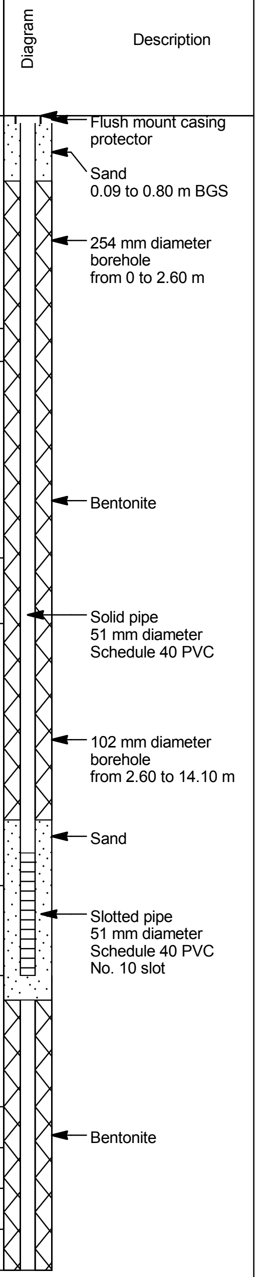
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	01-May-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-30383.805
Contractor:	All Service Drilling Inc.	**Northing:**	5656987.083

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
OVERBURDEN	0.00
SANDSTONE Coarse grained, weathered, few fractures	2.60
MUDSTONE AND CLAYSTONE Interbedded, massive - mudstone: brown, friable, has been weathered to clay along fractured - claystone: grey to light grey, with minor fractures, oxidation on fractures	3.00
SANDSTONE Grey to brown, fine grained, well defined cross-bedding	5.40
SILTSTONE Grey to brown, highly fractured and weathered, portions are highly friable and weathered to clay	6.20
SANDSTONE Grey to brown, medium grained, planar laminated, competent core	9.40
SILTSTONE Highly fractured with weathering to silt along fractures	10.50
SANDSTONE Fine grained, finely cross-bedded, few fractures with oxidation along fracture surfaces	12.10
SILTSTONE Grey, highly fractured and weathered	12.60
SANDSTONE Fine grained, finely cross-bedded, few fractures	13.10
SILTSTONE Highly fractured and friable	13.60
End of Borehole	14.10

INSTALLATION DETAILS



Screen Interval: 9.00 - 10.50 m BGS
Sand Pack Interval: 8.60 - 10.80 m BGS
Well Seal Interval: 10.80 - 14.10 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

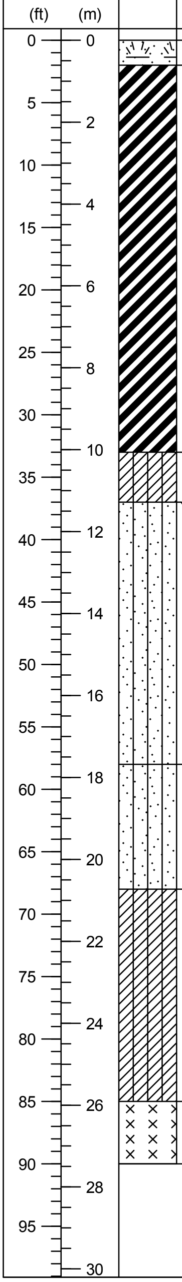
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-21-11

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-22-26 (D27)

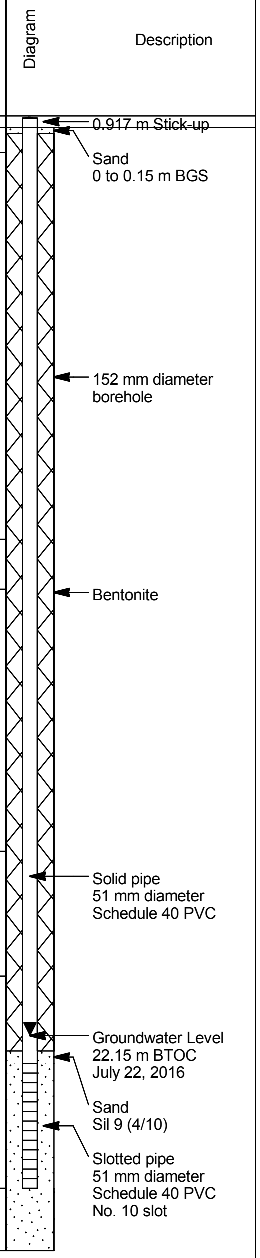
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	21-Jul-2016 / 22-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29330.853
Contractor:	All Service Drilling Inc.	**Northing:**	5656907.343

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
CLAY - from 0.61 to 2.44 m: beige to light brown, with silt, moist, high plastic - from 2.44 to 10.06 m: medium brown, trace fine grained sand, trace gravel, some silt, medium plastic	0.61
SILTY CLAY Medium brown, some very fine grained sand, trace gravel, medium plastic, minor oxidation within sand stringers - @ 11.28 m: sand content increases to 15-30%, gravel content increases to 5-15%	10.06
SANDY SILT Medium brown, with gravel, dry to moist, friable - below 15.85 m: dry	11.28
SANDY SILT (TILL) Medium to dark grey, some gravel, with clay, dry, medium plastic	17.68
SILTY CLAY (TILL) Dark grey, with gravel, dry to moist, medium plastic	20.73
SILTSTONE Light to medium grey	25.91
End of Borehole	27.43

INSTALLATION DETAILS



Screen Interval: 22.86 - 25.91 m BGS
Sand Pack Interval: 22.56 - 27.43 m BGS
Well Seal Interval: 0.15 - 22.56 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-22-26

Stantec

Drawn By/Checked By: M. Kuhl / D. King

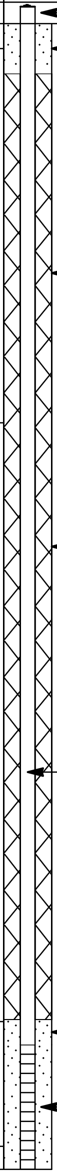
Monitoring Well: MW16-23-14 (D36S)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	24-Jul-2016 / 25-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29019.682
Contractor:	All Service Drilling Inc.	**Northing:**	5657309.567

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
0	0		Ground Surface	
			TOPSOIL	0.00
		▨	CLAY Light to medium brown, trace very fine grained sand, some silt, moist, medium plastic	0.30
		▨	SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist	4.88
			SILT Light brown, trace very fine grained sand, moist - @ 13.41 m: becomes wet	12.19
		▨	CLAY Low plastic - from 13.72 to 14.02 m: some silt	13.72
			End of Borehole	14.00

INSTALLATION DETAILS



Description

- 0.855 m Stick-up
- Sand 0 to 0.61 m BGS
- 152 mm diameter borehole
- Bentonite
- Solid pipe 51 mm diameter Schedule 40 PVC
- Sand Sil 9 (4/10)
- Slotted pipe 51 mm diameter Schedule 40 PVC No. 10 slot

Screen Interval: 12.48 - 14.00 m BGS
Sand Pack Interval: 12.17 - 14.00 m BGS
Well Seal Interval: 0.61 - 12.17 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

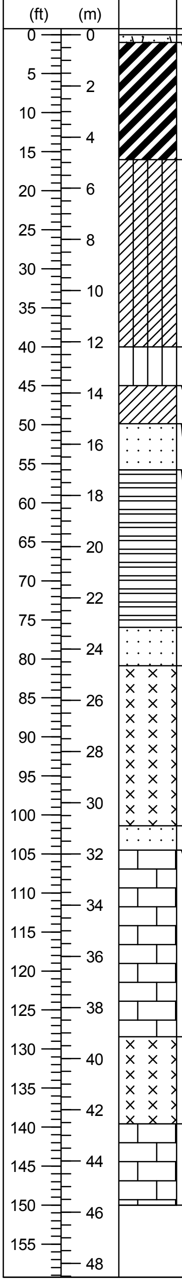
mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-23-14

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-23-36 (D36D)

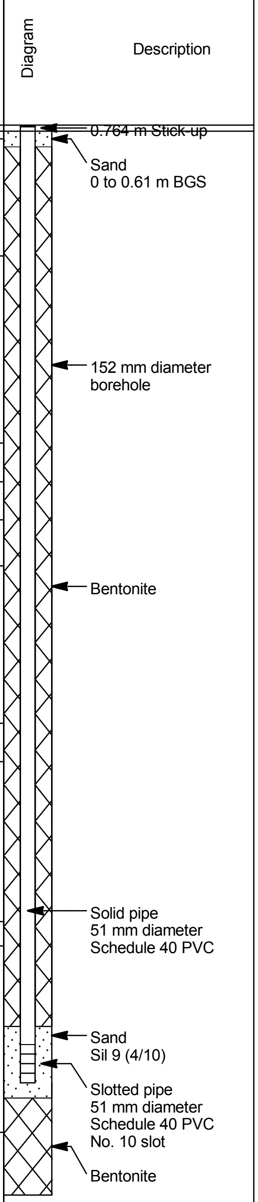
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger (Track mounted)/ Coring
Client:	Alberta Transportation	**Date started/completed:**	24-Jul-2016 / 25-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29019.349
Contractor:	All Service Drilling Inc.	**Northing:**	5657308.346

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
CLAY Light to medium brown, trace very fine grained sand, some silt, moist, medium plastic	0.30
SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist	4.88
SILT Light brown, trace very fine grained sand, moist - @ 13.41 m: becomes wet	12.19
CLAY Low plastic - from 13.72 to 14.02 m: some silt - from 14.02 to 15.20 m: light grey, dry to damp, mottled	13.72
SANDSTONE Medium brown, highly fractured	15.24
CLAYSTONE Grey, highly fractured, clay fracture gouge present	17.00
SANDSTONE Medium brown to grey	23.15
SILTSTONE Grey, some oxidation on fractured surfaces - from 28.05 to 28.45 m: highly fractured - below 28.45 m: some bedding present	24.65
SANDSTONE Grey, fine grained	30.90
MUDSTONE Grey to dark grey, fractured	31.85
SILTSTONE Grey, fractured - from 41.05 to 41.65 m: some bedding	39.15
MUDSTONE Grey, fractured	42.55
End of Borehole	45.72

INSTALLATION DETAILS



Screen Interval:	35.70 - 37.20 m BGS
Sand Pack Interval:	35.00 - 37.80 m BGS
Well Seal Interval:	0.61 - 35.00 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-23-36

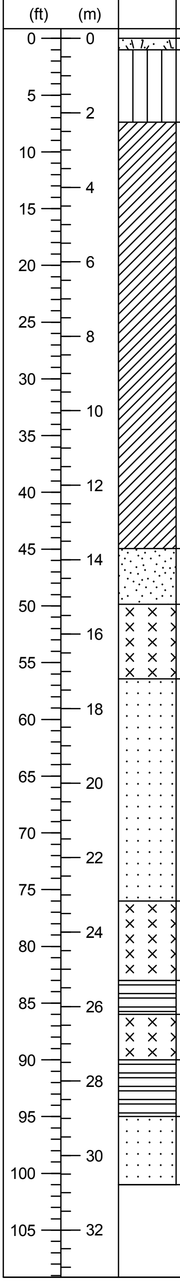
Stantec

Drawn By/Checked By: M. Kuhl / D. King

Monitoring Well: MW16-24-30 (D51)

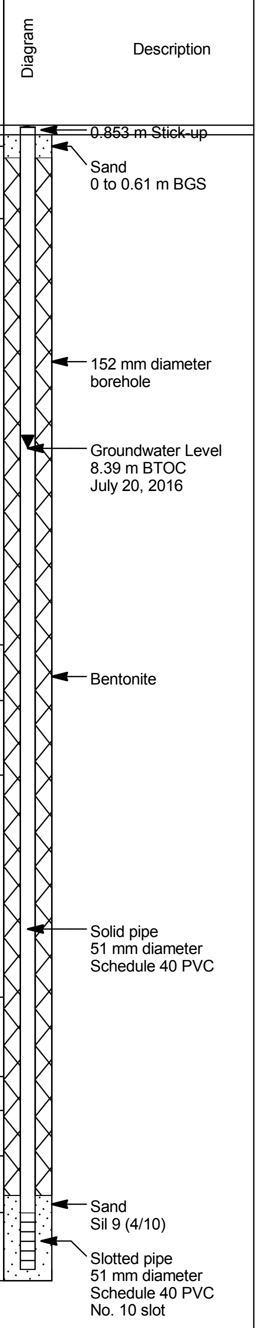
Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Hollow-stem auger / Coring
Client:	Alberta Transportation	**Date started/completed:**	19-Jul-2016 / 20-Jul-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-28761.753
Contractor:	All Service Drilling Inc.	**Northing:**	5657740.483

SUBSURFACE PROFILE



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILT With sand, trace gravel, dry to damp	0.30
CLAY Medium brown, trace sand and gravel, low plastic, minor oxidation, mottled - @ 11.9 m: becomes sandy	2.25
SAND Some gravel, some clay, dry, oxidized	13.70
SILTSTONE Light to medium grey, areas with high fracture intensity, some oxidation along larger fractures	15.20
SANDSTONE Brown to grey, planar bedded	17.20
SILTSTONE Light to medium grey, areas with high fracture intensity, some oxidation along larger fractures - below 24.08 m: fine planar laminations - below 24.69 m: grainsize begins to decrease towards bottom of interval	23.16
CLAYSTONE Dark to medium grey, some fracturing, minor weathering along fractures	25.30
SILTSTONE Light to medium grey, highly fractured, faint laminations and cross-bedding - below 27.13 m: some lenses of very fine grained sandstone	26.21
CLAYSTONE Medium grey, highly fractured and weathered to clay throughout interval	27.43
SANDSTONE Medium grey, very fine to fine grained, competent, few fractures	28.96
End of Borehole	30.78

INSTALLATION DETAILS



Screen Interval:	28.96 - 30.48 m BGS
Sand Pack Interval:	28.50 - 30.78 m BGS
Well Seal Interval:	0.61 - 28.50 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-24-30

Drawn By/Checked By: M. Kuhl / D. King

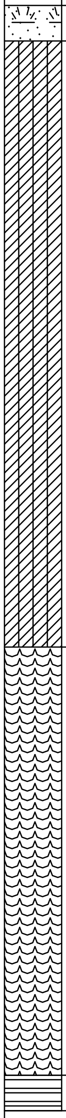
Monitoring Well: MW16-25-9 (BS3)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	19-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-29274.736
Contractor:	All Service Drilling Inc.	**Northing:**	5658230.981

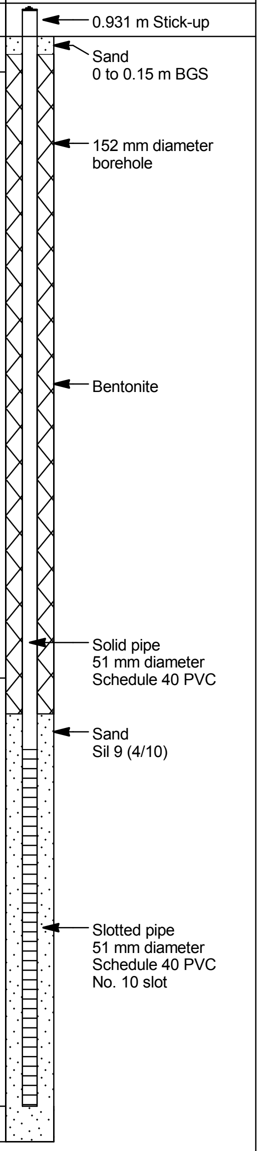
SUBSURFACE PROFILE

INSTALLATION DETAILS

Depth (ft) (m)



Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
SILTY CLAY Light to medium brown, moist, medium plastic, some mottling - @ 2.74 m: silt content decreases to 15-30% - @ 4.88 m: silt content increases to > 40% - below 5.18 m: trace gravel	0.30
SILT AND CLAY (TILL) Medium brown, some very fine grained sand, some gravel, moist, medium plastic	5.49
CLAYSTONE Light grey to brown, dry	9.14
End of Borehole	9.45



Depth (ft)	Depth (m)
0	0
5	2
10	4
15	6
20	8
25	10
30	

Screen Interval: 6.10 - 9.14 m BGS
Sand Pack Interval: 5.79 - 9.45 m BGS
Well Seal Interval: 0.15 - 5.79 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-25-9

Drawn By/Checked By: M. Kuhl / D. King

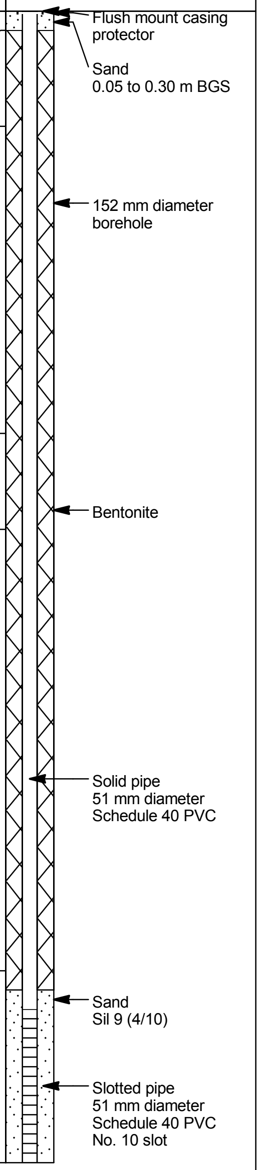
Monitoring Well: MW16-26-18 (H6)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32702.727
Contractor:	All Service Drilling Inc.	**Northing:**	5659178.128

SUBSURFACE PROFILE

Lithologic Description	Depth (m BGS)
Ground Surface	
TOPSOIL	0.00
CLAY Light to medium brown, with silt, moist, high plastic, mottled	0.30
SILTY CLAY (TILL) Medium brown, with very fine grained sand, some gravel, moist, medium plastic	1.83
SAND AND SILT Medium brown, very fine grained, moist - @ 7.32 m: saturated	6.71
CLAY (TILL) Dark grey, with very fine grained sand, with gravel, with silt, dry to moist, low to medium plastic	8.23
CLAYSTONE Grey, dry, crumbly - from 17.37 to 17.98 m: fractured, saturated interval	15.24
End of Borehole	18.29

INSTALLATION DETAILS



Screen Interval: 15.85 - 18.29 m BGS
Sand Pack Interval: 15.54 - 18.29 m BGS
Well Seal Interval: 0.30 - 15.54 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-26-18

Drawn By/Checked By: M. Kuhl / D. King

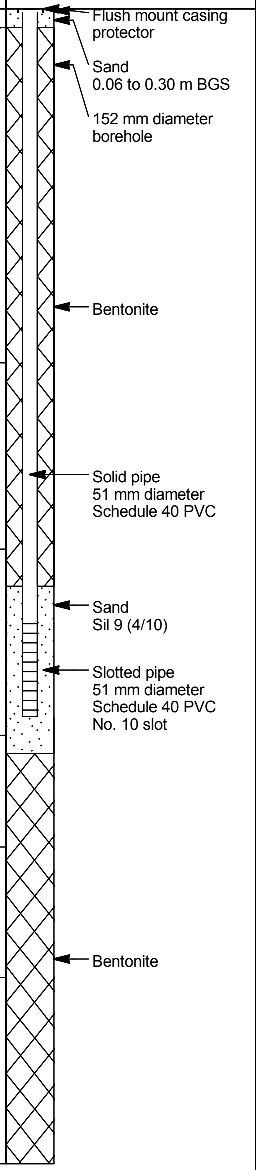
Monitoring Well: MW16-27-12 (H9)

Project:	Springbank Off-Stream Reservoir Project (SR1)	**Drilling method:**	Solid-stem auger (Track mounted)
Client:	Alberta Transportation	**Date started/completed:**	29-Aug-2016
Location:	Rocky View County, Alberta	**Ground surface elevation:**	n/a
Number:	110773396	**Top of casing elevation:**	n/a
Field investigator:	D. Nisbet	**Easting:**	-32702.328
Contractor:	All Service Drilling Inc.	**Northing:**	5659766.161

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)
			Ground Surface	
0	0		TOPSOIL	0.00
1	0.3	▨	SILTY CLAY Light to medium brown, moist, high plastic, mottled - @ 2.74 m: silt content increases to > 40%	0.30
19	5.79	▨	CLAY (TILL) Some gravel, with silt, moist, high plastic	5.79
29	8.84		SAND AND SILT Medium brown, very fine grained, moist - @ 10.36 m: saturated	8.84
39	11.89		SILT (TILL) Medium brown, with very fine grained sand, with gravel, with clay, dry to moist, medium plastic	11.89
45	13.72	▨	CLAY (TILL) Dark grey, with sand, with gravel, with silt, dry to moist, medium plastic	13.72
52	15.85	☰	CLAYSTONE Light grey, dry, some zones are highly fractured and saturated, crumbly	15.85
62	18.90		End of Borehole	18.90

INSTALLATION DETAILS



Screen Interval: 10.06 - 11.58 m BGS
Sand Pack Interval: 9.45 - 12.19 m BGS
Well Seal Interval: 0.30 - 9.45 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

mm - millimetres
Coordinate System - NAD 1983 3TM 114
Completed as Well MW16-27-9

Drawn By/Checked By: M. Kuhl / D. King

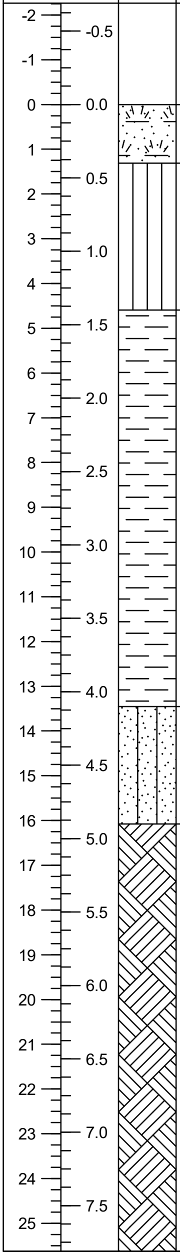
Sheet 1 of 1

Monitoring Well: MW21-3-15

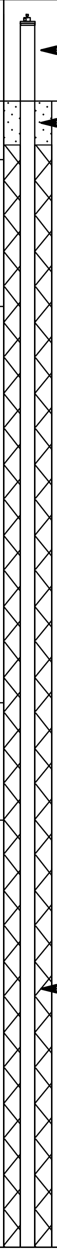
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	26-Aug-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677300
Contractor:	All Service Drilling	**Northing:**	5660000

SUBSURFACE PROFILE

INSTALLATION DETAILS



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL some organics, brown to black, dry	0.00
SILT AND SAND very fine sand, some clay, light brown to brown, low plasticity, dry	0.40
CLAYEY SILT some sand, trace gravel, trace oxidaiton staining and white mineral precipitates, low plasticity	1.40
SILTY SAND very fine sand, brown, moist - at 4.9 m BGS, auger refusal, switch to coring	4.10
MUDSTONE highly fractured and oxidized surfaces, greyish brown - at 6.0 m BGS, some clay and silt along fractures - at 6.95 m BGS, thin clay layer	4.90



Description

- Aboveground casing 0.69 m
- 50 mm solid PVC pipe packed in 10-20 filter sand
- 50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 11.8 m BGS

Screen Interval: 12.40 - 15.40 m BGS
Sand Pack Interval: 11.80 - 15.40 m BGS
Well Seal Interval: 0.30 - 11.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

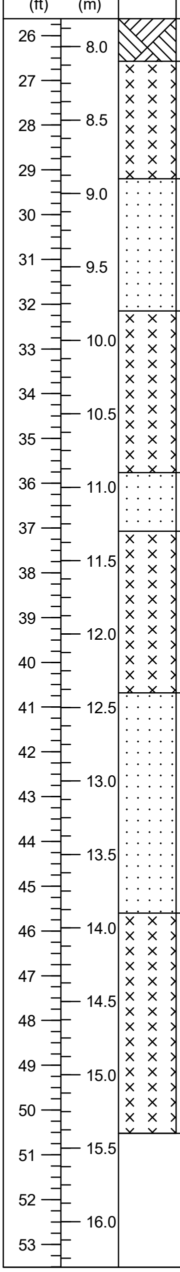
Stantec

Drawn By/Checked By: JL/DK

Monitoring Well: MW21-3-15

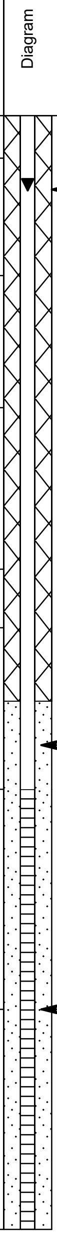
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	26-Aug-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677300
Contractor:	All Service Drilling	**Northing:**	5660000

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
MUDSTONE highly fractured and oxidized surfaces, greyish brown	
SILTSTONE highly oxidized, grayish green to grey - at 8.3 to 8.8 m BGS, extensive weathering and fractures, clays and silts in fractures	8.10
SANDSTONE very fine grained, greyish green to grey	8.90
SILTSONE greenish grey to grey - at 9.8 to 10.1 m BGS, very weathered to poorly consolidated silts and some clays in fractures	9.80
SANDSTONE very fine grained, grey to very light grey	10.90
SILTSTONE grey to dark grey, poorly consolidated - at 12.1 to 12.3 m BGS, few fractures throughout	11.30
SANDSTONE fine grained, grey to very light grey, few fractures - at 12.8 to 13.1 m BGS, thin layer of siltstone	12.40
SILTSTONE grey to dark grey, thin coal layer to 14.1 m BGS - at 14.1 to 14.4 m BGS, poorly consolidated	13.90
End of Borehole	15.40

INSTALLATION DETAILS



Description

Water level
8.319 m BTOC
4-May-22

50 mm solid PVC
pipe packed in
10-20 filter sand
11.8 to 12.4 m BGS

50 mm slotted PVC
pipe packed in
10-20 filter sand
12.4 to 15.4 m BGS

Screen Interval: 12.40 - 15.40 m BGS
Sand Pack Interval: 11.80 - 15.40 m BGS
Well Seal Interval: 0.30 - 11.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

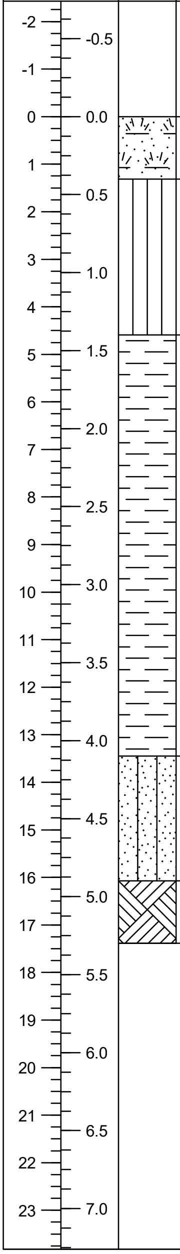
Stantec

Drawn By/Checked By: JL/DK

Monitoring Well: MW21-3-5

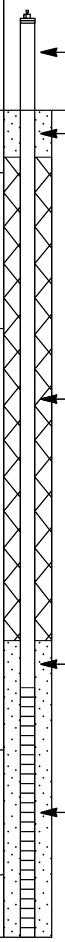
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	27-Aug-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677301
Contractor:	All Service Drilling	**Northing:**	5660000

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL some organics, brown to black, dry	0.00
SILT AND SAND very fine sand, some clay, light brown to brown, low plasticity, dry	0.40
CLAYEY SILT some sand, trace gravel, trace oxidaiton staining and white mineral precipitates, low plasticity	1.40
SILTY SAND very fine sand, brown, moist - at 4.9 m BGS, auger refusal, switch to coring	4.10
MUDSTONE highly fractured and oxidized surfaces, greyish brown	4.90
End of Borehole	5.30

INSTALLATION DETAILS



Description

- Aboveground casing 0.74 m
- 50 mm solid PVC pipe packed in 10-20 filter sand
- 50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 3.4 m BGS
- 50 mm solid PVC pipe packed in 10-20 filter sand 3.4 to 3.7 m BGS
- 50 mm slotted PVC pipe packed in 10-20 filter sand 3.7 to 5.3 m BGS

Screen Interval:	3.70 - 5.30 m BGS
Sand Pack Interval:	3.40 - 5.30 m BGS
Well Seal Interval:	0.30 - 3.40 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

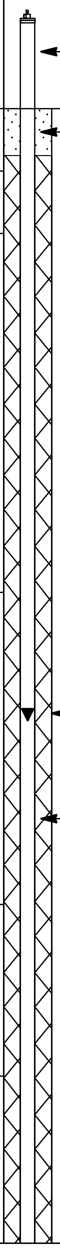
Monitoring Well: MW21-6-12

Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	27-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677606
Contractor:	All Service Drilling	**Northing:**	5658026

SUBSURFACE PROFILE

Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL organics, black, dry	0.00
SILT AND SAND some gravel, light brown, dry	0.40
SILTY CLAY TILL some sand, and gravel, trace oxidaiton staining, light brown to brown, mediun plasticity, dry	0.80
SANDY CLAY trace siltstone and sandstone, low plasticity, moist	3.10
SILTY SAND trace clay and gravel, light brown, damp, moist at bottom	5.10
SILTSTONE highly fractured, oxidated surfaces, weathered, friable - at 6.7 to 7.0 m BGS, colour changes to greenish grey	6.20

INSTALLATION DETAILS



Aboveground casing 0.73 m

50 mm solid PVC pipe packed in 10-20 filter sand

Water level 3.92 m BTOC 5-May-22

50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 8.87 m BGS

Screen Interval: 9.10 - 12.10 m BGS
Sand Pack Interval: 8.80 - 12.30 m BGS
Well Seal Interval: 0.30 - 8.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available
m BTOC - metres below top of casing
Locaiton coordinates are approximate

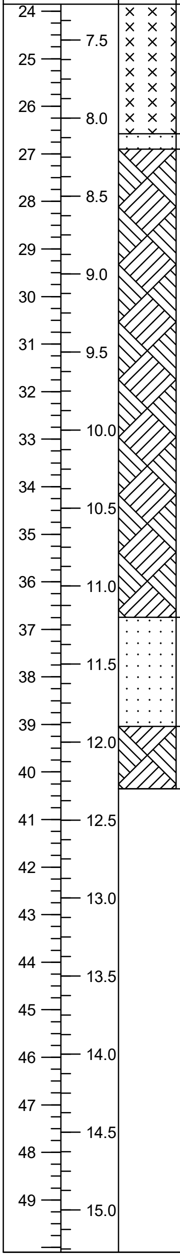
Stantec

Drawn By/Checked By: JL/DK

Monitoring Well: MW21-6-12

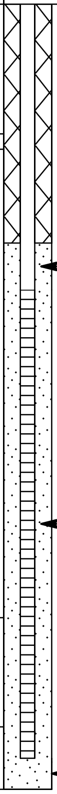
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	27-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677606
Contractor:	All Service Drilling	**Northing:**	5658026

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
SILTSTONE highly fractured, oxidated surfaces, weathered, friable	
SANDSTONE very fine grained, grey to very light grey, oxidation of fractured surfaces	8.10
MUDSTONE grey to very light grey, weathering, oxidaiton along fractures - at 8.6 to 8.9 m BGS, poorly consolidated - at 8.9 to 9.7 m BGS consolidated - 9.7 to 10.1 m BGS, well cemented - 10.1 to 10.5 m BGS, weathered and poorly consolidated clays and silts - at 11.1 m BGS, well cemented	8.20
SANDSTONE grey to very light grey, fossils	11.20
MUDSTONE brown to grey, slight weathering at upper contact	11.90
End of Borehole	12.30

INSTALLATION DETAILS



Description

- 50 mm solid PVC pipe packed in 10-20 filter sand 8.8 to 9.1 m BGS
- 50 mm slotted PVC pipe packed in 10-20 filter sand 9.1 to 12.1 m BGS
- 10-20 filter sand

Screen Interval: 9.10 - 12.10 m BGS
Sand Pack Interval: 8.80 - 12.30 m BGS
Well Seal Interval: 0.30 - 8.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

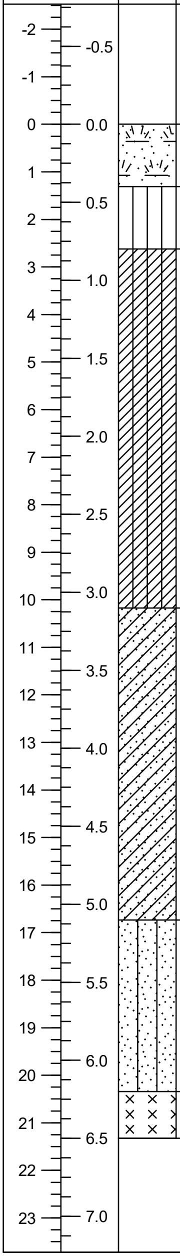
Monitoring Well: MW21-6-7

Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	27-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677606
Contractor:	All Service Drilling	**Northing:**	5658026

SUBSURFACE PROFILE

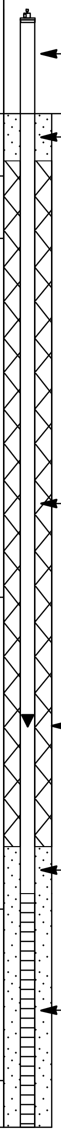
Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL organics, black, dry	0.00
SILT AND SAND some gravel, light brown, dry	0.40
SILTY CLAY TILL some sand, and gravel, trace oxidaiton staining, light brown to brown, medium plasticity, dry	0.80
SANDY CLAY trace siltstone and sandstone, low plasticity, moist	3.10
SILTY SAND trace clay and gravel, light brown, damp, moist at bottom	5.10
SILTSTONE highly fractured, oxidated surfaces, weathered, friable	6.20
End of Borehole	6.50

Depth (ft) (m); Graphic Log



INSTALLATION DETAILS

Diagram



Description

- Aboveground casing 0.77 m
- 50 mm solid PVC pipe packed in 10-20 filter sand
- 50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 4.7 m BGS
- Water level 3.929 m BTOC 4-May-22
- 50 mm solid PVC pipe packed in 10-20 filter sand 4.7 to 5.0 m BGS
- 50 mm slotted PVC pipe packed in 10-20 filter sand 5.0 to 6.5 m BGS

Screen Interval:	5.00 - 6.50 m BGS
Sand Pack Interval:	4.70 - 6.50 m BGS
Well Seal Interval:	0.30 - 4.70 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

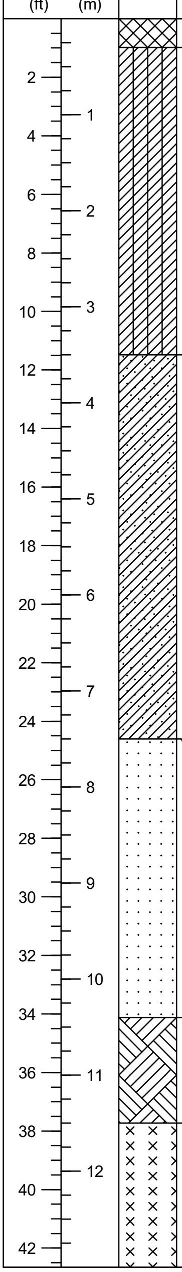
Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-13-37

Project: SR1/Springank
Client: Alberta Transportaiton
Location: Rockyview County
Number: 10773396.5210.215
Field investigator: WT
Contractor: All Service Drilling

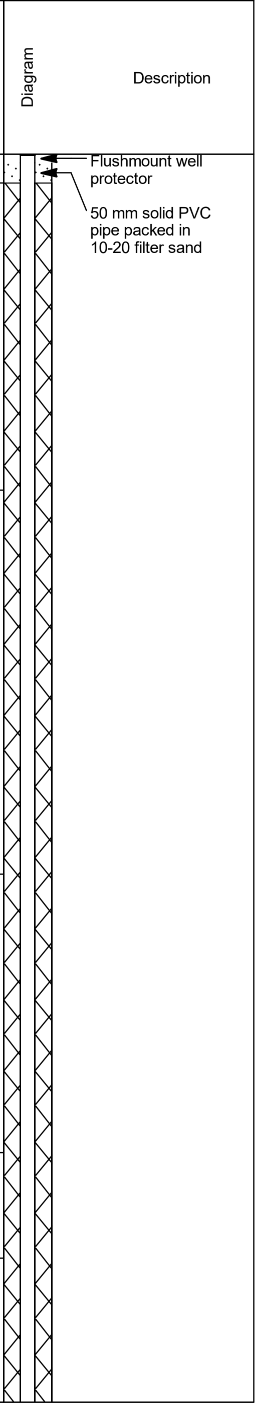
Method: Solid Stem Auger
Date started/completed: 24-Aug-2021
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: 680595
Northing: 5660430

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
Ground Surface	
GRAVEL FILL	0.00
SILTY CLAY TILL some sand, trace gravel and coal, oxidaiton staining, and white mineral precipitate, medium plasticity, brown, moist - at 3.2 m BGS, increasing sand	0.30
SANDY SILTY CLAY some gravel, brown, moist - at 4.6 m BGS, some cobbles - at 7.4 m BGS, sandstone chips	3.50
SANDSTONE weathered - at 8.6 m BGS, auger refusal, switch to air rotary - at 9.0 m BGS, very fine grained, greyish brown to grey	7.50
MUDSTONE brown to dark brown, dry	10.40
SILTSTONE some weathering and oxidized fractures, grey to dark grey	11.50

INSTALLATION DETAILS



Screen Interval: 33.50 - 36.50 m BGS
Sand Pack Interval: 33.00 - 36.50 m BGS
Well Seal Interval: 0.30 - 33.00 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

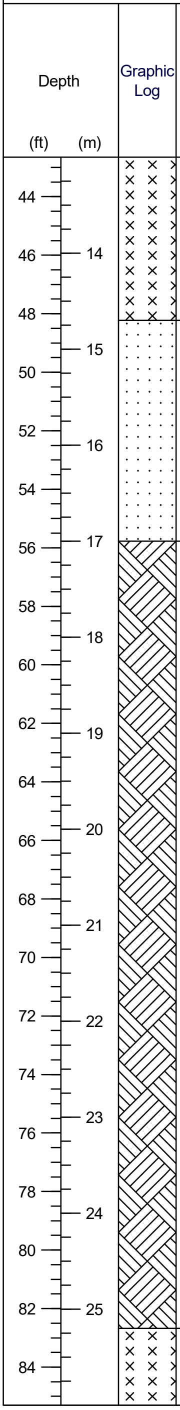
m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-13-37

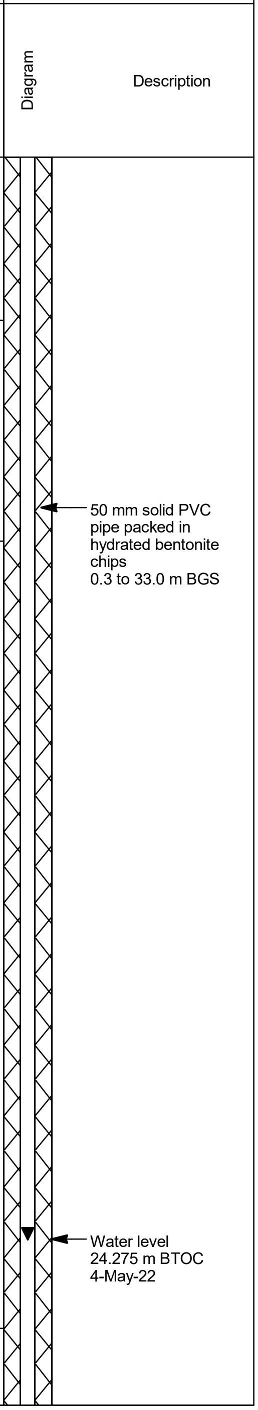
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	24-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	680595
Contractor:	All Service Drilling	**Northing:**	5660430

