Environment Act Proposal Form

Manitoba

Name of the development:
City of Winkler Wastewater Treatment Facility

Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):
Class 2 - Biosolids Land Application

Legal name of the applicant:
City of Winkler

Mailing address of the applicant: 185 Main Street

Contact Person: Tim Wiebe

City: Winkler Province: Manitoba Postal Code: R6W 1B4

Phone Number: (204) 325-9525 Fax: email: tim.wiebe@cityofwinkler.ca

Location of the development: Winkler, MB

Contact Person: Tim Wiebe

Street Address:

Legal Description: S1/2 of 22-03-04WPM and SW23-03-04WPM Municipality of Stanley

City/Town: Winkler Province: Manitoba Postal Code: R6W 1B4

Phone Number: (204) 325-9525 Fax: email: tim.wiebe@cityofwinkler.ca

Name of proponent contact person for purposes of the environmental assessment:
Darren Keam

Phone: (204) 259-1488
Fax: (204) 474-2864

Mailing address: 1600 Buffalo Place, Wpg, MB, R3T 6B8

Email address: darren.keam@wsp.com

Webpage address: wsp.com

Date: 2025-05-12

Signature of proponent, or corporate principal of corporate proponent:
[redacted]

Printed name:

PRINT RESET

A complete **Environment Act Proposal (EAP)** consists of the following components:

- [x] **Cover letter**
- [x] **Environment Act Proposal Form**
- [x] **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information)
- [ ] **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$1,000
Class 2 Developments	$7,500
Class 3 Developments:	
Transportation and Transmission Lines	$10,000
Water Developments	$60,000
Energy and Mining	$120,000

Submit the complete EAP to:
Director
Environmental Approvals Branch
Environment and Climate Change
Box 35, 14 Fultz Boulevard
Winnipeg MB R3Y 0L6
EABDirector@gov.mb.ca

For more information:
Toll-Free: 1-800-282-8069
Phone: 204-945-8321
Fax: 204-945-5229

https://www.gov.mb.ca/sd/permits_licenses_approvals/eal/licence/index.html

Internal Use Only
$1,000.....C1 B-02
$7,500.....C2 B-02
$10,000....TT B-02
$60,000.....WD B-02
$120,000...EM B-02

PENN-CO CONSTRUCTION CANADA (2003) LTD.

ENVIRONMENT ACT PROPOSAL

CITY OF WINKLER WASTEWATER TREATMENT RESIDUALS LAND APPLICATION MANAGEMENT

MAY 13, 2025

ENVIRONMENT ACT PROPOSAL

CITY OF WINKLER WASTEWATER TREATMENT RESIDUALS LAND APPLICATION MANAGEMENT

PENN-CO CONSTRUCTION CANADA (2003) LTD.

FINAL

PROJECT NO.: CA0045899.2099
DATE: MAY 13, 2025

WSP
1600 BUFFALO PLACE
WINNIPEG, MB
CANADA R3T 6B8

T: +1 204 477-6650
F: +1 204 474-2864
WSP.COM

May 13, 2025

Environmental Approvals Branch
Manitoba Environment and Climate Change
14 Fultz Boulevard
Winnipeg, MB R3Y 0L6

Attention: Director

Subject: Environment Act Proposal to Complete Residuals Land Application.
File 2708.03

WSP Canada Inc. (WSP) was retained by Penn-Co Construction Canada (2003) Ltd. to complete an Environment Act Proposal (EAP). This EAP is submitted to the Manitoba Environment and Climate Change (MECC), Environmental Approvals Branch (EAB), as required under the Manitoba *Environment Act*. The purpose of this EAP submission is to request an Environment Act Licence for residuals from Cell 1 to be permitted for agricultural land application.

For your consideration, please find enclosed an electronic copy (as a searchable portable document file) of the EAP document, the application form and the application fee of $7000.00 as required for an EAP submission. Please note that $500 was paid under the previous submission as a Notice of Alteration.

If you have any questions or concerns about this submission, please contact the undersigned at your convenience.

Kind regards,

ORIGINAL SIGNED

Darren Keam, M.Sc., P.Ag.
Group Manager, Manitoba

DK/DS/AD/ef
Encl. Environment Act Proposal
cc: Tim Wiebe (City of Winkler), Miguel Young (Penn-co)
WSP ref.: CA0045899.2099

1600 BUFFALO PLACE
WINNIPEG, MB
CANADA R3T 6B8

T: +1 204 477-6650
F: +1 204 474-2864
wsp.com

REVISION HISTORY

FIRST ISSUE				
February 28, 2025	DRAFT			
Prepared by	Approved By			
Darren Keam	Allyson Desgroseilliers			
REVISION 1				
May 13, 2025	FINAL			
Prepared by	Approved By			
Darren Keam	Allyson Desgroseilliers			

SIGNATURES

PREPARED BY

ORIGINAL SIGNED

Darren Keam, M.Sc., P.Ag.
Group Manager, Manitoba

May 13, 2025
Date

APPROVED[1] BY *(must be reviewed for technical accuracy prior to approval)*

ORIGINAL SIGNED

Allyson Desgroseilliers, P.Eng.
VP, Environment Management, Earth & Environment

May 13, 2025
Date

WSP Canada Inc ("WSP") prepared this report solely for the use of the intended recipient, PENN-CO CONSTRUCTION CANADA (2003) LTD., in accordance with the professional services agreement between the parties. In the event a contract has not been executed, the parties agree that the WSP General Terms for Consultant shall govern their business relationship which was provided to you prior to the preparation of this report.

The report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

[1] Approval of this document is an administrative function indicating readiness for release and does not impart legal liability on to the Approver for any technical content contained herein. Technical accuracy and fit-for-purpose of this content is obtained through the review process. The Approver shall ensure the applicable review process has occurred prior to signing the document.

The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

WSP disclaims any obligation to update this report if, after the date of this report, any conditions appear to differ significantly from those presented in this report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

WSP makes no other representations whatsoever concerning the legal significance of its findings.

The intended recipient is solely responsible for the disclosure of any information contained in this report. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report.

WSP has provided services to the intended recipient in accordance with the professional services agreement between the parties and in a manner consistent with that degree of care, skill and diligence normally provided by members of the same profession performing the same or comparable services in respect of projects of a similar nature in similar circumstances. It is understood and agreed by WSP and the recipient of this report that WSP provides no warranty, express or implied, of any kind. Without limiting the generality of the foregoing, it is agreed and understood by WSP and the recipient of this report that WSP makes no representation or warranty whatsoever as to the sufficiency of its scope of work for the purpose sought by the recipient of this report.

In preparing this report, WSP has relied in good faith on information provided by others, as noted in the report. WSP has reasonably assumed that the information provided is correct and WSP is not responsible for the accuracy or completeness of such information.

Benchmark and elevations used in this report are primarily to establish relative elevation differences between the specific testing and/or sampling locations and should not be used for other purposes, such as grading, excavating, construction, planning, development, etc.

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect construction methods and costs. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

Overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

The original of this digital file will be kept by WSP for a period of not less than 10 years. As the digital file transmitted to the intended recipient is no longer under the control of WSP, its integrity cannot be assured. As such, WSP does not guarantee any modifications made to this digital file subsequent to its transmission to the intended recipient.

This limitations statement is considered an integral part of this report.

CONTRIBUTORS

CLIENT

Prime Contractor	Penn-co Construction Canada (2003) Ltd.
Owner	City of Winkler

WSP

Project Manager, Technical Advisor	Darren Keam, M.Sc., P.Ag.
Senior Reviewer	Allyson Desgroseilliers, P.Eng.

TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Proponent 1

1.2 Project Location 1

1.3 Objective 1

2 DESCRIPTION OF PROPOSED NOTICE OF ALTERATION 2

2.1 Need, Purpose, Alternatives, and Benefits 2

2.1.1 Needs and Alternatives 2

2.1.2 Land Application Benefits 2

2.2 Local Study Area 3

2.3 Land Ownership 3

2.3.1 Land Use Development Controls 3

2.4 Regulatory Framework 4

2.5 Project Schedule 4

3 DESCRIPTION OF EXISTING ENVIRONMENT 5

3.1 Existing Land Use 5

3.2 Ecostratification 5

3.3 Climate 5

3.4 Soil and Terrain 5

3.5 Surficial and Bedrock Geology 5

3.6 Regional Groundwater 6

3.7 Vegetation, Wildlife and Habitat 6

3.8 Aquatic Habitat 6

3.9 Potential Species of Conservation Concern 7

4 DESCRIPTION OF SOCIOECONOMIC ENVIRONMENT 8
4.1 Parks, Open Spaces, and Trails 8
4.2 Heritage Resources 8
4.3 Indigenous Communities 8
5 RESIDUALS QUANTITY AND QUALITY 9
5.1 Residuals Quantity 9
5.2 Residuals Quality 9
5.2.1 Foreign Non-compostable Objects 9
5.2.2 Nutrient Content 10
5.2.3 Salinity 10
5.2.4 Trace Elements 11
5.2.5 Emerging Substances of Concern 11
6 RESIDUALS LAND APPLICATION PROGRAM 13
6.1 Agricultural Land Requirements 13
6.1.1 Canada Land Inventory – Soil Capability for Agricultural 13
6.1.2 Nutrient Management Zones 15
6.1.3 Agronomy 16
6.2 Land Application Rate Parameters 17
6.2.1 Nutrient Management and Setback Distances 17
6.3 Best Management and Good Neighborhood Practices 19
6.4 Application Logistics 19
6.5 Transportation, Route Planning, and Spill Control 19
6.6 Greenhouse Gases 20
7 EFFECTS AND MITIGATION MEASURES 21
7.1 Potential Biophysical Effects 21
7.1.1 Soil Quality Effects and Mitigation 22
7.1.2 Water Quality Effects and Mitigation 24

7.1.3 Socio-Economic Effects....24

8 MONITORING AND REPORTING....27

9 SUMMARY....28

BIBLIOGRAPHY....29

TABLES

TABLE 1 PROJECT TASKS AND SCHEDULE 4
TABLE 2 SOIL SERIES, TEXTURE AND CLI RATING WITHIN LSA 14
TABLE 3 SOIL SERIES, TEXTURE, AND CLI RATING WITHIN LSA 16
TABLE 4 LAND APPLICATION NUTRIENT MANAGEMENT INPUTS AND ASSUMPTIONS 17
TABLE 5 NUTRIENT BUFFER ZONES TO BE ESTABLISHED FOR BIOSOLID APPLICATION 18
TABLE 6 GREENHOUSE GAS EMISSIONS BY ECONOMIC SECTOR (1) 20
TABLE 7 SUMMARY OF EFFECTS AND MITIGATION MEASURES 21
TABLE 8 ECONOMIC VALUE FOR NITROGEN AND PHOSPHORUS IN APPLIED RESIDUALS 24

APPENDICES

A SUPPORTING DOCUMENTS

A-1 Authorization for EAP

A-2 Memo Summary of Findings

B FIGURES

C PUBLIC RESOURCES

C-1 GWDrill Groundwater Logs

C-2 Manitoba Conservation Data Centre

C-3 Canada Land Inventory

D TABLES

E CERTIFICATE OF ANALYSIS

1 INTRODUCTION

This Environment Act Proposal (EAP) is submitted to the Manitoba Environment and Climate Change (MECC), Environmental Approvals Branch (EAB), as required under *The Environment Act* of Manitoba. The purpose of this EAP submission is to request an Environment Act Licence (EAL) be granted in a timely manner to permit residuals from the City of Winkler wastewater treatment Cell 1 recycled through agricultural land application.

WSP Canada Inc. (WSP) was retained by Penn-Co Construction Canada (2003) Ltd. (Penn-co) to prepare the EAL on behalf of the City of Winkler.

1.1 PROPONENT

The request for this EAL has been approved by the City of Winkler Engineering Service Manager, Mr. Tim Wiebe. (Appendix A-1, Authorization to Draft a Notice of Alteration).

Tim Wiebe
Engineering Service Manager
City of Winkler
185 Main Street, Winkler MB R6W 1B4

1.2 PROJECT LOCATION

The City of Winkler Wastewater treatment facility, lagoons, are in the S1/2 of 22-03-04WPM and SW23-03-04WPM within the Municipality of Stanley, Manitoba. With Cell 1 located in the legal subdivisions 1 and 2 of SE-22-03-04WPM, hereinafter referred to as the "Site" (Figure 1, Appendix B).

1.3 OBJECTIVE

The objective of this EAP is to provide documentation in support of the granting of an EAL for the City of Winkler to establish an agronomically and environmentally sustainable land application program for residuals from their wastewater treatment lagoon Cell 1. It is anticipated that land application may be required periodically over the years to ensure lagoon storage capacity is maintained.

In addition to being completed in an agri-environmentally sustainable manner, the land application program will comply with all applicable regulations, will be allied with participating agricultural producer fertilization and crop management practices and will implement best management practices, including incorporating good neighbour practices. Residuals loading limits will be determined to target optimum available nitrogen and phosphorus levels for small grain – oil seed crops and set metal loading limits for the agricultural fields in the application program. This objective meets the principals of environmentally sustainable land application outlined by MECC and within the Canadian Council of Ministers of the Environment (CCME) Guidance Document for the Beneficial Use of Municipal Biosolids, Municipal Sludge and Treated Septage (December 2012).

2 DESCRIPTION OF PROPOSED NOTICE OF ALTERATION

The proposed alteration involves the development of a long-term land application program for wastewater residuals that target application as required based on the City of Winkler's wastewater treatment lagoon storage capacity. The first land application event scheduled as part of this program is targeted for the September of 2025 and would include:

- The removal and land application in September of 2025 of approximately 31,700 cubic metres (m^3) of residuals from Cell 1 of the city's wastewater treatment lagoon based on an average residuals depth of 1.2 metres (m) surveyed on March 26, 2024.
- The residual materials from the lagoon cell will be land applied based on appropriate agronomic rates calculated for each of the agricultural fields participating in the application program. The proposed receiving agricultural fields are located on neighbouring agricultural land. The main components and activities of the land application activities are described in the sections below.

2.1 NEED, PURPOSE, ALTERNATIVES, AND BENEFITS

2.1.1 NEEDS AND ALTERNATIVES

The City of Winkler has not completed a land application event recently, and with pending upgrades to the City's wastewater treatment system, the residuals in Cell 1 need to be removed to facilitate the upgrades. Currently, disposal of residuals is permitted under EAL #2525RR Clause 25 via disposal into a waste management facility. However, this is not a cost effective, nor a sustainable disposal means for an organic, nutrient-enriched resource with economic benefit to agriculture. As such, residual land application is proposed in this EAP as a more cost effective and sustainable means to permit nutrient resource use.

2.1.2 LAND APPLICATION BENEFITS

Land application is a sustainable way to manage wastewater treatment residuals. It provides an opportunity to re-use the residuals, keeping them out of the landfill. Land application of residuals:

- Meets regulatory requirements.
- Returns much-needed nutrients to local agricultural land (nitrogen, phosphorus, potassium, sulfur, and micronutrients).
- Enhances the microbial health of the soil through amendment of organic matter, nutrients, and microbial inoculation.
- Provides organic matter that improves soil structure, drainage, aeration, and erosion protection.
- Reduces greenhouse gases (GHGs) through carbon sequestration.
- Provides economic value for agricultural producers for multiple years, in reduced fertilizer cost and improved crop yields.
- Removes significant volume of material from the landfill.

2.2 LOCAL STUDY AREA

To facilitate direct pumping of the residuals to the receiving agricultural fields from the lagoon site, the land application program Local Study Area (LSA) is proposed to include neighbouring agricultural land 2 kilometres (km) south of the wastewater treatment lagoon site and 4 km north of the wastewater treatment lagoon site. As such, the LSA is comprised of the following parcels (refer to Figure 2, Appendix B):

- 15-03-04WPM
- 14-03-04WPM
- SW, NW, and NE 22-03-04WPM
- SE, NW, and NE 23-03-04WPM
- 27-03-04WPM
- 26-04-03WPM
- 34-04-03WPM
- 35-04-03WPM

These parcels are provided in this EAP as the targeted LSA for the land application program. Under the program, if future additional lands are required, these additional parcels will be reviewed for suitability (e.g., soil suitability, setback distances, sensitive features, public concern) and submitted to MECC for validation.

2.3 LAND OWNERSHIP

Currently, no cooperating farm producers or landowners have been approached to receive residual materials from the City of Winkler wastewater treatment lagoon. Under the land application program, when a land application event is being prepared for execution, cooperating farm producers and landowners will be approached, engaged with a land use agreement, and the proposed land parcels and associated landowner information will be submitted to MECC for records maintenance (including Manitoba Land Title Certificates).

2.3.1 LAND USE DEVELOPMENT CONTROLS

The Rural Municipality of Stanley Zoning By-Law No. 8-18 identifies most of the agricultural fields of the LSA are zoned as Agricultural General with S1/2 of 14 and 15-04-03WPM zoned as Agriculture Limited. The Zoning By-Law defines Agriculture General as: “a use of land for agriculture purposes. Typical uses include cropping and pasture. This use does not include livestock operations or natural resource developments.” There is no definition for Agriculture Limited.