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
SILTSTONE some weathering and oxidized fractures, grey to dark grey	
very fine to fine grained, friable, grey to light grey, dry - at 15.5 m BGS, interbedded sitlstone, grey to dark grey	14.70
MUDSTONE dark grey to dark brown, friable	17.00
SILTSTONE grey to dark grey	25.20

INSTALLATION DETAILS



50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 33.0 m BGS

Water level 24.275 m BTOC 4-May-22

Screen Interval: 33.50 - 36.50 m BGS
Sand Pack Interval: 33.00 - 36.50 m BGS
Well Seal Interval: 0.30 - 33.00 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-13-37

Project: SR1/Springank
Client: Alberta Transportaiton
Location: Rockyview County
Number: 10773396.5210.215
Field investigator: WT
Contractor: All Service Drilling

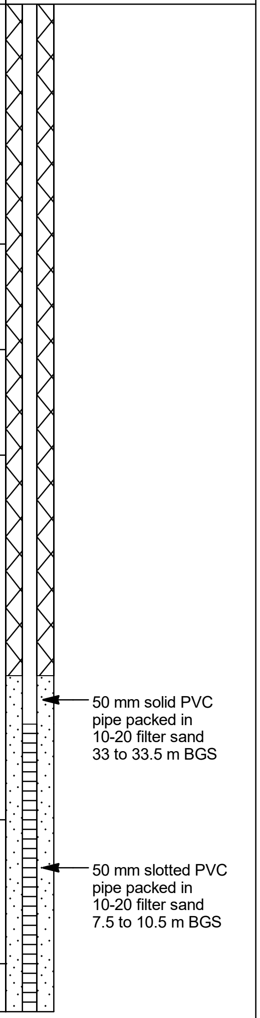
Method: Solid Stem Auger
Date started/completed: 24-Aug-2021
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: 680595
Northing: 5660430

SUBSURFACE PROFILE

Stratigraphic Description	Depth (m BGS)
SILTSTONE grey to dark grey	
MUDSTONE light grey to grey, dry	28.50
SILTSTONE dark grey, interbeded with very fine grained sandstone at 30.1 m BGS, SANDSTONE	29.60
MUDSTONE grey to light grey - at 32.0 m BGS, grey to dark grey with black speckled sandstone, saturated - at 33.0 m BGS, brown to grey	30.70
SILTSTONE grey to dark grey, oxidized fractures	34.50
MUDSTONE grey to greenish grey	36.00
End of Borehole	36.50

Depth scale: (ft) 86–126; (m) 27–38

INSTALLATION DETAILS



Screen Interval: 33.50 - 36.50 m BGS
Sand Pack Interval: 33.00 - 36.50 m BGS
Well Seal Interval: 0.30 - 33.00 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

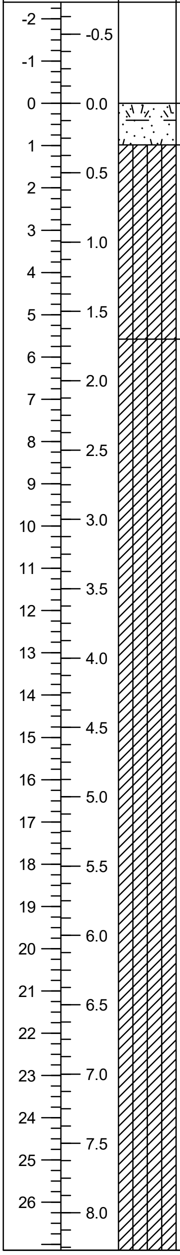
Monitoring Well: RMW16-16-17

Project: SR1/Springank
Client: Alberta Transportaiton
Location: Rockyview County
Number: 10773396.5210.215
Field investigator: WT
Contractor: All Service Drilling

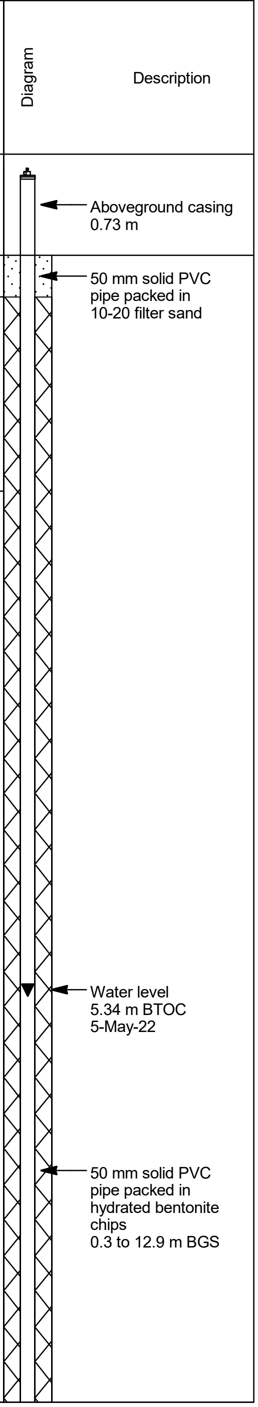
Method: Solid Stem Auger
Date started/completed: 25-Aug-2021
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: 677090
Northing: 565364

SUBSURFACE PROFILE

INSTALLATION DETAILS



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL organics, black, dry	0.00
SILTY CLAY trace sand, white mineral precipitates, occasional lenses of silt and very fine sand, light brown, grey mottling, high plasticity	0.30
SILTY CLAY TILL some sand, trace gravel, white mineral precipitates, high plasticity, light brown with grey mottling, dry to moist - at 3.3 m BGS, slight increase in silt and sand, medium plasticity - at 6.0 m BGS, colour changes to brown - at 6.2 m BGS, ioncreasing gravel, occasional cobble	1.70



Description

Aboveground casing
0.73 m

50 mm solid PVC
pipe packed in
10-20 filter sand

Water level
5.34 m BTOC
5-May-22

50 mm solid PVC
pipe packed in
hydrated bentonite
chips
0.3 to 12.9 m BGS

Screen Interval: 13.50 - 16.50 m BGS
Sand Pack Interval: 12.90 - 16.50 m BGS
Well Seal Interval: 0.30 - 12.90 m BGS

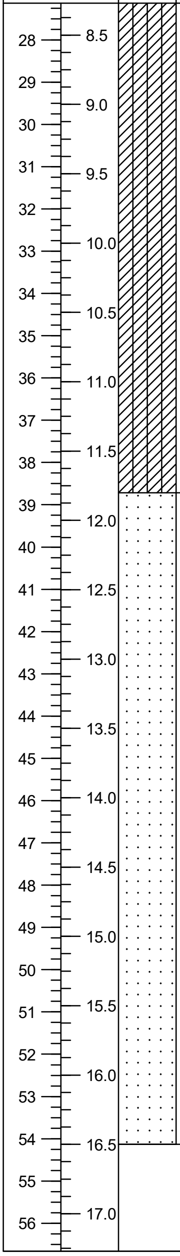
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available
m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-16-17

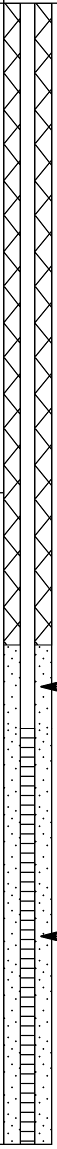
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	25-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677090
Contractor:	All Service Drilling	**Northing:**	565364

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
SILTY CLAY TILL some sand, trace gravel, white mineral precipitates, high plasticity, light brown with grey mottling, dry to moist - at 10.0 m BGS, some moisture	
SANDSTONE very fine grained, weathered, friable, light brown to grey, weathered - at 15.0 m BGS, bery poor recovery - at 15.8 m BGS, saturated, auger refusal	11.80
End of Borehole	16.50

INSTALLATION DETAILS



Description

50 mm solid PVC pipe packed in 10-20 filter sand 12.9 to 13.5 m BGS

50 mm slotted PVC pipe packed in 10-20 filter sand 13.5 to 16.5 m BGS

Screen Interval: 13.50 - 16.50 m BGS
Sand Pack Interval: 12.90 - 16.50 m BGS
Well Seal Interval: 0.30 - 12.90 m BGS

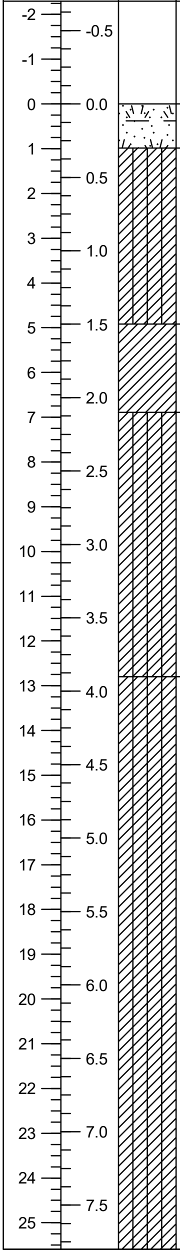
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available
m BTOC - metres below top of casing
Locaiton coordinates are approximate

Monitoring Well: RMW16-17-10

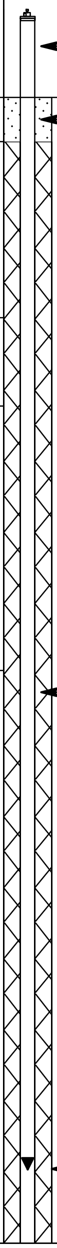
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	25-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677476
Contractor:	All Service Drilling	**Northing:**	5657319

SUBSURFACE PROFILE

INSTALLATION DETAILS



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL organics, black, dry	0.00
SILT AND CLAY trace fine sand, light brown, low to medium plasticity, dry	0.30
CLAY trace silt, trace pockets of sand, olive with gray mottling, dry to moist	1.50
SILTY CLAY TILL some sand, trace oxidation staining and white mineral precipitates, oilive with grey mottling, dry to moist	2.10
SILT AND CLAY some sand, trace gravel, occasional cobble, brown to dark brown, medium plasticity, moist	3.90



Description

Aboveground casing
0.70 m

50 mm solid PVC
pipe packed in
10-20 filter sand

50 mm solid PVC
pipe packed in
hydrated bentonite
chips
0.3 to 7.8 m BGS

Water level
7.299 m BTOC
10-May-22

Screen Interval: 8.10 - 9.60 m BGS
Sand Pack Interval: 7.80 - 9.80 m BGS
Well Seal Interval: 0.30 - 7.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

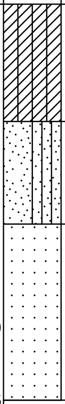
Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-17-10

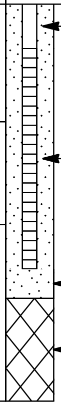
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	25-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	677476
Contractor:	All Service Drilling	**Northing:**	5657319

SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Stratigraphic Description	Depth (m BGS)
26–28	8.0–8.5	SILT AND CLAY some sand, trace gravel, occasional cobble, brown to dark brown, medium plasticity, moist	
28–30	8.6–9.3	SILT AND SAND fine grained sand, some clay and gravel, white mineral precipitates, green to brown, medium plasticity, moist to damp	8.60
30–34	9.3–10.5	SANDSTONE fine to very fine grained, weathered, very light grey, weathered	9.30
		End of Borehole	10.50



INSTALLATION DETAILS



Description
50 mm solid PVC pipe packed in 10-20 filter sand 7.8 to 8.1 m BGS
50 mm slotted PVC pipe packed in 10-20 filter sand 8.1 to 9.6 m BGS
10-20 filter sand
Hydrated bentonite chips

Screen Interval: 8.10 - 9.60 m BGS
Sand Pack Interval: 7.80 - 9.80 m BGS
Well Seal Interval: 0.30 - 7.80 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

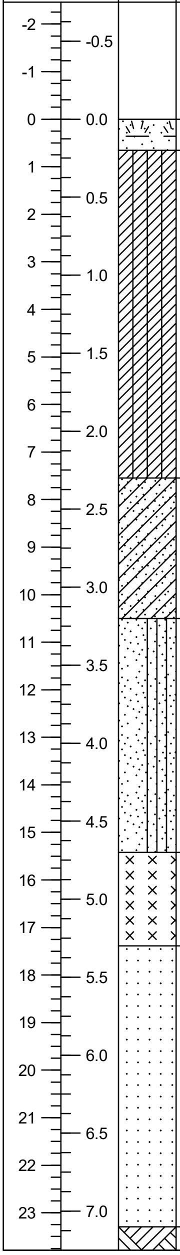
Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-18-13

Project: SR1/Springank
Client: Alberta Transportaiton
Location: Rockyview County
Number: 10773396.5210.215
Field investigator: WT
Contractor: All Service Drilling

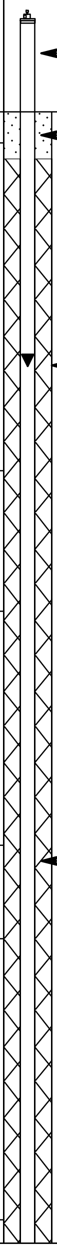
Method: Solid Stem Auger
Date started/completed: 26-Aug-2021
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: 678068
Northing: 5657928

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL organics, black, dry	0.00
SILTY CLAY TILL some sand, trace gravel, trace oxidation statining (light orange), brown, medium plasticity	0.20
SANDY CLAY some gravel and cobbles, brown, dry	2.30
SILT AND SAND some gravel, trace clay, brown, moist	3.20
SILTSTONE very poor recovery, grey, weathered	4.70
SANDSTONE grey to greenish grey,	5.30
	7.10

INSTALLATION DETAILS



Description

Aboveground casing
0.75 m

50 mm solid PVC
pipe packed in
10-20 filter sand

Water level
1.629 m BTOC
5-May-22

50 mm solid PVC
pipe packed in
hydrated bentonite
chips
0.3 to 9.3 m BGS

Screen Interval: 9.60 - 12.60 m BGS
Sand Pack Interval: 9.30 - 12.60 m BGS
Well Seal Interval: 0.30 - 9.30 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

Stantec

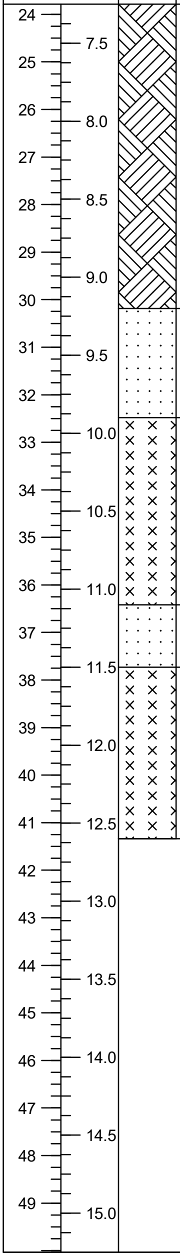
Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-18-13

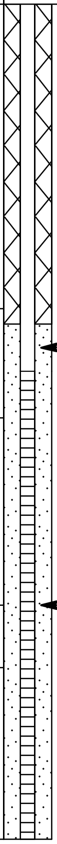
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	26-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	678068
Contractor:	All Service Drilling	**Northing:**	5657928

SUBSURFACE PROFILE

INSTALLATION DETAILS



Stratigraphic Description	Depth (m BGS)
MUDSTONE dark brown to dark grey - at 7.3 to 7.5 m BGS, oxidation and slight weathering - at 7.85 m BGS, fracture - at 8.1 to 8.8 m BGS light grey clay, alogr multiple fractures - at 8.8 m BGS, highly fractured and oxidized	
SANDSTONE fine grained, slight oxidation, greenish grey to grey	9.20
SILTSTONE greenish grey to grey, highly fractured with some silts and clays along fractured zones - at 10.6 m BGS, no silts and clays	9.90
SANDSTONE greenish grey to grey	11.10
SILTSTONE greenish grey to grey, well consolidated, highly fractured	11.50
End of Borehole	12.60



Description

50 mm solid PVC pipe packed in 10-20 filter sand 9.3 to 9.6 m BGS

50 mm slotted PVC pipe packed in 10-20 filter sand 9.6 to 12.6 m BGS

Screen Interval: 9.60 - 12.60 m BGS
Sand Pack Interval: 9.30 - 12.60 m BGS
Well Seal Interval: 0.30 - 9.30 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

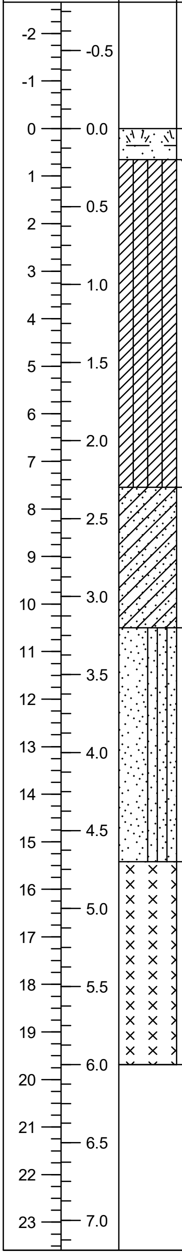
m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-18-5

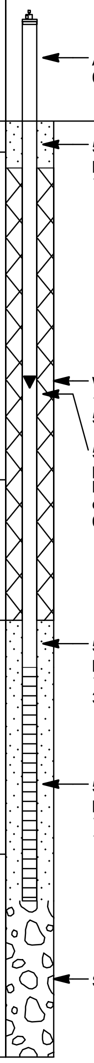
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	23-Aug-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT	**Easting:**	678066
Contractor:	All Service Drilling	**Northing:**	5657928

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL organics, black, dry	0.00
SILTY CLAY TILL some sand, trace gravel, trace oxidation statining (light orange), brown, medium plasticity	0.20
SANDY CLAY some gravel and cobbles, brown, dry	2.30
SILT AND SAND some gravel, trace clay, brown, moist	3.20
SILTSTONE very poor recovery, grey, weathered	4.70
End of Borehole	6.00

INSTALLATION DETAILS



Description

- Aboveground casing 0.73 m
- 50 mm solid PVC pipe packed in 10-20 filter sand
- Water level 1.71 m BTOC 5-May-22
- 50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 3.2 m BGS
- 50 mm solid PVC pipe packed in 10-20 filter sand 3.2 to 3.5 m BGS
- 50 mm slotted PVC pipe packed in 10-20 filter sand 13.5 to 16.5 m BGS
- Slough

Screen Interval: 3.50 - 5.00 m BGS
Sand Pack Interval: 3.20 - 5.00 m BGS
Well Seal Interval: 0.30 - 3.20 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

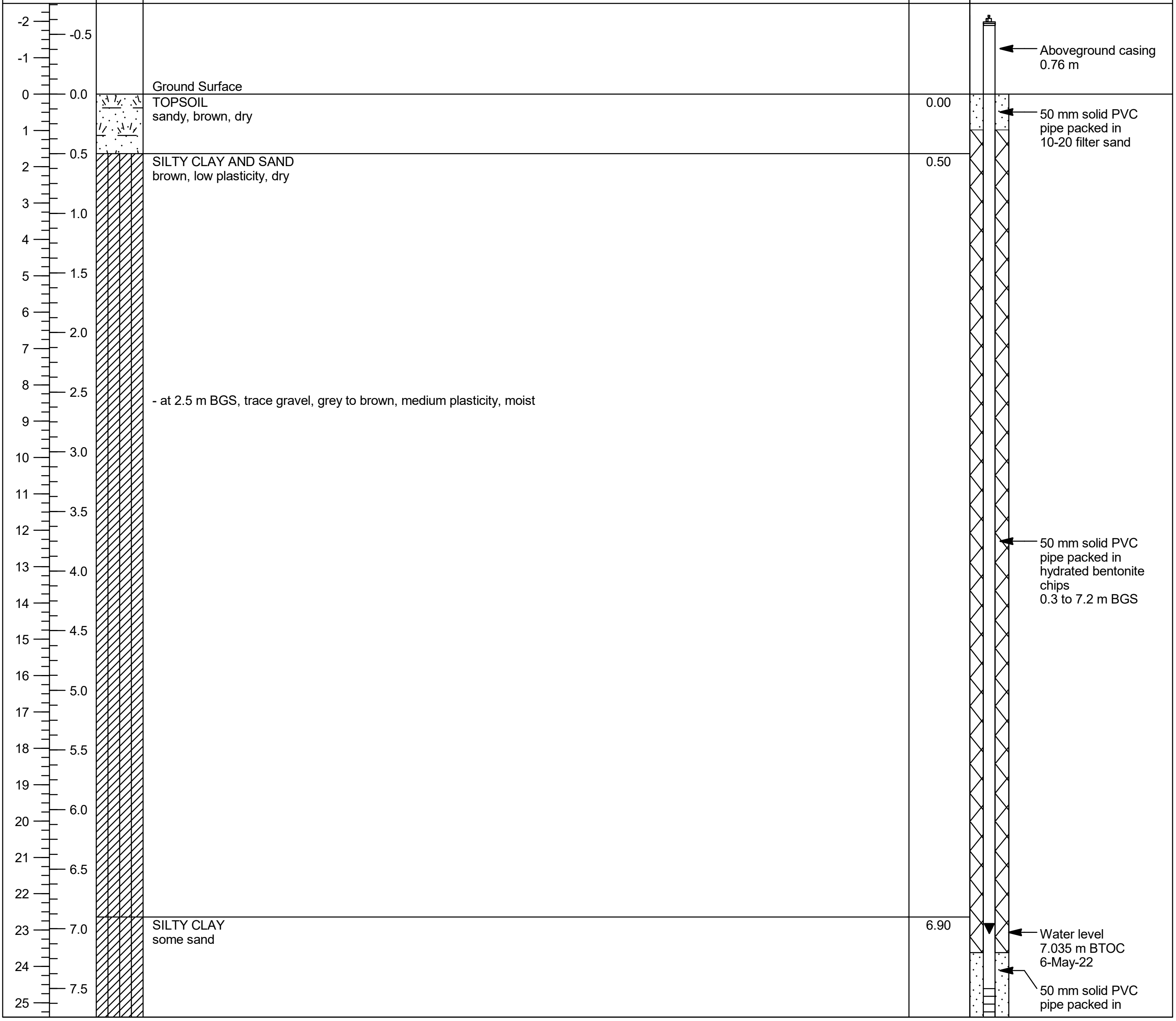
Stantec

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-19-10

Project:	SR1/Springank	**Method:**	Soid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	29-Nov-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/AK	**Easting:**	n/a
Contractor:	All Service Drilling	**Northing:**	n/a

SUBSURFACE PROFILE | INSTALLATION DETAILS



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL sandy, brown, dry	0.00
SILTY CLAY AND SAND brown, low plasticity, dry - at 2.5 m BGS, trace gravel, grey to brown, medium plasticity, moist	0.50
SILTY CLAY some sand	6.90

Installation Details – Description:

- Aboveground casing 0.76 m
- 50 mm solid PVC pipe packed in 10-20 filter sand
- 50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 7.2 m BGS
- Water level 7.035 m BTOC 6-May-22
- 50 mm solid PVC pipe packed in

Screen Interval:	7.50 - 10.50 m BGS
Sand Pack Interval:	7.20 - 10.50 m BGS
Well Seal Interval:	0.30 - 7.20 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing

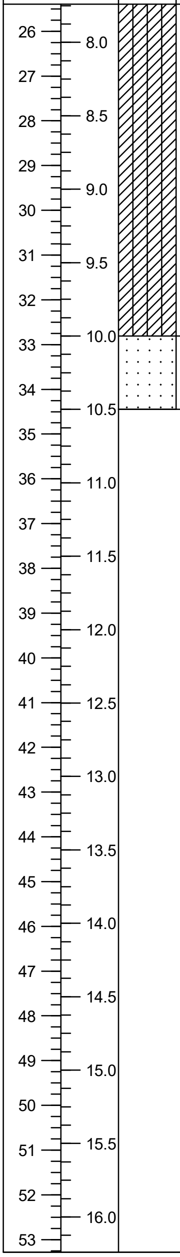
STANTEC BOREHOLE AND WELL V2 SPRINGBANK_LOGS_20220808.GPJ STANTEC - DATA TEMPLATE.GDT 8/11/22 JLAUTERMILCH

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-19-10

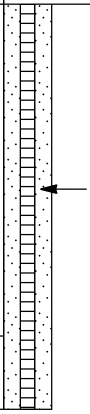
Project:	SR1/Springank	**Method:**	Soid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	29-Nov-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/AK	**Easting:**	n/a
Contractor:	All Service Drilling	**Northing:**	n/a

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
SILTY CLAY some sand	
SANDSTONE finegrained, brown, wet	10.00
End of Borehole	10.50

INSTALLATION DETAILS



Description

10-20 filter sand
7.2 to 7.5 m BGS

50 mm slotted PVC
pipe packed in
10-20 filter sand
7.5 to 10.5 m BGS

Screen Interval:	7.50 - 10.50 m BGS
Sand Pack Interval:	7.20 - 10.50 m BGS
Well Seal Interval:	0.30 - 7.20 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing

Stantec

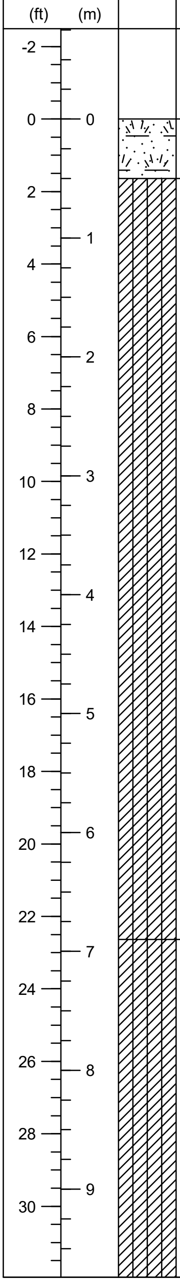
Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-19-19

Project: SR1/Springank
Client: Alberta Transportaiton
Location: Rockyview County
Number: 10773396.5210.215
Field investigator: WT/AK
Contractor: All Service Drilling

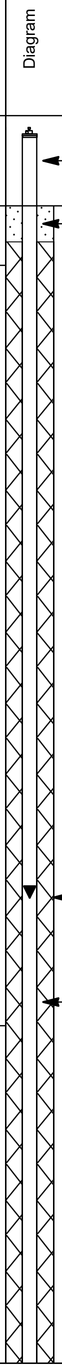
Method: Soid Stem Auger
Date started/completed: 29-Nov-2021
Ground surface elevation: n/a
Top of casing elevation: n/a
Easting: n/a
Northing: n/a

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL sandy, brown, dry	0.00
SILTY CLAY AND SAND brown, low plasticity, dry - at 2.5 m BGS, trace gravel, grey to brown, medium plasticity, moist	0.50
SILTY CLAY some sand	6.90

INSTALLATION DETAILS



Description
Aboveground casing 0.76 m
50 mm solid PVC pipe packed in 10-20 filter sand
Water level 5.824 m BTOC 6-May-22
50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 13.1 m BGS

Screen Interval: 17.50 - 19.50 m BGS
Sand Pack Interval: 13.10 - 19.50 m BGS
Well Seal Interval: 0.30 - 13.10 m BGS

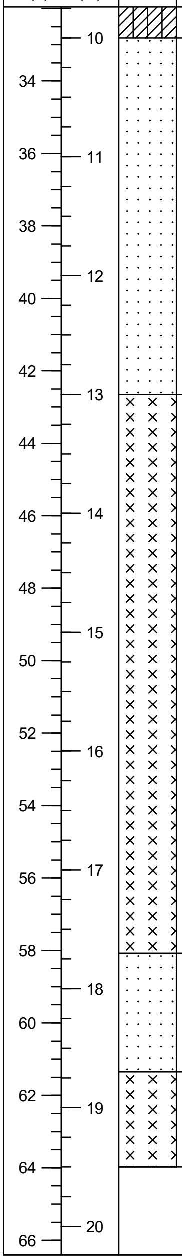
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available
m BTOC - metres below top of casing

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-19-19

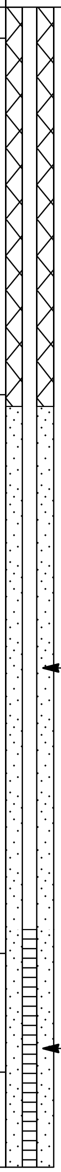
Project:	SR1/Springank	**Method:**	Soid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	29-Nov-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/AK	**Easting:**	n/a
Contractor:	All Service Drilling	**Northing:**	n/a

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
SANDSTONE finegrained, brown, wet	10.00
SILTSTONE some sand and clay, grey, low plasticity, dry	13.00
SANDSTONE fine grained, grey, moist	17.70
SILTSTONE some sand and clay, grey, low plasticity, moist	18.70
End of Borehole	19.50

INSTALLATION DETAILS



Description

50 mm solid PVC pipe packed in 10-20 filter sand 13.1 to 17.5 m BGS

50 mm slotted PVC pipe pre-packed packed in filter sand 17.5 to 19.5 m BGS

Screen Interval: 17.50 - 19.50 m BGS
Sand Pack Interval: 13.10 - 19.50 m BGS
Well Seal Interval: 0.30 - 13.10 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

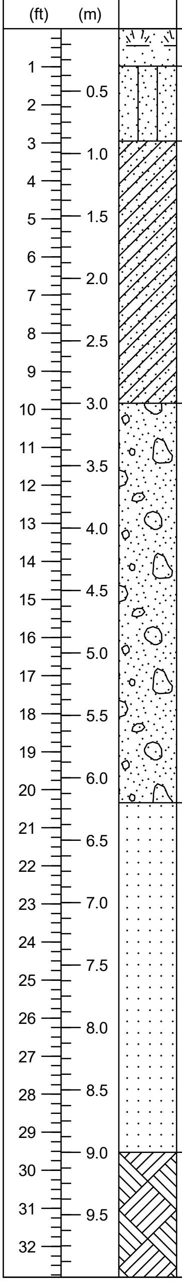
m BTOC - metres below top of casing

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-23-13

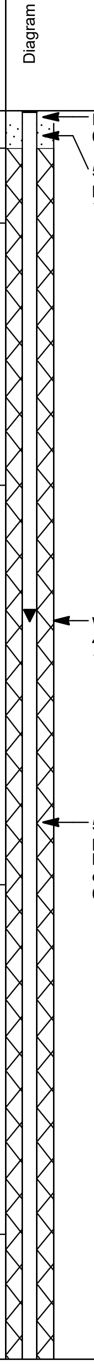
Project:	SR1/Springank	**Method:**	Air Rotary
Client:	Alberta Transportaiton	**Date started/completed:**	12-May-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/IM	**Easting:**	n/a
Contractor:	All Service Drilling	**Northing:**	n/a

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL darkbrown to black, moist	0.00
SILTY SAND trace gravel, light brown to grey, dry to moist	0.30
SANDY CLAY TILL trace gravel, trace mineral precipitate, oxidation staining, low plasticity, light brown to brown, - at 1.4 m BGS, cobble sized gravel - at 1.5 m BGS, increased gravel to approximately 30 percent	0.90
SAND AND GRAVEL brown, dry - at 4.5 m BGS, becomes moist	3.00
SANDSTONE fine grained, brown, poor recovery - at 7.2 m BGS, colour changes to grey, moist - at 7.7 m BGS, colour changes to brown - at 8.4 m BGS, Colour changes to grey, weathered	6.20
MUDSTONE grey, moist	9.00

INSTALLATION DETAILS



Description

Flushmount casing
0.76 m

50 mm solid PVC pipe packed in 10-20 filter sand

Water level
4.09 m BTOC
13-May-22

50 mm solid PVC pipe packed in hydrated bentonite chips
0.3 to 11.1 m BGS

Screen Interval: 11.40 - 12.90 m BGS
Sand Pack Interval: 11.10 - 12.90 m BGS
Well Seal Interval: 0.30 - 11.10 m BGS

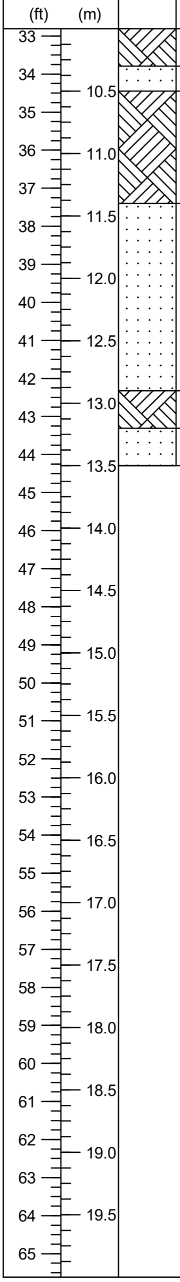
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available
m BTOC - metres below top of casing

Drawn By/Checked By: JD/DK

Monitoring Well: RMW16-23-13

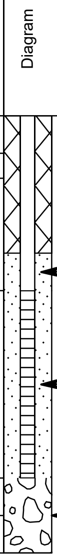
Project:	SR1/Springank	**Method:**	Air Rotary
Client:	Alberta Transportaiton	**Date started/completed:**	12-May-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/IM	**Easting:**	n/a
Contractor:	All Service Drilling	**Northing:**	n/a

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
SANDSTONE fine grained, trace silt, moist	10.30
MUDSTONE saturated, grey	10.50
SANDSTONE saturated, grey to brown - at 12.4 to 12.5 m BGS, mudstone lens	11.40
MUDSTONE saturated, grey to brown	12.90
SANDSTONE saturated, grey to brown	13.20
End of Borehole	13.50

INSTALLATION DETAILS



Description

- 50 mm solid PVC pipe packed in 10-20 filter sand 11.1 to 11.4 m BGS
- 50 mm slotted PVC pipe packed in 10-20 filter sand 11.4 to 12.9 m BGS
- Slough

Screen Interval: 11.40 - 12.90 m BGS
Sand Pack Interval: 11.10 - 12.90 m BGS
Well Seal Interval: 0.30 - 11.10 m BGS

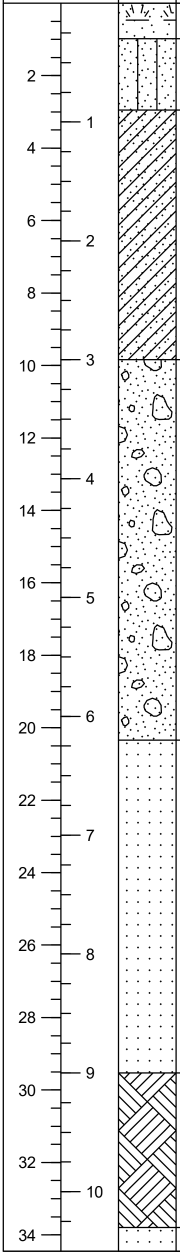
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available
m BTOC - metres below top of casing

Drawn By/Checked By: JD/DK

Monitoring Well: RMW16-23-32

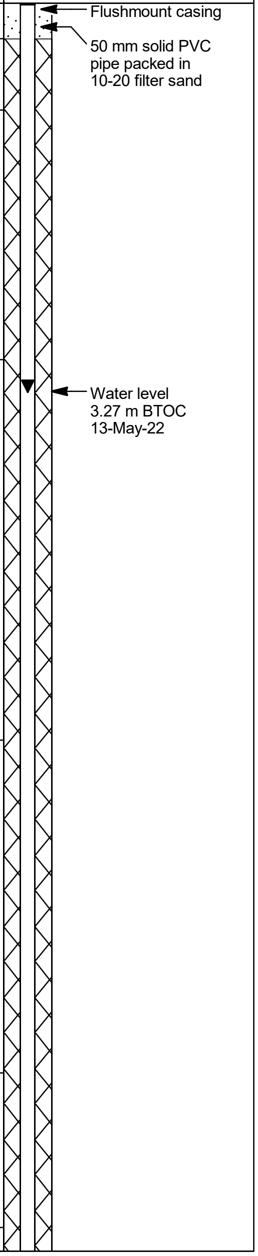
Project:	SR1/Springank	**Method:**	Air Rotary
Client:	Alberta Transportaiton	**Date started/completed:**	13-May-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/IM	**Easting:**	681934
Contractor:	All Service Drilling	**Northing:**	5658853

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL darkbrown to black, moist	0.00
SILTY SAND trace gravel, light brown to grey, dry to moist	0.30
SANDY CLAY TILL trace gravel, trace mineral precipitate, oxidation staining, low plasticity, light brown to brown, - at 1.4 m BGS, cobble sized gravel - at 1.5 m BGS, increased gravel to approximately 30 percent	0.90
SAND AND GRAVEL brown, dry - at 4.5 m BGS, becomes moist	3.00
SANDSTONE fine grained, brown, poor recovery - at 7.2 m BGS, colour changes to grey, moist - at 7.7 m BGS, colour changes to brown - at 8.4 m BGS, Colour changes to grey, weathered	6.20
MUDSTONE grey, moist	9.00
SANDSTONE	10.30

INSTALLATION DETAILS



Screen Interval: 29.50 - 31.00 m BGS
Sand Pack Interval: 29.20 - 31.00 m BGS
Well Seal Interval: 0.30 - 29.20 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

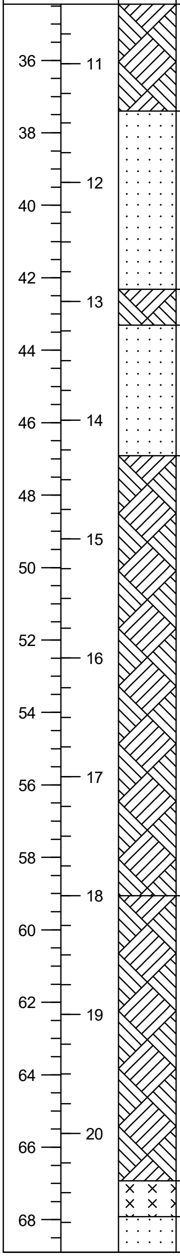
Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-23-32

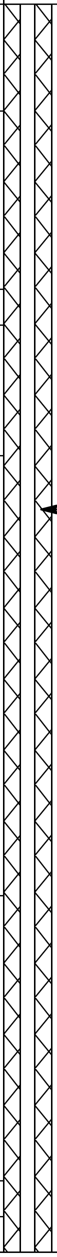
Project:	SR1/Springank	**Method:**	Air Rotary
Client:	Alberta Transportaiton	**Date started/completed:**	13-May-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/IM	**Easting:**	681934
Contractor:	All Service Drilling	**Northing:**	5658853

SUBSURFACE PROFILE

INSTALLATION DETAILS



Stratigraphic Description	Depth (m BGS)
fine grained, trace silt, moist	10.50
MUDSTONE saturated, grey	
SANDSTONE saturated, grey to brown - at 12.4 to 12.5 m BGS, mudstone lens	11.40
MUDSTONE saturated, grey to brown	12.90
SANDSTONE saturated, grey to brown	13.20
SANDSTONE AND MUDSTONE intebedded dark grey mudstone and fine grained grey to blackish grey sandstones	14.30
MUDSTONE grey to dark grey - at 19.8 m BGS, becomes sturated, grey	18.00
SILTSTONE grey to dark grey, saturated	20.40
SANDSTONE saturated, dark grey	20.70



Description

50 mm solid PVC pipe packed in hydrated bentonite chips
0.3 to 29.2 m BGS

Screen Interval: 29.50 - 31.00 m BGS
Sand Pack Interval: 29.20 - 31.00 m BGS
Well Seal Interval: 0.30 - 29.20 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

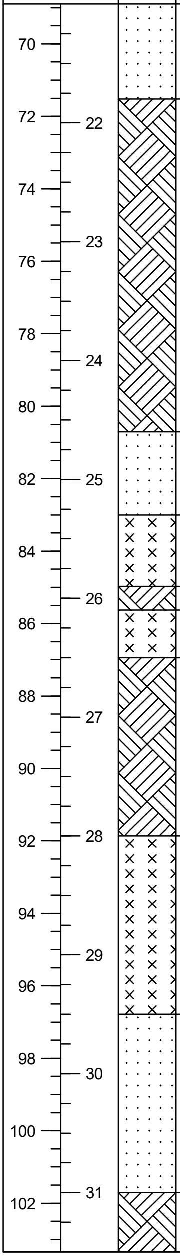
Stantec

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-23-32

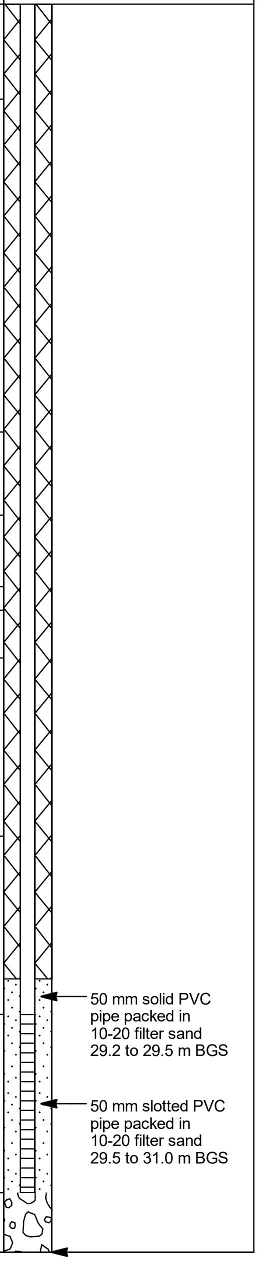
Project:	SR1/Springank	**Method:**	Air Rotary
Client:	Alberta Transportaiton	**Date started/completed:**	13-May-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/IM	**Easting:**	681934
Contractor:	All Service Drilling	**Northing:**	5658853

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
SANDSTONE saturated, dark grey	
MUDSTONE saturated, grey to light grey	21.80
SANDSTONE saturated, grey	24.60
SILTSTONE saturated, black	25.30
MUDSTONE saturated, grey	25.90
SILTSTONE saturated, dark grey	26.10
MUDSTONE saturated, grey - at 27.6 m BGS, becomes weathered	26.50
SILTSTONE saturated, brown to grey	28.00
SANDSTONE saturated, grey to greyish brown	29.50
MUDSTONE saturated, dark grey	31.00

INSTALLATION DETAILS



50 mm solid PVC pipe packed in 10-20 filter sand 29.2 to 29.5 m BGS

50 mm slotted PVC pipe packed in 10-20 filter sand 29.5 to 31.0 m BGS

Screen Interval: 29.50 - 31.00 m BGS
Sand Pack Interval: 29.20 - 31.00 m BGS
Well Seal Interval: 0.30 - 29.20 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-23-32

Project:	SR1/Springank	**Method:**	Air Rotary
Client:	Alberta Transportaiton	**Date started/completed:**	13-May-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/IM	**Easting:**	681934
Contractor:	All Service Drilling	**Northing:**	5658853

SUBSURFACE PROFILE

INSTALLATION DETAILS

Depth (ft)	Depth (m)	Graphic Log	Stratigraphic Description	Depth (m BGS)	Diagram	Description
104		▨				Slough
	32	☰	SILTSTONE SHALE saturated, dark grey	31.70		
106			End of Borehole	32.00		
108	33					
110						
112	34					
114						
116	35					
118	36					
120						
122	37					
124	38					
126						
128	39					
130						
132	40					
134	41					
136						

Screen Interval: 29.50 - 31.00 m BGS
Sand Pack Interval: 29.20 - 31.00 m BGS
Well Seal Interval: 0.30 - 29.20 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

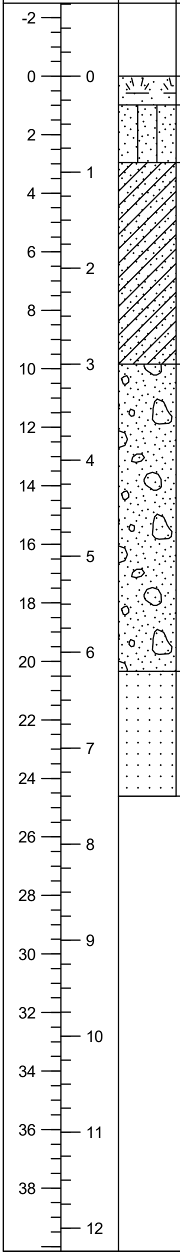
m BTOC - metres below top of casing
Locaiton coordinates are approximate

Drawn By/Checked By: JL/DK

Monitoring Well: RMW16-23-7

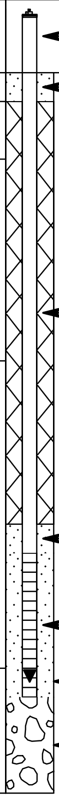
Project:	SR1/Springank	**Method:**	Solid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	11-May-2022
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/IM	**Easting:**	n/a
Contractor:	All Service Drilling	**Northing:**	n/a

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
Ground Surface	
TOPSOIL darkbrown to black, moist	0.00
SILTY SAND trace gravel, light brown to grey, dry to moist	0.30
SANDY CLAY TILL trace gravel, trace mineral precipitate, oxidation staining, low plasticity, light brown to brown, - at 1.4 m BGS, cobble sized gravel - at 1.5 m BGS, increased gravel to approximately 30 percent	0.90
SAND AND GRAVEL brown, dry - at 4.5 m BGS, becomes moist	3.00
SANDSTONE fine grained, brown, poor recovery	6.20
End of Borehole	7.50

INSTALLATION DETAILS



Description

- Aboveground casing 0.76 m
- 50 mm solid PVC pipe packed in 10-20 filter sand
- 50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 tto 4.7 m BGS
- 50 mm solid PVC pipe packed in 10-20 filter sand 4.7 to 5.0 m BGS
- 50 mm slotted PVC pipe packed in 10-20 filter sand 5.0 to 6.5 m BGS
- Water level 6.34 m BTOC 13-May-22
- Slough

Screen Interval:	5.00 - 6.50 m BGS
Sand Pack Interval:	4.70 - 6.50 m BGS
Well Seal Interval:	0.30 - 4.70 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing

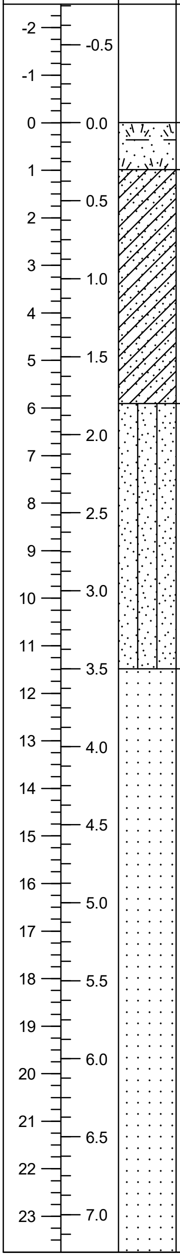
Drawn By/Checked By: JL/DK

Monitoring Wells: RMW16-5-12

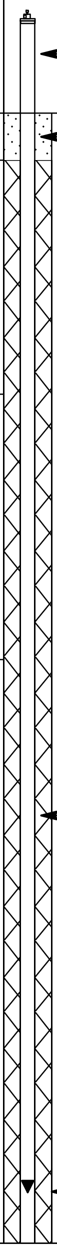
Project:	SR1/Springank	**Method:**	Soid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	30-Nov-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/AK	**Easting:**	n/a
Contractor:	All Service Drilling	**Northing:**	n/a

SUBSURFACE PROFILE

Stratigraphic Description	Depth (m BGS)
Ground Surface TOPSOIL	0.00
SANDY CLAY fine grained sand, some oxidation and organics, greyish brown, dry	0.30
SILTY SAND some gravel, trace clay, low plasticity, reddish brown, moist	1.80
SANDSTONE fine to very fine sand, brown, dry	3.50



INSTALLATION DETAILS



Description
Aboveground casing 0.76 m
50 mm solid PVC pipe packed in 10-20 filter sand
50 mm solid PVC pipe packed in hydrated bentonite chips 0.3 to 8.7 m BGS
Water level 6.914 m BTOC 4-May-22

Screen Interval:	9.00 - 12.00 m BGS
Sand Pack Interval:	8.70 - 12.00 m BGS
Well Seal Interval:	0.30 - 8.70 m BGS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

m BTOC - metres below top of casing

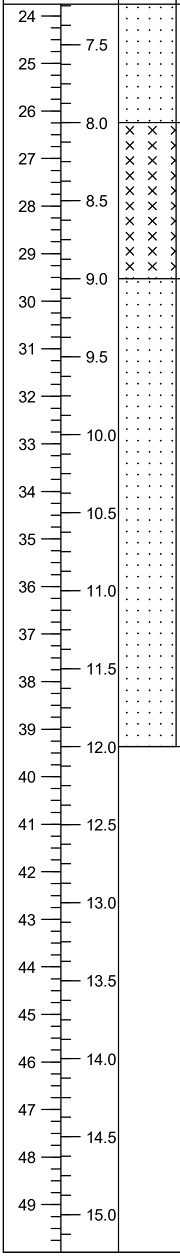
Stantec

Drawn By/Checked By: JL/DK

Monitoring Wells: RMW16-5-12

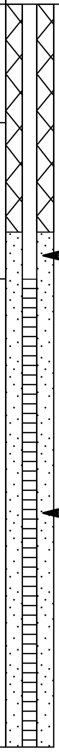
Project:	SR1/Springank	**Method:**	Soid Stem Auger
Client:	Alberta Transportaiton	**Date started/completed:**	30-Nov-2021
Location:	Rockyview County	**Ground surface elevation:**	n/a
Number:	10773396.5210.215	**Top of casing elevation:**	n/a
Field investigator:	WT/AK	**Easting:**	n/a
Contractor:	All Service Drilling	**Northing:**	n/a

SUBSURFACE PROFILE



Stratigraphic Description	Depth (m BGS)
SANDSTONE fine to very fine sand, brown, dry	
SILTSTONE traces of coal, grey, wet	8.00
SANDSTONE very fine sand, silt seams, grey, dry	9.00
End of Borehole	12.00

INSTALLATION DETAILS



Description

50 mm solid PVC pipe packed in 10-20 filter sand 8.7 to 9.0 m BGS

50 mm slotted PVC pipe packed in 10-20 filter sand 9.0 to 12.0 m BGS

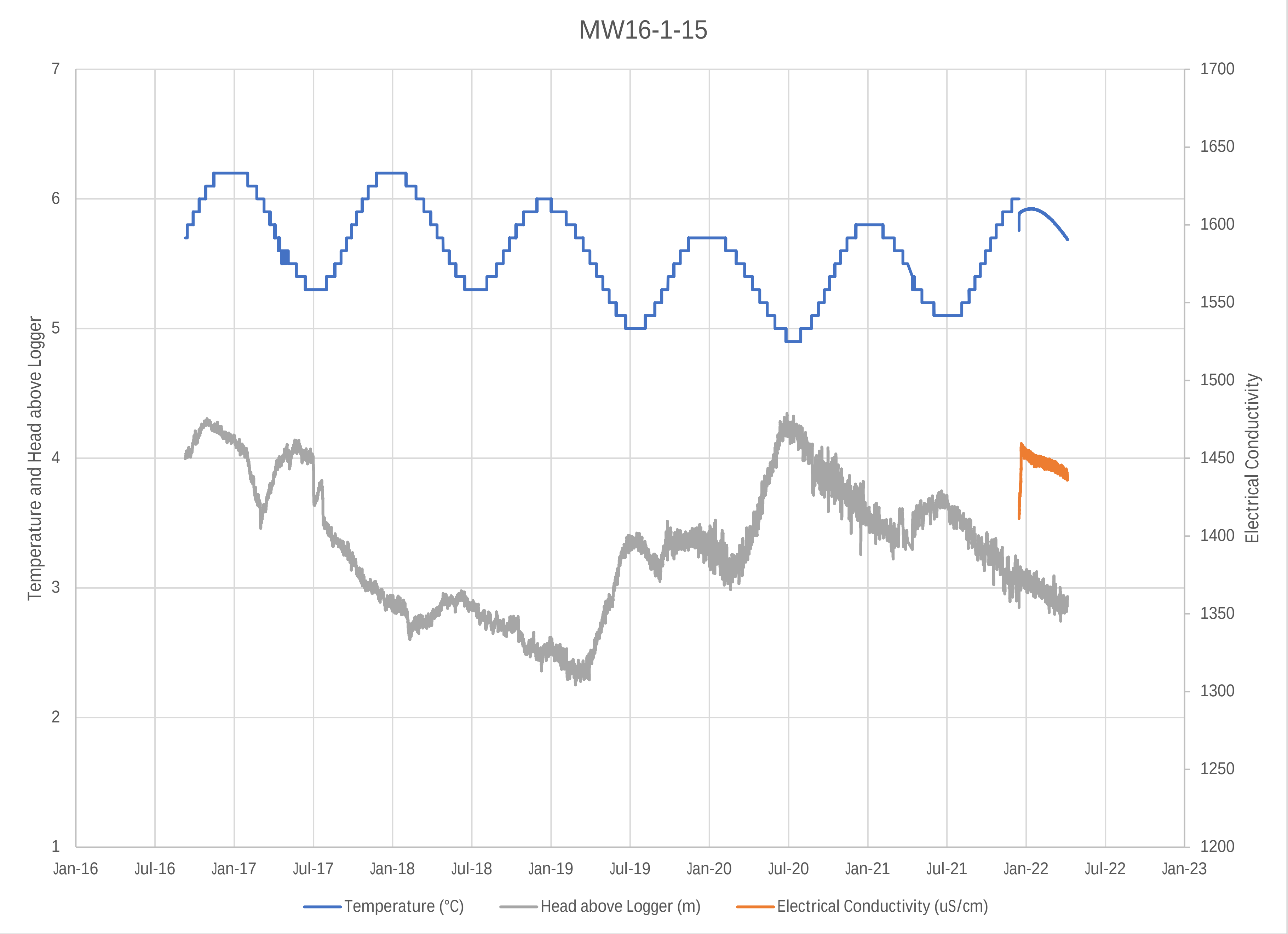
Screen Interval: 9.00 - 12.00 m BGS
Sand Pack Interval: 8.70 - 12.00 m BGS
Well Seal Interval: 0.30 - 8.70 m BGS

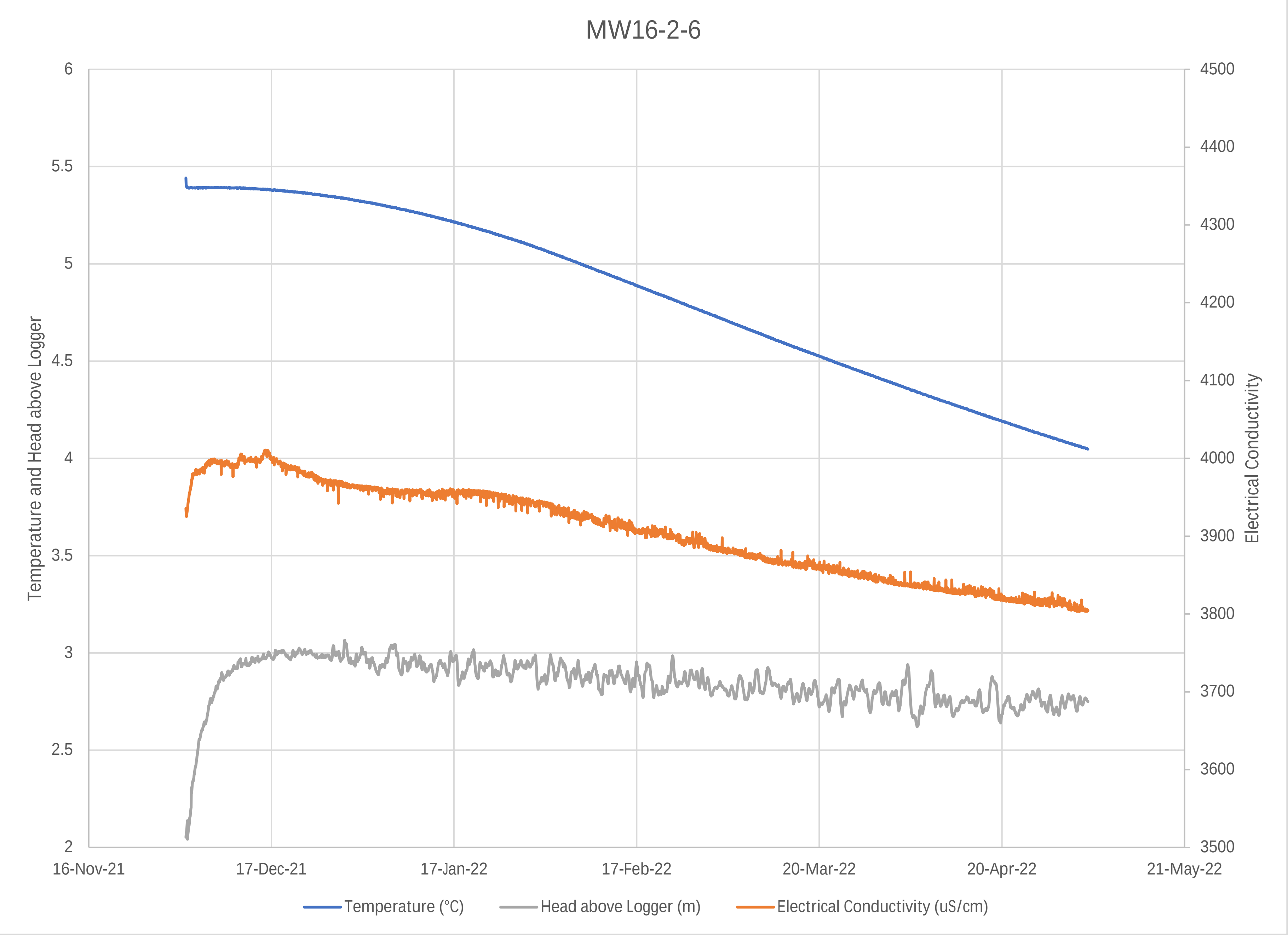
Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available
m BTOC - metres below top of casing

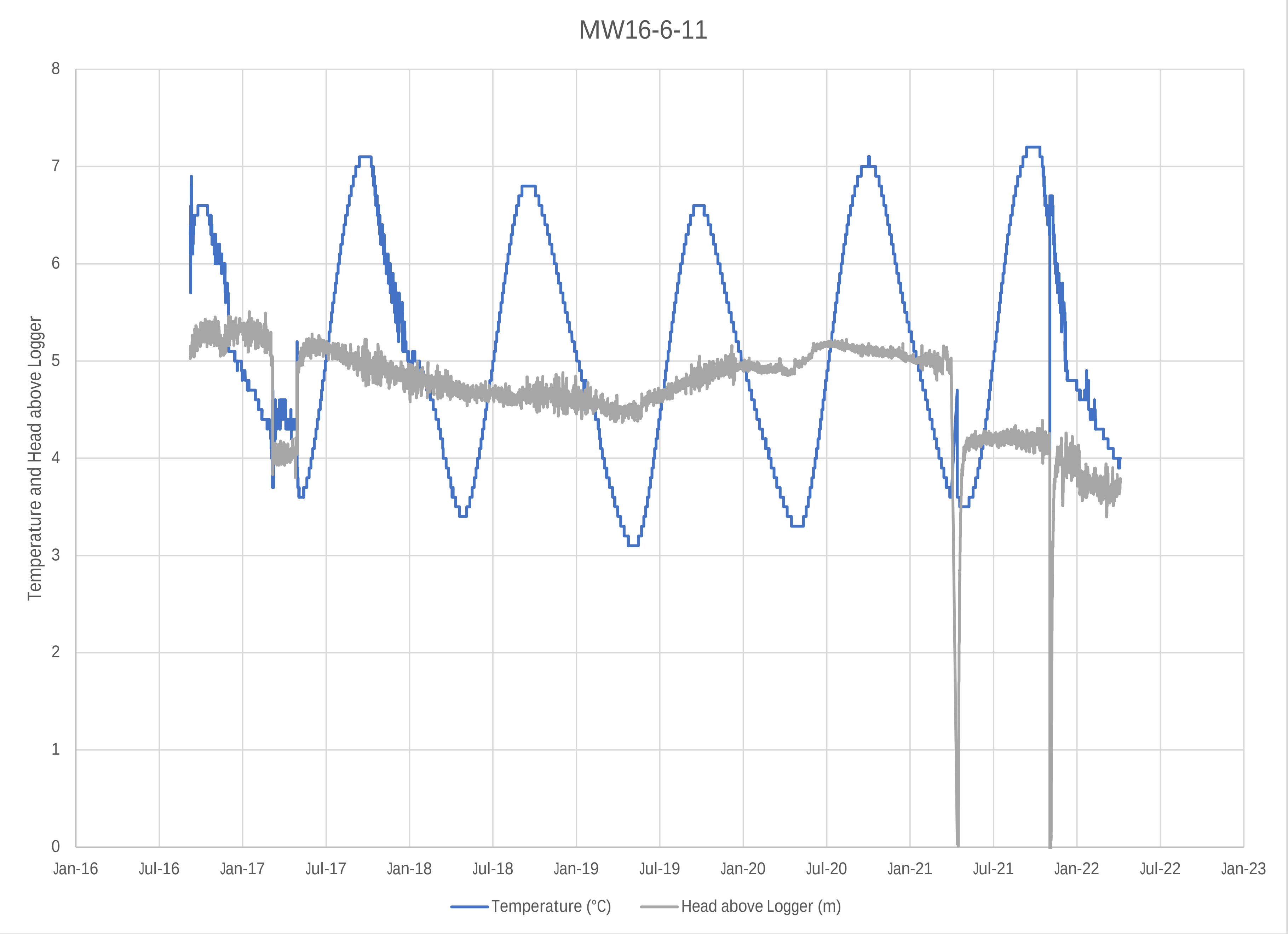
Stantec

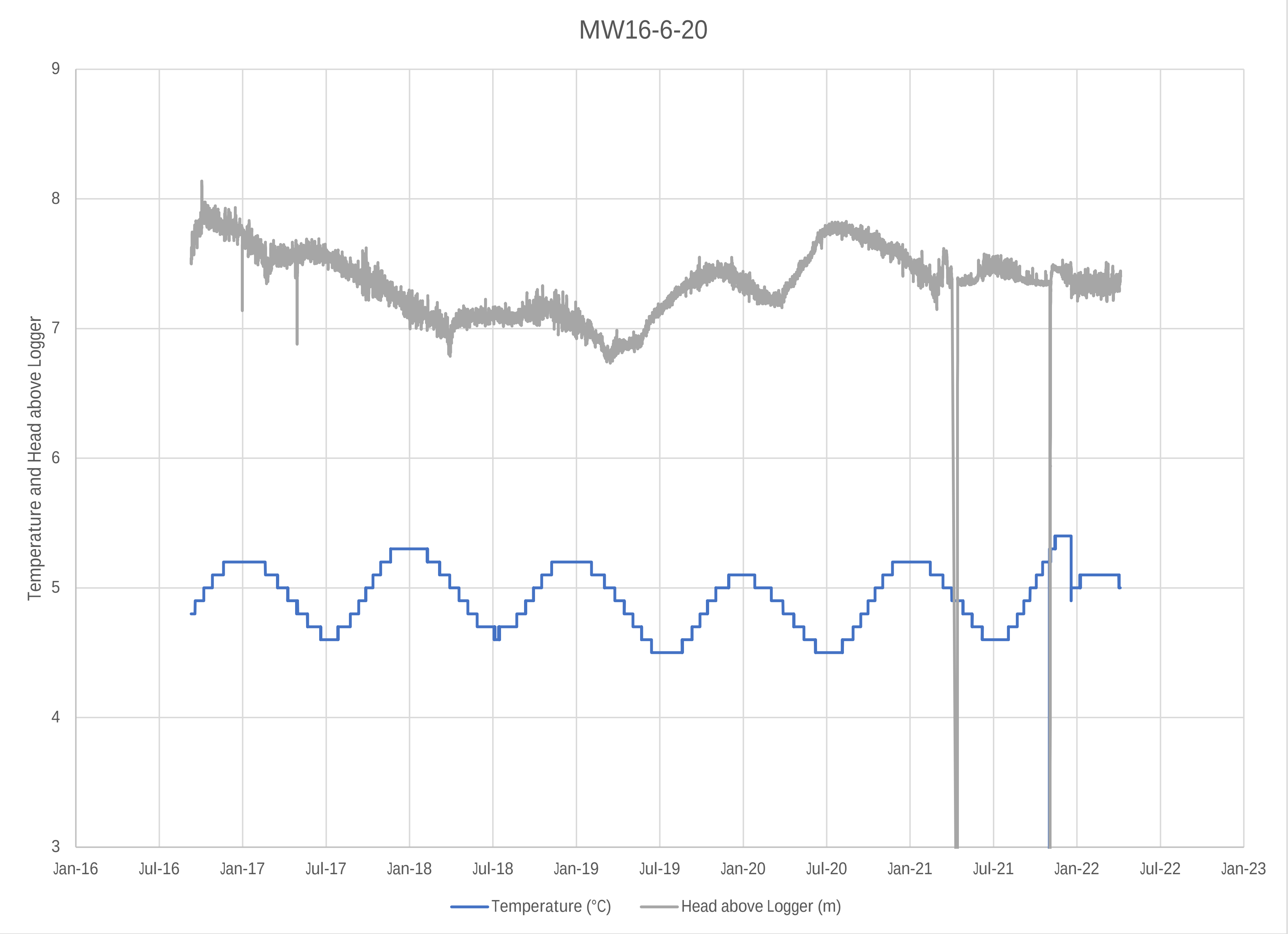
Drawn By/Checked By: JL/DK

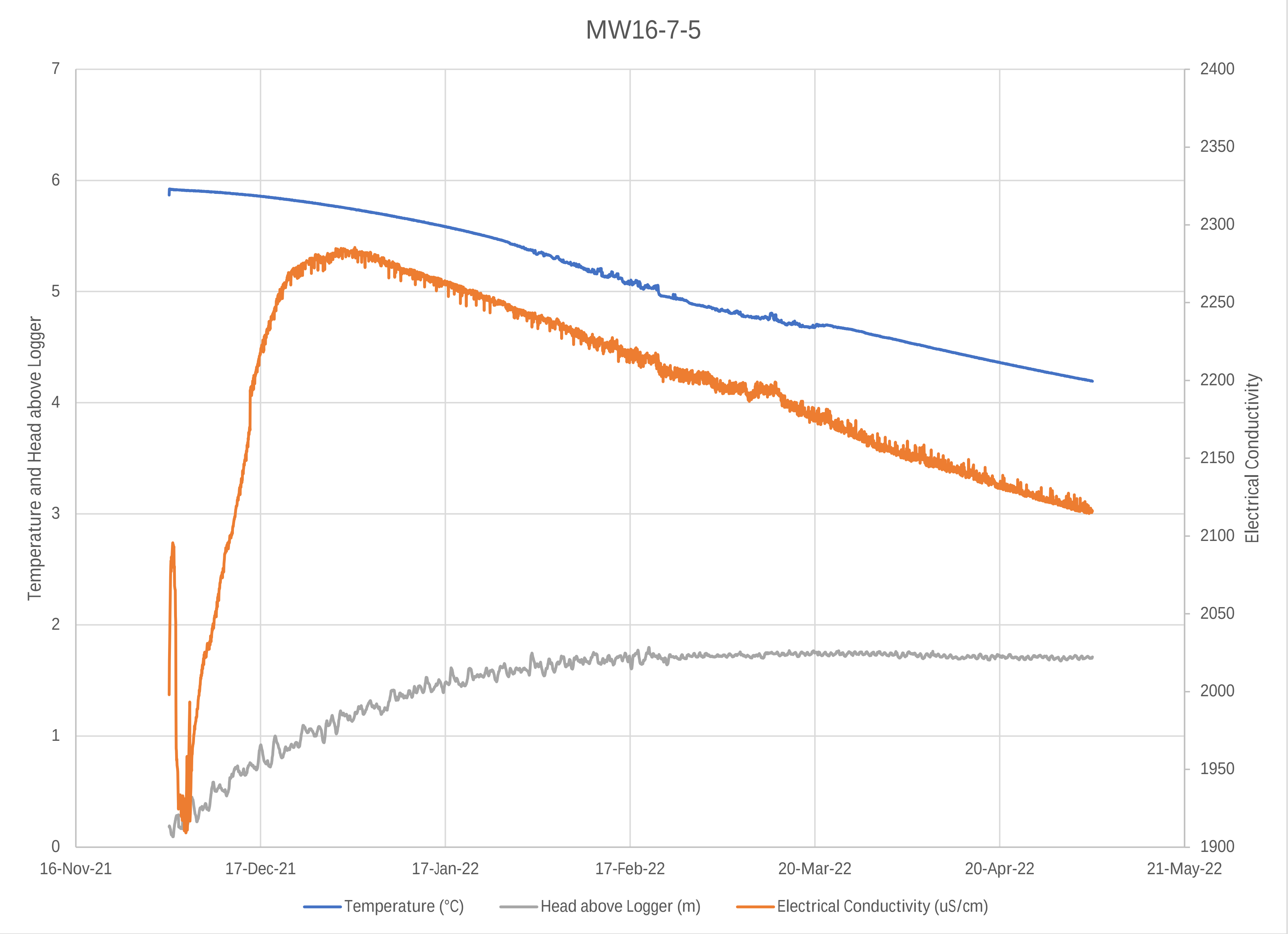
Appendix C Data Logging Pressure Transducer Data

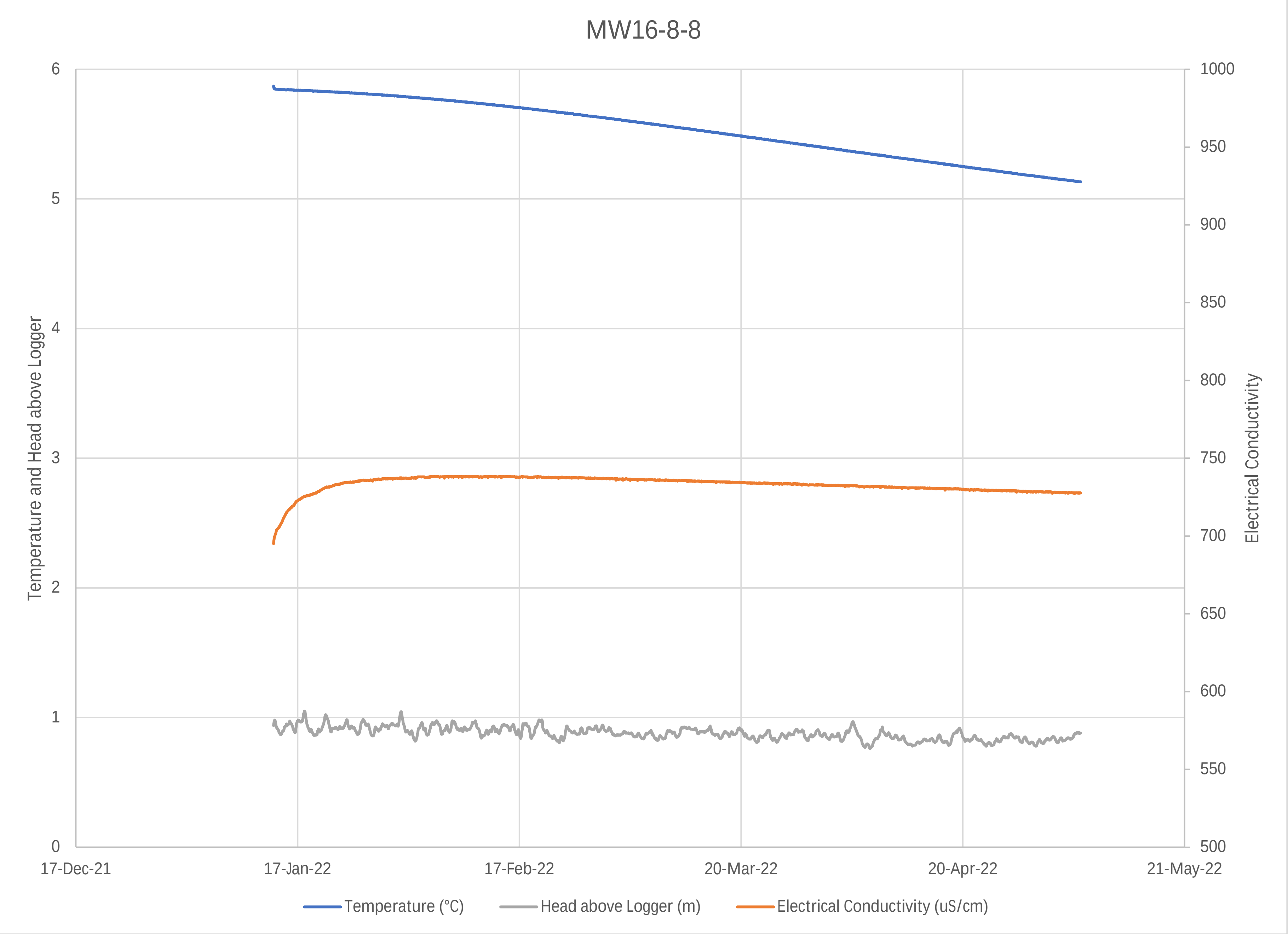

MW16-1-15
7
6
5
4
3
2
1
Temperature and Head above Logger
1700
1650
1600
1550
1500
1450
1400
1350
1300
1250
1200
Electrical Conductivity
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Jul-20
Jan-21
Jul-21
Jan-22
Jul-22
Jan-23
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

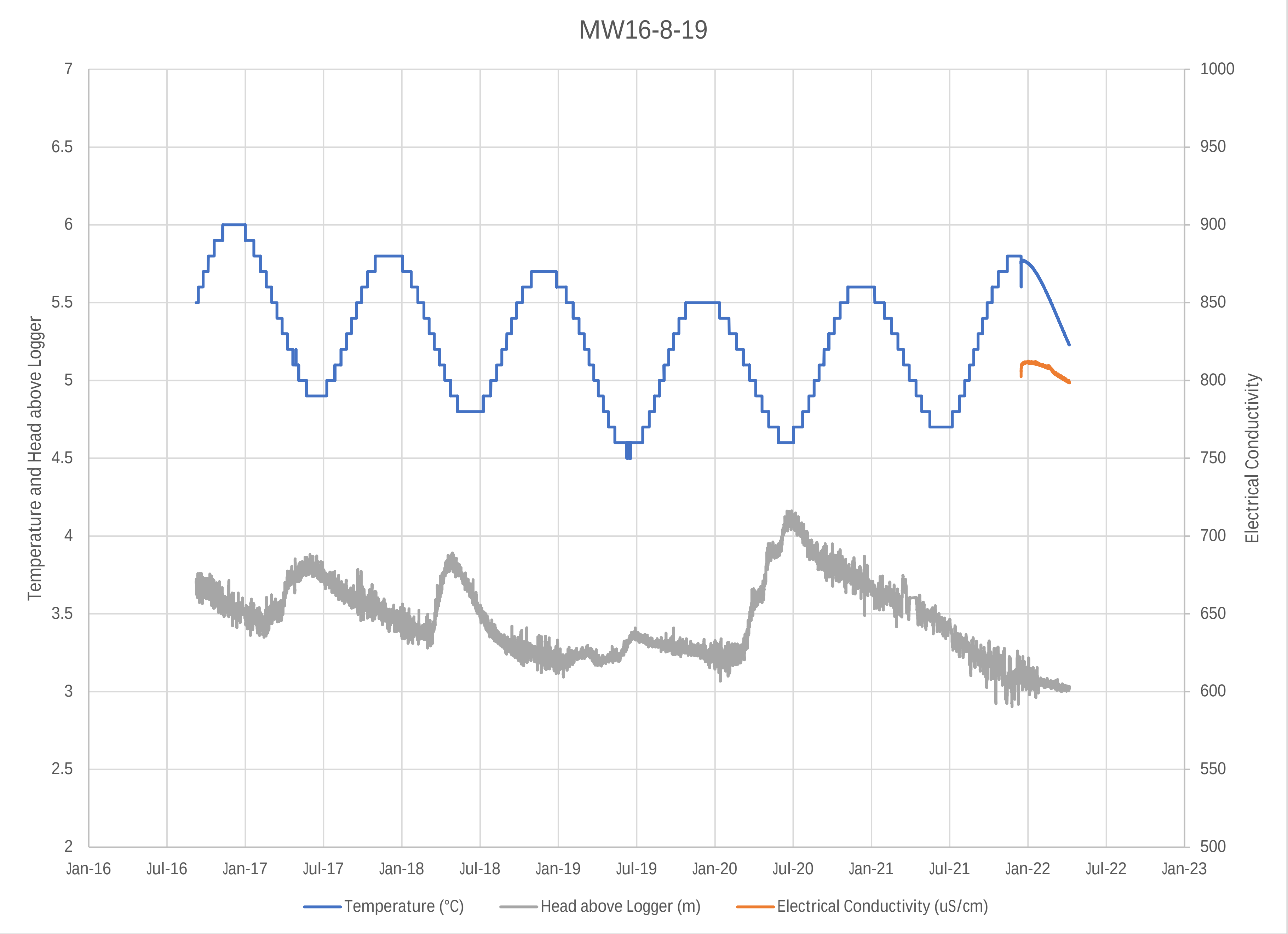

MW16-2-6
Temperature and Head above Logger
Electrical Conductivity
6
5.5
5
4.5
4
3.5
3
2.5
2
4500
4400
4300
4200
4100
4000
3900
3800
3700
3600
3500
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