2.4 REGULATORY FRAMEWORK

The following Acts and Regulations apply to the project and will be adhered to throughout the completion of the project:

1. *The Environment Act C.C.S.M. c. E125 (1987)*
    a. *Licensing Procedures Regulations* 163/88
    b. *Classes of Development Regulation* 164/88
    c. *Environment Act Fees Regulation* 168/96
    d. *Livestock Manure and Mortalities Management Regulation* 42/98
    e. Environmental Regulations for Treatment and Disposal of Biosolids in Manitoba, Mike Van Den Bosch, P.Eng., Municipalities & Industrial Approvals, Manitoba Environment
2. *The Water Protection Act C.C.S.M. c. W65 (2005)*
    a. *Nutrient Management Regulation* 62/2008

2.5 PROJECT SCHEDULE

The project tasks and schedule of events for the proposed project are outlined below in Table 1.

Table 1 Project Tasks and Schedule

TASK	TIMELINE
Submission of NOA for the project	March 2025
NOA submission rejected by EAB, identifying that the proper approach would be as an EAP for a full EAP	May 2025
Submission of EAP for the project	May 2025
EAL granted by EAB	September 2025
Soil sample collection for laboratory analysis of physical and chemical parameters for biosolid application	August 2025
Land application of biosolid materials from Cell 1	August – October 2025
Continuation of Land Application Program, Monitoring & Reporting	2026 and on, as applicable

3 DESCRIPTION OF EXISTING ENVIRONMENT

3.1 EXISTING LAND USE

The parcels of land that are to receive the residuals are classified as agricultural and are used to produce annual crops such as cereals and oilseeds. The City of Winkler is located within 2.5 km to the south of the wastewater treatment lagoon site. Several rural residential properties are also located within the LSA (Figure 3, Appendix B).

3.2 ECOSTRATIFICATION

The proposed project is located within the Winkler Ecodistrict of the Lake Manitoba Plain Ecoregion, which is covered by the broader Prairies Ecozone (Smith et al., 1998).

3.3 CLIMATE

The Winkler Ecodistrict is found within the warmest subdivision of the Grassland Transition Ecoclimatic Region in southern Manitoba. The ecodistrict is characterized by short, warm summers and long, cold winters with a mean average temperature of 3.1°C (Smith et al., 1998). The average crop growing season is 185 days with approximately 1800 growing degree-days. Mean annual precipitation is 515 millimetres (mm), one quarter of which is in the form of snowfall. The Winkler Ecodistrict has a moderately cool, subhumid, boreal soil climate (Smith et al., 1998).

3.4 SOIL AND TERRAIN

Soils in the Winkler ecodistrict consist primarily of moderately well drained to imperfectly drained Black Chernozem that has developed on shallow, strongly calcareous, loamy to clayey glaciolacustrine sediments.

Additional information pertaining to soils within the LSA (e.g., soil texture and agricultural capability) is provided in Section 6.

3.5 SURFICIAL AND BEDROCK GEOLOGY

The dominant bedrock types of the area include the Amaranth, Sundance, Swan River, Ashville, Favel, and Vermillion River formations. Overlying the bedrock is glacial till deposited by continental glaciers during the Pleistocene era. This till varies in thickness from a few feet to over 73 m (240 feet) and was deposited in a preglacial valley running through Winkler and the Roland areas, and the average thickness is between 6 and 9 m (20 and 30 feet). The till is composed of shale and clay mixed with stones and rock flour derived from granitic and limestone rocks carried into the area by glaciers (Smith et al., 1973).

3.6 REGIONAL GROUNDWATER

The Winkler aquifer consists of a buried elongated glaciofluvial sand and gravel deposit that is estimated to be 27.3 km (17 miles) long, has a thickness of up to 61 m (200 feet) and widths varying from 4.8 km (3 miles) to less than 1.6 km (1 mile). The Winkler aquifer underlies an area of some 12,172 hectares (ha) (47 square miles) extending southeast and northwest of the City of Winkler. The Winkler aquifer system consists of a sand and gravel unit that rests predominantly on Mesozoic shales of the Melita and Swan River Formations. The shale units generally contain minor sandstone and carbonated rock beds (Render, 1990). Except for a small area of approximately 81 ha (200 acres) at the north end of the aquifer, it is confined by overlying till and clay. In this exposed area, the aquifer interacts with the Deadhorse Creek and, to a lesser extent, the Shannon Creek (Render, 1990). Render (1990) identifies that the dominant recharge area for this aquifer is a gravel quarry at the north end of some 12 ha (30 acres) otherwise, the remaining area of the aquifer has limited recharge potential.

A search of the Manitoba GWDrill (2022) logs for groundwater wells within the LSA found 18 registered groundwater wells. Outlined in Table 2 are the well identification number and groundwater use. The groundwater well search results are included in Appendix C-1.

3.7 VEGETATION, WILDLIFE AND HABITAT

The native vegetation of the Winkler Ecodistrict originally consisted of tall prairie grasses and associated herbs, but because of cultivation, much of the native vegetation in the district has been replaced by agricultural development (Smith et al., 1998). Native forest vegetation is primarily located along waterways and comprised of green ash, white elm and Manitoba maple (Smith et al., 1998).

Habitat for wildlife species is limited within the LSA due to the predominance of agricultural production and is primarily associated with the riparian zones of the Deadhorse and Shannon Creeks. Species which persist in the LSA and the surrounding region have adapted to the agricultural landscape and include species such as white-tailed deer, jack rabbit, raccoon, skunks, red fox, voles and mice, as well as various bird species such as crows, blackbirds, and songbirds.

3.8 AQUATIC HABITAT

A fish community and fish habitat inventory of streams and drains conducted between 2002 and 2006 by the Department of Fisheries and Oceans Canada (DFO) Central and Arctic Region in agricultural areas of Manitoba identified the Deadhorse Creek as a Type A fish habitat, with simple habitat up and downstream of the sampling point (B-03-095) that may support indicator fish species (Milani 2013). Milani (2013) reported an assessment of the Deadhorse Creek was completed on the north side of the wastewater treatment lagoon cells with fish sampling effort resulting in the capture of two forage fish species, including: brook stickleback (*Culaea inconstans*) and silver redhorse (*Moxostoma anisurum*) with fathead minnow (*Pimephales promelas*) in the area also detected.

3.9 POTENTIAL SPECIES OF CONSERVATION CONCERN

For the purposes of this EAP, Species of Conservation Concern (SOCC) are identified as floral or faunal species that are:

- protected by the Federal *Species at Risk Act* (SARA)
- protected by Manitoba's *Endangered Species and Ecosystems Act* (MBESEA)
- those listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as threatened, endangered, or special concern
- those that are tracked as S1, S2, and S3 by the Manitoba Conservation Data Centre (MBCDC)

A request was submitted to the MBCDC on January 7, 2025, for a search of any records they may have for SOCC historically found to occur within the LSA and within 2 and 5 km of the LSA (refer to Appendix C-2 for a complete listing of species). Historically within the LSA, the yellow-banded bumble bee (ranked as S3S5 – vulnerable to secure; "special concern" under SARA and COSEWIC) (*Bombus terricola*) and the American pellitory (ranked as S3S4 – vulnerable to apparently secure) (*Parietaria pensylvanica*), were observed in 1951 and 1953, respectively.

Historic observations for SOCC have been recorded within 2 km of the LSA, including one plant species (American pellitory), two bird species (bobolink (*Dolichonyx oryzivorus*), barn swallow (*Hirundo rustica*), and one invertebrate species (yellow-banded bumblebee); the most recent recorded observation was for the bobolink in 2011.

It should also be noted that as much of the LSA consists of agricultural land, potential SOCC within the LSA are likely limited to wooded natural areas primarily located along stream channels and in small areas/pockets in non-cultivated areas where setback distances will be accounted for as part of the land application program.

4 DESCRIPTION OF SOCIOECONOMIC ENVIRONMENT

Any future agricultural lands participating in the land application program not discussed in this EAP will be reviewed for proximity to parks, protected areas, and Indigenous and Crown Lands prior to inclusion in the program.

4.1 PARKS, OPEN SPACES, AND TRAILS

According to the iMaQs integrated online mapping resource, there are no parks, open spaces or public trails within the LSA (Manitoba Mines Branch, Accessed January 7, 2025).

4.2 HERITAGE RESOURCES

No heritage resources are anticipated to be affected by the land application program as the LSA includes only agricultural land influenced by farming practices (e.g., tillage). No new land will be disturbed beyond the current agricultural practices, with no topsoil transfers, excavations, or stockpiles occurring.

Direct soil injection is where the residual slurry from the bottom of the lagoon cell is dredged and pumped to special equipment like an injection manure applicator. The applicator is attached to an agricultural tractor, and an umbilical pipe is dragged with the equipment supplying the liquid residual material. The liquid residual material is metered out at a prescribed rate to supply a known quantity per hectare based on nutrient values. The applicator is constructed with a disc that breaks the crop residual followed by the tine that is knifing through the soil surface and injecting the residual sludge between 10 to 15 centimetres (cm) below the soil surface. The activity of injecting the residuals in the manner described has minimal disturbance to the soil profile and is similar to the practices of crop production. The applicator is constructed with 12 injection tines and causes minimal disturbance to the soil surface.

The land application of residuals is regulated by *The Water Protection Act, Nutrient Management Regulation,* which are outlined in Section 6.2.1. and applies required setback distances. The applicable nutrient buffer zones and setback distances will concurrently mitigate against undisturbed parcels of land within these buffer zones and setbacks further protecting heritage resources in these zones.

4.3 INDIGENOUS COMMUNITIES

According to the iMaQs integrated online mapping resource, there are no Indigenous communities or Treaty Land Entitlements/claims within the LSA (Manitoba Mines Branch, Accessed January 7, 2025).

5 RESIDUALS QUANTITY AND QUALITY

5.1 RESIDUALS QUANTITY

The estimated volume of residuals is approximately 31,700 m^3 based on an average residuals depth of 1.2 m as surveyed in March 2024 and reported by Penn-co.

5.2 RESIDUALS QUALITY

A composite sample of residual materials from each lagoon cell was collected by Penn-Co Construction and submitted to ALS Laboratory Group for analysis of nutrients and metals (May 2024). Results tables are presented in Appendix D and the Certificate of Analysis is presented in Appendix E.

5.2.1 FOREIGN NON-COMPOSTABLE OBJECTS

On December 5, 2024, WSP completed a site visit to the City of Winkler wastewater treatment site to complete observations of excavated residuals from Cell 1 for the presence of foreign non-compostable objects to aid in confirming the suitability of the residuals material for land application. Eight locations were sampled, including four along the south berm, three along the north berm and one along the west berm. Sample locations were situated where best access was permitted for the track hoe. For further details reference Appendix A-2, Memo on Cell 1 Foreign Object Sampling.

Eight buckets of material were excavated from Cell 1 to view foreign objects within the residuals. Within the residuals at location 2, a plastic string was observed, and at location 4, a metal pipe was observed.

On December 19, 2024, WSP held a conference call with the City of Winkler representatives to further understand the history of their concerns for Clause 25 in EAL# 2525R. In general, the concern is with disposable flushable wipes through the wastewater treatment system. The operators have observed disposable wipes collecting in the gravity sewer system and collecting on Cell 1 aeration equipment. Periodically, the operators need to clean the aeration system of Cell 1 and various other locations within the wastewater network of disposable wipes.

Foreign objects such as the observed plastic string do indicate that small plastic objects do enter the wastewater treatment system; however, plastic objects of this nature would not impede the land application process nor impede the pumping equipment. No flushable wipes were observed. It would be preferred not to have any plastic objects applied to the land; however, the limited findings (one plastic string) demonstrate that there appears to be limited potential environmental impact to agricultural land.

A foreign object such as the pipe or other larger metal objects would also not impede a land application program as they would be screened out before the material was drawn into the pumping equipment.

Further clarification was obtained from the land application contractor (Assiniboine Injections Ltd.) regarding their experience with foreign objects, such as flushable wipes and plastics impacting on the dredging or agitating equipment for pumping. Assiniboine Injections indicated that with the equipment they have, the flushable wipes and other refuse are typically screened out prior to the pump and thus, a limited volume of these materials makes it through to the agricultural land with direct injection of the residuals.

5.2.2 NUTRIENT CONTENT

To determine environmentally sustainable and agronomically appropriate residuals prescription rates, it is important to determine nutrient quality for the residuals material and then tailor the application rate based on targeted crop uptake and removal rates and soil fertility concentrations. The nutrient values currently determined will be utilized to evaluate the prescription rates and are outlined in Table D.3 in Appendix D.

When utilizing an organic source as a fertilizer, only a portion of the total nitrogen is immediately available. A portion of the total nitrogen is in the organic form and goes through a mineralization process. Mineralization is the conversion of organic nitrogen to ammonium nitrogen. Like livestock manure, the anticipated mineralization rate for the residuals in year one is 25 percent, for year two is 12 percent, and for year three is 6 percent. Residual nutrients are typically not in balance with the nutrient requirements of most crops, and while phosphorus is usually found in residuals in smaller quantities than nitrogen, crops also require significantly less phosphorus than nitrogen to achieve target yields. Thus, when land application of residuals occurs, the application rate is typically based on phosphorus and targets a multiple of a crop's phosphorus removal rate.

NITROGEN

At a Carbon to Nitrogen (C:N) ratio that exceeds 30:1, N becomes a limiting nutrient for decomposer organisms, and this can reduce the rate of decomposition and result in N immobilization. The C:N ratio for Cell 1's residuals material is below the 30:1 threshold; thus, mineralization will continue at anticipated rates.

The plant available nitrogen in year 1 for Cell 1 residuals is approximately 6.1 kg per dry Tonne (Appendix D, Table D.3). In the subsequent year (year 2), the estimated plant available nitrogen is estimated to be 2.2 kg per dry Tonne, and in year 3, the estimated plant available nitrogen is estimated to be 1.1 kg per dry Tonne.

PHOSPHORUS

Total Carbon analysis was not completed; however, as this is a typical wastewater treatment cell, it can be assumed that the Carbon to Phosphorus (C:P) ratio would be between 200:1 and 300:1, mineralization and immobilization balance each other to result in no net release of P from the decomposing residuals. When C:P is below this range, P is released, and when above this range, P will be tied up and not released for crop use (Appendix D, Table D.3).

When animal and municipal wastes have N:P ratios ranging from 1:1 to 1:2 and are applied based on N rates on soils, over time, P will accumulate. Cell 1 residuals material's N:P ratio is determined to be 6.59:1; thus, it is anticipated that P will not accumulate when applied at a sustainable rate.

5.2.3 SALINITY

The residuals material from Cell 1 has an electrical conductivity (E.C.) value of 3.44 milli-siemens per centimetre (mS/cm). The residuals material may be considered as "slightly-saline" and, as such, pose a slight environmental risk for soil salinization, as soil E.C. and soluble ions (e.g., sodium, potassium, chloride, and sulfate) increase directly with the rate of application. Comparatively, the reported salinity is less than or similar to hog manure as reported by Racz and Fitsgerald (2001), where it was found that the mean E.C. (based on 145 Manitoba hog manure samples) has a value of 16.0 dS m^{-1} (16 mS/cm) and a Sodium Absorption Ration (SAR) of 5.1. It is reported by Sullivan et al. (2007) that repeated biosolid applications in soil did not result in detrimental salt accumulations in soil even at locations with low precipitation and no irrigation. Sullivan et al. (2007) reported that annual applications of dewatered cake biosolids (80 percent moisture) that have been made for over 10 years have not increased soil salinity above 1 mmho cm^{-1} (1 mS/cm). Salinity analysis results for the Cell 1 residuals are found in Table D.1 in Appendix D.

5.2.4 TRACE ELEMENTS

In “The Effect of Biosolids on Crops, Soil and Environmental Quality, A Summary of the Research” conducted by the Department of Soil Science at the University of Manitoba, Fitzgerald and Racz (1999) reported that for loading rates for City of Winnipeg biosolids (i.e., 0, 50, 100, and 200 tonnes per hectare) cadmium was not mobile and was not plant available and that very little of the cadmium was taken up by wheat plants. It was also reported that for concentrations of other heavy metals (e.g., copper, zinc, nickel, and lead), no consistent effect on the heavy metal content of wheat grain was observed due to increasing rates of added biosolids. Fitzgerald and Racz concluded that heavy metals in the biosolids-treated soils were like that of wheat produced in the Canadian Prairies and that loading rates as high as 200 tons per hectare (t ha^{-1}) did not affect grain quality.