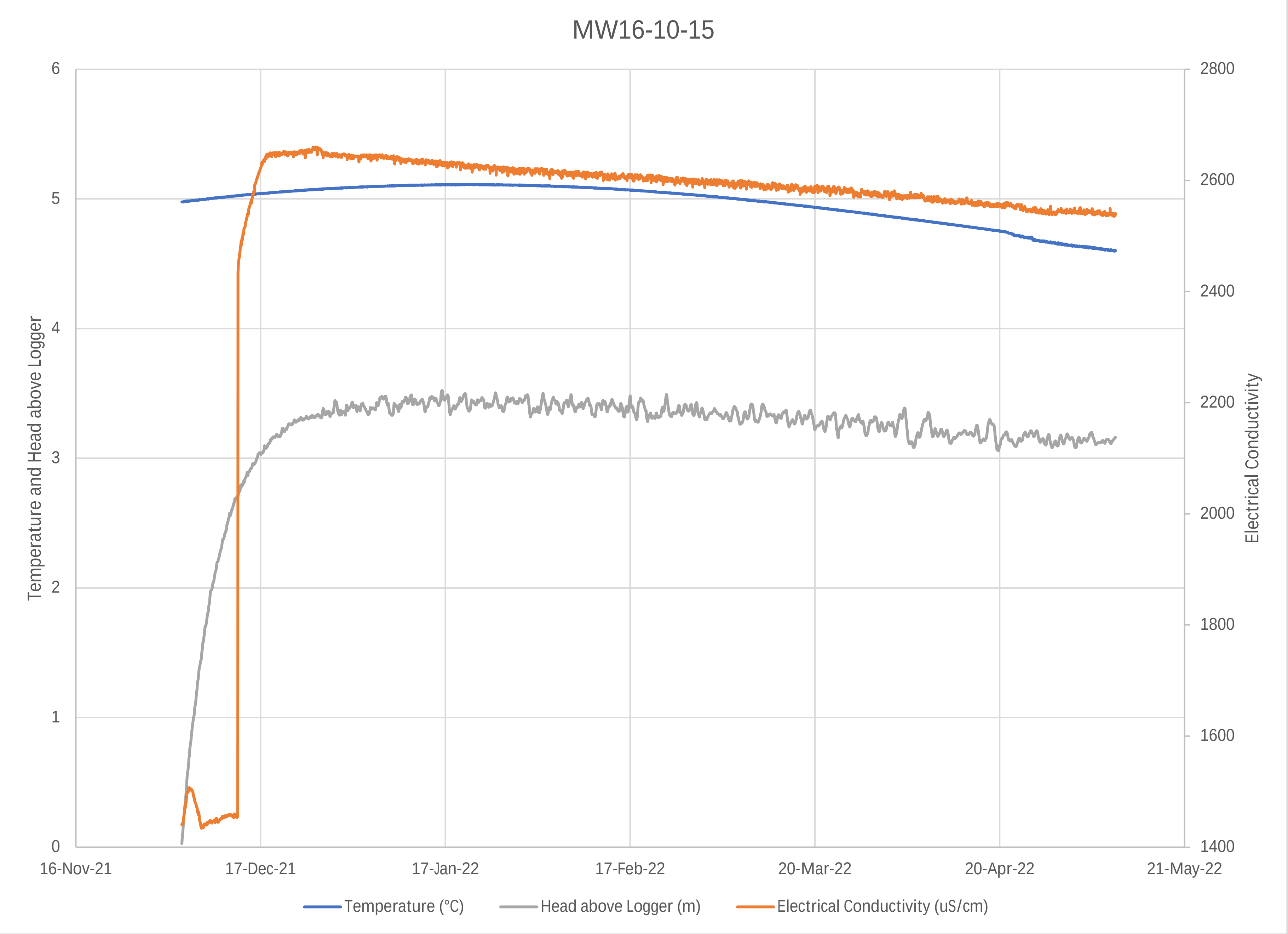

MW16-6-11
Temperature and Head above Logger
8
7
6
5
4
3
2
1
0
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Jul-20
Jan-21
Jul-21
Jan-22
Jul-22
Jan-23
Temperature (°C)
Head above Logger (m)


MW16-6-20
Temperature and Head above Logger
9
8
7
6
5
4
3
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Jul-20
Jan-21
Jul-21
Jan-22
Jul-22
Jan-23
Temperature (°C)
Head above Logger (m)

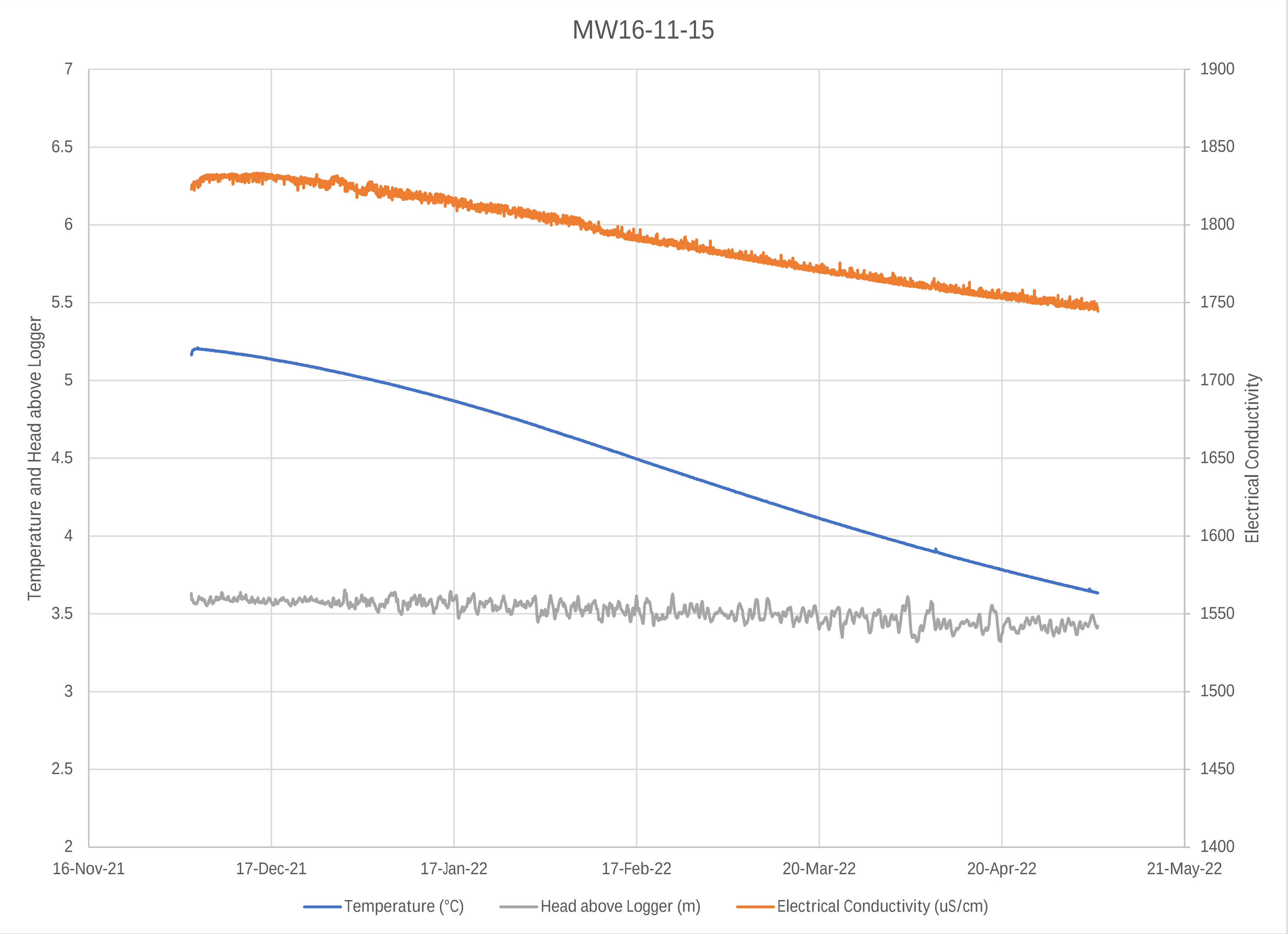

MW16-7-5
Temperature and Head above Logger
Electrical Conductivity
7
6
5
4
3
2
1
0
2400
2350
2300
2250
2200
2150
2100
2050
2000
1950
1900
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

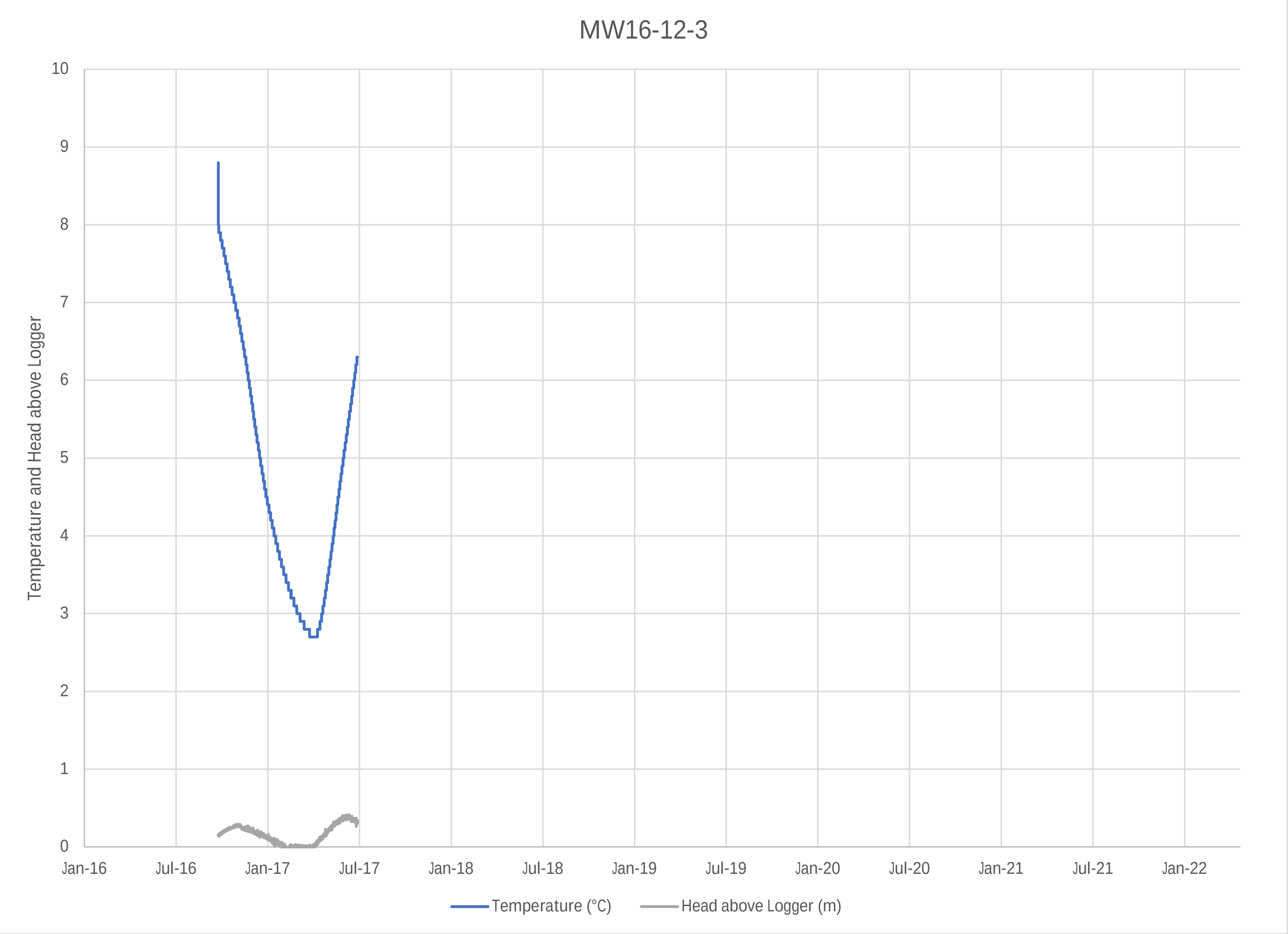

MW16-8-8
Temperature and Head above Logger
Electrical Conductivity
6
5
4
3
2
1
0
1000
950
900
850
800
750
700
650
600
550
500
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

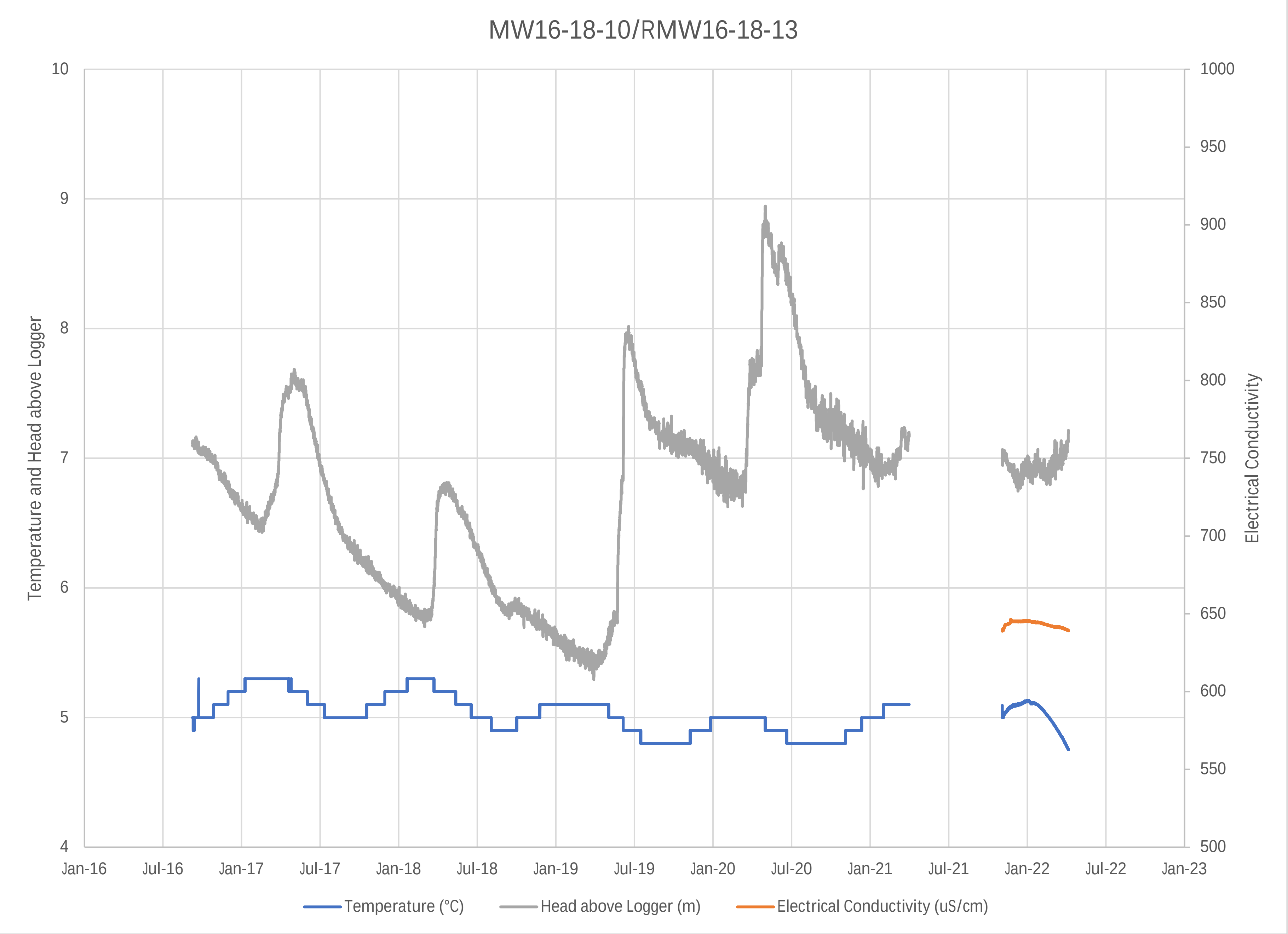

MW16-8-19
Temperature and Head above Logger
Electrical Conductivity
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1000
950
900
850
800
750
700
650
600
550
500
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Jul-20
Jan-21
Jul-21
Jan-22
Jul-22
Jan-23
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)



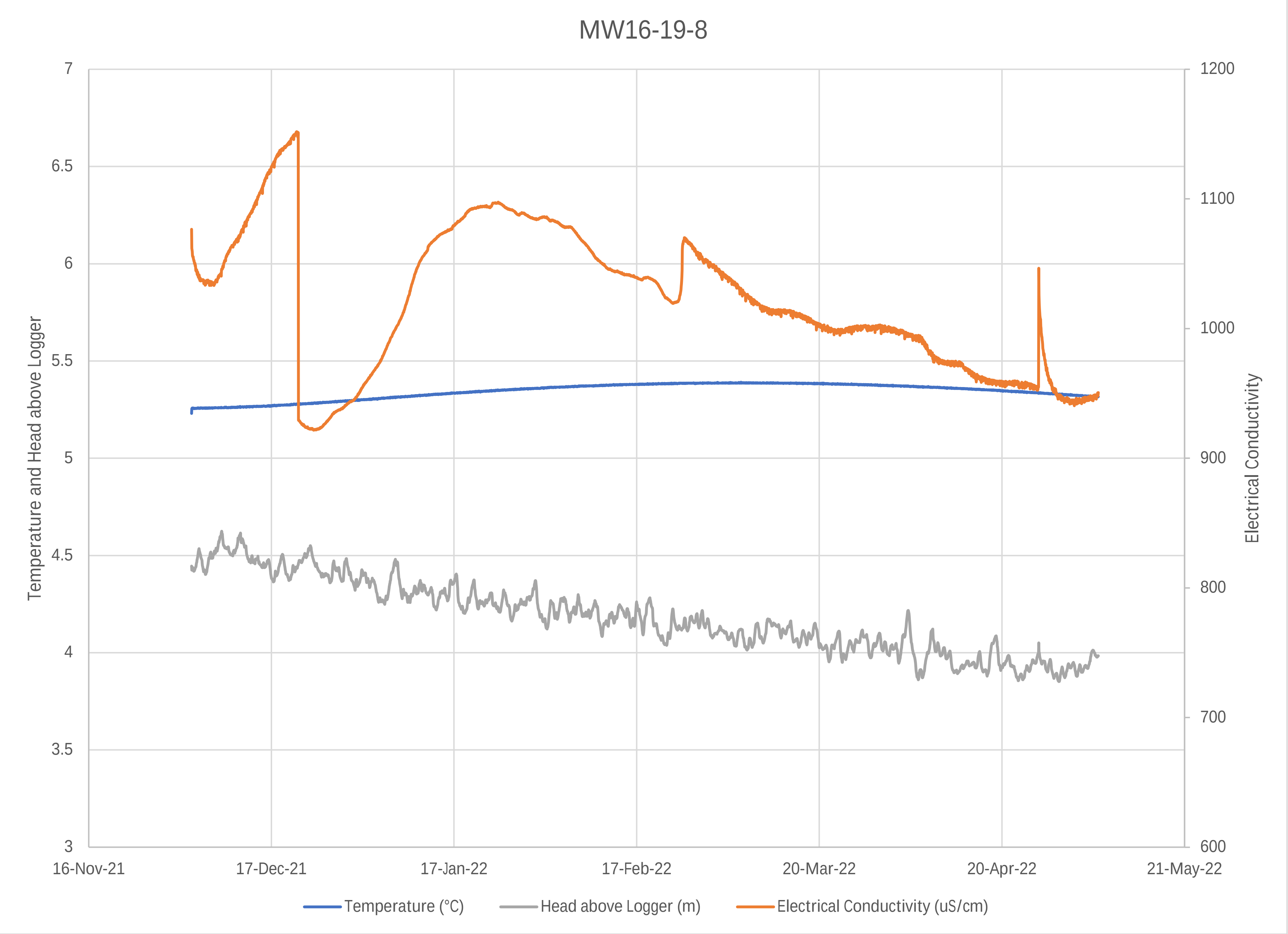
MW16-10-15
Temperature and Head above Logger
6
5
4
3
2
1
0
Electrical Conductivity
2800
2600
2400
2200
2000
1800
1600
1400
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

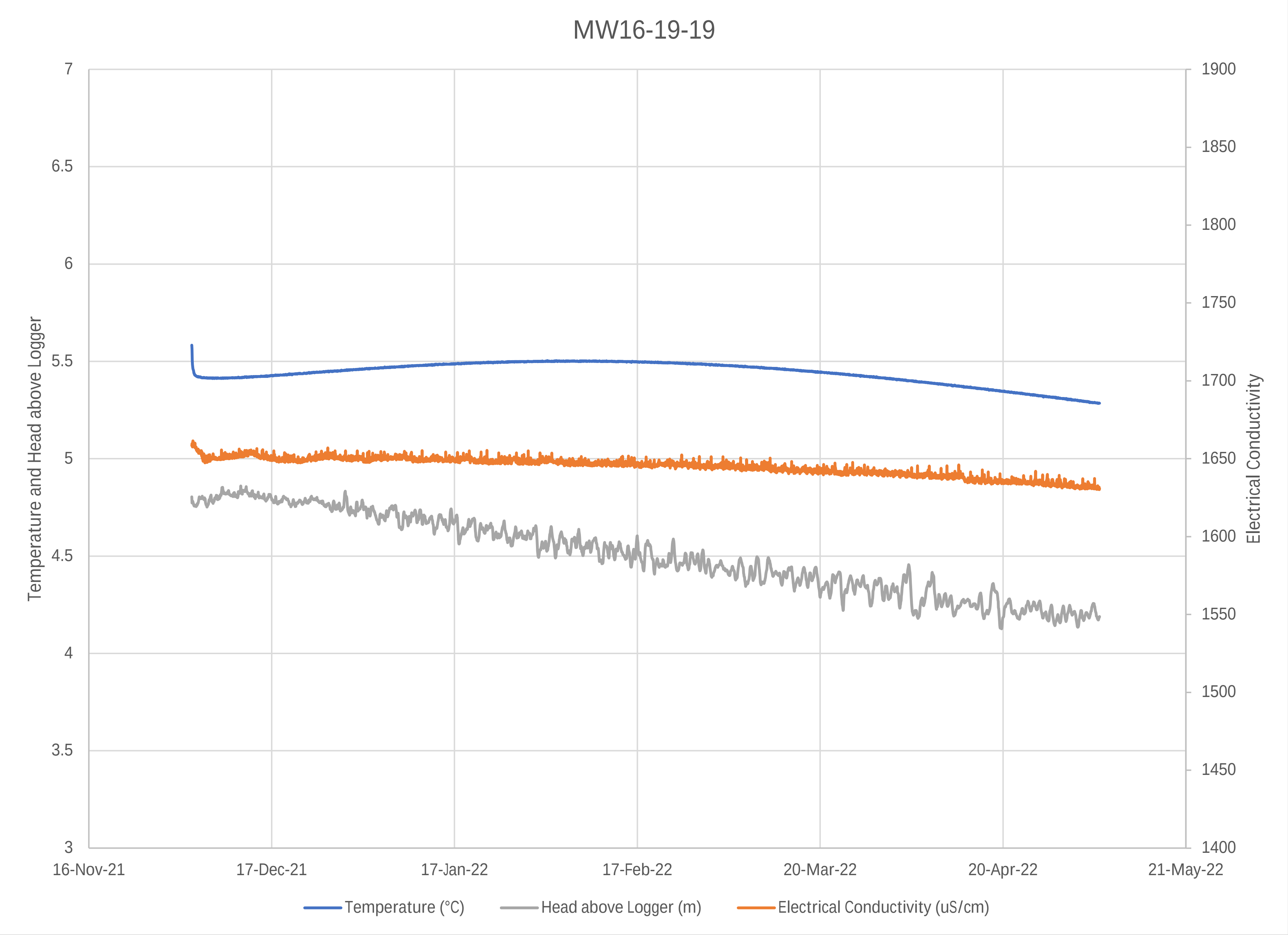

MW16-11-15
Temperature and Head above Logger
Electrical Conductivity
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1900
1850
1800
1750
1700
1650
1600
1550
1500
1450
1400
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)


MW16-12-3
Temperature and Head above Logger
10
9
8
7
6
5
4
3
2
1
0
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Jul-20
Jan-21
Jul-21
Jan-22
Temperature (°C)
Head above Logger (m)

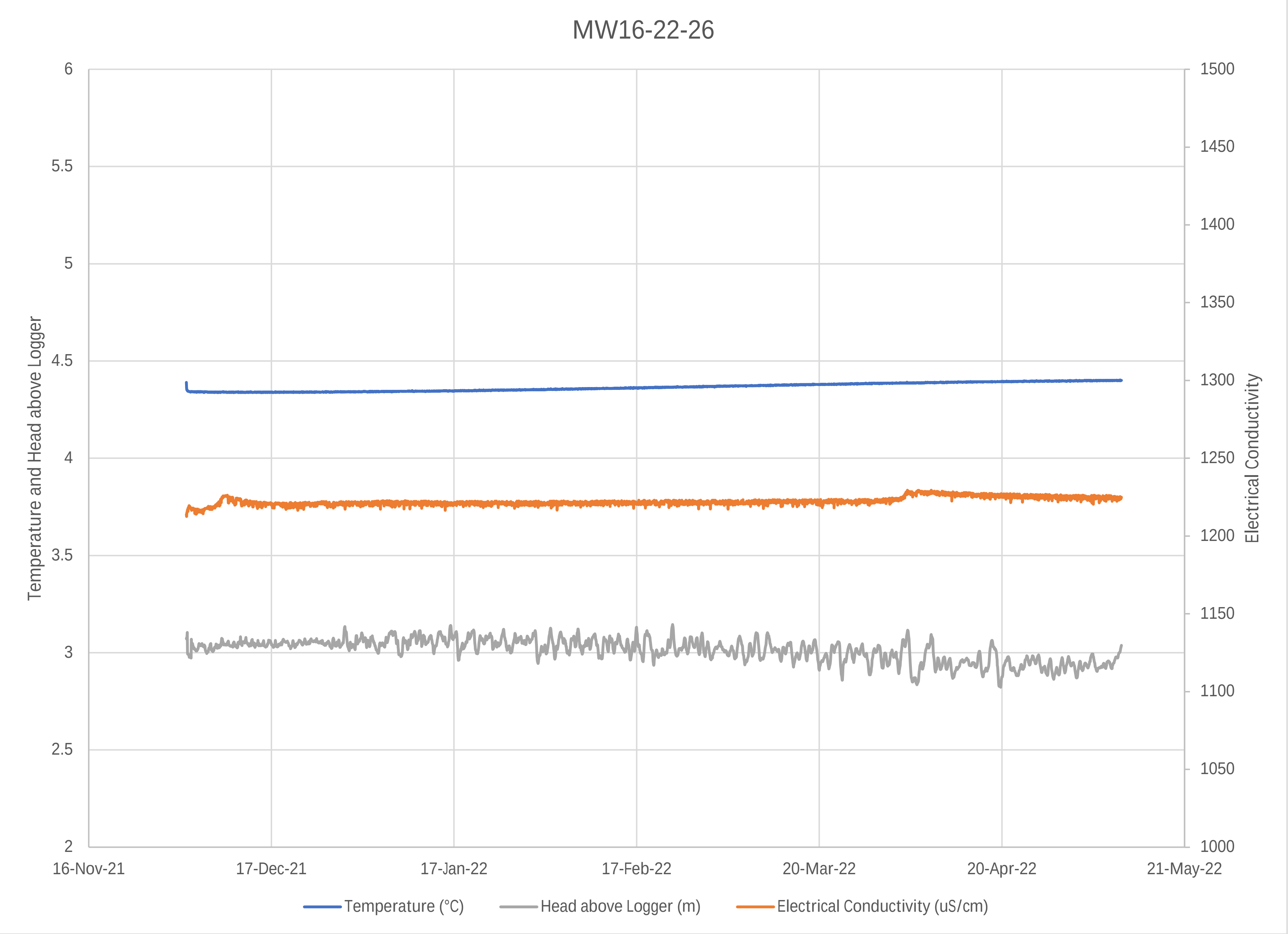


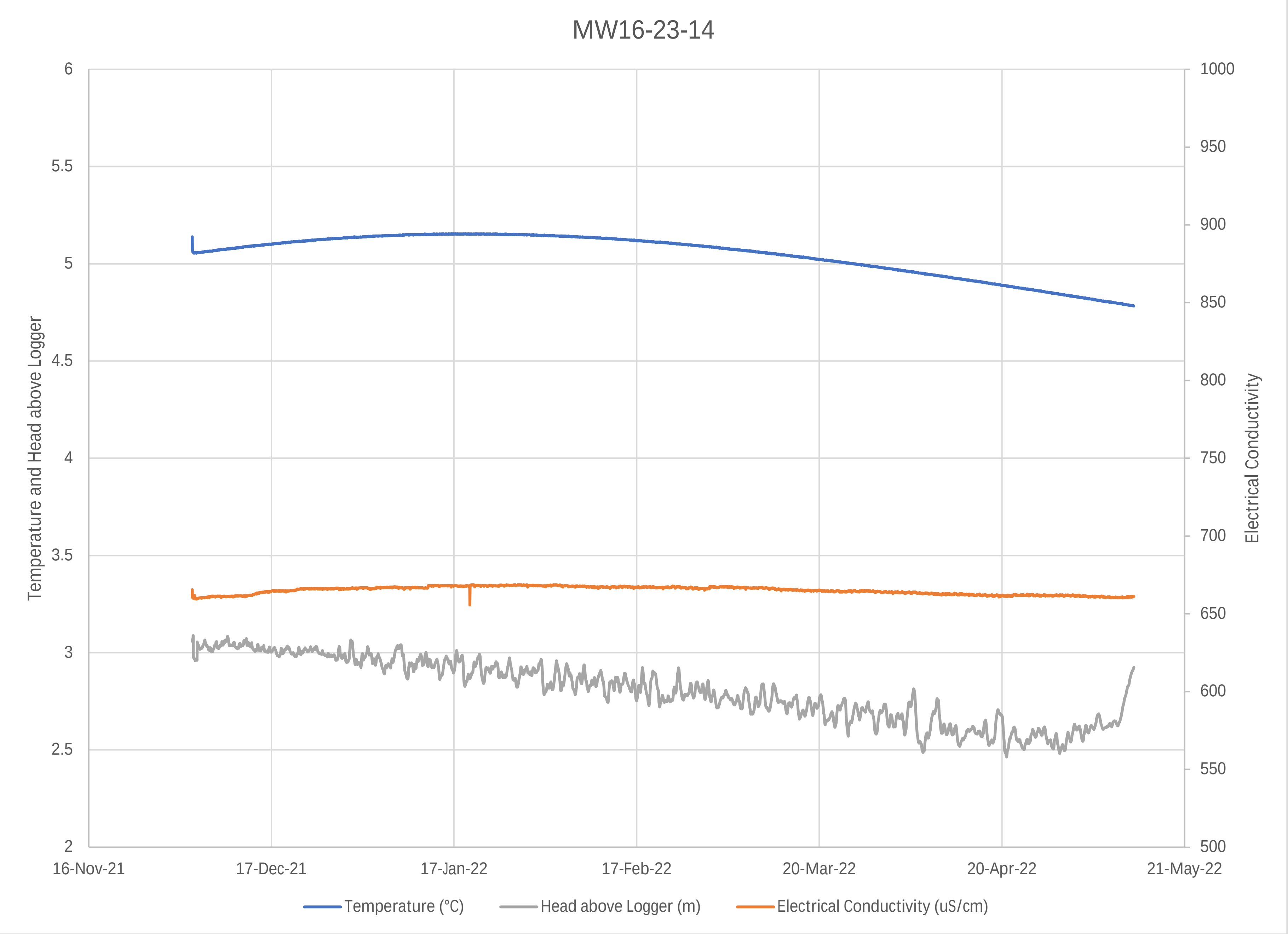
MW16-18-10/RMW16-18-13
Temperature and Head above Logger
Electrical Conductivity
10
9
8
7
6
5
4
1000
950
900
850
800
750
700
650
600
550
500
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19
Jul-19
Jan-20
Jul-20
Jan-21
Jul-21
Jan-22
Jul-22
Jan-23
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

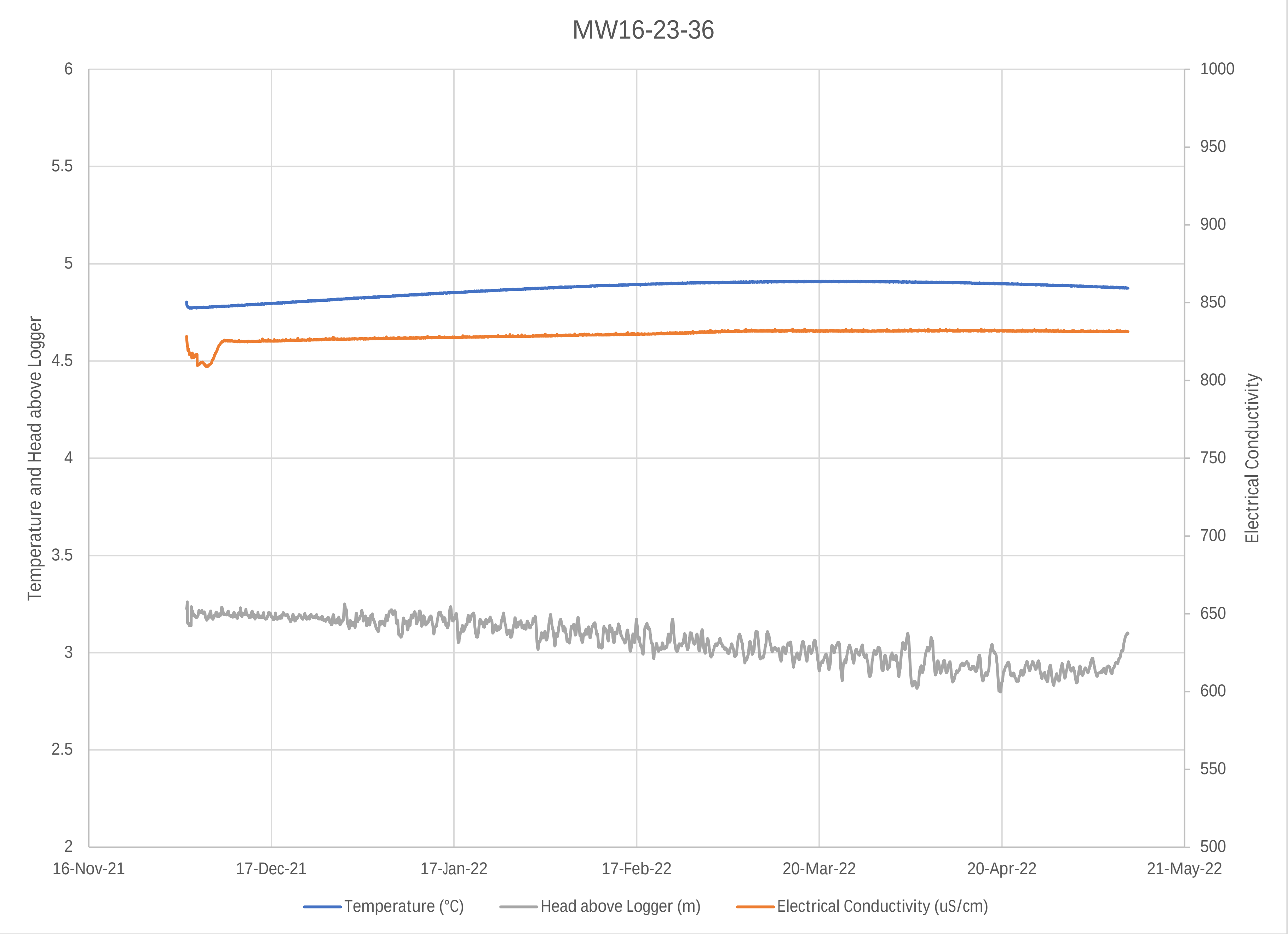

MW16-19-8
Temperature and Head above Logger
7
6.5
6
5.5
5
4.5
4
3.5
3
Electrical Conductivity
1200
1100
1000
900
800
700
600
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

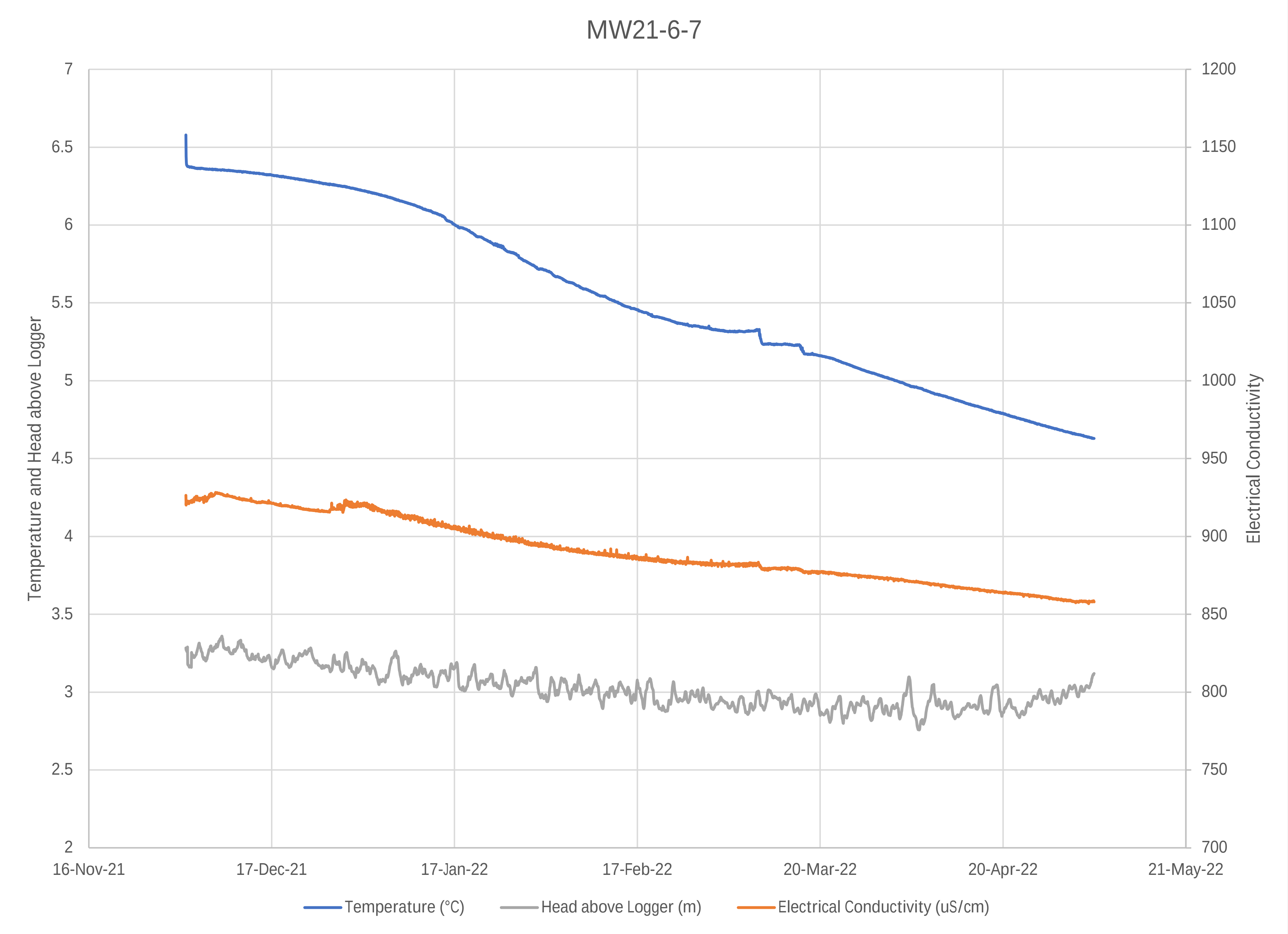


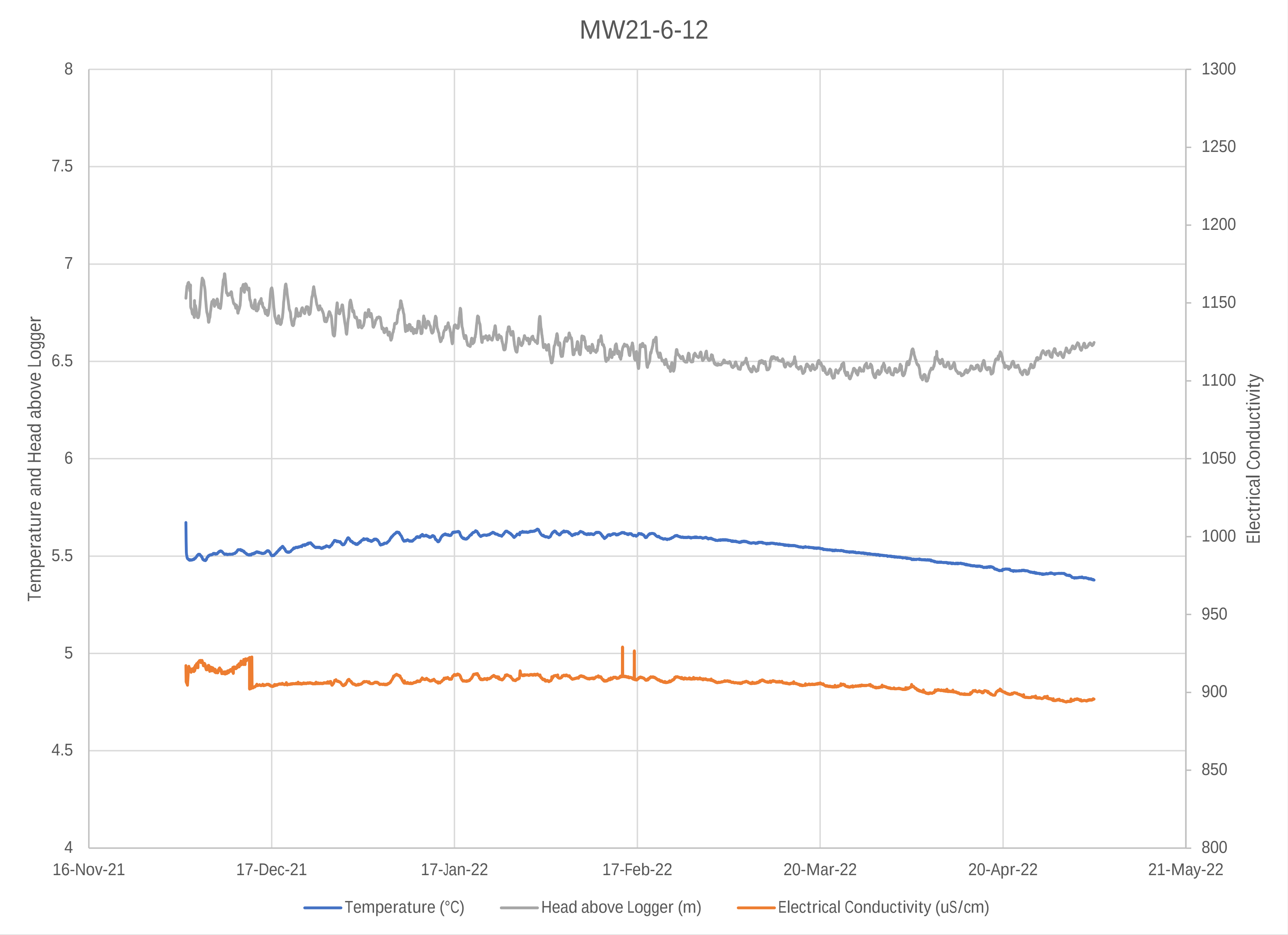
MW16-19-19
Temperature and Head above Logger
Electrical Conductivity
7
6.5
6
5.5
5
4.5
4
3.5
3
1900
1850
1800
1750
1700
1650
1600
1550
1500
1450
1400
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

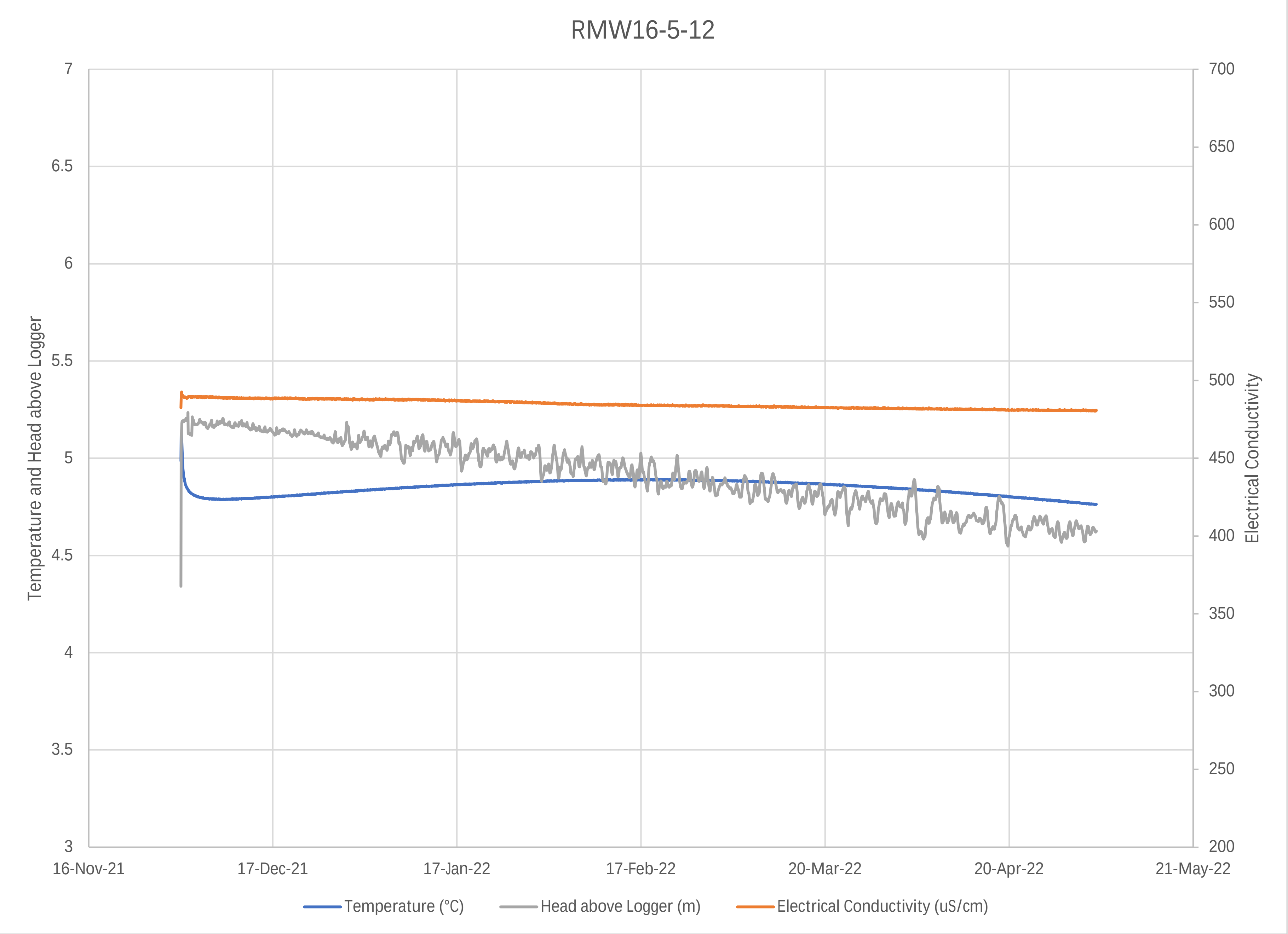

MW16-22-26
Temperature and Head above Logger
6
5.5
5
4.5
4
3.5
3
2.5
2
Electrical Conductivity
1500
1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

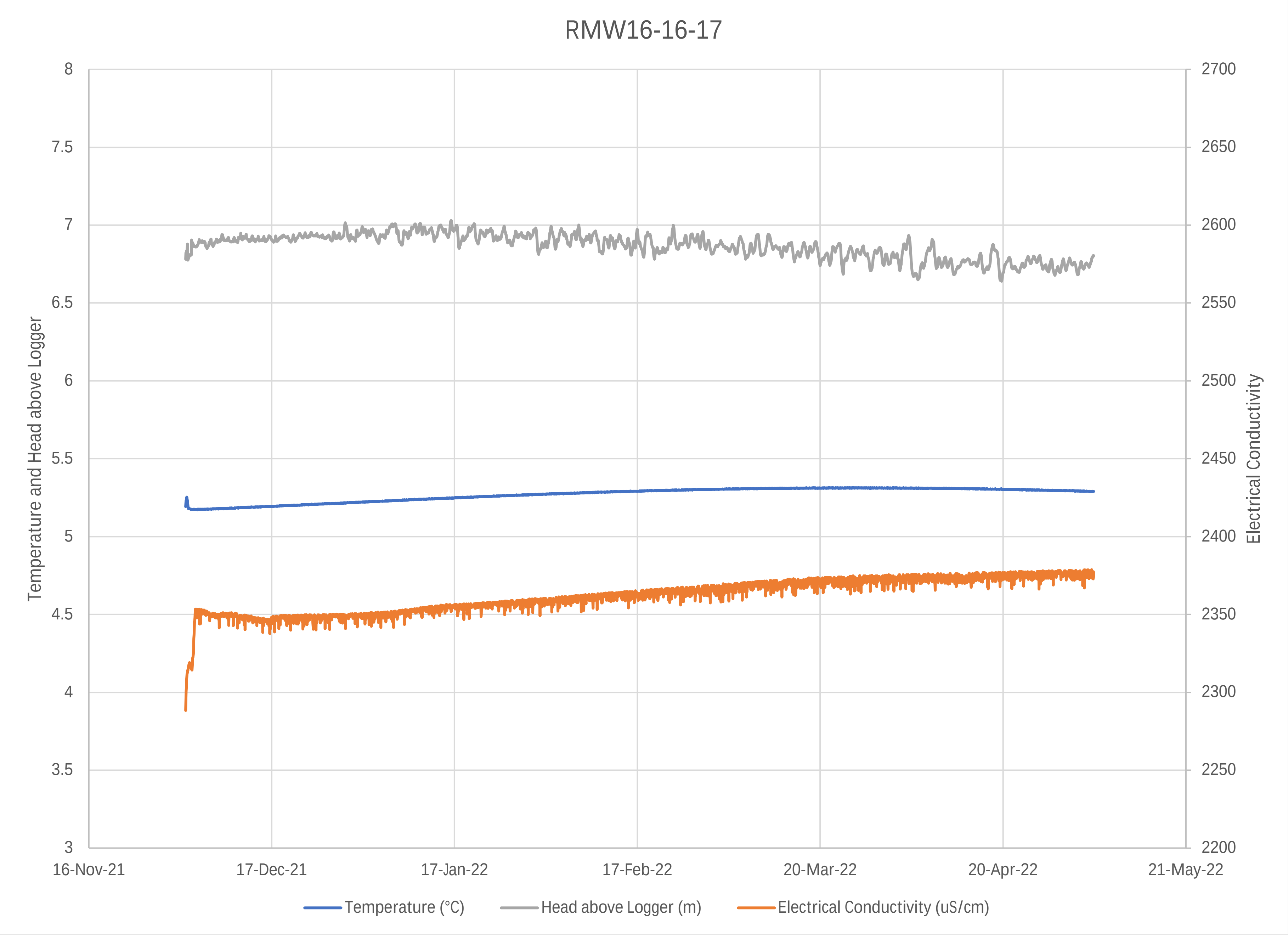

MW16-23-14
Temperature and Head above Logger
6
5.5
5
4.5
4
3.5
3
2.5
2
Electrical Conductivity
1000
950
900
850
800
750
700
650
600
550
500
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

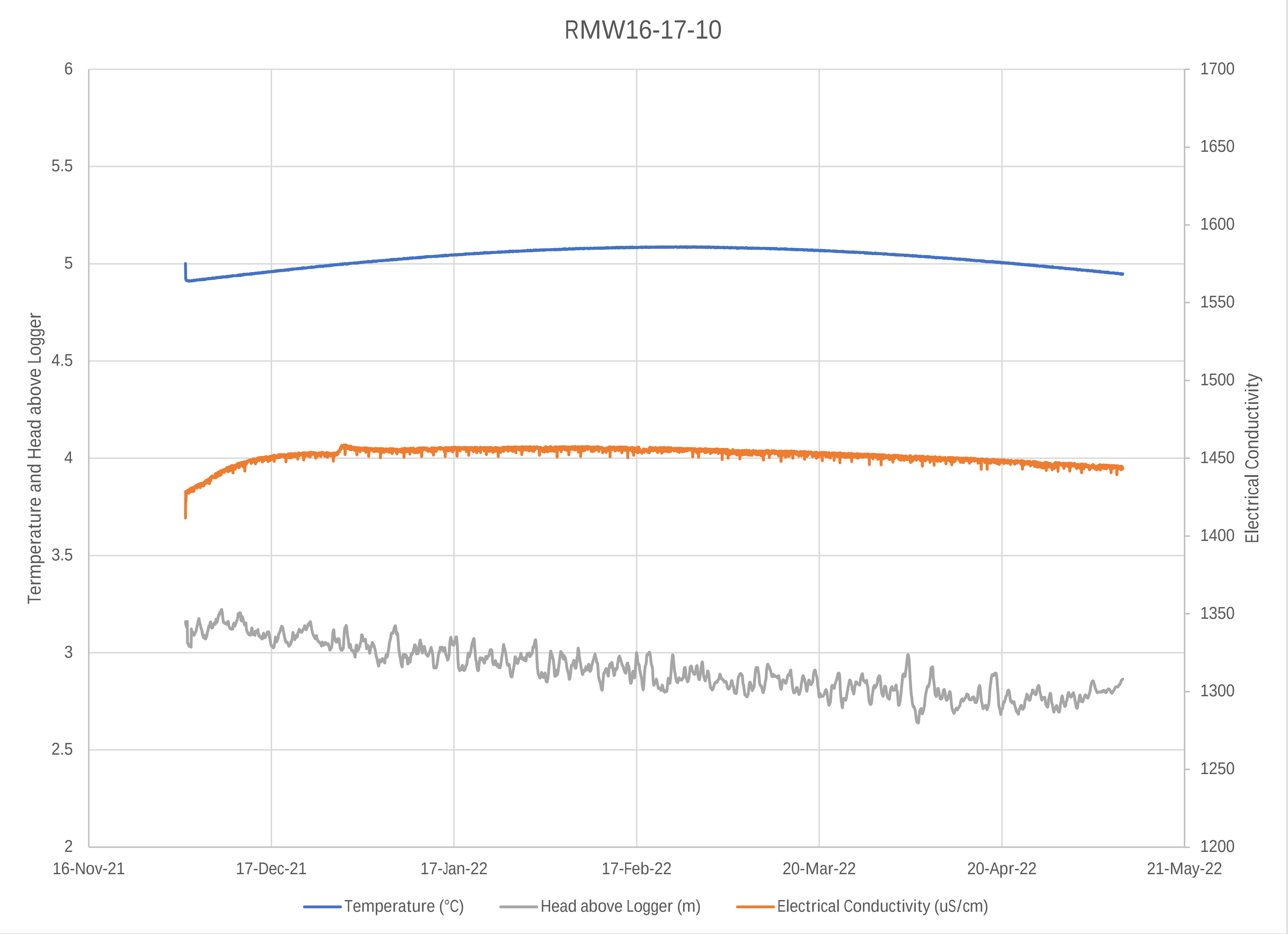

MW16-23-36
Temperature and Head above Logger
Electrical Conductivity
6
5.5
5
4.5
4
3.5
3
2.5
2
1000
950
900
850
800
750
700
650
600
550
500
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

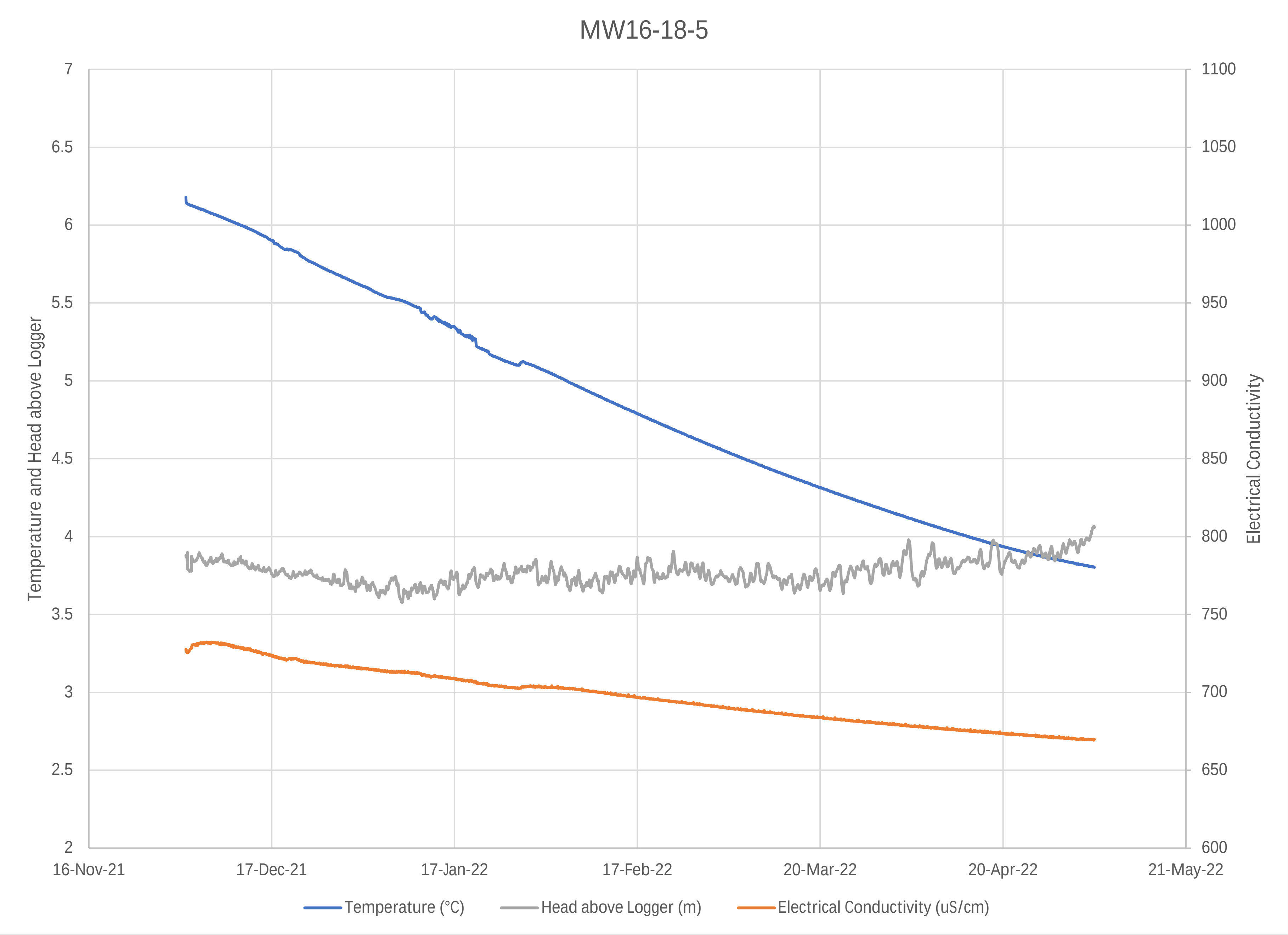

MW21-6-7
Temperature and Head above Logger
Electrical Conductivity
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1200
1150
1100
1050
1000
950
900
850
800
750
700
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)


MW21-6-12
8
7.5
7
6.5
6
5.5
5
4.5
4
Temperature and Head above Logger
1300
1250
1200
1150
1100
1050
1000
950
900
850
800
Electrical Conductivity
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)


RMW16-5-12
Temperature and Head above Logger
Electrical Conductivity
7
6.5
6
5.5
5
4.5
4
3.5
3
700
650
600
550
500
450
400
350
300
250
200
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)


RMW16-16-17
Temperature and Head above Logger
Electrical Conductivity
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2700
2650
2600
2550
2500
2450
2400
2350
2300
2250
2200
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)


RMW16-17-10
6
5.5
5
4.5
4
3.5
3
2.5
2
Termperature and Head above Logger
1700
1650
1600
1550
1500
1450
1400
1350
1300
1250
1200
Electrical Conductivity
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)


MW16-18-5
Temperature and Head above Logger
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
Electrical Conductivity
1100
1050
1000
950
900
850
800
750
700
650
600
16-Nov-21
17-Dec-21
17-Jan-22
17-Feb-22
20-Mar-22
20-Apr-22
21-May-22
Temperature (°C)
Head above Logger (m)
Electrical Conductivity (uS/cm)

Appendix D Laboratory Analytical Data and Historical Data Tables

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells

Sample Location				**MW16-1-15**				**MW16-2-6**				**MW16-3-7**				**MW16-4-16**	**MW16-4-22**			
Sample Date				**3-Oct-16**	**12-May-21**	**13-Jan-22**	**5-May-22**	**30-Sep-16**	**12-May-21**	**24-Nov-21**	**4-May-22**	**28-Sep-16**	**12-May-21**	**24-Nov-21**	**4-May-22**	**4-Oct-16**	**4-Oct-16**	**12-May-21**	**24-Nov-21**	**4-May-22**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**
Field Parameters																				
Dissolved oxygen, Field	mg/L	n/v	n/v	-	1.43	2.83	3.18	-	3.79	3.92	2.33	-	8.41	6.99	4.05	-	-	6.51	3.59	2.73
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**1,978^{A}**	**2,187^{A}**	**2,134^{A}**	**2,192^{A}**	**5,210^{A}**	**6,179^{A}**	**6,105^{A}**	**6,392^{A}**	**2,410^{A}**	**1,307^{A}**	**1,845^{A}**	**2,566^{A}**	-	**3,550^{A}**	**2,857^{A}**	**4,143^{A}**	**4,362^{A}**
Oxidation Reduction Potential, field	mV	n/v	n/v	-	60.2	44.7	68.2	-	92.4	95.3	-21.3	-	51.9	104.4	85.6	-	-	11.9	37.2	-28.7
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.2	7.23	7.64	7.16	7.1	**6.86^{B}**	**6.93^{B}**	**6.38^{AB}**	7.3	7.30	7.1	**6.64^{B}**	-	7.2	**6.75^{B}**	**6.88^{B}**	**6.33^{AB}**
Temperature, Field	deg C	n/v	≤15^{B}	7.7	8.8	5.6	7.7	8.6	7.4	5.09	9	9.4	8.4	7.46	10.4	-	6.2	8.5	5.38	14.7
Calculated Parameters																				
Anion Sum	meq/L	n/v	n/v	25	27	29	29	83	97	-	94	32	29	-	33	55	54	61	-	60
Cation Sum	meq/L	n/v	n/v	28	26	27	29	83	96	-	96	33	28	-	35	51	50	57	-	59
Hardness (as CaCO3)	mg/L	n/v	n/v	1,000	990	1,000	1,100	2,600	3,100	3,390	3,100	950	770	823	1,000	1,700	1,700	1,900	1,660	2,000
Ion Balance	%	n/v	n/v	1.1	2.4	2.2	0.84	1.0	0.61	114	1.3	1.0	2.6	120	2.4	0.94	0.94	3.4	94	1.1
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**1,600^{AB}**	**1,700^{AB}**	**1,800^{AB}**	**1,800^{AB}**	**5,300^{AB}**	**6,100^{AB}**	**6140^{AB}**	**6,000^{AB}**	**2,000^{AB}**	**1,800^{AB}**	**1,550^{AB}**	**2,000^{AB}**	**3,400^{AB}**	**3,400^{AB}**	**3,800^{AB}**	**3,600^{AB}**	**3,800^{AB}**
BTEX and Petroleum Hydrocarbons																				
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.00040	<0.00040	<0.00040	<0.00040	0.00044	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.00080	<0.00089	<0.00089	<0.00089	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00080	<0.00089	<0.0005	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.10	<0.10	<0.10	0.47	**5.9^{A}**	<0.1	0.28	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10
Miscellaneous Inorganics																				
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	2.6	2.4	2.1	2.4	6.2	4.2	4.774	4.1	8.0	5.1	6.396	3.7	5.2	5.1	6.5	5.386	5.6
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**2,100^{A}**	**2,200^{A}**	**2,200^{A}**	**2,200^{A}**	**5,900^{A}**	**6,400^{A}**	**6,550^{A}**	**6,500^{A}**	**2,600^{A}**	**2,400^{A}**	**2,140^{A}**	**2,500^{A}**	**4,000^{A}**	**4,000^{A}**	**4,200^{A}**	**4,310^{A}**	**4,300^{A}**
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.88	7.63	7.56	7.74	7.95	7.31	7.82	7.41	8.16	7.48	8.07	7.81	7.45	7.52	7.37	7.79	7.64
Anions																				
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<1.0	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<0.50	<1.0	<5	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	300	320	320	300	520	650	615	650	450	420	387	470	460	460	470	448	490
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	360	390	400	370	630	790	751	800	550	510	472	570	560	570	580	547	590
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<1.0	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<0.50	<1.0	<5	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<1.0	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<0.50	<1.0	<5	<1.0
Sulfate	mg/L	$429_{n5,e}^{A}$	$\leq500_{j}^{B}$	**910 CD^{AB}**	**990 CD^{AB}**	**1,000^{AB}**	**1,100^{AB}**	**3,500 CD^{AB}**	**4,000 CD^{AB}**	**3,880^{AB}**	**3,900^{AB}**	**1,100 CD^{AB}**	**910 CD^{AB}**	**710^{AB}**	**1,100^{AB}**	**2,200 CD^{AB}**	**2,100 CD^{AB}**	**2,500 CD^{AB}**	**2,320^{AB}**	**2,400^{AB}**
Chloride	mg/L	100^{A}	≤250^{B}	3.8	9.3	11	11	6.0	2.9	1.2	1.8	12	62	63.7	41	3.0	3.0	2.1	<1.0	1.1
Nutrients																				
Ammonia (as N)	mg/L	0.737_{n2}^{A}	n/v	*<0.050*	0.045	0.036	0.036	0.27	0.2	0.15	0.16	0.2	0.073	0.05	0.051	**1.0^{A}**	**0.96^{A}**	**0.97^{A}**	**0.93^{A}**	**1.0^{A}**
Nitrate (as N)	mg/L	3^{A}	10^{C}	<0.010	<0.050	<0.050	<0.050	<0.050 MI	<0.050	<0.02	<0.10	0.29	0.26	0.18	<0.050	0.010	<0.010	<0.050	<0.02	<0.050
Nitrite (as N)	mg/L	$0.06/0.6_{n4,e}^{A}$	1^{C}	<0.010	<0.010	<0.010	<0.010	0.024	<0.010	<0.01	<0.010	0.016	<0.010	<0.01	<0.010	<0.010	<0.010	<0.010	<0.01	<0.010
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	<0.020	<0.050 MI	<0.050 AT	<0.050 AT	0.024	<0.050 MI	<0.02	<0.10 DB	0.30	0.26	0.18	<0.050 DB	<0.020	<0.020	<0.050 MI	<0.02	<0.050 DB
Nitrogen	mg/L	n/v	n/v	-	0.26 DB	0.26	0.86 DB	-	7.2 DB	-	<2.0 DB	-	1.4 DB	-	0.72 DB	-	-	1.5 DB	-	1.6 DB
Orthophosphate (as P)	mg/L	n/v	n/v	<0.0030	<0.0030	0.0041	<0.0030	0.0041	0.0059	<0.15	<0.0030	0.0099 OG	0.013	<0.15	0.0046	<0.0030	<0.0030	<0.0030	<0.15	<0.0030
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	<0.0030	<0.0030	0.52 DB	<0.0030	0.0094	0.0060	-	0.0032	0.0067	0.021	-	0.0089	<0.0030	<0.0030 MA	0.017	-	0.0041
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.5 DB	0.26	0.258	0.86	5.1 DB	7.2	2.3	<2.0	1.7 DB	1.11	2.0	0.72	1.1	1.1	1.46	2.8	1.57

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-1-15				MW16-2-6				MW16-3-7				MW16-4-16	MW16-4-22			
Sample Date				3-Oct-16	12-May-21	13-Jan-22	5-May-22	30-Sep-16	12-May-21	24-Nov-21	4-May-22	28-Sep-16	12-May-21	24-Nov-21	4-May-22	4-Oct-16	4-Oct-16	12-May-21	24-Nov-21	4-May-22
Sample Type	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well
Metals - Dissolved																				
Aluminum	mg/L	0.05$_{n1,e}^{A}$	0.1$_{a}^{B}$ 2.9^{C}	<0.0030	<0.0030	<0.0030	<0.0030	0.016	0.0069	0.021	0.0036	0.0064	<0.0030	0.045	0.0089	<0.0030	<0.0030	**0.14**^{AB}	0.005	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.00060	<0.00060	<0.00060	0.00073	<0.00060	<0.001	<0.00060	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.00060	<0.00060	<0.001	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	<0.00020	<0.00020	0.00036	0.00051	0.0044	0.00035	<0.001	0.0010	0.00078	<0.00020	<0.001	0.00045	0.0019	0.0017	0.0020	0.001	0.00075
Barium	mg/L	1^{A}	2.0^{C}	0.018	<0.010	0.012	0.012	0.018	<0.010	<0.05	<0.010	0.035	0.025	<0.05	0.025	<0.010	<0.010	<0.010	<0.05	<0.010
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.078	0.078	0.077	0.080	0.11	0.10	0.11	0.11	0.10	0.088	0.08	0.10	0.11	0.11	0.12	0.12	0.13
Cadmium	mg/L	0.00037$_{n3,e}^{A}$	0.007^{C}	<0.000020	<0.000020	0.00032	0.000066	0.000092	0.000039	0.000124	0.00027	0.000036	0.000020	0.000058	0.000054	<0.000020	<0.000020	<0.000020	<0.000016	0.000026
Calcium	mg/L	n/v	n/v	230	220	230	250	390	400	451	410	170	140	130	160	380	380	440	340	450
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	0.0018	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010
Cobalt	mg/L	n/v	n/v	0.0012	0.00087	0.00098	0.00099	0.0060	0.0021	0.0027	0.0029	0.0023	0.00087	<0.0009	0.00063	0.00031	0.00034	0.00055	0.0013	0.00033
Copper	mg/L	0.007^{A}	≤1.0^{B} 2^{C}	<0.00020	0.00020	0.00097	<0.0010	0.00084	0.00090	0.0034	0.0015	0.00085	0.00029	0.0042	<0.0010	<0.00020	<0.00020	0.00026	<0.0008	<0.0010
Iron	mg/L	0.3^{A}	≤0.3^{B}	<0.060	0.069	<0.060	<0.060	<0.060	<0.060	<0.1	<0.060	0.17	<0.060	<0.1	<0.060	**2.2**^{AB}	**2.2**^{AB}	**3.1**^{AB}	**1.7**^{AB}	<0.060
Lead	mg/L	0.007$_{n3,e}^{A}$	0.005^{C}	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	<0.00020	0.0012	<0.00020	<0.00020	<0.00020	<0.00020	<0.0002	<0.00020
Lithium	mg/L	n/v	n/v	0.022	<0.020	<0.020	<0.020	0.11	0.099	-	0.11	0.057	0.041	-	0.055	0.074	0.070	0.082	-	0.078
Magnesium	mg/L	n/v	n/v	110	100	100	110	400	520 CD	549	490	130	110	121	150	180	180	200	197	210
Manganese	mg/L	0.05^{A}	≤0.02^{B} 0.12^{C}	**0.88**^{ABC}	**0.82**^{ABC}	**0.83**^{ABC}	**0.82**^{ABC}	**1.5**^{ABC}	**1.3**^{ABC}	**1.31**^{ABC}	**1.3**^{ABC}	**0.39**^{ABC}	**0.26**^{ABC}	**0.201**^{ABC}	**0.23**^{ABC}	**0.60**^{ABC}	**0.60**^{ABC}	**0.90**^{ABC}	**0.803**^{ABC}	**0.78**^{ABC}
Mercury	mg/L	0.000005^{A}	0.001^{C}	0.0000029	<0.0000019	<0.0000019	<0.0000019	<0.0000020	<0.0000019	<0.0000025	<0.0000019	<0.0000020	<0.0000019	<0.0000025	<0.0000019	<0.0000020	<0.0000020	<0.0000019	<0.0000025	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.0028	0.0017	0.0019	0.0019	0.0071	0.00091	<0.001	0.00092	0.0020	0.0011	0.002	0.0011	0.0015	0.0016	0.00090	0.004	0.00095
Nickel	mg/L	0.17$_{n3,e}^{A}$	n/v	0.001	0.00083	0.0013	0.00099	0.016	0.0059	0.007	0.0071	0.0065	0.0028	0.005	0.003	<0.00050	<0.00050	0.0013	0.004	0.00083
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	<0.10	<0.10	<0.08	<0.10
Potassium	mg/L	n/v	n/v	4.8	3.6	3.8	4.2	9.4	7.5	8.8	8.3	6.1	4.1	4.7	4.8	8.5	8.2	8.5	8.9	9.4
Selenium	mg/L	0.002^{A}	0.05^{C}	<0.00020	<0.00020	<0.00020	<0.00020	0.0013	<0.00020	<0.0005	0.00024	0.00026	<0.00020	<0.0005	<0.00020	<0.00020	<0.00020	<0.00020	0.0011	<0.00020
Silicon	mg/L	n/v	n/v	4.7	4.3	4.4	4.5	5.9	4.8	-	5.2	5.1	4.2	-	4.9	4.4	4.3	5.4	-	4.8
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00010	0.00005	<0.00010
Sodium	mg/L	200^{A}	≤200^{B}	160	140	160	170	**690 CD**^{AB}	**750 CD**^{AB}	**882**^{AB}	**800**^{AB}	**320**^{AB}	**280**^{AB}	**289**^{AB}	**330**^{AB}	**390**^{AB}	**370**^{AB}	**400**^{AB}	**466**^{AB}	**430**^{AB}
Strontium	mg/L	n/v	7.0^{C}	1.6	1.4	1.6	1.6	4.6	5.8 CD	-	6.0	1.6	1.5	-	1.7	5.9 CD	6.0 CD	6.1 CD	-	6.7
Sulfur	mg/L	n/v	n/v	340	330	310	310	1,200 CD	1,400 CD	-	1,300	370	300	-	380	720 CD	730 CD	690 CD	-	850
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.00020	0.0001	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.002	<0.0010	<0.0010	<0.0010	0.002	0.0027	<0.0010	<0.0010	0.0029	0.002	0.0011
Uranium	mg/L	0.01^{A}	0.02^{C}	0.0054	0.0043	0.0042	0.0048	**0.040**^{AC}	**0.029**^{AC}	**0.031**^{AC}	**0.029**^{AC}	**0.014**^{A}	**0.012**^{A}	**0.012**^{A}	**0.014**^{A}	0.0022	0.0023	0.0023	0.002	0.0022
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	0.0012	0.0016	<0.0010	-	0.0013	<0.0010	<0.0010	-	0.0013	<0.0010	<0.0010	<0.0010	-	<0.0010
Zinc	mg/L	0.03^{A}	≤5.0^{B}	<0.0030	<0.0030	<0.0030	<0.0030	0.016	0.0031	<0.005	<0.0030	<0.0030	<0.0030	0.007	<0.0030	<0.0030	<0.0030	<0.0030	<0.005	<0.0030
Metals - Total																				
Mercury	mg/L	0.000005^{A}	0.001^{C}	***<0.0020 DB***	**0.0000473**^{A}	**0.000038**^{A}	**0.000055**^{A}	***<0.0060 DB***	**0.000277 DB**^{A}	**0.000032**^{A}	**0.00071**^{A}	***<0.0060 DB***	**0.00117 DB**^{AC}	**0.000016**^{A}	**0.000047**^{A}	***<0.0060 DB***	***<0.0020 DB***	**0.000114 DB**^{A}	<0.0000025	***<0.000019***
Microbiological Parameters																				
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<10 DB***	***<10 MI***	***<10 VV***	***<10***	***<100 DB***	***<100 MI***	***<1***	***<2.0 AT***	***<10 DB***	***<100 MI***	**24**^{D}	***<2.0 AT***	***<2.0 DB***	***<2.0 DB***	***<100 MI***	***<1***	***<2.0 AT***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<10 DB***	***<10 MI***	***<10***	***<10***	***<100 DB***	***<100 MI***	**2**^{D}	***<10 AT***	***<10 DB***	***<100 MI***	**40**^{D}	***<10 AT***	***<2.0 DB***	***<2.0 DB***	***<100 MI***	**3**^{D}	***<10 AT***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	4,900 DB	5,500	10,000 VV	2,700	49,000 DB	6,100 MI	8,700	6,200 DVM	>6000	5,700 MI	10,900	2,600	630 DB	550 DB	4,100 MI	500	3,300
Total Coliforms	mpn/100mL	n/v	0^{D}	**230 DB**^{D}	***<10 MI***	**680 VV**^{D}	**260**^{D}	***<100 DB***	***<100 MI***	**7**^{D}	***<2.0 AT***	**450 DB**^{D}	***<100 MI***	**238**^{D}	***<2.0 AT***	***<2.0 DB***	***<2.0 DB***	***<100 MI***	**7**^{D}	***<2.0 AT***