For the residuals in the Winkler lagoon Cell 1, the metals of principal concern to agriculture include arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Manitoba Conservation and Water Stewardship (MCWS) previously established cumulative loading rates for each of these metals. The cumulative weight per hectare of each heavy metal in the soil is calculated by adding the amount of each metal in the biosolid at the prescription rate to the background soil level of the same metal. As the EAP has not determined actual soil metal concentrations at this time, mean trace element concentrations were obtained for soil series with the largest land area within the LSA from the Haluschak et al. (1998) study for selected trace elements in agricultural soil of southern Manitoba (Reinland, 459 ha; Gnadenthal, 495 ha; and Graysville, 262 ha). Actual metal loading rates to the soil within LSA will be determined based on infield soil results and prescription application rates, as discussed in Section 6.3. Based on an application rate of 29 tonnes per ha for Cell 1 and the mean concentrations of trace elements, the metal loading rates will be below the limit criteria (Table D.4 in Appendix D).

5.2.5 EMERGING SUBSTANCES OF CONCERN

5.2.5.1 PHARMACEUTICALS, PERSONAL CARE PRODUCTS AND OTHERS

Emerging substances of concern (ESOC), including pharmaceuticals, antibiotics, endocrine-disrupting chemicals (EDCs), hormones and personal care products (PPCPs), continue to be studied in Canada and around the world to assure environmental and public safety (CCME, 2012). ESOCs continue to emerge due to the development of new detection methods and changes in technologies (McCarthy and Loyo-Rosales, 2015). In general, most ESOCs are found in very low concentrations (nanograms) in wastewater residuals and do not necessarily imply risk to the environment or human health based on detection (CCME, 2012).

While ESOC, EDCs and PPCPs are likely to present in the Winkler wastewater treatment lagoon residuals, Winkler is not a major centre of industrial manufacturing or chemical processing, and the direct source of ESOC, EDCs, and PPCPs is likely from residential sources and would be limited even more in concentration than major cities. Currently, there are no federal or provincial requirements to address ESOC in residuals land application programs.

5.2.5.2 PER AND POLYFLUOROALKYLATED SUBSTANCES

Per and polyfluoroalkylated substances (PFAS) are a large group of human-made compounds originally created in the 1940s. PFAS are found in many consumer products used daily, for example in some repellents, fire fighting foams, textiles, personal care products and cosmetics, non-stick cookware, and food packaging materials. PFAS are characterized by their persistence and stability in the environment due to their strong carbon-fluorine bond. These compounds are referred to as “forever chemicals” because they break down or decompose extremely slowly. PFAS have been detected in humans, wildlife, and the environment around the world and have been associated with a range of human health effects when individuals are exposed to high concentrations for prolonged periods.

The manufacture, use, sale, offer for sale, and import of PFOS, PFOA, long-chain perfluoro carboxylic acids, their salts and precursors are prohibited under the Canadian Prohibition of Certain Toxic Substances Regulations, 2012, with a limited number of exemptions. Most of these exemptions were removed in 2022. PFOS and PFOA levels have been observed to be slowly declining across North America with the phasing out of these compounds.

Wastewater treatment plants or lagoons do not generate, produce, or directly use PFAS; rather, municipal lagoons are considered “receivers” of PFAS. PFAS compounds enter the wastewater stream when we use products that contain PFAS in manufacturing. For example, PFAS compounds found in non-stick cookware or clothing can enter the wastewater stream through human ingestion or through washing these household products.

Currently, PFAS are not listed under the Canadian Wastewater Systems Effluent Regulations (WSER), but Environment and Climate Change Canada and Agriculture and Agri-Food Canada are monitoring for PFAS in wastewater and residuals. The land application of residuals is provincially regulated across Canada with rigorous mitigation measures and environmental monitoring practices required. Currently, Quebec is the only provincial jurisdiction considering the implementation of guidelines for PFAS in residuals.

6 RESIDUALS LAND APPLICATION PROGRAM

To assess whether lands within the LSA are suitable to receive residuals, a desktop assessment of the LSA soils was completed that included a review of the dominant soil series, agricultural capability, nutrient management zone classes and anticipated agronomic practices of the participating landowner as outlined below.

6.1 AGRICULTURAL LAND REQUIREMENTS

The agricultural land parcels presented in the LSA are under consideration at this time; however, no cooperating farm producers have been approached. Agricultural fields put forward by potential cooperating farm producers will be assessed for suitability based on soil characteristics (e.g., agricultural capability, residual soil nutrient levels) and agronomic practices (e.g., crop rotation, nutrient management). This information will then be mapped to select agricultural fields to be used in a four-year rotation for the program.

6.1.1 CANADA LAND INVENTORY – SOIL CAPABILITY FOR AGRICULTURAL

The Water Protection Act (C.C.sMc W65, 2005) Nutrient Management Regulation (62/2008) outlines nutrient application restrictions based on Canada Land Inventory Soil Capability Classification for agriculture ratings (Government of Manitoba, 2008). The Canada Land Inventory (CLI) is a dry-land agriculture capability inventory for rural Canada. The CLI limitations are based on climate, geology, soil chemical and physical characteristics (salinity and structure), draughtiness, inundation, erosion, stoniness, and landscape topography of the soils. The CLI groups mineral soils into seven classes with the same relative degree of limitation and then delineates subclasses within each class based on the type of limitation (Fraser et al., 2001). Classes one to seven are based on increasing degree of limitation; the first three classes are capable of sustained cultivated crop production, class four is marginal for sustained arable cropping, class five is capable of pasture or hay, class six is capable of permanent pasture and class seven has no capability for arable crop or permanent pasture. There are thirteen different subclasses or limitations. The dominant soils series within the LSA are identified as being of Classes 1, 2, and 3, with subclass designations of M, E, W, and I. A full description of Classes 1, 2, and 3 and subclasses M, E, W, and I are outlined in Appendix C-3.

Agricultural soil capability within the LSA is dominated by Classes 1 (691 ha), 2 (1167 ha) and 3 (290 ha) with four subclasses (applied to Class 2 and 3 soils). Table 2 provides a summary of soils series, texture and CLI rating for soils within the LSA (also refer to Figures 5 - 7, Appendix B).

Table 2 Soil Series, Texture and CLI Rating within LSA

SOIL SERIES	SURFACE TEXTURE	DESCRIPTION	AREA IN LSA (HA)	CLI RATING
Blumengart (BMG)	Clay	Poorly drained Rego Humic Gleysol	80.68	3I
Chortitz (CTZ)	Clay loam	Imperfectly drained Gleyed Cumulic Regosol	60.78	3I
Deadhorse (DHO)	Clay	Imperfectly drained Gleyed Rego Black Chernozem	24.7	2W
Deadhorse, variant (DHO)	Clay loam	Imperfectly drained Gleyed Rego Black Chernozem – clay loam variant	3.94	2W
Dugas (DGS)	Clay	Imperfectly drained Gleyed Rego Black Chernozem	149.87	2W
Edenburg (EBG)	Clay loam	Orthic Black Chernozem	5.77	1
Gnadenthal (GDH)	Sandy clay loam	Imperfectly drained Gleyed Rego Black Chernozem	494.95	1
Graysville (GYV)	Clay loam	Imperfectly drained Gleyed Rego Black Chernozem	261.96	2W
Hibsin (HIN)	Very fine sandy loam	Moderately well drained Orthic Black Chernozem	17.61	2M
Hochfeld (HHF)	Fine sandy loam	Moderately well drained Orthic Black Chernozem	148.60	3M
Jorden (JOD)	Clay	Moderately well drained Orthic Black Chernozem	6.67	1
Neuenberg	Very fine sandy loam	Imperfectly drained Gleyed Rego Black Chernozem	30.51	1
Newton Siding	Clay loam	Imperfectly drained Gleyed Rego Black Chernozem	37.97	2W
Plum Coulee, variant	Clay loam	Imperfectly drained Gleyed Black Chernozem	1.77	2W
Red River Morris	Clay	Imperfectly drained Gleyed Rego Black Chernozem Imperfectly drained Gleyed Solonetzic Black Chernozem	183.24	2W
Reinfeld	Very fine sandy loam	Moderately well to well drained Orthic Black Chernozem	33.14	2M
Reinland	Very fine sandy loam	Imperfectly drained, Gleyed Rego Black Chernozem	459.24	2M / 2ME
Rignold	Sandy clay loam	Imperfectly drained Gleyed Black Chernozem	97.88	1
Rosengart	Very fine sandy loam	Moderately well drained Orthic Black Chernozem	27.25	2M
Winkler	Clay	Moderately well drained Orthic Black Chernozem	4.34	1
Winkler, variant	Clay loam	Moderately well drained Orthic Black Chernozem, clay loam variant	18.55	1

6.1.2 NUTRIENT MANAGEMENT ZONES

The *Nutrient Management Regulation* (NMR), as designated under the Manitoba *Water Protection Act (C.C.S.M.c W65)* outlines criteria for the application of nutrients (nitrogen and phosphorus) to agricultural land. The purpose of the NMR is to protect water quality by encouraging responsible nutrient planning. The objective to regulate the application of substances containing nitrogen or phosphorus to land is a protective measure for sensitive water bodies and/or groundwater (Manitoba Water Stewardship 2008). The Water Quality Management Zones (N1, N2, and N3) are defined within the regulation based on soil characterization using the approach described in the Canada Land Inventory Report No. 2 (1972) Soil Capability Classification for Agriculture.