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-5-11		MW16-6-11				MW16-6-20				MW16-7-5				MW16-8-8		
Sample Date				4-Oct-16	14-May-21	27-Sep-16	12-May-21	1-Dec-21	5-May-22	27-Sep-16	12-May-21	1-Dec-21	5-May-22	27-Sep-16	13-May-21	1-Dec-21	5-May-22	4-Oct-16	13-May-21	13-Jan-22
Sample Type	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2
Field Parameters																				
Dissolved oxygen, Field	mg/L	n/v	n/v	-	12.81	-	3.72	14.78	2.59	-	3.26	10.78	5.24	-	13.59	8.14	2.9	-	14.49	3.65
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	710	707.5	**3,070**^{A}	**3,269**^{A}	**3,104**^{A}	**3,157**^{A}	**1,715**^{A}	**2,104**^{A}	**2,079**^{A}	**2,255**^{A}	**3,660**^{A}	**3,246**^{A}	**3,318**^{A}	**3,271**^{A}	**1,003**^{A}	**1,081**^{A}	**1,410**^{A}
Oxidation Reduction Potential, field	mV	n/v	n/v	-	73.6	-	53.9	87.5	14.2	-	-52.6	48.8	12.1	-	63.0	95.7	5.8	-	88.7	73.6
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.1	7.40	7.3	**6.95**^{B}	7.13	**6.97**^{B}	7.5	7.75	8.01	7.67	7.5	7.26	7.28	7.09	7.1	7.38	7.59
Temperature, Field	deg C	n/v	≤15^{B}	6.7	7.4	7.7	13.4	5.78	8	9.6	7.3	4.23	8.1	7.6	6.5	5.94	7.4	7.7	7.1	6
Calculated Parameters																				
Anion Sum	meq/L	n/v	n/v	8.8	8.3	43	46	-	43	21	28	-	49	55	36	-	38	12	12	13
Cation Sum	meq/L	n/v	n/v	8.7	8.1	41	43	-	45	21	22	-	26	49	44	-	43	12	13	14
Hardness (as CaCO3)	mg/L	n/v	n/v	340	320	1,300	1,400	1,530	1,400	340	250	234	210	1,600	1,400	1,440	1,300	550	590	620
Ion Balance	%	n/v	n/v	0.99	1.2	0.95	3.9	119	2.4	0.98	12	112	32	0.90	9.8	120	6.8	1.0	3.3	1.7
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	440	410	**2,700**^{AB}	**2,900**^{AB}	**2,730**^{AB}	**2,800**^{AB}	**1,400**^{AB}	**1,700**^{AB}	**1,500**^{AB}	**2,400**^{AB}	**3,400**^{AB}	**2,400**^{AB}	**2,560**^{AB}	**2,500**^{AB}	**640**^{AB}	**660**^{AB}	**720**^{AB}
BTEX and Petroleum Hydrocarbons																				
Benzene	mg/L	0.005^{A}	0.005^{C}	0.00055	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	0.0013	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.00080	<0.00089	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00089	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics																				
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	2.8	3.6	4.3	3.3	3	2.8	4.1	3.0	4	3.0	9.2	3.6	4	3.8	2.8	1.6	1.8
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	780	720	**3,300**^{A}	**3,400**^{A}	**3,320**^{A}	**3,200**^{A}	**2,000**^{A}	**2,300**^{A}	**2,290**^{A}	**2,200**^{A}	**3,900**^{A}	**3,400**^{A}	**3,470**^{A}	**3,200**^{A}	**1,100**^{A}	**1,100**^{A}	**1,100**^{A}
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.96	7.96	7.53	7.46	8.07	7.71	7.99	8.10	8.49	8.18	7.57	7.91	8.19	7.82	7.90	7.81	7.50
Anions																				
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	6	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	380	370	330	370	276	400	260	460	243	1,500	380	440	415	400	370	370	400
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	470	450	410	460	336	480	320	560	281	1,900	470	540	507	490	450	460	490
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	7	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<1.0
Sulfate	mg/L	429$_{n5,e}^{A}$	≤500$_{j}^{B}$	43	36	**1,800 CD**^{AB}	**1,900 CD**^{AB}	**1,660**^{AB}	**1,700**^{AB}	**770 CD**^{AB}	**920 CD**^{AB}	**814**^{AB}	**890**^{AB}	**2,200 CD**^{AB}	**1,300 CD**^{AB}	**1,450**^{AB}	**1,400**^{AB}	140	180 CD	210
Chloride	mg/L	100^{A}	≤250^{B}	4.8	3.3	4.3	2.1	1.0	1.6	4.0	3.2	1.0	1.7	14	8.8	6.9	5.8	60	27	28
Nutrients																				
Ammonia (as N)	mg/L	0.737$_{n2}^{A}$	n/v	0.062	0.14	0.37	0.32	0.38	0.39	0.49	**1.1**^{A}	**2.04**^{A}	**1.3**^{A}	0.16	0.11	0.06	0.029	0.055	<0.015	<0.015
Nitrate (as N)	mg/L	3^{A}	10^{C}	0.76	0.62	<0.010	<0.050	<0.02	<0.050	0.020	<0.010	<0.02	<0.010	<0.010	0.014	0.50	0.020	1.6	0.81	0.81
Nitrite (as N)	mg/L	0.06/0.6$_{n4,e}^{A}$	1^{C}	<0.010	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.010
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	0.76	0.62	<0.020	<0.050 MI	<0.02	<0.050 MSE AT	<0.020	<0.010	<0.02	<0.010	<0.020	0.014	0.50	0.020	1.6	0.81 MI	0.81
Nitrogen	mg/L	n/v	n/v	-	3.0 DB	-	0.92 DB	-	12 DB	-	1.2	-	4.3 DB	-	<1.0 DB	-	1.8 DB	-	0.99	0.94
Orthophosphate (as P)	mg/L	n/v	n/v	<0.0030	<0.0030	<0.0030	0.0040	<0.15	0.0034	<0.0030	0.0031	<0.15	<0.0030	0.012 OG	0.011	<0.15	0.011	<0.0030	0.0049	0.0043
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	0.0034	0.0059	<0.0030	0.0032	-	0.0052	<0.0030	0.0087	-	0.019	0.0065	0.012	-	0.010	0.0045	0.0053	1.4 DB
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	7.5 DB	2.4	6.5 DB	0.92	17.92	12.5	1.3	1.25	16.64	4.3	0.62	<1.0	0.89	1.80	0.95	0.182	0.131

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				**MW16-5-11**		**MW16-6-11**				**MW16-6-20**				**MW16-7-5**				**MW16-8-8**		
Sample Date				**4-Oct-16**	**14-May-21**	**27-Sep-16**	**12-May-21**	**1-Dec-21**	**5-May-22**	**27-Sep-16**	**12-May-21**	**1-Dec-21**	**5-May-22**	**27-Sep-16**	**13-May-21**	**1-Dec-21**	**5-May-22**	**4-Oct-16**	**13-May-21**	**13-Jan-22**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**	**Tier 2**	**Tier 2**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**
Metals - Dissolved																				
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	0.011	0.018	0.0041	<0.0030	**0.117^{AB}**	<0.0030	0.0067	<0.0030	**0.397^{AB}**	<0.0030	0.0048	<0.0030	0.039	<0.0030	<0.0030	0.0096	0.0049
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.00060	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.00060	<0.001	0.00065	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.00060	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	0.0010	0.00047	0.00050	0.00039	0.002	0.00054	0.00043	0.00041	<0.001	0.00081	0.0010	0.00046	<0.001	0.00063	<0.00020	0.00025	<0.00020
Barium	mg/L	1^{A}	2.0^{C}	0.068	0.071	0.021	0.011	<0.05	0.017	0.031	0.014	<0.05	0.023	0.032	0.013	<0.05	0.019	0.039	0.044	0.045
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.036	0.043	0.13	0.13	0.13	0.14	0.093	0.11	0.11	0.12	0.12	0.10	0.11	0.10	0.043	0.052	0.042
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	<0.000020	0.000022	0.000058	0.000030	0.000096	0.000037	<0.000020	<0.000020	<0.000016	0.000069	0.00013	0.000021	0.000028	<0.00002	0.000040	<0.000020	<0.00002
Calcium	mg/L	n/v	n/v	76	69	310	320	361	320	76	63	63.2	55	250	210	234	200	120	130	130
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	0.0008	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	0.0010	0.00040	0.0041	0.0023	0.0018	0.0013	0.00056	0.00049	<0.0009	0.00069	0.0051	0.00077	0.0018	0.00085	0.00057	<0.00030	<0.00030
Copper	mg/L	0.007^{A}	$\leq1.0^{B}$ 2^{C}	<0.00020	0.0013	<0.00020	0.00038	0.0009	<0.0010	0.00056	**0.013^{A}**	0.0011	<0.0010	0.00097	0.00023	<0.0008	<0.0010	0.00032	0.0020	0.00053
Iron	mg/L	0.3^{A}	$\leq0.3^{B}$	0.061	<0.060	0.11	0.16	<0.1	<0.060	<0.060	0.25	0.2	<0.060	<0.060	<0.060	<0.1	<0.060	<0.060	<0.060	<0.060
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	<0.00020	<0.00020	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	0.00045	0.0006	0.00027	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	<0.020	0.022	0.049	0.044	-	0.047	0.044	0.048	-	0.070	0.077	0.070	-	0.060	<0.020	0.020	<0.020
Magnesium	mg/L	n/v	n/v	38	37	140	140	152	150	36	22	18.5	17	230	210	209	190	60	67	70
Manganese	mg/L	0.05^{A}	$\leq0.02^{B}$ 0.12^{C}	**0.15^{ABC}**	**0.11^{AB}**	**0.85^{ABC}**	**1.2^{ABC}**	**1.10^{ABC}**	**0.68^{ABC}**	**0.16^{ABC}**	**0.22^{ABC}**	**0.119^{AB}**	**0.17^{ABC}**	**0.81^{ABC}**	**0.30^{ABC}**	**0.389^{ABC}**	**0.22^{ABC}**	**0.12^{AB}**	0.013	**0.025^{B}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000020	<0.0000019	<0.0000020	<0.0000019	-	<0.0000019	<0.0000020	<0.0000019	-	<0.0000019	0.0000020	<0.0000019	-	<0.0000019	<0.0000020	<0.0000019	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.012	0.0056	0.0014	0.00065	0.001	0.0018	0.0060	0.0026	0.004	0.0043	0.0026	0.0011	0.002	0.0014	0.0011	0.00073	0.00078
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	0.002	0.001	0.0064	0.0046	0.004	0.0032	<0.00050	0.0013	<0.003	0.0013	0.011	0.0035	0.006	0.0027	0.0025	0.0011	0.0011
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	3.7	3.7	8.5	6.4	7.5	8.1	4.9	4.2	4.8	5.5	5.9	4.5	5.0	5.5	5.8	5.7	6.1
Selenium	mg/L	0.002^{A}	0.05^{C}	**0.0031^{A}**	**0.0025^{A}**	0.00044	<0.00020	<0.0005	0.00069	<0.00020	<0.00020	<0.0005	0.00022	0.00046	0.00021	<0.0005	0.00094	**0.011^{A}**	**0.0044^{A}**	**0.0038^{A}**
Silicon	mg/L	n/v	n/v	4.2	4.5	5.0	4.8	-	4.1	3.4	3.5	-	2.7	5.6	5.0	-	4.6	4.2	4.9	4.4
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	200^{A}	$\leq200^{B}$	39	35	**330^{AB}**	**350^{AB}**	**388^{AB}**	**380^{AB}**	**320^{AB}**	**390^{AB}**	**452^{AB}**	**490^{AB}**	**400^{AB}**	**370^{AB}**	**405^{AB}**	**400^{AB}**	25	24	25
Strontium	mg/L	n/v	7.0^{C}	0.82	0.93	2.4	2.9	-	3.0	0.78	1.1	-	1.0	2.4	2.3	-	2.1	0.90	1.1	1.2
Sulfur	mg/L	n/v	n/v	13	11	580 CD	530 CD	-	570	250	300	-	280	700 CD	610 CD	-	530	45	73	62
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.0001	0.00025	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	0.002	<0.0010	<0.0010	<0.0010	0.003	<0.0010	<0.0010	<0.0010	0.002	<0.0010	<0.0010	<0.0010	0.0012
Uranium	mg/L	0.01^{A}	0.02^{C}	0.0053	0.0067	0.0085	0.0067	0.008	0.0067	0.0021	0.00071	<0.001	0.00092	**0.020^{A}**	**0.014^{A}**	**0.018^{A}**	**0.016^{A}**	**0.011^{A}**	**0.011^{A}**	**0.012^{A}**
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	-	0.0024	<0.0010	<0.0010	-	0.0013	<0.0010	<0.0010	<0.0010
Zinc	mg/L	0.03^{A}	$\leq5.0^{B}$	<0.0030	<0.0030	<0.0030	<0.0030	<0.005	<0.0030	<0.0030	0.0036	0.007	<0.0030	<0.0030	<0.0030	<0.005	<0.0030	<0.0030	0.0036	<0.0030
Metals - Total																				
Mercury	mg/L	0.000005^{A}	0.001^{C}	***<0.020 DB***	**0.000383 DB^{A}**	***<0.02 DB***	**0.000361 DB^{A}**	**0.000080^{A}**	**0.00376^{AC}**	***<0.00020 DB***	**0.0000064^{A}**	**0.000022^{A}**	**0.000208^{A}**	***<0.0020 DB***	**0.0000292^{A}**	**0.000013^{A}**	**0.000114^{A}**	***<0.02 DB***	**0.0000091^{A}**	**0.000146^{A}**
Microbiological Parameters																				
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<100 DB***	***<100 MI***	***<100***	***<100 MI***	**1^{D}**	***<100***	***<1.0***	***<1.0***	**2^{D}**	***<100***	***<10***	***<10 SVH MI***	**14^{D}**	***<100***	***<100 DB***	***<1.0***	***<10 VV***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<100 DB***	***<100 MI***	***<100 DB***	***<100 MI***	**9^{D}**	***<100***	***<1.0***	***<100 MI***	**5^{D}**	***<100***	***<10 DB***	**20 SVH MI^{D}**	**35^{D}**	***<100***	***<100 DB***	***<1.0***	***<10 VV***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	44,000 DB	18,000 MI	56,000 DB	7,100 MI	12,100	22,000	>6000	4,000	13,800	26,000	920	210	1,760	2,400	34,000 DB	1,100	16,000 VV
Total Coliforms	mpn/100mL	n/v	0^{D}	***<100 DB***	***<100 MI***	**$9{,}300^{D}$**	***<100 MI***	**113^{D}**	***<100***	**$>2400^{D}$**	**4.1^{D}**	**204^{D}**	***<100***	**$1{,}700^{D}$**	***<10 SVH MI***	**365^{D}**	***<100***	***<100 DB***	**$>2400^{D}$**	**200 VV^{D}**

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-8-19				MW16-9-6	MW16-10-15				MW16-11-15				MW16-12-3	MW16-14-33	MW16-15-16	MW16-15-34
Sample Date				4-Oct-16	13-May-21	13-Jan-22	6-May-22	30-Sep-16	4-Oct-16	13-May-21	24-Nov-21	9-May-22	30-Sep-16	13-May-21	22-Nov-21	6-May-22	6-Oct-16	27-Sep-16	28-Sep-16	26-Sep-16
Sample Type	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	Tier 2
Field Parameters																				
Dissolved oxygen, Field	mg/L	n/v	n/v	-	2.75	4.81	3.3	-	-	20.18	3.1	5.02	-	1.52	4.7	2.77	-	-	-	-
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**1,130^{A}**	**1,246^{A}**	**1,282^{A}**	**1,292^{A}**	**1,515^{A}**	**2,890^{A}**	**3,992^{A}**	**3,930^{A}**	**4,422^{A}**	**2,750^{A}**	**3,012^{A}**	**2,842^{A}**	**2,921^{A}**	**2,370^{A}**	**1,906^{A}**	-	984
Oxidation Reduction Potential, field	mV	n/v	n/v	-	88.4	84.1	84.5	-	-	-54.3	60.5	-0.25	-	48.7	47.5	-8.3	-	-	-	-
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.4	7.09	7.4	**6.97^{B}**	7.2	7.2	**6.80^{B}**	**6.49^{AB}**	**6.86^{B}**	7.1	7.01	7.08	**6.94^{B}**	7	7.5	-	7.4
Temperature, Field	deg C	n/v	≤15^{B}	6.8	6.9	4.8	7.5	11	9	9.5	5.03	9	9.4	8.0	4.35	8.5	6.7	8	-	8
Calculated Parameters																				
Anion Sum	meq/L	n/v	n/v	15	14	14	13	21	45	61	-	64	39	41	-	36	33	45	12	11
Cation Sum	meq/L	n/v	n/v	14	15	16	16	22	42	62	-	63	38	42	-	38	31	160	14	10
Hardness (as CaCO3)	mg/L	n/v	n/v	580	640	670	680	930	1,400	2,300	2,510	2,500	1,200	1,400	1,240	1,200	1,300	6,700	160	52
Ion Balance	%	n/v	n/v	0.93	3.1	5.7	9.3	1.1	0.94	0.93	113	0.85	0.98	0.17	108	1.8	0.94	3.4	1.1	0.95
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**750^{AB}**	**750^{AB}**	**760^{AB}**	**740^{AB}**	**1,200^{AB}**	**2,800^{AB}**	**3,900^{AB}**	**3,960^{AB}**	**4,000^{AB}**	**2,400^{AB}**	**2,600^{AB}**	**2,390^{AB}**	**2,300^{AB}**	**1,900^{AB}**	**4,700^{AB}**	**720^{AB}**	**610^{AB}**
BTEX and Petroleum Hydrocarbons																				
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	-	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	-	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	-	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.00080	<0.00089	<0.00089	<0.00089	<0.00080	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00089	<0.0005	<0.00089	-	<0.00080	<0.00080	<0.00080
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	-	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	-	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	-	<0.10	<0.10	<0.10
Miscellaneous Inorganics																				
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	1.3	0.63	0.95	1.8	4.7	4.2	2.3	4.391	2.6	3.1	2.4	6	3.0	-	3.9	1.4	1.7
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**1,300^{A}**	**1,300^{A}**	**1,300^{A}**	**1,200^{A}**	**1,700^{A}**	**3,000^{A}**	**4,300^{A}**	**4,390^{A}**	**4,300^{A}**	**3,100^{A}**	**3,100^{A}**	**3,000^{A}**	**2,900^{A}**	**2,600^{A}**	**2,000^{A}**	**1,100^{A}**	1,000
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.74	7.69	7.43	7.65	7.88	7.65	7.52	7.87	7.29	7.99	7.69	8.07	7.86	7.97	7.80	8.18	8.31
Anions																				
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<1.0	<1.0	<0.50	<5.0	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	81	<0.50	<0.50
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	460	440	450	420	510	380	480	472	490	410	410	400	370	410	1,500	460	350
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	560	530	540	510	630	470	580	575	600	500	500	497	450	510	1,600	560	430
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<1.0	<1.0	<0.50	<5.0	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	97	<0.50	<0.50
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<1.0	<1.0	<0.50	<5.0	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<5.0	<0.50	<0.50
Sulfate	mg/L	$429_{n5,e}^{A}$	$≤500_{j}^{B}$	110	82	85	84	**490 CD^{A}**	**1,800 CD^{AB}**	**2,500 CD^{AB}**	**2,450^{AB}**	**2,600^{AB}**	**1,500 CD^{AB}**	**1,600 CD^{AB}**	**1,380^{AB}**	**1,400^{AB}**	**900 CD^{AB}**	**730 CD^{AB}**	150	170
Chloride	mg/L	100^{A}	≤250^{B}	**110^{A}**	**130^{A}**	**120^{A}**	**120 AT^{A}**	1.6	7.1	3.7	2.3	2.6	1.7	1.5	<1.0	<1.0	**230 CD^{A}**	25	2.4	3.4
Nutrients																				
Ammonia (as N)	mg/L	0.737_{n2}^{A}	n/v	***<0.050***	0.018	<0.015	<0.015	0.16	0.59	0.43	0.46	0.46	0.49	0.39	0.53	0.46	-	**1.5^{A}**	**0.84 A*^{A}**	**0.99 A*^{A}**
Nitrate (as N)	mg/L	3^{A}	10^{C}	0.70	0.87	0.92	0.88	0.015	0.027	<0.050	<0.02	<0.050	<0.010	<0.050	<0.02	<0.010	0.34	0.016	<0.010	<0.010
Nitrite (as N)	mg/L	$0.06/0.6_{n4,e}^{A}$	1^{C}	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	0.70	0.87 MI	0.92	0.88	<0.020	0.027	<0.050 MI	<0.02	<0.050 AT	<0.020	<0.050 MI	<0.02	<0.010	0.34	<0.020	<0.020	<0.020
Nitrogen	mg/L	n/v	n/v	-	1.0	1.0	0.95	-	-	1.9 DB	-	1.5 DB	-	1.7 DB	-	4.0 DB	-	-	-	-
Orthophosphate (as P)	mg/L	n/v	n/v	<0.0030	<0.0030	<0.0030	<0.0030	0.0036	<0.0030	<0.0030	<0.15	<0.0030	<0.0030	<0.0030	<0.15	<0.0030	-	0.0039	<0.0030	0.0038
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	<0.0030	<0.0030	0.11 DB	<0.0030	0.0059	0.0035	0.017	-	0.021	0.0033	<0.0030	-	<0.0030	-	0.0073	0.0069	0.0057
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.3	0.177	0.105	0.075	0.20	5.4 CD	1.88	11.1	1.5	3.7 DB	1.67	39.8	4.0	-	38 CD	0.81	0.90 A*

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-8-19				MW16-9-6	MW16-10-15				MW16-11-15				MW16-12-3	MW16-14-33	MW16-15-16	MW16-15-34
Sample Date				4-Oct-16	13-May-21	13-Jan-22	6-May-22	30-Sep-16	4-Oct-16	13-May-21	24-Nov-21	9-May-22	30-Sep-16	13-May-21	22-Nov-21	6-May-22	6-Oct-16	27-Sep-16	28-Sep-16	26-Sep-16
Sample Type	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	Tier 2
Metals - Dissolved																				
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0042	<0.0030	**0.069^{A}**	<0.0030	<0.0030	0.0057	<0.004	<0.0030	0.0070	0.016 NF MA	<0.0030	0.0040
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.00079	<0.00060	<0.001	<0.00060	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	0.0021	<0.00060	0.0013
Arsenic	mg/L	0.005^{A}	0.010^{C}	<0.00020	<0.00020	<0.00020	<0.00020	0.00093	0.0012	0.00053	<0.001	0.00034	0.0012	0.0011	0.002	0.00060	0.00092	0.0017	0.0022	0.0010
Barium	mg/L	1^{A}	2.0^{C}	0.054	0.062	0.063	0.067	0.039	0.022	0.015	<0.05	0.012	0.016	0.012	<0.05	0.012	0.12	**3.8^{AC}**	0.018	0.013
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.043	0.053	0.047	0.052	0.14	0.12	0.22	0.21	0.21	0.10	0.12	0.09	0.12	0.051	***<2.0***	0.089	0.040
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	0.000029	0.000020	0.000023	0.000028	0.000073	0.0001	<0.000020	0.000262	0.000067	0.000043	0.000052	0.000288	0.000078	0.000036	0.000024	<0.000020	<0.000020
Calcium	mg/L	n/v	n/v	130	150	150	150	220	320	470	514	460	290	330	297	280	270	2,300	38	14
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	<0.0010	<0.0010	<0.0010	0.0043	<0.0010	<0.0010	0.0008	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	<0.00030	<0.00030	<0.00030	<0.00030	0.0037	0.0043	0.0041	0.0050	0.0044	0.0016	0.0014	0.0018	0.0013	<0.00030	0.00065	<0.00030	<0.00030
Copper	mg/L	0.007^{A}	$\leq1.0^{B}$ 2^{C}	<0.00020	0.00022	0.00051	<0.0010	0.00064	<0.00020	<0.00020	**0.0127^{A}**	<0.0010	0.00029	0.00072	<0.0008	<0.0010	0.0018	<0.00020	<0.00020	<0.00020
Iron	mg/L	0.3^{A}	$\leq0.3^{B}$	<0.060	<0.060	<0.060	<0.060	0.13	<0.060	**0.35^{AB}**	<0.1	<0.060	**0.37^{AB}**	**0.52^{AB}**	<0.1	<0.060	<0.060	**68^{AB}**	0.15	<0.060
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.0005	<0.00020	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	<0.020	0.021	0.028	<0.020	0.030	0.055	0.050	-	0.025	0.050	0.055	-	0.044	0.030	<2.0	0.053	0.074
Magnesium	mg/L	n/v	n/v	60	67	70	72	94	140	280	299	310	110	140	122	120	160	190	15	4.2
Manganese	mg/L	0.05^{A}	$\leq0.02^{B}$ 0.12^{C}	0.0062	0.0058	<0.0040	<0.0040	**0.93^{ABC}**	**1.0^{ABC}**	**3.0^{ABC}**	**2.80^{ABC}**	**2.8^{ABC}**	**0.77^{ABC}**	**1.2^{ABC}**	**0.721^{ABC}**	**0.84^{ABC}**	**0.025^{B}**	**14^{ABC}**	**0.066^{AB}**	**0.028^{B}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.000002	<0.0000019	0.0000022	<0.0000019	<0.0000020	<0.0000020	<0.0000019	<0.0000025	<0.0000019	0.0000036	<0.0000019	<0.0000025	<0.0000019	<0.0000020	<0.0000020	<0.0000020	<0.0000020
Molybdenum	mg/L	n/v	n/v	0.00085	0.0011	0.00068	0.00060	0.00082	0.0034	0.00047	<0.001	0.00066	0.0015	0.00057	0.001	0.0011	0.0021	0.028	0.0015	0.018
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	<0.00050	<0.00050	<0.00050	<0.00050	0.0071	0.013	0.007	0.013	0.008	0.0027	0.0025	<0.003	0.0022	0.0041	0.0036	<0.00050	<0.00050
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10	49	<0.10	<0.10
Potassium	mg/L	n/v	n/v	5.7	6.1	6.5	6.8	5.6	11	10	11.2	10	6.0	5.9	6.9	6.3	6.4	53	3.9	2.4
Selenium	mg/L	0.002^{A}	0.05^{C}	**0.0080^{A}**	**0.0061^{A}**	**0.0086^{A}**	**0.0077^{A}**	<0.00020	0.00038	0.00052	<0.0005	<0.00020	<0.00020	<0.00020	0.0010	0.0010	0.0016	0.0011	<0.00020	0.00065
Silicon	mg/L	n/v	n/v	3.7	4.6	4.1	4.1	5.5	4.5	6.0	-	5.4	4.8	5.3	-	4.2	6.1	25	3.6	2.6
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	200^{A}	$\leq200^{B}$	47	51	56	56	71	**330^{AB}**	**350^{AB}**	**401^{AB}**	**320^{AB}**	**320^{AB}**	**320^{AB}**	**343^{AB}**	**320^{AB}**	110	**410^{AB}**	**230^{AB}**	**210^{AB}**
Strontium	mg/L	n/v	7.0^{C}	1.3	1.4	1.5	1.5	1.4	3.4	6.6 CD	-	**7.1^{C}**	2.6	3.0	-	2.9	1.1	**9.7^{C}**	0.65	0.25
Sulfur	mg/L	n/v	n/v	29	31	27	27	180	650 CD	920 CD	-	890	480	590 CD	-	470	270	220	50	51
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	0.0011	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.003	<0.0010	<0.0010	<0.0010	0.003	<0.0010	<0.0010	0.0020	<0.0010	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.0053	0.0044	0.0049	0.0050	0.0086	**0.012^{A}**	0.0080	**0.011^{A}**	0.010	0.0071	0.0054	0.006	0.0061	0.010	**0.012^{A}**	0.00020	0.00024
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	-	<0.0010	0.0011	<0.0010	<0.0010	<0.0010
Zinc	mg/L	0.03^{A}	$\leq5.0^{B}$	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	**0.035^{A}**	<0.0030	0.0053	<0.0030	<0.005	<0.0030	<0.0030	0.0036	<0.0030	<0.0030
Metals - Total																				
Mercury	mg/L	0.000005^{A}	0.001^{C}	***<0.000100 DB***	**0.0000262^{A}**	**0.0000104^{A}**	**0.0000058^{A}**	***<0.000020 DB***	***<0.02 DB***	**0.000195 DB^{A}**	**0.000092^{A}**	**0.000169^{A}**	***<0.0060 DB***	**0.000215 DB^{A}**	**0.000052^{A}**	**0.0009^{A}**	**0.00030 DB^{A}**	***<0.02 DB***	<0.0000020	***<0.00010 DB***
Microbiological Parameters																				
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<1.0***	***<10 MI***	***<1.0***	***<1.0***	***<1.0***	***<100 DB***	***<10 MI***	**6^{D}**	***<10 AT***	***<100 DB***	***<10 MI***	**11^{D}**	***<100 DVM***	-	***<20***	***<1.0***	***<1.0***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<1.0***	***<10 MI***	***<1.0***	***<1.0***	***<1.0***	**100 DB^{D}**	***<10 MI***	**23^{D}**	***<50 AT***	***<100 DB***	***<10 MI***	**11^{D}**	***<100 DVM***	-	***<20 DB***	***<1.0***	***<1.0***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	620	210	140	73	1,100	>6000 DB	5,400 MI	91,500	1,200 AT	23,000 DB	370	5,800	1,900 AT	-	>6000	120	39
Total Coliforms	mpn/100mL	n/v	0^{D}	**27^{D}**	***<10 MI***	***<1.0***	***<1.0***	**390^{D}**	**9,100 DB^{D}**	**310 MI^{D}**	**154^{D}**	***<10 AT***	**100 DB^{D}**	***<10 MI***	**205^{D}**	***<100 DVM***	-	**$2,300^{D}$**	**1.0^{D}**	***<1.0***

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				**MW16-16-11**		**MW16-17-5**	**MW16-18-6**		**MW16-18-10**		**MW16-19-8**	**MW16-19-19**	**MW16-20-21**	**MW16-21-11**	**MW16-22-26**				**MW16-23-14**	
Sample Date				**3-Oct-16**	**13-May-21**	**6-Oct-16**	**4-Oct-16**	**13-May-21**	**4-Oct-16**	**13-May-21**	**27-Sep-16**	**27-Sep-16**	**27-Sep-16**	**29-Sep-16**	**28-Sep-16**	**14-May-21**	**23-Nov-21**	**10-May-22**	**29-Sep-16**	**14-May-21**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**EIA Project Well**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**
Field Parameters																				
Dissolved oxygen, Field	mg/L	n/v	n/v	-	14.91	-	-	23.79	-	5.11	-	-	-	-	-	4.71	4.89	5.34	-	9.22
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**4,840^{A}**	**5,210^{A}**	**6,290^{A}**	**1,029^{A}**	**1,060^{A}**	**1,049^{A}**	**1,211^{A}**	**2,400^{A}**	**2,850^{A}**	**1,996^{A}**	848	**2,080^{A}**	**1,897^{A}**	**1,922^{A}**	**2,120^{A}**	**1,064^{A}**	993
Oxidation Reduction Potential, field	mV	n/v	n/v	-	84.2	-	-	62.5	-	69.4	-	-	-	-	-	65.8	89.4	130.3	-	0.1
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.2	**6.76^{B}**	7	7.1	7.43	7	7.53	7.6	7.2	7.2	7.2	7.2	7.37	7.68	7.25	7.2	**6.96^{B}**
Temperature, Field	deg C	n/v	≤15^{B}	12.1	12.2	6.7	6.3	6.4	6.3	6.5	8	8.2	6.2	8.5	7.9	14.0	3.56	4.8	9.4	10.4
Calculated Parameters																				
Anion Sum	meq/L	n/v	n/v	78	81	110	13	12	13	13	32	36	25	9.2	26	24	-	24	13	13
Cation Sum	meq/L	n/v	n/v	75	80	100	12	13	12	13	31	34	24	9.9	26	24	-	23	14	12
Hardness (as CaCO3)	mg/L	n/v	n/v	2,400	2,700	3,500	480	490	160	200	980	600	740	440	640	680	704	680	540	510
Ion Balance	%	n/v	n/v	0.95	0.41	0.93	0.98	2.0	0.93	0.068	0.96	0.95	0.97	1.1	1.0	0.53	116	4.1	1.0	1.7
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**4,900^{AB}**	**5,100^{AB}**	**6,900^{AB}**	**650^{AB}**	**620^{AB}**	**680^{AB}**	**740^{AB}**	**2,000^{AB}**	**2,200^{AB}**	**1,500^{AB}**	480	**1,700^{AB}**	**1,600^{AB}**	**1,480^{AB}**	**1,500^{AB}**	**680^{AB}**	**620^{AB}**
BTEX and Petroleum Hydrocarbons																				
Benzene	mg/L	0.005^{A}	0.005^{C}	**0.0056^{AC}**	<0.00040	-	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.0010	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	0.024	<0.00040	-	<0.00040	<0.00040	0.0013	<0.00040	<0.00040	<0.00040	0.00050	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	**0.0034^{AB}**	<0.00040	-	0.00062	<0.00040	0.00068	<0.00040	<0.00040	<0.00040	<0.00040	0.00059	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	0.019	<0.00089	-	0.0030	<0.00089	0.0041	<0.00089	<0.00080	<0.00080	<0.00080	0.0019	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10
Miscellaneous Inorganics																				
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	4.6	3.4	-	4.9	3.8	2.6	1.6	6.3	3.9	3.8	4.8	3.3	2.4	3	1.5	4.1	2.1
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**5,400^{A}**	**5,500^{A}**	**6,900^{A}**	**1,100^{A}**	**1,100^{A}**	**1,200^{A}**	**1,200^{A}**	**2,500^{A}**	**3,000^{A}**	**2,100^{A}**	800	**2,200^{A}**	**2,000^{A}**	**2,000^{A}**	**2,000^{A}**	**1,100^{A}**	**1,100^{A}**
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.57	7.48	7.81	8.01	7.93	8.10	7.96	7.56	7.54	7.59	7.96	8.04	7.80	8.13	7.94	7.94	7.52
Anions																				
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<0.50	<0.50	<1.0	<0.50	<1.0	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<5	<1.0	<0.50	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	630	720	520	420	450	410	420	420	520	450	390	180	180	184	180	600	580
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	770	870	640	510	550	500	510	520	640	540	470	220	220	232	220	730	710
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<0.50	<0.50	<1.0	<0.50	<1.0	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<5	<1.0	<0.50	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<0.50	<1.0	<0.50	<0.50	<1.0	<0.50	<1.0	<0.50	<0.50	<0.50	<0.50	<0.50	<1.0	<5	<1.0	<0.50	<1.0
Sulfate	mg/L	$429_{n5,e}^{A}$	≤500_{i}^{B}	**3,100 CD^{AB}**	**3,200 CD^{AB}**	**4,800 CD^{AB}**	100	82	110	94	**1,100 CD^{AB}**	**1,200 CD^{AB}**	**760 CD^{AB}**	50	**1,100 CD^{AB}**	**970 CD^{AB}**	**845^{AB}**	**1,000^{AB}**	70	45
Chloride	mg/L	100^{A}	≤250^{B}	7.9	5.9	8.7	72	45	78	**110^{A}**	1.9	1.7	3.3	4.6	4.9	3.5	12.8	3.1	3.5	<1.0
Nutrients																				
Ammonia (as N)	mg/L	0.737_{n2}^{A}	n/v	0.6	0.33	-	*<0.050*	<0.015	*<0.050*	0.034	0.07	**1.1^{A}**	0.57	***<0.050***	0.68	0.021	0.14	0.39	0.14	0.089
Nitrate (as N)	mg/L	3^{A}	10^{C}	0.031	<0.050	1.1	1.2	0.93	0.12	0.35	0.42	<0.010	0.019	**4.8^{A}**	0.012	0.73	0.34	<0.010	<0.010	<0.010
Nitrite (as N)	mg/L	$0.06/0.6_{n4,e}^{A}$	1^{C}	<0.010	<0.010	**0.17^{A}**	0.031	<0.010	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.01	0.021	<0.010	<0.010
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	0.031	<0.050 MI	1.3	1.2	0.93 MI	0.13	0.35	0.42	<0.020	<0.020	4.8	<0.020	0.73	0.34	0.022	<0.020	<0.010
Nitrogen	mg/L	n/v	n/v	-	1.2 DB	-	-	1.7 DB	-	1.2 DB	-	-	-	-	-	0.62	-	0.81	-	0.15
Orthophosphate (as P)	mg/L	n/v	n/v	0.0045	0.0037	-	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0041 OG	0.0076 OG	0.0068	<0.15	0.0092 DXE	<0.0030	0.0033
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	0.011	<0.0030	-	0.0038	0.0031	<0.0030	<0.0030	0.0037	<0.0030	<0.0030	0.013	<0.0030	0.0081	-	<0.0030	<0.0030	0.0045
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	14 DB	1.25	-	1.3	0.72	18 CD	0.89	0.70 DB	1.5 DB	11 DB	3.3 DB	0.97	<0.020	0.3	0.788	2.8 CD	0.149