The Water Quality Management Zone nitrogen application limits within Zones N1, N2, and N3 are summarized as a rate of application that results in a residual concentration of nitrate-nitrogen within the top 0.6 m of soil at the end of the growing season at any place within the application area not greater than:

- Zone N1: 157.1 kg/ha (140 lb/ac)
- Zone N2: 101 kg/ha (90 lb/ac)
- Zone N3: 33 kg/ha (30 lb/ac)

The Water Quality Management Zone phosphorus application limits within Zones N1 to N3 where soil test phosphorus levels (i.e., Olsen procedure) for any place in the application area is 60 parts per million (ppm) or more except at a rate of application that does not exceed:

- Two times the application phosphorus removal rate if the soil test phosphorus levels are less than 120 ppm.
- The applicable phosphorus removal rate if the soil test phosphorus levels are 120 ppm or more but less than 180 ppm.

The land parcels within the LSA are within Zone N1 and N2 and are subject to the aforementioned nitrogen and phosphorus application restrictions. Table 3 identifies the soil series, land area, texture, CLI and the equivalent Water Quality Management Zone of the *NMR*.

As outlined in Table 3, the soil series of the LSA are all within Water Quality Management Zones N1 and N2; as such, the rate of application that results in a residual concentration of nitrate-nitrogen within the top 0.6 m of soil at the end of the growing season is capped at 101 kg/ha, not creating any real limitation to the land application program.

Table 3 Soil Series, Texture, and CLI Rating within LSA

SOIL SERIES	AREA IN LSA (HA)	CLI RATING	WATER QUALITY MANAGEMENT ZONE
Blumengart	80.68	3I	N1
Chortitz	60.78	3I	N1
Deadhorse	24.7	2W	N1
Deadhorse, variant	3.94	2W	N1
Dugas	149.87	2W	N1
Edenburg	5.77	1	N1
Gnadenthal	494.95	1	N1
Graysville	261.96	2W	N1
Hibsin	17.61	2M	N1
Hochfeld	148.60	3M	N2
Jorden	6.67	1	N1
Neuenberg	30.51	1	N1
Newton Siding	37.97	2w	N1
Plum Coulee, variant	1.77	2W	N1
Red River/Morris	183.24	2W	N1
Reinfeld	33.14	2M	N1
Reinland	459.24	2M / 2ME	N1
Rignold	97.88	1	N1
Rosengart	27.25	2M	N1
Winkler	4.34	1	N1
Winkler, variant	18.55	1	N1

6.1.3 AGRONOMY

Crops that can be grown on lands receiving wastewater residual materials include cereals, corn, and oil seeds. Application of residual materials will increase soil health (water-holding capacity, tilth) and provide beneficial macro (nitrogen, phosphorus, potassium, sulfur) and micronutrients (e.g., boron, chloride, copper, iron, manganese, molybdenum, nickel, and zinc) to the soil for crop production. Any farm producer participating in the program will be advised of the benefits of residuals application and that the application of commercial fertilizers should only be completed to supplement nutrient levels from the residuals at agronomically sustainable rates.

Any agricultural producers that participate in the land application program will be required to sign a land use agreement that meets the terms and conditions of the program. Listed below are a few of the articles included in the agreement:

- Maintain an appropriate crop rotation for three years with cereal, oil seed, pulse, soybean, and corn crops. Direct edible crops, such as potatoes, are also not permitted for a period of three years.
- No livestock grazing for a period of three years post application growing season.
- Conducting a nutrient management program that accounts for residual nutrients from the residuals application.
- Farm producers will permit soil sampling and analysis monitoring for a period of 3 full years after application.
- Land application occurs at no cost to the producer.

6.2 LAND APPLICATION RATE PARAMETERS

The prescription rate calculations are based on several key pieces of information and the basics of nutrient management with assumptions for determining available nutrient calculations. Table 4 provides a summary of these inputs and assumptions.

Table 4 Land Application Nutrient Management Inputs and Assumptions

CATEGORIES	INPUTS
Information Requirements	– Target crop and anticipated yield – this information is provided by the participating agricultural producer for three years following application. – Target nutrient recommendations to achieve the desired yield – this is based on the understanding of crop uptake and removal. This information is typically sourced from the Manitoba Soil Fertility Guide. – Soil testing – soil sampling for nutrient and metals profile is completed (0-15 cm and 15-60 cm). – Residuals testing – testing of the nutrient and trace elements (metals) profile for the residuals is completed pre-application.
Assumptions	– Nitrogen Mineralization rates: — Estimated at 25% in year one. — Less than 12% in year two and less than 6% in year 3. – Plant available phosphorus: — Estimated at 50% of total phosphorus.
Methods	– Residuals are directly injected into the soil; therefore, the estimated volatilization of ammonia loss is 0% regardless of weather (cool/wet, cool/dry, warm/wet, and warm/dry, respectively).
Indicators	– If C:N exceeds 30:1 in the residuals, then N becomes a limiting nutrient for decomposer organisms, and this can reduce the rate of decomposition and results in N immobilization and loss of plant available nitrogen. – When C:P ratio is between 200:1 and 300:1 in the residuals, mineralization and immobilization balance each other to result in no net release of P from decomposing residuals. When C:P is below this range, P is released. – When animal and municipal wastes with N:P ratios ranging from 1:1 to 1:2 are applied based on N rates on soils, over time P will accumulate.

6.2.1 NUTRIENT MANAGEMENT AND SETBACK DISTANCES

The Water Protection Act (C.C.sMc W65, 2005), NMR (62/2008) outlines criteria for the application of nutrients (nitrogen and phosphorus) to agricultural land. The purpose of the NMR is to protect water quality by encouraging responsible nutrient planning. The objective to regulate the application of substances containing nitrogen or phosphorus to land is a protective measure for sensitive water bodies and/or groundwater.

To minimize risk to human and environmental health and safety from the land application of wastewater residuals, buffer zones will be established as outlined in the NMR and the Farm Practices Guidelines for Pig Producers in Manitoba (April 2007). Buffer zones around residential areas, residences, groundwater wells and surface water drainage systems will be established as outlined in Table 5.

Table 5 Nutrient Buffer Zones to be Established for Biosolid Application

DESCRIPTION	RECOMMENDED BUFFER ZONE DISTANCE
No application on land where there is less than 1.5 m of clay or clay till between the soil surface and the water table	Exclusion of such areas from the program
Identifiable boundary of an aquifer which is exposed to the ground surface	100 m (328 ft)
On soils with a pH of less than 6.0	Exclusion of such areas from the program
On land where the slope is greater than 5%	Exclusion of such areas from the program
SETBACK DISTANCES ON LAND ADJACENT TO SURFACE WATER OR A SURFACE WATER COURSE[1]	
A roadside ditch or an Order 1 or 2 drain	No direct application to ditches and Order 1 and 2 drains
A groundwater feature	15 m (49 ft) – vegetated buffer 20 m (66 ft) – non vegetated buffer
A wetland, bog, marsh or swamp other than a major wetland, bog, marsh or swamp[a]	Distance between the water's edge and the high-water mark[b]
A lake or reservoir designated as vulnerable[c]	30 m (98 ft) - vegetated buffer 35 m (115 ft) – non vegetated buffer
A lake or reservoir (not including a constructed storm water retention pond) not designated as vulnerable[c] A river, creek or stream designated as vulnerable[c]	15 m (49 ft) - vegetated buffer 20 m (66 ft) – non vegetated buffer
A river, creek or stream not designated as vulnerable[c] An Order 3, 4, 4 or 6 drain[d] A major wetland, bog, marsh or swamp[d] A constructed storm water retention pond	3 m (10 ft) – vegetated buffer 8 m (26 ft) – non vegetated buffer
SETBACK DISTANCES FROM NEIGHBOURS	
Designated residential areas, parks and protected areas[2]	1,000 m (3,280 ft)
Occupied Residence (other than the residence occupied by the owner of the land on which the residuals are to be applied)[2]	75 m (246 ft)
Property line with residence[2]	10 m (33 ft)
Property line without residence[2]	1.0 m (3.3 ft)

Notes:

[1] As outlined in the *Nutrient Management Regulation*

[a] As defined in 1(2) in the NMR. "For the purposes of this regulation, a wetland, bog, marsh or swamp is major if:

- It has an area greater than 2 ha (4.94 acres);
- It is connected to one or more downstream water bodies or groundwater features; and
- It contains standing water or saturated soils for periods of time sufficient to support the development of hydrophytic vegetation."

[b] Nutrient Buffer Zone is measured from the water body's high-water mark or the top of the outermost bank on that side of the waterbody, whichever is further from the water.

[c] Designated as vulnerable if listed in the Schedule in the NMR.

[d] Designated on a Manitoba Water Stewardship plan that shows the designation of drains.

[2] As outlined in: Farm Practice for Pig Producers in Manitoba (April 2007).

6.3 BEST MANAGEMENT AND GOOD NEIGHBORHOOD PRACTICES

The following best management and good neighbour practices will also be implemented for the land application program:

- Informing both the RM and residents of properties adjacent to the agricultural field, which are to receive the residuals of the date of the commencement of the land application event and the approximate timeline to complete the event. Notifications will include a map of the application fields, application start date, and contact information for the City of Winkler. The method of notification (e.g., registered mail, hand-delivery of flyers, etc.) has not yet been determined.
- Addressing any odour or other concerns by the City of Winkler and local residents in a timely manner.

6.4 APPLICATION LOGISTICS

The residuals will be dredged using a slurry agitation pump, which pumps the slurry directly from the lagoon bottom through pipes to a nurse tank typically located at the lagoon berm. Through an umbilical pipe, the residuals are then pumped to the injection equipment at the agricultural field. These materials are then directly injected into the soil sub-surface in the fall after crop harvest at the calculated prescribed agronomic rates for the residual materials from the lagoon cell. Applicator equipment will be equipped with a Global Positioning System (GPS) and volume control measures to facilitate accurate land application.

Application events are expected to occur over a 5-to-7-day period. Application will only occur under favourable conditions (e.g., no rainfall; no excess soil moisture to prevent tracking, excessive wind direct to neighbours, and compaction) and after crop harvest. Wind direction and speed are to be monitored to mitigate against neighbour residents being overwhelmed by odour.

6.5 TRANSPORTATION, ROUTE PLANNING, AND SPILL CONTROL

To direct pump the residuals slurry material to the receiving lands and eliminate the need for tanker trucks to transport the materials, a review of available culvert locations will be conducted during a pre-application site visit to the area to identify culvert crossings that would accommodate a hose to pass under the municipal road to connect with the applicator's equipment. Any applicable permits/approvals required from Manitoba Transportation and Infrastructure and/or the RM of Stanley will be obtained for passing of application hoses through culvert crossings prior to the land application.

6.6 GREENHOUSE GASES

There are 10 primary GHGs, four of which are naturally occurring, including water vapour (H_20), carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Although the most abundant and dominant GHG in the atmosphere, water vapour is not used to assess GHG emissions as its presence is dependent on temperate and other meteorological conditions and not directly from anthropogenic activities (Centre for Sustainable Systems, 2022). The main anthropogenic GHG that accounts for 78% of human contributions to the greenhouse effect is CO_2. Global Warming Potentials (GWPs) are used as a measure of the relative effectiveness of GHGs in trapping heat from the Earth over a certain time frame (Centre for Sustainable Systems, 2022). CO_2 is used as the reference gas for GWP and has a GWP = 1. Generally, GHG emissions are discussed in terms of mass of carbon dioxide equivalent (CO_2eq), which is calculated by multiplying the mass of emissions by the GWP for the gas (Centre for Sustainable Systems, 2022).

Canada's total GHG emissions in 2021 were estimated to be 670 megatonnes (Mt) of CO_2eq, and Manitoba's GHG emissions in 2021 were 20.7 Mt of CO_2eq or 3% of the national average (Environment and Natural Resources, 2023). According to the chart of greenhouse gas emissions by economic sector for Canada, between the years 1990 to 2021 (Environment and Natural Resources, 2023), in 2021, the "waste and others" sector (consists of emissions from light manufacturing, construction, forest resources and coal production) produced a total of 47.0 Mt CO_2eq (Environment and Natural Resources, 2023), which equates to approximately 7% of the total GHG emissions produced in Canada in 2021. Table 6 provides comparative values of GHG production by other economic sectors in 2021.

Table 6 Greenhouse Gas Emissions by Economic Sector [(1)]

ECONOMIC SECTOR	MT CO_2EQ EMISSIONS	% OF TOTAL
Oil and Gas	189.2	28.2
Transport	150.1	22.4
Buildings	87.2	13.0
Electricity	51.7	7.7
Heavy Industry	76.8	11.5
Agriculture	68.5	10.2
Waste and Others	47.0	7.0
TOTAL	**670.5**	**100.0**

Source: [(1)] Environment and Natural Resources, 2023.

7 EFFECTS AND MITIGATION MEASURES

7.1 POTENTIAL BIOPHYSICAL EFFECTS

The following sections outline the potential environmental and socio-economic effects associated with the residuals land application program as well as the proposed mitigation measures that will be implemented for the program to minimize potential negative effects. A summary of the potential effects is provided in Table 7.

Table 7 Summary of Effects and Mitigation Measures

POTENTIAL BIOPHYSICAL EFFECTS	PROPOSED MITIGATION MEASURES
SOIL & TERRESTRIAL QUALITY EFFECTS	
Nutrient Loading	Targeted prescriptions, cropping systems, soil monitoring, participating agricultural producer nutrient management, uniform application procedures, GPS tracking of application loads, auto-steer equipment, and calibrated equipment.
Trace Element Loading	Residuals monitoring, soil monitoring, soil chemistry, CCME guidelines.
Salinity and Sodicity	Residuals monitoring, soil monitoring, CCME guidelines.
Soil Compaction	Restrict travel to field entrance and field edges, heavy equipment fitted with flotation tires, calibrated equipment and wide row spacing.
Vegetation, Wildlife and Species of Conservation Concern	Existing agricultural land use, timing of application, setback distances, and cropping system
WATER QUALITY EFFECTS	
Surface Water	Compliance with applicable Provincial regulations, targeted prescription rates, setback distance of 30 m from lakes and 15 m from rivers, creeks and Order 3 or greater drains, direct injection, cropping systems, soil monitoring.
Groundwater	Compliance with applicable Provincial regulations and the establishment of setback distances of 75 m from groundwater wells[4] and 100 m from an identifiable boundary of an aquifer which is exposed to the ground surface or gravel and sand lenses, 1.5 m clay underlay at application sites, targeted prescription rates, soil monitoring.
SOCIO-ECONOMIC EFFECTS	
Economic Value	Replaces commercial fertilizer with value added soil amendment to the value of approximately $240.40 per hectare.
Greenhouse Gases	Land application of residuals provides significant benefits through the reduction of GHG production that occurs with landfill disposal, carbon sequestration in soil organic matter and reduced use of inorganic commercial fertilizers from petroleum-based sources within the LSA.
Heritage Resources	Completed on existing agricultural land, no new land disturbance and no change in land use, direct injections, and setback distances applied.
Public Safety and Health Effects	Direct soil injection of residuals, setback distances, restricted access, separation in space and time to next harvest, 1.5 m clay underlay, cropping systems, soil monitoring and compliance with Manitoba Acts and Regulations.

POTENTIAL BIOPHYSICAL EFFECTS	PROPOSED MITIGATION MEASURES
Pathogens	Tillage, climate exposure, setback distances, restricted access, exposure time between application events and harvest.
Odour	Setback distances, tillage.
Emerging Substances of Concern including PFAS	Climate exposure, microbial degradation, photo-degradation, direct injection, setback distances, restricted access, separation in time between land application event (fall), crop harvest (the next fall), and land rotation.
Accidents and Malfunctions	Maintain equipment in good working order, spill control/response plan.
Noise and Dust from Residuals Transport	Use of paved roads where possible, hauling during regular work hours, direct injections, maintain equipment in good working order, pump by umbilical pipe where possible, and regular inspections.

7.1.1 SOIL QUALITY EFFECTS AND MITIGATION

7.1.1.1 NUTRIENT LOADING

The objective of the proposed program is to manage nitrogen and phosphorus based on beneficial farm management practices and following prescription rates based on residual soil nutrient levels and residuals quality, as well as per applicable regulations. Residuals will be applied based on nutrient requirements for each agricultural field.

Prescribed nitrogen and phosphorus rates will target the uptake and removal ability of small grains, oil seed, pulse and soybean crops and corn. The land application program will be compliant with the regulatory requirements outlined in the NMR of *The Water Protection Act* for both maximum residual nitrogen and phosphorus criteria in nutrient management zones N1, N2 and N3.