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-16-11		MW16-17-5	MW16-18-6		MW16-18-10		MW16-19-8	MW16-19-19	MW16-20-21	MW16-21-11	MW16-22-26				MW16-23-14	
Sample Date				3-Oct-16	13-May-21	6-Oct-16	4-Oct-16	13-May-21	4-Oct-16	13-May-21	27-Sep-16	27-Sep-16	27-Sep-16	29-Sep-16	28-Sep-16	14-May-21	23-Nov-21	10-May-22	29-Sep-16	14-May-21
Sample Type	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2
Metals - Dissolved																				
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	0.0056	0.0050	0.0039	<0.0030	0.0053	<0.0030	0.0032	0.0039	0.0033	0.0040	0.0033	0.0036	0.0057	0.015	<0.0030	<0.0030	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.00060	0.00062	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	<0.001	0.0020	<0.00060	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	0.00085	0.00056	0.00053	0.00022	0.00026	0.00039	<0.00020	0.00030	0.00033	0.00043	0.00045	0.00073	<0.00020	0.002	0.00048	**0.0056^{A}**	0.0013
Barium	mg/L	1^{A}	2.0^{C}	0.026	0.013	0.041	0.075	0.080	0.030	0.028	0.013	<0.010	0.018	0.087	0.034	0.020	<0.05	0.016	0.12	0.090
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.20	0.29	0.12	0.088	0.092	0.14	0.16	0.092	0.13	0.076	0.061	0.098	0.14	0.14	0.12	0.13	0.13
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	0.00014 NF	0.000098	0.00028	<0.000020	<0.000020	<0.000020	<0.000020	0.000057	<0.000020	<0.000020	0.000073	<0.000020	0.000042	0.000052	<0.00002	0.000033	<0.000020
Calcium	mg/L	n/v	n/v	440	460	410	86	85	38	47	230	140	160	86	170	170	184	160	130	130
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	0.0037	0.0036	0.00083	<0.00030	<0.00030	0.00034	<0.00030	<0.00030	<0.00030	0.00085	0.00062	0.00087	<0.00030	<0.0009	0.00050	0.0020	0.00079
Copper	mg/L	0.007^{A}	$\leq1.0^{B}$ 2^{C}	**0.0097^{A}**	0.00022	0.0017	0.00067	0.00080	<0.00020	0.00041	0.00059	<0.00020	<0.00020	0.0013	<0.00020	0.00026	<0.0008	<0.0010	<0.00020	0.0056
Iron	mg/L	0.3^{A}	$\leq0.3^{B}$	<0.060	**0.51^{AB}**	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	**2.6^{AB}**	**0.69^{AB}**	0.078	0.11	<0.060	<0.1	<0.060	**0.50^{AB}**	**0.91^{AB}**
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.0003	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	0.15	0.15	0.15	0.026	0.027	0.031	0.039	0.029	0.056	0.053	0.028	0.064	0.064	-	0.032	0.032	0.033
Magnesium	mg/L	n/v	n/v	320	370	600 CD	63	67	16	21	99	62	82	54	54	58	59.3	66	53	45
Manganese	mg/L	0.05^{A}	$\leq0.02^{B}$ 0.12^{C}	**2.3^{ABC}**	**3.4^{ABC}**	**0.39^{ABC}**	**0.058^{AB}**	0.0047	**0.20^{ABC}**	**0.21^{ABC}**	**0.071^{AB}**	**0.37^{ABC}**	**0.34^{ABC}**	**0.17^{ABC}**	**0.51^{ABC}**	**0.27^{ABC}**	**0.400^{ABC}**	**0.46^{ABC}**	**0.75^{ABC}**	**0.37^{ABC}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000020	<0.0000019	<0.0000020	<0.0000020	<0.0000019	<0.0000020	<0.0000019	<0.0000020	<0.0000020	<0.0000020	<0.0000020	<0.0000020	<0.0000019	**0.0000056^{A}**	<0.0000019	<0.0000020	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.0011	0.00041	0.0015	0.0019	0.0015	0.0037	0.0018	0.00060	0.0012	0.0052	0.0010	0.0039	0.0032	0.003	0.0028	0.0053	0.00052
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	0.0066	0.007	0.0054	0.00099	0.0006	<0.00050	0.0025	<0.00050	<0.00050	<0.00050	0.0016	0.0018	0.0014	<0.003	0.0008	0.0053	0.00088
Phosphorus	mg/L	n/v	n/v	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	15	13	11	2.4	2.2	1.3	1.3	5.9	5.9	8.9	7.6	7.1	6.7	6.8	6.6	6.5	4.5
Selenium	mg/L	0.002^{A}	0.05^{C}	0.00038	0.00030	**0.034^{A}**	0.0012	**0.0023^{A}**	0.00066	0.0013	**0.056^{AC}**	<0.00020	0.00090	0.0019	0.00023	0.00048	0.0010	<0.00020	<0.00020	<0.00020
Silicon	mg/L	n/v	n/v	6.3	7.1	5.2	4.1	4.3	3.4	4.0	3.6	3.4	4.0	4.7	4.8	4.4	-	4.0	6.5	5.9
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010
Sodium	mg/L	200^{A}	$\leq200^{B}$	**600 CD^{AB}**	**590 CD^{AB}**	**750 CD^{AB}**	66	62	**200^{B}**	**210^{AB}**	**260^{AB}**	**490^{AB}**	**210^{AB}**	21	**310^{AB}**	**230^{AB}**	**252^{AB}**	**200^{B}**	59	40
Strontium	mg/L	n/v	7.0^{C}	4.9	6.0 CD	4.7	0.75	0.80	0.27	0.36	1.4	2.1	2.0	1.1	2.4	3.1	-	2.9	1.1	1.3
Sulfur	mg/L	n/v	n/v	1,000 CD	1,200 CD	1,500 CD	29	31	33	36	370	370	240	19	350	330	-	340	25	15
Thallium	mg/L	n/v	n/v	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	0.011	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	**0.033^{AC}**	**0.019^{A}**	**0.031^{AC}**	**0.011^{A}**	0.0076	0.0064	0.0049	**0.013^{A}**	0.00092	0.0032	0.0067	0.0044	0.0026	0.003	0.0022	0.0052	0.0026
Vanadium	mg/L	n/v	n/v	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010
Zinc	mg/L	0.03^{A}	$\leq5.0^{B}$	<0.0030	<0.0030	0.0062	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.016	<0.005	0.015	<0.0030	<0.0030
Metals - Total																				
Mercury	mg/L	0.000005^{A}	0.001^{C}	***<0.0060 DB***	**0.0000788^{A}**	***<0.00020 DB***	***<0.0060 DB***	**0.0000383^{A}**	***<0.0060 DB***	***<0.00019 DB***	***<0.0020 DB***	***<0.00020 DB***	***<0.0060 DB***	***<0.02 DB***	***<0.0060 DB***	<0.0000019	**0.0000056^{A}**	<0.0000019	***<0.02 DB***	**0.0000234^{A}**
Microbiological Parameters																				
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<100 DB***	***<10 SVH MI***	-	***<10 DB***	***<10 MI***	***<100 DB***	***<10 MI***	**63^{D}**	***<10***	***<100***	***<10 DB***	***<10 DB***	***<1.0***	***<1***	***<1.0***	***<10 DB***	***<10 MI***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<100 DB***	***<10 SVH MI***	-	***<10 DB***	***<10 MI***	***<100 DB***	***<10 MI***	***<10 DB***	***<10 DB***	***<100 DB***	***<10 DB***	***<10 DB***	***<1.0***	**1^{D}**	**3.1^{D}**	***<10 DB***	***<10 MI***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	50,000 DB	350	-	4,400 DB	140	17,000 DB	450	>6000	1,700	17,000 DB	3,200 DB	>6000	510	3,800	1,200	20,000 DB	6,100 MI
Total Coliforms	mpn/100mL	n/v	0^{D}	**200 DB^{D}**	***<10 SVH MI***	-	**140 DB^{D}**	***<10 MI***	**310 DB^{D}**	***<10 MI***	**280^{D}**	**10^{D}**	**750^{D}**	**20 DB^{D}**	**2,000 DB^{D}**	**1,200^{D}**	**488^{D}**	**460^{D}**	**>2400 DB^{D}**	***<10 MI***

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location					MW16-23-36			MW16-24-30				MW16-25-9				MW16-26-18				
Sample Date				23-Nov-21	29-Sep-16	14-May-21	23-Nov-21	28-Sep-16	14-May-21	23-Nov-21	10-May-22	30-Sep-16	14-May-21	23-Nov-21	10-May-22	28-Sep-16	12-May-21	24-Nov-21	4-May-22	28-Sep-16
Sample Type	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well	EIA Project Well
Field Parameters																				
Dissolved oxygen, Field	mg/L	n/v	n/v	4.31	-	13.11	2.8	-	11.89	3.65	3.46	-	11.01	4.01	2.93	-	7.76	3.68	3.08	-
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**1,016^{A}**	**1,256^{A}**	**1,298^{A}**	**1,281^{A}**	**1,114^{A}**	**1,107^{A}**	**1,074^{A}**	**1,178^{A}**	**1,039^{A}**	**1,647^{A}**	**1,279^{A}**	**1,293^{A}**	**1,207^{A}**	**3,581^{A}**	**1,238^{A}**	**1,372^{A}**	**1,902^{A}**
Oxidation Reduction Potential, field	mV	n/v	n/v	31.9	-	-72.6	-38.1	-	-10.9	25.8	36.5	-	62.3	36.6	98.7	-	-32.5	80.1	-3.8	-
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	**6.92^{B}**	7.3	7.64	7.71	7	7.83	7.47	7.46	7.1	7.11	7.17	7.11	7.4	7.70	7.23	7.29	7.3
Temperature, Field	deg C	n/v	≤15^{B}	2.17	8.3	7.8	3.88	8.2	7.0	3.4	6.5	7.3	8.0	3.32	8.2	7.1	5.6	6.78	10.1	8.2
Calculated Parameters																				
Anion Sum	meq/L	n/v	n/v	-	14	15	-	13	13	-	13	13	21	-	16	14	16	-	14	25
Cation Sum	meq/L	n/v	n/v	-	14	14	-	14	12	-	13	14	21	-	16	14	16	-	16	22
Hardness (as CaCO3)	mg/L	n/v	n/v	565	180	190	198	160	160	170	170	590	810	745	650	140	170	71	150	800
Ion Balance	%	n/v	n/v	111	0.99	1.8	112	1.1	2.8	113	1.8	1.1	0.40	115	0.77	1.0	0.57	100	6.0	0.90
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**639^{AB}**	**850^{AB}**	**900^{AB}**	**858^{AB}**	**730^{AB}**	**690^{AB}**	**691^{AB}**	**720^{AB}**	**680^{AB}**	**1,200^{AB}**	**903^{AB}**	**830^{AB}**	**870^{AB}**	**990^{AB}**	**780^{AB}**	**910^{AB}**	**1,400^{AB}**
BTEX and Petroleum Hydrocarbons																				
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.0003	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.0005	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.0005	<0.00080	<0.00089	<0.0005	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080	<0.00089	<0.0005	<0.00089	<0.00080
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10
Miscellaneous Inorganics																				
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	6	2.9	2.3	4	1.2	2.8	4	1.1	5.6	4.8	7	4.1	2.1	2.3	3.274	1.8	1.8
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**1,040^{A}**	**1,300^{A}**	**1,400^{A}**	**1,380^{A}**	**1,100^{A}**	**1,100^{A}**	**1,150^{A}**	**1,100^{A}**	**1,100^{A}**	**1,700^{A}**	**1,350^{A}**	**1,200^{A}**	**1,300^{A}**	**1,500^{A}**	**1,310^{A}**	**1,300^{A}**	**2,000^{A}**
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.90	8.22	8.16	8.33	8.19	8.05	8.34	8.18	8.11	7.74	8.07	7.73	8.29	8.21	8.32	8.26	7.77
Anions																				
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<5	<0.50	<1.0	<5	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	561	290	300	314	460	470	456	480	470	530	532	560	260	280	265	290	530
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	702	350	370	386	560	570	567	590	580	650	660	690	310	340	319	350	650
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<5	<0.50	<1.0	<5	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<5	<0.50	<1.0	<5	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50	<1.0	<5	<1.0	<0.50
Sulfate	mg/L	429$_{n5,e}^{A}$	≤500$_{j}^{B}$	35.7	380 CD	410 CD	339	160	150	120	150	150	**500 CD^{AB}**	253	210	400 CD	380 CD	344	370	**690 CD^{AB}**
Chloride	mg/L	100^{A}	≤250^{B}	5.5	3.2	2.2	3.1	<1.0	2.5	2.0	1.0	8.2	3.8	1.6	<1.0	2.0	84	1.2	19	2.1
Nutrients																				
Ammonia (as N)	mg/L	0.737$_{n2}^{A}$	n/v	0.1	**0.83^{A}**	**1.1^{A}**	**1.11^{A}**	**0.86^{A}**	**0.81^{A}**	**0.77^{A}**	**0.83^{A}**	0.12	0.029	<0.02	<0.015	0.64	**0.76^{A}**	0.62	**0.79^{A}**	0.38
Nitrate (as N)	mg/L	3^{A}	10^{C}	<0.02	<0.010	<0.010	<0.02	<0.010	<0.010	<0.02	<0.010	0.015	<0.010	<0.02	<0.010	<0.010	<0.010	<0.02	<0.010	<0.010
Nitrite (as N)	mg/L	0.06/0.6$_{n4,e}^{A}$	1^{C}	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010	<0.010	<0.01	<0.010	<0.010
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	<0.02	<0.020	<0.010	<0.02	<0.020	<0.010	<0.02	<0.010	<0.020	<0.010	<0.02	<0.010	<0.020	<0.010	<0.02	<0.010	<0.020
Nitrogen	mg/L	n/v	n/v	-	-	1.9 DB	-	-	1.1	-	1.0	-	0.69 DB	-	2.3 DB	-	1.4 DB	-	<2.0 DB	-
Orthophosphate (as P)	mg/L	n/v	n/v	0.17	0.0040 OG	0.0043	<0.15	<0.0030	0.0034	<0.15	<0.0030	0.0086	0.0079	<0.15	0.012	<0.0030	0.0065	<0.15	<0.0030	<0.0030
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	-	0.013	0.016	-	<0.0030	<0.0030	-	<0.0030	0.016	0.018	-	0.0064	0.0062	0.013	-	0.0031	<0.0030
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.0	1.3	1.86	4.3	0.88	1.10	0.9	1.03	0.54 DB	0.69	1.4	2.26	4.5 DB	1.42	1.7	<2.0	1.1

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location					MW16-23-36			MW16-24-30				MW16-25-9				MW16-26-18				
Sample Date				**23-Nov-21**	**29-Sep-16**	**14-May-21**	**23-Nov-21**	**28-Sep-16**	**14-May-21**	**23-Nov-21**	**10-May-22**	**30-Sep-16**	**14-May-21**	**23-Nov-21**	**10-May-22**	**28-Sep-16**	**12-May-21**	**24-Nov-21**	**4-May-22**	**28-Sep-16**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**
Metals - Dissolved																				
Aluminum	mg/L	0.05$_{n1,e}^{A}$	0.1$_{a}^{B}$ 2.9^{C}	<0.004	0.0074	<0.0030	0.004	<0.0030	0.0032	0.013	<0.0030	0.028	<0.0030	0.033	<0.0030	0.0037	<0.0030	**0.109^{AB}**	0.0049	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.001	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.001	<0.00060	<0.00060	<0.00060	<0.001	0.0014	<0.00060	<0.00060	<0.001	<0.00060	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	0.002	0.00035	0.00029	0.002	0.0023	0.0025	0.005	0.0025	0.00078	0.00041	0.001	0.00060	<0.00020	<0.00020	<0.001	0.0010	0.00036
Barium	mg/L	1^{A}	2.0^{C}	<0.05	0.030	0.053	<0.05	0.019	0.037	<0.05	0.018	0.053	0.063	<0.05	0.050	<0.010	0.053	<0.05	0.018	<0.010
Beryllium	mg/L	n/v	n/v	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.12	0.086	0.095	0.09	0.089	0.093	0.09	0.088	0.099	0.070	0.06	0.071	0.13	0.12	0.13	0.14	0.13
Cadmium	mg/L	0.00037$_{n3,e}^{A}$	0.007^{C}	0.000029	<0.000020	<0.000020	0.000017	<0.000020	<0.000020	0.000021	<0.00002	0.000065	0.000077	0.000023	0.000046	<0.000020	<0.000020	<0.000016	<0.00002	0.000026
Calcium	mg/L	n/v	n/v	146	50	51	54.4	38	38	41.2	41	140	160	148	120	40	47	16.0	41	200
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	0.0007	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	<0.0009	<0.00030	<0.00030	<0.0009	<0.00030	<0.00030	<0.0009	<0.00030	0.0020	0.00067	<0.0009	0.00069	<0.00030	<0.00030	<0.0009	<0.00030	0.0014
Copper	mg/L	0.007^{A}	≤1.0^{B} 2^{C}	<0.0008	<0.00020	0.00025	<0.0008	<0.00020	<0.00020	0.0016	<0.0010	0.0011	0.0016	0.0026	<0.0010	0.00021	0.00021	0.0015	<0.0010	<0.00020
Iron	mg/L	0.3^{A}	≤0.3^{B}	<0.1	<0.060	**0.77^{AB}**	<0.1	0.14	0.10	<0.1	<0.060	0.16	<0.060	<0.1	<0.060	0.15	0.14	<0.1	<0.060	**0.42^{AB}**
Lead	mg/L	0.007$_{n3,e}^{A}$	0.005^{C}	<0.0002	<0.00020	<0.00020	<0.0002	<0.00020	<0.00020	0.0010	<0.00020	<0.00020	<0.00020	0.0007	<0.00020	<0.00020	<0.00020	0.0011	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	-	0.066	0.075	-	0.054	0.056	-	0.075	0.034	0.071	-	0.043	0.035	0.028	-	0.038	0.041
Magnesium	mg/L	n/v	n/v	48.6	14	15	15.2	16	15	16.2	17	59	100	91.2	82	11	13	7.5	12	75
Manganese	mg/L	0.05^{A}	≤0.02^{B} 0.12^{C}	**0.368^{ABC}**	**0.083^{AB}**	**0.10^{AB}**	**0.073^{AB}**	**0.067^{AB}**	**0.076^{AB}**	**0.065^{AB}**	**0.067^{AB}**	**0.23^{ABC}**	**0.22^{ABC}**	**0.170^{ABC}**	**0.14^{ABC}**	**0.083^{AB}**	**0.10^{AB}**	**0.066^{AB}**	**0.071^{AB}**	**0.41^{ABC}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.0000081^{A}**	<0.0000020	<0.0000019	<0.0000025	<0.0000020	<0.0000019	<0.0000025	<0.0000019	0.0000035	<0.0000019	<0.0000025	<0.0000019	<0.0000020	<0.0000019	<0.0000025	<0.0000019	<0.0000020
Molybdenum	mg/L	n/v	n/v	<0.001	0.0023	0.0023	0.005	0.0014	0.0035	0.001	0.0013	0.0036	0.0017	0.001	0.0014	0.0048	0.0045	0.005	0.0051	0.00058
Nickel	mg/L	0.17$_{n3,e}^{A}$	n/v	<0.003	<0.00050	<0.00050	<0.003	<0.00050	<0.00050	<0.003	<0.00050	0.0067	0.0036	0.004	0.0028	<0.00050	<0.00050	<0.003	0.0006	0.00062
Phosphorus	mg/L	n/v	n/v	<0.08	<0.10	<0.10	<0.08	<0.10	<0.10	<0.08	<0.10	<0.10	<0.10	0.09	<0.10	<0.10	<0.10	<0.08	<0.10	<0.10
Potassium	mg/L	n/v	n/v	5.0	4.2	4.0	4.3	4.0	3.6	3.9	4.0	6.6	5.9	5.7	5.8	2.8	2.8	1.9	2.7	4.9
Selenium	mg/L	0.002^{A}	0.05^{C}	0.0011	<0.00020	<0.00020	0.0020	<0.00020	<0.00020	0.0008	<0.00020	0.0014	<0.00020	0.0007	0.00045	<0.00020	<0.00020	0.0012	<0.00020	<0.00020
Silicon	mg/L	n/v	n/v	-	3.8	3.8	-	3.6	3.6	-	3.3	7.0	6.0	-	5.3	4.5	4.1	-	4.4	5.7
Silver	mg/L	0.0001^{A}	n/v	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00005	<0.00010	<0.00010
Sodium	mg/L	200^{A}	≤200^{B}	53.2	**230^{AB}**	**230^{AB}**	**252^{AB}**	**240^{AB}**	**200^{B}**	**229^{AB}**	**220^{AB}**	34	110	79.3	63	**250^{AB}**	**290^{AB}**	**253^{AB}**	**290^{AB}**	140
Strontium	mg/L	n/v	7.0^{C}	-	0.77	0.83	-	0.66	0.63	-	0.66	0.74	1.7	-	1.3	0.61	0.65	-	0.67	1.6
Sulfur	mg/L	n/v	n/v	-	120	140	-	51	51	-	44	49	180	-	66	130	110	-	140	180
Thallium	mg/L	n/v	n/v	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.0001	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	0.002	<0.0010	<0.0010	0.001	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	0.002	<0.0010	<0.0010	<0.0010	0.004	<0.0010	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.003	0.00010	<0.00010	<0.001	0.00022	0.00029	<0.001	0.00021	**0.014^{A}**	**0.035^{AC}**	**0.028^{AC}**	**0.025^{AC}**	0.00013	0.00029	<0.001	0.00016	0.0049
Vanadium	mg/L	n/v	n/v	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	0.0011	<0.0010	-	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010
Zinc	mg/L	0.03^{A}	≤5.0^{B}	<0.005	<0.0030	<0.0030	<0.005	<0.0030	<0.0030	0.019	<0.0030	<0.0030	<0.0030	0.011	<0.0030	<0.0030	<0.0030	<0.005	<0.0030	<0.0030
Metals - Total																				
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.000013^{A}**	***<0.00020 DB***	**0.0000699^{A}**	**0.000025^{A}**	<0.0000020	0.0000042	**0.0000052^{A}**	<0.0000019	***<0.0020 DB***	**0.0000683^{A}**	**0.000097^{A}**	**0.000077^{A}**	***<0.0060 DB***	**0.0000096^{A}**	**0.000016^{A}**	**0.000131^{A}**	***<0.02 DB***
Microbiological Parameters																				
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	**1^{D}**	**11^{D}**	***<20 MI***	***<1***	***<1.0***	***<1.0***	***<1***	***<1.0***	***<10 DB***	***<10 MI***	**9^{D}**	***<10 AT***	***<10 DB***	***<10 MI***	***<1***	***<5.0 AT***	***<10 DB***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	**1^{D}**	**5.1^{D}**	***<20 MI***	***<1***	***<1.0***	***<1.0***	***<1***	***<1.0***	***<10 DB***	***<10 MI***	**26^{D}**	***<10 AT***	***<10 DB***	***<10 MI***	***<1***	***<10 AT***	***<10 DB***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	2,660	400	1,100 MI	2,450	48	750	925	100	7,900 DB	5,300 MI	21,100	2,700 AT	>6000	4,500	850	510	980
Total Coliforms	mpn/100mL	n/v	0^{D}	**17^{D}**	**520^{D}**	***<20 MI***	**81^{D}**	**2.0^{D}**	***<1.0***	**43^{D}**	**19^{D}**	**>2400 DB^{D}**	***<10 MI***	**70^{D}**	**30 AT^{D}**	**580 DB^{D}**	**640 MI^{D}**	**649^{D}**	**26 AT^{D}**	**850 DB^{D}**

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				MW16-27-9			MW21-3-15	MW21-6-7		MW21-6-12		RMW16-5-12		RMW16-8-8	RMW16-13-37		RMW16-16-17		RMW16-17-10	
Sample Date				12-May-21	24-Nov-21	4-May-22	4-May-22	22-Nov-21	5-May-22	22-Nov-21	5-May-22	1-Dec-21	4-May-22	6-May-22	24-Nov-21	9-May-22	2-Dec-21	5-May-22	22-Nov-21	10-May-22
Sample Type	Units	2019 AEP Tier 1	GCDWQ	EIA Project Well	EIA Project Well	EIA Project Well	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2
Field Parameters																				
Dissolved oxygen, Field	mg/L	n/v	n/v	1.77	38.5	5.31	4.76	17.92	3.55	7.91	2.24	8.3	5.12	4.15	6.07	5.11	6.62	3.98	7.13	3.61
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**1,826^{A}**	**1,479^{A}**	**1,580^{A}**	**1,145^{A}**	**1,306^{A}**	**1,427^{A}**	**1,425^{A}**	**1,592^{A}**	776	818	**1,157^{A}**	**3,344^{A}**	**3,027^{A}**	**5,160^{A}**	**5,086^{A}**	**2,077^{A}**	**2,143^{A}**
Oxidation Reduction Potential, field	mV	n/v	n/v	83.7	86.9	11.6	88.2	41.5	7.8	69	-53.6	-17.3	-45.2	68.1	-44.4	-101.7	5	-23.4	19.3	51.2
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.03	**6.85^{B}**	**6.52^{B}**	7.56	7.4	7	7.83	7.01	7.73	**6.96^{B}**	7.43	8.01	7.67	7.13	**6.9^{B}**	7.2	7.11
Temperature, Field	deg C	n/v	≤15^{B}	6.8	2.65	9.3	8.4	7.36	9	5.99	12.1	5.1	8.9	9.5	3.96	6.2	4.07	7.5	6.55	7.4
Calculated Parameters																				
Anion Sum	meq/L	n/v	n/v	29	-	18	21	-	15	-	16	-	9.2	14	-	35	-	59	-	26
Cation Sum	meq/L	n/v	n/v	24	-	21	13	-	19	-	20	-	9.6	16	-	34	-	66	-	27
Hardness (as CaCO3)	mg/L	n/v	n/v	800	739	760	22	351	390	336	380	329	310	710	155	110	1,520	1,400	826	850
Ion Balance	%	n/v	n/v	9.9	113	7.6	22	110	12	106	10	120	2.2	5.8	110	0.63	109	5.6	108	0.36
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**1,600^{AB}**	**1,100^{AB}**	**1,100^{AB}**	**990^{AB}**	**957^{AB}**	**950^{AB}**	**968^{AB}**	**980^{AB}**	426	480	**770^{AB}**	**2,470^{AB}**	**2,200^{AB}**	**4,460^{AB}**	**3,900^{AB}**	**1,530^{AB}**	**1,600^{AB}**
BTEX and Petroleum Hydrocarbons																				
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	0.00051	<0.0005	<0.00040	<0.0005	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10
Miscellaneous Inorganics																				
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	4.0	3.069	2.1	5.6	14	3.5	8	2.5	3	2.5	2.8	58.28	41	4	2.6	6	3.3
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**2,600^{A}**	**1,600^{A}**	**1,500^{A}**	**1,100^{A}**	**1,480^{A}**	**1,400^{A}**	**1,510^{A}**	**1,500^{A}**	729	780	**1,100^{A}**	**3,650^{A}**	**3,100^{A}**	**5,510^{A}**	**5,200^{A}**	**2,080^{A}**	**2,100^{A}**
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.71	7.92	7.63	**8.59^{A}**	8.13	7.83	8.07	7.91	8.26	8.04	7.78	8.33	8.02	8.14	7.89	8.02	7.80
Anions																				
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	13	<5	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<5	<1.0
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	420	482	510	910	549	500	537	480	334	410	430	450	640	683	640	453	450
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	510	588	620	1,100	684	610	669	590	408	500	520	540	780	833	780	566	550
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	16	<5	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<5	<1.0
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<5	<1.0	<1.0	<5	<1.0	<5	<1.0	<5	<1.0
Sulfate	mg/L	429$_{n5,e}^{A}$	≤500$_{j}^{B}$	**490 CD^{A}**	420	380	130	223	230	221	240	46.1	48	210	**1,130^{AB}**	**950^{AB}**	**2,560^{AB}**	**2,200^{AB}**	**744^{AB}**	**830^{AB}**
Chloride	mg/L	100^{A}	≤250^{B}	**370 CD^{AB}**	<1.0	<1.0	3.7	19.0	18	44.7	48	3.3	2.7	28	**156^{A}**	84	4.1	5.3	<1.0	<1.0
Nutrients																				
Ammonia (as N)	mg/L	0.737$_{n2}^{A}$	n/v	0.35	0.35	0.33	**0.90^{A}**	0.12	0.036	0.23	0.19	0.28	0.29	<0.015	**1.77^{A}**	**1.5^{A}**	**1.91^{A}**	**1.7^{A}**	0.05	0.066
Nitrate (as N)	mg/L	3^{A}	10^{C}	0.018	<0.02	<0.010	0.014	<0.02	<0.010	<0.02	<0.010	0.18	<0.010	0.74	0.16	<0.010	<0.02	<0.050	<0.02	<0.050
Nitrite (as N)	mg/L	0.06/0.6$_{n4,e}^{A}$	1^{C}	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.01	<0.010	<0.01	<0.010	<0.010	<0.01	<0.010	<0.01	<0.010	<0.01	<0.010
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	0.018	<0.02	<0.010	0.014	<0.02	<0.010	<0.02	<0.010	0.18	<0.010	0.74	0.16	<0.010	<0.02	<0.050 AT	<0.02	<0.050 AT
Nitrogen	mg/L	n/v	n/v	2.3 DB	-	<2.0 DB	14 DB	-	4.7 DB	-	0.47 DB	-	4.7 DB	15 DB	-	3.2 DB	-	4.8 DB	-	<2.0 DB
Orthophosphate (as P)	mg/L	n/v	n/v	0.034	<0.15	<0.0030	0.12	<0.15	<0.0030	<0.15	<0.0030	<0.15	<0.0030	<0.0030	<0.15	0.0078	<0.15	0.0037	<0.15	0.0043
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	0.20	-	<0.0030	0.13	-	0.010	-	<0.0030	-	0.058	<0.0030	-	0.0048	-	<0.0030	-	0.0034
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	2.29	4.6	<2.0	14.4	166	4.7	1.4	0.47	8.00	4.7	14.2	17.0	3.2	19.06	4.8	4.5	<2.0

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				**MW16-27-9**			**MW21-3-15**	**MW21-6-7**		**MW21-6-12**		**RMW16-5-12**		**RMW16-8-8**	**RMW16-13-37**		**RMW16-16-17**		**RMW16-17-10**	
Sample Date				**12-May-21**	**24-Nov-21**	**4-May-22**	**4-May-22**	**22-Nov-21**	**5-May-22**	**22-Nov-21**	**5-May-22**	**1-Dec-21**	**4-May-22**	**6-May-22**	**24-Nov-21**	**9-May-22**	**2-Dec-21**	**5-May-22**	**22-Nov-21**	**10-May-22**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**	**EIA Project Well**	**EIA Project Well**	**EIA Project Well**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**
Metals - Dissolved																				
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	**0.94^{AB}**	<0.004	<0.0030	**3.9^{ABC}**	0.009	<0.0030	0.005	<0.0030	**0.061^{A}**	0.0058	0.0033	**0.279^{AB}**	0.013	0.005	<0.0030	0.011	<0.0030
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.00060	<0.001	<0.00060	0.0016	<0.001	<0.00060	<0.001	<0.00060	<0.001	<0.00060	<0.00060	<0.001	0.00075	0.002	0.00096	<0.001	0.0014
Arsenic	mg/L	0.005^{A}	0.010^{C}	0.0011	<0.001	0.00033	**0.0065^{A}**	0.001	0.00023	0.001	0.00072	<0.001	0.00056	0.00030	0.003	0.0049	**0.014^{AC}**	**0.012^{AC}**	0.001	0.00042
Barium	mg/L	1^{A}	2.0^{C}	0.023	<0.05	0.013	0.041	<0.05	0.025	<0.05	0.015	0.07	0.069	0.046	0.09	0.049	<0.05	0.012	<0.05	0.022
Beryllium	mg/L	n/v	n/v	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.12	0.13	0.14	0.19	0.19	0.20	0.21	0.23	0.09	0.12	0.047	0.16	0.18	0.23	0.22	0.12	0.13
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	0.000035	0.000017	0.000047	0.000029	0.000037	0.000023	0.000077	<0.00002	0.000030	<0.00002	<0.00002	0.000098	<0.00002	0.000064	0.000087	0.000086	<0.00002
Calcium	mg/L	n/v	n/v	180	186	180	6.6	91.2	100	88.7	98	74.9	68	150	47.6	32	346	300	189	190
Chromium	mg/L	0.05^{A}	0.05^{C}	0.0013	<0.0005	<0.0010	0.0036	<0.0005	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	0.0006	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010
Cobalt	mg/L	n/v	n/v	0.0020	<0.0009	0.0010	0.0010	<0.0009	0.00037	<0.0009	0.00058	<0.0009	0.00042	<0.00030	<0.0009	0.00031	0.0096	0.0054	0.0022	0.0014
Copper	mg/L	0.007^{A}	$\leq1.0^{B}$ 2^{C}	0.0017	<0.0008	<0.0010	**0.0080^{A}**	<0.0008	<0.0010	0.0012	<0.0010	<0.0008	<0.0010	<0.0010	**0.0233^{A}**	<0.0010	<0.0008	<0.0010	<0.0008	<0.0010
Iron	mg/L	0.3^{A}	$\leq0.3^{B}$	<0.060	<0.1	<0.060	**0.95^{AB}**	<0.1	<0.060	<0.1	<0.060	<0.1	<0.060	<0.060	0.1	0.22	<0.1	<0.060	<0.1	<0.060
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	0.00047	<0.0002	<0.00020	0.0016	<0.0002	<0.00020	<0.0002	<0.00020	0.0004	<0.00020	<0.00020	0.0006	<0.00020	<0.0002	<0.00020	<0.0002	<0.00020
Lithium	mg/L	n/v	n/v	0.050	-	0.033	<0.020	-	0.032	-	0.045	-	<0.020	<0.020	-	0.085	-	0.24	-	0.022
Magnesium	mg/L	n/v	n/v	85	66.7	73	1.4	30.0	34	27.7	33	34.5	34	82	8.8	6.7	159	150	86.0	92
Manganese	mg/L	0.05^{A}	$\leq0.02^{B}$ 0.12^{C}	**0.65^{ABC}**	**0.362^{ABC}**	**0.32^{ABC}**	**0.034^{B}**	0.009	**0.17^{ABC}**	**0.149^{ABC}**	**0.18^{ABC}**	**0.122^{ABC}**	**0.14^{ABC}**	0.019	**0.187^{ABC}**	**0.16^{ABC}**	**0.902^{ABC}**	**0.69^{ABC}**	**0.648^{ABC}**	**0.72^{ABC}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	<0.0000019	<0.0000025	<0.0000019	0.000002	**0.0000054^{A}**	<0.0000019	***<0.0000125***	<0.0000019	-	<0.0000019	<0.0000019	<0.0000025	<0.0000019	-	<0.0000019	**0.0000052^{A}**	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.0035	0.004	0.00053	0.023	0.002	0.0016	0.002	0.0012	0.006	0.0039	0.0010	0.046	0.064	0.025	0.0085	0.001	0.0010
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	0.0047	<0.003	0.00093	0.0067	<0.003	0.0019	0.005	0.0016	0.003	0.0015	0.00082	0.003	0.0022	0.06	0.029	0.006	0.0018
Phosphorus	mg/L	n/v	n/v	<0.10	0.10	<0.10	0.11	<0.14	<0.10	<0.08	<0.10	<0.08	<0.10	<0.10	0.08	<0.10	<0.08	<0.10	<0.08	<0.10
Potassium	mg/L	n/v	n/v	6.3	4.7	5.1	1.2	6.2	5.2	4.3	5.1	8.1	8.2	6.8	5.6	5.1	14.0	12	5.4	5.6
Selenium	mg/L	0.002^{A}	0.05^{C}	<0.00020	**0.0025^{A}**	<0.00020	**0.0022^{A}**	<0.0005	0.00023	<0.0005	<0.00020	<0.0005	0.00029	**0.0035^{A}**	**0.0042^{A}**	0.00096	<0.0005	0.0011	<0.0005	<0.00020
Silicon	mg/L	n/v	n/v	7.1	-	5.7	4.5	-	4.9	-	4.5	-	4.1	4.6	-	5.0	-	5.0	-	4.5
Silver	mg/L	0.0001^{A}	n/v	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010
Sodium	mg/L	200^{A}	$\leq200^{B}$	170	135	130	**300^{AB}**	**251^{AB}**	**260^{AB}**	**253^{AB}**	**270^{AB}**	58.0	73	28	**860^{AB}**	**740^{AB}**	**972^{AB}**	**880^{AB}**	**232^{AB}**	**220^{AB}**
Strontium	mg/L	n/v	7.0^{C}	1.4	-	1.4	0.053	-	1.0	-	1.8	-	1.2	1.3	-	0.59	-	7.0	-	2.7
Sulfur	mg/L	n/v	n/v	210	-	150	46	-	72	-	73	-	18	68	-	320	-	830	-	250
Thallium	mg/L	n/v	n/v	<0.00020	0.0001	<0.00020	<0.00020	<0.0001	<0.00020	<0.0001	<0.00020	<0.0001	<0.00020	<0.00020	<0.0001	<0.00020	0.0001	<0.00020	<0.0001	<0.00020
Tin	mg/L	n/v	n/v	<0.0010	-	<0.0010	<0.0010	-	<0.0010	-	<0.0010	-	0.0015	0.0021	-	<0.0010	-	<0.0010	-	<0.0010
Titanium	mg/L	n/v	n/v	0.097	0.002	<0.0010	0.15	0.005	<0.0010	0.001	<0.0010	0.002	0.0016	0.0010	0.007	0.0019	0.002	<0.0010	0.002	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	**0.017^{A}**	0.006	0.0050	0.0072	0.008	0.0070	0.004	0.0043	0.002	0.0022	**0.013^{A}**	**0.029^{AC}**	**0.030^{AC}**	0.005	0.0014	0.007	0.0067
Vanadium	mg/L	n/v	n/v	0.0026	-	<0.0010	0.011	-	0.0014	-	0.0014	-	0.0011	<0.0010	-	0.0011	-	0.0010	-	<0.0010
Zinc	mg/L	0.03^{A}	$\leq5.0^{B}$	0.0042	<0.005	<0.0030	0.0065	<0.005	<0.0030	<0.005	<0.0030	<0.005	<0.0030	<0.0030	0.018	<0.0030	<0.005	<0.0030	<0.005	<0.0030
Metals - Total																				
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.000306 DB^{A}**	**0.000072^{A}**	**0.000177^{A}**	**0.00446^{AC}**	**0.000060^{A}**	**0.00169^{AC}**	**0.000010^{A}**	**0.0000122^{A}**	**0.000055^{A}**	**0.000096^{A}**	**0.00278^{AC}**	***<0.0000125***	**0.000522^{A}**	**0.000035^{A}**	**0.000491^{A}**	***<0.0000125***	**0.000239^{A}**
Microbiological Parameters																				
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<100 MI***	**6^{D}**	***<2.0 AT***	***<100 AT***	**4^{D}**	***<10***	***<1***	**10^{D}**	**411^{D}**	**10 AT^{D}**	***<100 DVM***	**3^{D}**	***<10 AT***	**1^{D}**	***<10***	**3^{D}**	***<10 AT***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<100 MI***	**27^{D}**	***<10 AT***	***<100 AT***	**9^{D}**	***<100***	***<1***	***<10***	**579^{D}**	**10 AT^{D}**	***<100 DVM***	**5^{D}**	**10 AT^{D}**	**2^{D}**	***<100***	**8^{D}**	**10 AT^{D}**
Heterotrophic Plate Count	cfu/mL	n/v	n/v	1,300 MI	2,400	430	100,000 DVM	73,000	1,200	5,650	210	4,600	>6000 DVM	470 AT	111,000	150,000 AT	18,300	740	95,000	900 AT
Total Coliforms	mpn/100mL	n/v	0^{D}	**410 MI^{D}**	**173^{D}**	**8.2 AT^{D}**	***<100 AT***	**830^{D}**	**30^{D}**	**548^{D}**	**10^{D}**	**2,424^{D}**	**10 AT^{D}**	**530 DVM^{D}**	**178^{D}**	**85 AT^{D}**	**550^{D}**	**210^{D}**	**1,990^{D}**	**160 AT^{D}**

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				RMW16-18-5		RMW16-18-13		RMW16-19-10		RMW16-19-19		RMW16-23-7	RMW16-23-13	RMW16-23-32
Sample Date				22-Nov-21	5-May-22	22-Nov-21	5-May-22	1-Dec-21	6-May-22	1-Dec-21	6-May-22	13-May-22	13-May-22	13-May-22
Sample Type	Units	2019 AEP Tier 1	GCDWQ	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2	Tier 2
Field Parameters														
Dissolved oxygen, Field	mg/L	n/v	n/v	41.26	3.71	3.19	2.56	5.19	5.09	2.75	2.04	5.87	4.73	3.6
Electrical Conductivity, Field	µS/cm	1,000^{A}	n/v	**1,073**^{A}	**1,143**^{A}	**1,011**^{A}	**1,098**^{A}	**3,024**^{A}	**3,057**^{A}	**2,642**^{A}	**2,642**^{A}	947	**1,257**^{A}	**1,169**^{A}
Oxidation Reduction Potential, field	mV	n/v	n/v	62.1	67	52.3	66.9	123.8	52.2	-4.7	-103	-6.5	81.2	27.1
pH, Field	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	7.94	7.42	7.64	7.45	7.07	7.09	7.23	7.05	7.46	7.49	7.71
Temperature, Field	deg C	n/v	≤15^{B}	6.32	8.2	5.04	7.5	4.28	10.6	3.89	6.8	6.4	6.9	5.5
Calculated Parameters														
Anion Sum	meq/L	n/v	n/v	-	12	-	12	-	38	-	32	10	13	12
Cation Sum	meq/L	n/v	n/v	-	13	-	13	-	42	-	33	9.7	13	12
Hardness (as CaCO3)	mg/L	n/v	n/v	265	260	132	180	1,180	1,200	485	480	390	340	63
Ion Balance	%	n/v	n/v	109	3.3	103	5.3	117	4.4	108	1.3	2.0	1.1	1.3
Total Dissolved Solids	mg/L	500^{A}	≤500^{B}	**665**^{AB}	**650**^{AB}	**640**^{AB}	**660**^{AB}	**2,330**^{AB}	**2,500**^{AB}	**1,850**^{AB}	**2,000**^{AB}	**560**^{AB}	**750**^{AB}	**660**^{AB}
BTEX and Petroleum Hydrocarbons														
Benzene	mg/L	0.005^{A}	0.005^{C}	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.00040
Toluene	mg/L	0.024^{A}	0.024^{B} 0.06^{C}	<0.0003	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040	<0.0003	<0.00040	<0.00040	<0.00040	<0.00040
Ethylbenzene	mg/L	0.0016^{A}	0.0016^{B} 0.14^{C}	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.0005	<0.00040	<0.00040	<0.00040	<0.00040
Xylenes, Total	mg/L	0.02^{A}	0.02^{B} 0.09^{C}	<0.0005	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089	<0.0005	<0.00089	<0.00089	<0.00089	<0.00089
PHC F1 (C6-C10 range)	mg/L	n/v	n/v	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10
PHC F1 (C6-C10 range) minus BTEX	mg/L	2.2^{A}	n/v	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10
PHC F2 (>C10-C16 range)	mg/L	1.1^{A}	n/v	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.1	<0.10	<0.10	<0.10	<0.10
Miscellaneous Inorganics														
Dissolved Organic Carbon (DOC)	mg/L	n/v	n/v	6	2.2 DSM	4	1.8	6	5.7	4	3.6	2.8	2.5	1.7
Electrical Conductivity, Lab	µS/cm	1,000^{A}	n/v	**1,130**^{A}	**1,100**^{A}	**1,080**^{A}	**1,100**^{A}	**3,110**^{A}	**3,100**^{A}	**2,760**^{A}	**2,600**^{A}	900	**1,200**^{A}	**1,200**^{A}
pH, lab	S.U.	6.5-8.5^{A}	7.0-10.5^{B}	8.25	7.95	8.40	8.20	8.12	7.57	8.24	8.01	7.98	7.97	8.37
Anions														
Alkalinity (P as CaCO3)	mg/L	n/v	n/v	<5	<1.0	6	<1.0	<5	<1.0	<5	<1.0	<1.0	<1.0	4.5
Alkalinity, Total (as CaCO3)	mg/L	n/v	n/v	408	380	386	390	402	480	519	620	250	390	480
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	n/v	511	470	468	470	490	590	634	750	300	480	570
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	n/v	<5	<1.0	7	<1.0	<5	<1.0	<5	<1.0	<1.0	<1.0	5.4
Alkalinity, Hydroxide (as CaCO3)	mg/L	n/v	n/v	<5	<1.0	<5	<1.0	<5	<1.0	<5	<1.0	<1.0	<1.0	<1.0
Sulfate	mg/L	$429_{n5,e}^{A}$	≤500_{j}^{B}	62.2	70	82.4	80	**1,280**^{AB}	**1,400**^{AB}	**883**^{AB}	**940**^{AB}	170	240	110
Chloride	mg/L	100^{A}	≤250^{B}	80.2	92	64.3	76	2.5	2.1	<1.0	1.2	54	16	<1.0
Nutrients														
Ammonia (as N)	mg/L	0.737_{n2}^{A}	n/v	0.05	0.017	0.04	<0.015	0.08	0.043	**1.14**^{A}	**1.0**^{A}	0.13	0.24	**0.80**^{A}
Nitrate (as N)	mg/L	3^{A}	10^{C}	0.97	0.93	0.34	0.63	<0.02	<0.050	<0.02	<0.010	0.084	0.054	0.012
Nitrite (as N)	mg/L	$0.06/0.6_{n4,e}^{A}$	1^{C}	<0.01	0.012	<0.01	<0.010	<0.01	<0.010	<0.01	<0.010	0.014	<0.010	<0.010
Nitrate + Nitrite (as N)	mg/L	100^{A}	n/v	0.97	0.95	0.34	0.63	<0.02	<0.050 AT	<0.02	<0.010	0.098 AT	0.054 AT	0.012
Nitrogen	mg/L	n/v	n/v	-	1.6 DB	-	0.93 DB	-	1.5 DB	-	1.3	1.6 DB	0.42 DB	1.0
Orthophosphate (as P)	mg/L	n/v	n/v	<0.15	0.0049	<0.15	<0.0030	<0.15	0.0035	<0.15	<0.0030	<0.0030	<0.0030	0.0076
Phosphorus, Total (Dissolved)	mg/L	n/v	n/v	-	0.0069	-	<0.0030	-	<0.0030	-	<0.0030	0.0066	<0.0030	0.0078
Total Kjeldahl Nitrogen	mg/L	n/v	n/v	1.7	0.63	1.1	0.30	10.58	1.45	5.66	1.27	1.52	0.37	0.989

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Sample Location				**RMW16-18-5**		**RMW16-18-13**		**RMW16-19-10**		**RMW16-19-19**		**RMW16-23-7**	**RMW16-23-13**	**RMW16-23-32**
Sample Date				**22-Nov-21**	**5-May-22**	**22-Nov-21**	**5-May-22**	**1-Dec-21**	**6-May-22**	**1-Dec-21**	**6-May-22**	**13-May-22**	**13-May-22**	**13-May-22**
Sample Type	**Units**	**2019 AEP Tier 1**	**GCDWQ**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**	**Tier 2**
Metals - Dissolved														
Aluminum	mg/L	$0.05_{n1,e}^{A}$	0.1_{a}^{B} 2.9^{C}	0.017	0.015	0.017	<0.0030	**0.072^{A}**	<0.0030	**0.102^{AB}**	<0.0030	0.0060	<0.0030	0.0033
Antimony	mg/L	0.006^{A}	0.006^{C}	<0.001	<0.00060	<0.001	<0.00060	<0.001	<0.00060	<0.001	<0.00060	0.0028	0.00061	<0.00060
Arsenic	mg/L	0.005^{A}	0.010^{C}	0.001	0.00029	<0.001	0.00035	0.002	0.00035	<0.001	<0.00020	0.00039	0.00021	0.00056
Barium	mg/L	1^{A}	2.0^{C}	<0.05	0.065	<0.05	0.041	<0.05	0.015	<0.05	<0.010	0.11	0.030	0.019
Beryllium	mg/L	n/v	n/v	<0.0005	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010
Boron	mg/L	1.0^{A}	5^{C}	0.11	0.11	0.13	0.14	0.12	0.13	0.15	0.15	0.027	0.070	0.087
Cadmium	mg/L	$0.00037_{n3,e}^{A}$	0.007^{C}	0.000047	<0.00002	0.000082	<0.00002	0.000096	0.000051	0.000035	<0.00002	<0.00002	0.000030	<0.00002
Calcium	mg/L	n/v	n/v	54.7	52	29.5	38	309	290	119	110	99	79	17
Chromium	mg/L	0.05^{A}	0.05^{C}	<0.0005	<0.0010	0.0005	<0.0010	<0.0005	<0.0010	<0.0005	<0.0010	<0.0010	<0.0010	<0.0010
Cobalt	mg/L	n/v	n/v	<0.0009	0.00031	<0.0009	<0.00030	0.0012	0.00068	<0.0009	<0.00030	0.00036	0.00047	<0.00030
Copper	mg/L	0.007^{A}	$\leq1.0^{B}$ 2^{C}	0.0011	<0.0010	0.0016	<0.0010	0.0011	<0.0010	<0.0008	<0.0010	<0.0010	<0.0010	<0.0010
Iron	mg/L	0.3^{A}	$\leq0.3^{B}$	<0.1	<0.060	<0.1	<0.060	<0.1	<0.060	<0.1	<0.060	<0.060	<0.060	<0.060
Lead	mg/L	$0.007_{n3,e}^{A}$	0.005^{C}	<0.0002	<0.00020	0.0002	<0.00020	0.0006	<0.00020	0.0002	<0.00020	<0.00020	<0.00020	<0.00020
Lithium	mg/L	n/v	n/v	-	<0.020	-	<0.020	-	0.024	-	0.053	<0.020	0.030	0.037
Magnesium	mg/L	n/v	n/v	31.1	32	14.1	21	100	110	45.6	49	34	35	5.1
Manganese	mg/L	0.05^{A}	$\leq0.02^{B}$ 0.12^{C}	**0.099^{AB}**	**0.099^{AB}**	**0.078^{AB}**	**0.12^{AB}**	**0.537^{ABC}**	**0.61^{ABC}**	**0.248^{ABC}**	**0.28^{ABC}**	**0.074^{AB}**	**0.42^{ABC}**	**0.027^{B}**
Mercury	mg/L	0.000005^{A}	0.001^{C}	0.0000039	<0.0000019	<0.0000025	<0.0000019	-	<0.0000019	-	<0.0000019	<0.0000019	<0.0000019	<0.0000019
Molybdenum	mg/L	n/v	n/v	0.004	0.0032	0.005	0.0036	<0.001	0.00081	0.002	0.0015	0.0076	0.0066	0.0022
Nickel	mg/L	$0.17_{n3,e}^{A}$	n/v	<0.003	0.0013	<0.003	<0.00050	0.004	0.0026	<0.003	<0.00050	0.0016	0.00085	<0.00050
Phosphorus	mg/L	n/v	n/v	<0.08	<0.10	<0.08	<0.10	<0.08	<0.10	<0.08	<0.10	<0.10	<0.10	<0.10
Potassium	mg/L	n/v	n/v	2.6	2.2	1.3	1.4	6.5	6.8	5.3	5.7	7.6	4.9	2.5
Selenium	mg/L	0.002^{A}	0.05^{C}	<0.0005	0.00060	<0.0005	0.00053	<0.0005	**0.0030^{A}**	<0.0005	<0.00020	**0.0023^{A}**	0.00039	0.00029
Silicon	mg/L	n/v	n/v	-	3.8	-	3.0	-	3.9	-	3.6	3.4	4.2	3.5
Silver	mg/L	0.0001^{A}	n/v	<0.00005	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010	<0.00005	<0.00010	<0.00010	<0.00010	<0.00010
Sodium	mg/L	200^{A}	$\leq200^{B}$	179	170	**210^{AB}**	**210^{AB}**	**388^{AB}**	**410^{AB}**	**486^{AB}**	**530^{AB}**	40	140	**240^{AB}**
Strontium	mg/L	n/v	7.0^{C}	-	0.41	-	0.28	-	1.9	-	1.8	0.44	0.55	0.29
Sulfur	mg/L	n/v	n/v	-	22	-	24	-	450	-	320	48	79	38
Thallium	mg/L	n/v	n/v	<0.0001	<0.00020	<0.0001	<0.00020	<0.0001	<0.00020	<0.0001	<0.00020	<0.00020	<0.00020	<0.00020
Tin	mg/L	n/v	n/v	-	<0.0010	-	<0.0010	-	<0.0010	-	<0.0010	0.0014	<0.0010	<0.0010
Titanium	mg/L	n/v	n/v	0.001	<0.0010	<0.001	<0.0010	0.002	<0.0010	0.002	<0.0010	<0.0010	<0.0010	<0.0010
Uranium	mg/L	0.01^{A}	0.02^{C}	0.008	0.0080	0.005	0.0056	**0.013^{A}**	**0.012^{A}**	0.002	0.00088	**0.011^{A}**	0.0023	0.00024
Vanadium	mg/L	n/v	n/v	-	0.0016	-	0.0018	-	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010
Zinc	mg/L	0.03^{A}	$\leq5.0^{B}$	<0.005	<0.0030	<0.005	<0.0030	<0.005	<0.0030	<0.005	<0.0030	<0.0030	<0.0030	<0.0030
Metals - Total														
Mercury	mg/L	0.000005^{A}	0.001^{C}	**0.000069^{A}**	**0.000225^{A}**	**0.000049^{A}**	**0.0000083^{A}**	**0.000081^{A}**	**0.00072^{A}**	**0.000041^{A}**	**0.0000099^{A}**	**0.000377^{A}**	**0.0000211^{A}**	0.0000024
Microbiological Parameters														
Escherichia coli (E.Coli)	mpn/100mL	n/v	0^{D}	***<1***	***<100***	**1^{D}**	***<1.0***	**13^{D}**	***<100 DVM***	**1^{D}**	***<1.0***	***<1.0***	***<1.0***	***<1.0***
Fecal Coliforms	mpn/100mL	n/v	0^{D}	***<1***	***<100***	**1^{D}**	***<10***	**26^{D}**	***<100 DVM***	**2^{D}**	***<1.0***	***<1.0***	***<1.0***	***<1.0***
Heterotrophic Plate Count	cfu/mL	n/v	n/v	89,500	79,000	6,200	2,500	8,900	1,100 AT	1,350	140	2,000	35	110
Total Coliforms	mpn/100mL	n/v	0^{D}	**85^{D}**	***<100***	**770^{D}**	**12^{D}**	**194^{D}**	**410 DVM^{D}**	**86^{D}**	**5.2^{D}**	**3.1^{D}**	**8.6^{D}**	**20^{D}**

See notes on last page

D.1 Historical Water Quality Analytical Results - Tier 2 and EIA Project Wells (continued)

Notes:

2019 AEP Tier 1	Alberta Environment and Parks (AEP). 2019. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division 199 pp.
^{A}	Table 2. Alberta Tier 1 Groundwater Remediation Guidelines - Agricultural - Fine
GCDWQ	Health Canada (June 2022). Guidelines for Canadian Drinking Water Quality—Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.
^{B}	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives/ Operational Guidelines
^{C}	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentration
^{D}	Guidelines for Canadian Drinking Water Quality - Microbiological Parameters
6.5^{A}	Concentration exceeds the indicated standard.
15.2	Measured concentration did not exceed the indicated standard.
<0.50	Laboratory reporting limit was greater than the applicable standard.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
^{a}	This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum found in groundwater. The operational guidance values of 0.1 mg/L applies to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.
^{c,n}	NGA - no guideline available. Standard is applicable to total xylenes, and m & p-xylenes and o-xylenes should be summed for comparison.
^{f}	Guidelines only provided for Nitrate (as N). Nitrate guideline (as NO3) is calculated by multiplying the Nitrate (as N) guideline by 4.43.
^{i}	High levels (above 500 mg/L) can cause physiological effects such as diarrhea or dehydration.
^{n1,e}	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.1 for further guidance on aquatic life pathway, standard varies with pH, long term guideline shown (see Table 1.1 for short term guideline). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
^{n2}	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.2 for further guidance on aquatic life pathway, standard varies with pH and temperature (see Table 1.2 for guideline and is for total ammonia (NH3 as N).
^{n3,e}	See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.3 for further guidance on aquatic life pathway, standard varies with hardness, long term is shown (see Table 1.3 for short term). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
^{n4,e}	Overall guideline value for ecological receptors only. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.4 for further guidance on aquatic life pathway, standard varies with chloride, maximum nitrite-N is shown (see Table 1.4 for 30-day average). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
$^{n4,e,\ g}$	Overall guideline value for ecological receptors only. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.4 for further guidance on aquatic life pathway, standard varies with chloride, maximum nitrite-N is shown (see Table 1.4 for 30-day average). Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines. Guidelines only provided for Nitrite (as N). Nitrite guideline (as NO2) is calculated by multiplying the Nitrite (as N) guideline by 3.29.
^{n5,e}	Guideline for protection of aquatic life is below detection limit, groundwater monitoring is required. See Environmental Quality Guideline for Alberta Surface Waters (AEP, 2018), Tables 1 and 1.7 for further guidance on aquatic life pathway, standard varies with hardness. Must refer to Tables in Appendix B of the Tier 1 guidelines and select lowest of aquatic life guideline and all other guidelines.
A*	Ammonia greater than TKN. Results are within acceptable limits of precision.
AT	Detection limit raised due to interference.
CD	Detection limits raised due to dilution to bring analyte within the calibrated range.
DB	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
DSM	Detection limits raised due to sample matrix
DVM	Detection limit raised based on sample volume used and sample matrix
DXE	Dissolved greater than total. Unable to re-analyze due to insufficient sample.
MA	Matrix Spike outside acceptance limits due to matrix interference. Reanalysis yields similar results.
MI	Detection limit was raised due to matrix interferences.
MSE	Matrix spike exceeds acceptance limits due to probable matrix interference.
NF	Duplicate exceeds acceptance criteria due to sample non homogeneity.
OG	Orthophosphate greater than phosphate. Results within acceptable limits of precision.
SVH	Sample analyzed over hold time. Sample analysis is recommended within 24 hours of sampling.
VV	Detection limit raised based on sample volume used for analysis.
RPD	Relative Percent Difference.
61%	RPD exceeds data quality objective of 30%.
nc	RPD is not calculated if one or more values is non detect or if one or more values is less than five times the reportable detection limit.

D.2
2021-2022 Groundwater QA/QC Analytical Results

Sample Location		**MW16-1-15**			**MW16-3-7**			**MW16-7-5**			**MW16-8-19**		
Sample Date		**5-May-22**	**5-May-22**		**12-May-21**	**12-May-21**		**13-May-21**	**13-May-21**		**13-May-21**	**13-May-21**	
Sample ID		**MW16-1-15**	**MW22-1-5**		**MW16-3-7**	**QC21-01**		**MW16-7-5**	**QC21-02**		**MW16-8-19**	**QC21-03**	
Sampling Company		**STANTEC**	**STANTEC**		**STANTEC**	**STANTEC**		**STANTEC**	**STANTEC**		**STANTEC**	**STANTEC**	
Laboratory		**BV**	**BV**		**BV**	**BV**		**BV**	**BV**		**BV**	**BV**	
Laboratory Work Order		**C230164** **Tier 2**	**C230164** **Tier 2**		**C131657** **EIA Project Well**	**C131657** **EIA Project Well**		**C132075** **Tier 2**	**C132075** **Tier 2**		**C132075** **Tier 2**	**C132075** **Tier 2**	
Laboratory Sample ID		**ASP036**	**ASP044**	**RPD**	**ZU0434**	**ZU0429**	**RPD**	**ZU2983**	**ZU2990**	**RPD**	**ZU2985**	**ZU2991**	**RPD**
Sample Type	**Units**		**Field Duplicate**	**(%)**		**Field Duplicate**	**(%)**		**Field Duplicate**	**(%)**		**Field Duplicate**	**(%)**
Calculated Parameters													
Anion Sum	meq/L	29	28	nc	29	30	nc	36	42	nc	14	14	nc
Cation Sum	meq/L	29	31	nc	28	28	nc	44	44	nc	15	15	nc
Hardness (as CaCO3)	mg/L	1,100	1,100	0%	770	780	1%	1,400	1,400	0%	640	620	3%
Ion Balance	%	0.84	3.7	nc	2.6	2.8	nc	9.8	2.5	nc	3.1	0.69	nc
Nitrate	mg/L	<0.22	<0.044	nc	1.1	1.2	9%	0.062	0.059	nc	3.8	3.9	3%
Nitrate + Nitrite (as N)	mg/L	<0.050 AT	<0.010	nc	0.26	0.26	0%	0.014	0.013	nc	0.87 MI	0.87 MI	0%
Nitrite	mg/L	<0.033	<0.033	nc	<0.033	<0.033	nc	<0.033	<0.033	nc	<0.033	<0.033	nc
Total Dissolved Solids	mg/L	1,800	1,800	0%	1,800	1,800	0%	2,400	2,700	12%	750	750	0%
BTEX and Petroleum Hydrocarbons													
Benzene	mg/L	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc
Toluene	mg/L	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc
Ethylbenzene	mg/L	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc	<0.00040	<0.00040	nc
Xylenes, Total	mg/L	<0.00089	<0.00089	nc	<0.00089	<0.00089	nc	<0.00089	<0.00089	nc	<0.00089	<0.00089	nc
PHC F1 (C6-C10 range)	mg/L	<0.10	<0.10	nc	<0.10	<0.10	nc	<0.10	<0.10	nc	<0.10	<0.10	nc
PHC F1 (C6-C10 range) minus BTEX	mg/L	<0.10	<0.10	nc	<0.10	<0.10	nc	<0.10	<0.10	nc	<0.10	<0.10	nc
PHC F2 (>C10-C16 range)	mg/L	<0.10	<0.10	nc	<0.10	<0.10	nc	<0.10	<0.10	nc	<0.10	<0.10	nc
Miscellaneous Inorganics													
Dissolved Organic Carbon (DOC)	mg/L	2.4	2.4	nc	5.1	4.4	15%	3.6	4.5	22%	0.63	0.68	nc
Electrical Conductivity, Lab	µS/cm	2,200	2,200	0%	2,400	2,400	0%	3,400	3,300	3%	1,300	1,300	0%
pH, lab	S.U.	7.74	7.92	nc	7.48	7.46	nc	7.91	7.91	nc	7.69	7.69	nc
Anions													
Alkalinity (P as CaCO3)	mg/L	<1.0	<1.0	nc	<1.0	<1.0	nc	<1.0	<1.0	nc	<1.0	<1.0	nc
Alkalinity, Total (as CaCO3)	mg/L	300	300	0%	420	420	0%	440	440	0%	440	440	0%
Alkalinity, Bicarbonate (as CaCO3)	mg/L	370	370	0%	510	510	0%	540	540	0%	530	530	0%
Alkalinity, Carbonate (as CaCO3)	mg/L	<1.0	<1.0	nc	<1.0	<1.0	nc	<1.0	<1.0	nc	<1.0	<1.0	nc
Alkalinity, Hydroxide (as CaCO3)	mg/L	<1.0	<1.0	nc	<1.0	<1.0	nc	<1.0	<1.0	nc	<1.0	<1.0	nc
Sulfate	mg/L	1,100	1,100	0%	910 CD	940 CD	3%	1,300 CD	1,600 CD	21%	82	92	11%
Chloride	mg/L	11	12	9%	62	63	2%	8.8	8.7	1%	130	130	0%
Nutrients													
Ammonia (as N)	mg/L	0.036	0.034	nc	0.073	0.065	nc	0.11	0.12	9%	0.018	<0.015	nc
Nitrogen	mg/L	0.86 DB	0.99 DB	nc	1.4 DB	1.3 DB	7%	<1.0 DB	1.0 DB	nc	1.0	1.2 DB	18%
Nitrate (as N)	mg/L	<0.050	<0.010	nc	0.26	0.26	0%	0.014	0.013	nc	0.87	0.87	0%
Nitrite (as N)	mg/L	<0.010	<0.010	nc	<0.010	<0.010	nc	<0.010	<0.010	nc	<0.010	<0.010	nc
Orthophosphate (as P)	mg/L	<0.0030	<0.0030	nc	0.013	0.013	nc	0.011	0.011	nc	<0.0030	<0.0030	nc
Phosphorus, Total (Dissolved)	mg/L	<0.0030	<0.0030	nc	0.021	0.021	0%	0.012	0.015	nc	<0.0030	<0.0030	nc
Total Kjeldahl Nitrogen	mg/L	0.86	0.99	nc	1.11	1.00	10%	<1.0	1.0	nc	0.177	0.37	nc
Metals - Dissolved													
Aluminum	mg/L	<0.0030	<0.0030	nc	<0.0030	<0.0030	nc	<0.0030	0.0035	nc	<0.0030	<0.0030	nc
Antimony	mg/L	<0.00060	<0.00060	nc	<0.00060	<0.00060	nc	<0.00060	<0.00060	nc	<0.00060	<0.00060	nc
Arsenic	mg/L	0.00051	0.00041	nc	<0.00020	0.00024	nc	0.00046	0.00047	nc	<0.00020	<0.00020	nc
Barium	mg/L	0.012	0.013	nc	0.025	0.024	nc	0.013	0.013	nc	0.062	0.061	2%
Beryllium	mg/L	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc
Boron	mg/L	0.080	0.080	nc	0.088	0.089	nc	0.10	0.10	0%	0.053	0.051	nc
Cadmium	mg/L	0.000066	0.00010	nc	0.000020	<0.000020	nc	0.000021	0.000021	nc	0.000020	0.000022	nc
Calcium	mg/L	250	260	4%	140	140	0%	210	210	0%	150	140	7%
Chromium	mg/L	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc
Cobalt	mg/L	0.00099	0.00084	nc	0.00087	0.00085	nc	0.00077	0.00080	nc	<0.00030	<0.00030	nc
Copper	mg/L	<0.0010	<0.0010	nc	0.00029	0.00023	nc	0.00023	0.00029	nc	0.00022	0.00029	nc
Iron	mg/L	<0.060	<0.060	nc	<0.060	<0.060	nc	<0.060	<0.060	nc	<0.060	<0.060	nc
Lead	mg/L	<0.00020	<0.00020	nc	<0.00020	<0.00020	nc	<0.00020	<0.00020	nc	<0.00020	<0.00020	nc
Lithium	mg/L	<0.020	<0.020	nc	0.041	0.041	nc	0.070	0.069	nc	0.021	<0.020	nc
Magnesium	mg/L	110	120	9%	110	110	0%	210	210	0%	67	65	3%
Manganese	mg/L	0.82	0.84	2%	0.26	0.26	0%	0.30	0.29	3%	0.0058	0.0053	nc
Mercury	mg/L	<0.0000019	<0.0000019	nc	<0.0000019	<0.0000019	nc	<0.0000019	<0.0000019	nc	<0.0000019	<0.0000019	nc
Molybdenum	mg/L	0.0019	0.0019	0%	0.0011	0.0011	0%	0.0011	0.0010	10%	0.0011	0.0011	0%
Nickel	mg/L	0.00099	0.00093	nc	0.0028	0.0026	7%	0.0035	0.0034	3%	<0.00050	<0.00050	nc
Phosphorus	mg/L	<0.10	<0.10	nc	<0.10	<0.10	nc	<0.10	<0.10	nc	<0.10	<0.10	nc
Potassium	mg/L	4.2	4.4	5%	4.1	4.1	0%	4.5	4.5	0%	6.1	5.9	3%
Selenium	mg/L	<0.00020	<0.00020	nc	<0.00020	<0.00020	nc	0.00021	<0.00020	nc	0.0061	0.0064	5%
Silicon	mg/L	4.5	4.6	2%	4.2	4.1	2%	5.0	5.0	0%	4.6	4.5	2%
Silver	mg/L	<0.00010	<0.00010	nc	<0.00010	<0.00010	nc	<0.00010	<0.00010	nc	<0.00010	<0.00010	nc
Sodium	mg/L	170	170	0%	280	280	0%	370	370	0%	51	49	4%
Thallium	mg/L	<0.00020	<0.00020	nc	<0.00020	<0.00020	nc	<0.00020	<0.00020	nc	<0.00020	<0.00020	nc
Titanium	mg/L	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc	<0.0010	<0.0010	nc
Uranium	mg/L	0.0048	0.0046	4%	0.012	0.011	9%	0.014	0.014	0%	0.0044	0.0046	4%
Zinc	mg/L	<0.0030	<0.0030	nc	<0.0030	<0.0030	nc	<0.0030	<0.0030	nc	<0.0030	<0.0030	nc
Metals - Total													
Mercury	mg/L	0.000055	0.000053	nc	0.00117 DB	0.00021 DB	nc	0.0000292	0.0000154	**62%**	0.0000262	0.0000260	1%
Phosphorus	mg/L	-	-	-	-	-	-	-	-	-	-	-	-

See notes on last page

D.2
2021-2022 Groundwater QA/QC Analytical Results (continued)

Sample Location		**MW16-10-15**						**MW16-26-18**			**SW11-R4-02**		
Sample Date		**24-Nov-21**	**24-Nov-21**		**9-May-22**	**9-May-22**		**12-May-21**	**24-Nov-21**		**27-May-22**	**27-May-22**	
Sample ID		**MW16-10-15**	**21-2**		**MW16-10-15**	**MW22-10-4**		**MW16-26-18**	**21-1**		**SW11R4-2**	**SW22-1**	
Sampling Company		**STANTEC**	**STANTEC**		**STANTEC**	**STANTEC**		**STANTEC**	**STANTEC**		**STANTEC**	**STANTEC**	
Laboratory		**AGAT**	**AGAT**		**BV**	**BV**		**BV**	**AGAT**		**BV**	**BV**	
Laboratory Work Order		**21C834850**	**21C834850**		**C230795**	**C230795**		**C131657**	**21C834850**		**C235756**	**C235756**	
		Tier 2	**Tier 2**		**Tier 2**	**Tier 2**		**EIA Project Well**	**EIA Project Well**		**Tier 3**	**Tier 3**	
Laboratory Sample ID		**3249833**	**3249836**	**RPD**	**ASS483**	**ASS485**	**RPD**	**ZU0432**	**3249835**	**RPD**	**ATT544**	**ATT543**	**RPD**
Sample Type	**Units**		**Field Duplicate**	**(%)**		**Field Duplicate**	**(%)**		**Field Duplicate**	**(%)**		**Field Duplicate**	**(%)**
Calculated Parameters													
Anion Sum	meq/L	-	-	-	64	65	nc	16	-	-	5.2	5.2	nc
Cation Sum	meq/L	-	-	-	63	63	nc	16	-	-	5.1	5.7	nc
Hardness (as CaCO3)	mg/L	2,510	2,660	6%	2,500	2,400	4%	170	90	24%	55	62	12%
Ion Balance	%	113	119	5%	0.85	1.3	nc	0.57	102	2%	0.52	3.9	nc
Nitrate	mg/L	<0.5	<0.5	nc	<0.22	<0.22	nc	<0.044	<0.5	nc	<0.044	<0.044	nc
Nitrate + Nitrite (as N)	mg/L	<0.02	<0.02	nc	<0.050 AT	<0.050 AT	nc	<0.010	<0.02	nc	<0.010	<0.010	nc
Nitrite	mg/L	<0.10	<0.10	nc	<0.033	<0.033	nc	<0.033	<0.05	nc	<0.033	<0.033	nc
Total Dissolved Solids	mg/L	3960	4010	1%	4,000	4,100	2%	990	833	7%	290	300	3%
BTEX and Petroleum Hydrocarbons													
Benzene	mg/L	<0.0005	<0.0005	nc	<0.00040	<0.00040	nc	<0.00040	<0.0005	nc	<0.00040	<0.00040	nc
Toluene	mg/L	<0.0003	<0.0003	nc	<0.00040	<0.00040	nc	<0.00040	<0.0003	nc	<0.00040	<0.00040	nc
Ethylbenzene	mg/L	<0.0005	<0.0005	nc	<0.00040	<0.00040	nc	<0.00040	<0.0005	nc	<0.00040	<0.00040	nc
Xylenes, Total	mg/L	<0.0005	<0.0005	nc	<0.00089	<0.00089	nc	<0.00089	<0.0005	nc	<0.00089	<0.00089	nc
PHC F1 (C6-C10 range)	mg/L	<0.1	<0.1	nc	<0.10	<0.10	nc	<0.10	<0.1	nc	<0.10	<0.10	nc
PHC F1 (C6-C10 range) minus BTEX	mg/L	<0.1	<0.1	nc	<0.10	<0.10	nc	<0.10	<0.1	nc	<0.10	<0.10	nc
PHC F2 (>C10-C16 range)	mg/L	<0.1	<0.1	nc	<0.10	<0.10	nc	<0.10	<0.1	nc	<0.10	<0.10	nc
Miscellaneous Inorganics													
Dissolved Organic Carbon (DOC)	mg/L	4.391	3.972	nc	2.6	2.3	nc	2.3	5.493	nc	<0.50	<0.50	nc
Electrical Conductivity, Lab	µS/cm	4,390	4,380	0%	4,300	4,400	2%	1,500	1,330	2%	490	490	0%
pH, lab	S.U.	7.87	7.90	nc	7.29	7.31	nc	8.21	8.37	nc	8.35	8.35	nc
Anions													
Alkalinity (P as CaCO3)	mg/L	<5	<5	nc	<1.0	<1.0	nc	<1.0	<5	nc	1.5	2.0	nc
Alkalinity, Total (as CaCO3)	mg/L	472	452	4%	490	500	2%	280	267	1%	190	190	0%
Alkalinity, Bicarbonate (as CaCO3)	mg/L	575	551	4%	600	610	2%	340	317	1%	230	230	0%
Alkalinity, Carbonate (as CaCO3)	mg/L	<5	<5	nc	<1.0	<1.0	nc	<1.0	<5	nc	1.8	2.4	nc
Alkalinity, Hydroxide (as CaCO3)	mg/L	<5	<5	nc	<1.0	<1.0	nc	<1.0	<5	nc	<1.0	<1.0	nc
Sulfate	mg/L	2,450	2,450	0%	2,600	2,600	0%	380 CD	375	9%	60	62	3%
Chloride	mg/L	2.3	2.4	nc	2.6	2.8	nc	84	2.6	nc	4.6	4.5	nc
Nutrients													
Ammonia (as N)	mg/L	0.46	0.45	2%	0.46	0.44	4%	0.76	0.69	11%	0.19	0.19	0%
Nitrogen	mg/L	-	-	-	1.5 DB	2.5 DB	nc	1.4 DB	-	-	0.19	0.17	11%
Nitrate (as N)	mg/L	<0.02	<0.02	nc	<0.050	<0.050	nc	<0.010	<0.02	nc	<0.010	<0.010	nc
Nitrite (as N)	mg/L	<0.01	<0.01	nc	<0.010	<0.010	nc	<0.010	<0.01	nc	<0.010	<0.010	nc
Orthophosphate (as P)	mg/L	<0.15	<0.15	nc	<0.0030	<0.0030	nc	0.0065	<0.15	nc	0.0043	0.0045	nc
Phosphorus, Total (Dissolved)	mg/L	-	-	-	0.021	0.021	0%	0.013	-	-	<0.0030	<0.0030	nc
Total Kjeldahl Nitrogen	mg/L	11.1	12.0	8%	1.5	2.5	nc	1.42	1.6	6%	0.188	0.167	12%
Metals - Dissolved													
Aluminum	mg/L	0.069	0.007	nc	<0.0030	<0.0030	nc	<0.0030	0.011	nc	<0.0030	<0.0030	nc
Antimony	mg/L	<0.001	0.002	nc	<0.00060	<0.00060	nc	<0.00060	<0.001	nc	<0.00060	<0.00060	nc
Arsenic	mg/L	<0.001	0.001	nc	0.00034	0.00032	nc	<0.00020	0.003	nc	<0.00020	<0.00020	nc
Barium	mg/L	<0.05	<0.05	nc	0.012	0.012	nc	0.053	<0.05	nc	0.088	0.097	10%
Beryllium	mg/L	<0.0005	<0.0005	nc	<0.0010	<0.0010	nc	<0.0010	<0.0005	nc	<0.0010	<0.0010	nc
Boron	mg/L	0.21	0.22	5%	0.21	0.22	5%	0.12	0.13	0%	0.045	0.047	nc
Cadmium	mg/L	0.000262	0.000183	**36%**	0.000067	0.000099	nc	<0.000020	<0.000016	nc	<0.00002	<0.00002	nc
Calcium	mg/L	514	555	8%	460	470	2%	47	23.0	**36%**	15	16	6%
Chromium	mg/L	0.0008	<0.0005	nc	<0.0010	<0.0010	nc	<0.0010	<0.0005	nc	<0.0010	<0.0010	nc
Cobalt	mg/L	0.0050	0.0037	nc	0.0044	0.0045	2%	<0.00030	<0.0009	nc	<0.00030	<0.00030	nc
Copper	mg/L	0.0127	0.0018	nc	<0.0010	<0.0010	nc	0.00021	<0.0008	nc	0.0013	<0.0010	nc
Iron	mg/L	<0.1	<0.1	nc	<0.060	<0.060	nc	0.14	<0.1	nc	<0.060	<0.060	nc
Lead	mg/L	0.0005	<0.0002	nc	<0.00020	<0.00020	nc	<0.00020	<0.0002	nc	<0.00020	<0.00020	nc
Lithium	mg/L	-	-	-	0.025	0.045	nc	0.028	-	-	<0.020	<0.020	nc
Magnesium	mg/L	299	310	4%	310	290	7%	13	7.9	5%	4.5	5.1	13%
Manganese	mg/L	2.80	2.84	1%	2.8	1.9	**38%**	0.10	0.083	23%	0.048	0.052	8%
Mercury	mg/L	<0.0000025	<0.0000025	nc	<0.0000019	<0.0000019	nc	<0.0000019	<0.0000025	nc	<0.0000019	<0.0000019	nc
Molybdenum	mg/L	<0.001	0.005	nc	0.00066	0.00076	nc	0.0045	0.006	18%	0.0016	0.0016	0%
Nickel	mg/L	0.013	0.009	nc	0.0080	0.0082	2%	<0.00050	<0.003	nc	0.0010	<0.00050	nc
Phosphorus	mg/L	<0.08	<0.08	nc	<0.10	<0.10	nc	<0.10	<0.08	nc	<0.10	<0.10	nc
Potassium	mg/L	11.2	11.7	4%	10	11	10%	2.8	2.1	nc	0.76	0.84	nc
Selenium	mg/L	<0.0005	0.0043	nc	<0.00020	0.00024	nc	<0.00020	0.0014	nc	<0.00020	<0.00020	nc
Silicon	mg/L	-	-	-	5.4	4.6	16%	4.1	-	-	3.9	3.9	0%
Silver	mg/L	<0.00005	<0.00005	nc	<0.00010	<0.00010	nc	<0.00010	<0.00005	nc	<0.00010	<0.00010	nc
Sodium	mg/L	401	409	2%	320	360	12%	290	266	5%	92	100	8%
Thallium	mg/L	<0.0001	0.0001	nc	<0.00020	<0.00020	nc	<0.00020	<0.0001	nc	<0.00020	<0.00020	nc
Titanium	mg/L	0.003	0.002	nc	<0.0010	<0.0010	nc	<0.0010	0.002	nc	<0.0010	<0.0010	nc
Uranium	mg/L	0.011	0.013	17%	0.010	0.011	10%	0.00029	<0.001	nc	<0.00010	<0.00010	nc
Zinc	mg/L	0.035	<0.005	nc	<0.0030	<0.0030	nc	<0.0030	<0.005	nc	0.052	0.040	26%
Metals - Total													
Mercury	mg/L	0.000092	0.000058	**45%**	0.000169	0.00015	12%	0.0000096	0.000016	0%	<0.0000019	<0.0000019	nc
Phosphorus	mg/L	9.25	8.99	3%	-	-	-	-	0.54	4%	-	-	-

See notes on last page

D.2
2021-2022 Groundwater QA/QC Analytical Results

Notes:

15.2	Measured concentration.
<0.03	Analyte was not detected at a concentration greater than the laboratory reporting limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
A*	Ammonia greater than TKN. Results are within acceptable limits of precision.
AT	Detection limit raised due to interference.
CD	Detection limits raised due to dilution to bring analyte within the calibrated range.
DB	Due to the sample matrix, sample required dilution. Detection limit was adjusted accordingly.
DSM	Detection limits raised due to sample matrix
DVM	Detection limit raised based on sample volume used and sample matrix
DXE	Dissolved greater than total. Unable to re-analyze due to insufficient sample.
HX	Holding time had been exceeded upon sample receipt.
MA	Matrix Spike outside acceptance limits due to matrix interference. Reanalysis yields similar results.
MD	Dissolved greater than total. Results are within limits of uncertainty.
MI	Detection limit was raised due to matrix interferences.
MSE	Matrix spike exceeds acceptance limits due to probable matrix interference.
NF	Duplicate exceeds acceptance criteria due to sample non homogeneity.
NH	Duplicate exceeds acceptance criteria due to sample non homogeneity. Reanalysis yields similar results.
OG	Orthophosphate greater than phosphate. Results within acceptable limits of precision.
SVH	Sample analyzed over hold time. Sample analysis is recommended within 24 hours of sampling.
VV	Detection limit raised based on sample volume used for analysis.
RPD	Relative Percent Difference.
61%	RPD exceeds data quality objective of 30%.
nc	RPD is not calculated if one or more values is non detect or if one or more values is less than five times the reportable detection limit.