Post-harvest soil monitoring will be conducted on the participating agricultural fields for three years post application of residuals to monitor nutrient loading within the soils. Soil sampling and analysis will be completed as follows: sodium bicarbonate extractable phosphorus in 0-15 cm and nitrate-nitrogen and total nitrogen in 0-15 cm and 15-60 cm. Participating agricultural producers will be required to manage their nutrient program based on the annual soil residual nitrogen and phosphorus levels assessed through the monitoring program. This information will be supplied to the Director of the EAB by March 31 of each year following the application of residuals.

Nitrogen leaching to groundwater is not a significant concern within the LSA as the soils are primarily clay textured, imperfectly drained soils. In addition, by applying the residuals at prescribed rates that optimize crop uptake and by establishing buffer zones around sensitive features, the risk of surface runoff into the surrounding drainage system will be minimized.

Mitigation Measures: Targeted prescriptions, cropping systems, soil monitoring, participating agricultural producer nutrient management, direct injection.

7.1.1.2 TRACE ELEMENT LOADING

To prevent overloading of trace elements (i.e., metals) into soils, the prescribed application rates provide cumulative weight criteria for metals that are below the permitted soil guidelines established by the CCME.

The loading rates for trace elements in the residuals from Cell 1 have been determined based on the theoretical maximum application of 29 dry tonnes per hectare, as presented in Table D.4 in Appendix D. These calculated heavy metal loading rates to the soil in the LSA are all below the cumulative weight criteria.

Mitigation Measures: Benchmark soil sampling, residuals analysis, mass balance calculations, direct injection, CCME guidelines.

7.1.1.3 *SALINITY AND SODICITY*

The residuals materials may be considered as “slightly-saline” and, as such, does pose a slight environmental risk for soil salinization, as soil E.C., soluble ions (e.g., sodium, potassium, chloride, and sulfate) and SAR increase directly with application rate. The residual materials’ salinity is less than hog manure (Racz and Fitzgerald, 2001), and it is reported by Sullivan et al. (2007) that repeated residuals applications in soil have not resulted in detrimental salt accumulations in soil even at locations with low prescription and no irrigation.

The entire land base within the LSA is non-saline (Smith and Michalyna, 1973).

To prevent overloading of salts in the soils, the prescribed application rates will limit salinity loading to agricultural fields. Benchmark soil sampling will aid in the identification of soils where natural salinity may be present and if additions through the residuals land application may demonstrate a risk.

Mitigation Measures: Benchmark soil sampling, land rotation, CCME guidelines

7.1.1.4 *SOIL COMPACTION*

Soil compaction is the clasping together of soil particles, reducing the space available for air and water, thus increasing the density of the soil. Soil compaction impacts water and air movement, seedling emergence, and root growth and may reduce the yield potential of a field. The soil series identified within the LSA may be susceptible to physical compaction due to the clay texture.

Soil compaction may occur at entrances to the fields within the LSA due to heavy equipment traffic entering fields for residuals application. As these entrances are typically utilized by farm producers with heavy farm equipment for crop production activities, soil compaction in these areas is likely not of great concern. In addition, winter frost action also aids in the mitigation of soil compaction. However, should the farm producer have a concern with the potential compaction, field entrances may be deep ripped to mitigate compaction.

It should also be noted that the field equipment utilized to complete the land application of the residual materials is equipped with large floatation tires to minimize the compaction potential. Land application is completed with a single pass of direct injection equipment towing an umbilical pipe, and therefore, there is no large mass of equipment passing over repeated tracks.

Mitigation Measures: Restrict travel to field entrance and field edges, heavy equipment fitted with flotation tires, application equipment capable to provide even application with a wide row spacing, and umbilical pipe to pump residual liquid.

7.1.1.5 *VEGETATION, WILDLIFE AND SPECIES OF CONSERVATION CONCERN*

Impact to wildlife and wildlife habitat is considered low as land within the LSA primarily consists of cultivated land with minimal natural vegetative cover available as habitat located primarily along the Deadhorse Creek. In addition, the timing of residuals application will occur in the fall, outside of the breeding bird window.

Based on the MBCDC search results and limited natural habitat within and adjacent to the LSA, the potential for SOCC to be located within the LSA is low. However, should SOCC or their habitat be identified within 100 m of a selected agricultural field, appropriate mitigation measures will be developed and implemented (e.g., establishment of setback distances from natural area/habitat).

The wooded area associated with the Deadhorse Creek may have the potential to provide habitat for red-headed woodpeckers; however, setback distances from these waterways will be accounted for as part of the land application program. Thus, potential negative effects to red-headed woodpecker habitat from the land application program would be anticipated to be negligible to minimal.

Mitigation Measures: Existing agricultural land use, timing of application, setback distances, and cropping system.

7.1.2 WATER QUALITY EFFECTS AND MITIGATION

7.1.2.1 SURFACE WATER AND FISHERIES IMPACTS

Of primary concern associated with the land application of residuals is the leaching and/or surface runoff of nitrogen and phosphorus into the ground or surface water if application rates exceed crop removal rates and soil storing capacity. Nitrogen and phosphorus levels in the residual materials and soil will be managed through the annual development of targeted prescription rates.

Potential impacts to surface water and fish within the Deadhorse Creek drainage system include nutrient loading from surface runoff. However, the impact to surface water and fish is considered low as residual material will be applied at agronomically appropriate rates and will be injected directly into the soil, thereby minimizing the potential of overland flow to the drainage system. In addition, appropriate setback distances of 8 m will be established around all Order 3 or higher drains (**Figure 8**, **Appendix A**).

Mitigation Measures: Targeted prescriptions, setback distances, 1.5 m clay underlay, direct soil injection of residuals, cropping systems, soil monitoring and compliance with Manitoba Acts and Regulations.

7.1.2.2 GROUNDWATER IMPACTS

Groundwater pollution within the RM of Stanley may be a concern as the Winkler aquifer is a buried elongated glaciofluvial sand and gravel deposit running approximately southeast to northwest of the City of Winkler. However, much of this aquifer is confined with substantial clay over burden within the LSA as reported by Render (1990). A search of the Manitoba GWDrill (2022) logs for groundwater wells within the LSA found 18 registered groundwater wells (Appendix C-1)

Application of the residuals at agronomically appropriate rates for nitrogen and phosphorus will ensure plant uptake of these nutrients over the growing season, thereby further minimizing the potential of leaching to the groundwater. In addition, appropriate setback distances will be established around all residences and domestic wells, as outlined in Table 5 in Section 6.3.

Mitigation Measures: Targeted prescriptions, setback distances, 1.5 m clay underlay, cropping systems, soil monitoring and compliance with Manitoba Acts and Regulations.

7.1.3 SOCIO-ECONOMIC EFFECTS

7.1.3.1 ECONOMIC VALUE

The application of residuals to agricultural land provides a positive economic benefit to both the farm producer and City of Winkler. The objective of providing prescription application rates for residuals to crops is to provide an organic source for nutrient management. As outlined, residuals provide macro nutrients (nitrogen, phosphorus, potassium, and sulfur) and micro-nutrients (boron, chloride, copper, iron, manganese, molybdenum, nickel and zinc), all of which provide economic value to the farm producer. For example, based on the average fertilizer commodity price between October 2020 and February 2024 for Urea (46-0-0) and Triple Super Phosphate (0-45-0), the following economic value, as presented in Table 8, can be recognized from the prescribed residual land application of two times crop removal of P_2O_5.

Table 8 Economic Value for Nitrogen and Phosphorus in Applied Residuals

NUTRIENT	MARKET PRICE (OCT. 2024)	APPLICATION RATE	VALUE OF APPLIED RESIDUALS
Available Nitrogen	$1.20/kg	133 kg/ha	$159.60/ha
Total Available P_2O_5	$0.80/kg	101 kg/ha	$80.80/ha

The residuals are being provided at no charge to the farm producer, thus reducing the producer's fertilizer bill by approximately $240.40/ha (Table 8). For example, for Cell 1, with an anticipated 1,030 dry tonnes of residuals, at an application rate of 29 dry tonnes per hectare, this would require approximately 35 ha of land. This equates to approximately $8,414 of nutrient value in year one following land application and does not account for multiple years of available nitrogen and phosphorus from the mineralization of the organic materials. It also does not account for the added benefit of potassium, sulfur, and additional micro-nutrients in year one or for multiple years. Hence, the economic benefit to the farm producer is substantial based on the savings the farm producer will incur for crop fertilizer amendments in year one and subsequent years. It should also be noted that the economic benefit to the City of Winkler is recognized from no land use fees being paid to the farm producer for the application of the residuals; whereas, if the residuals were disposed of in the local landfill, the tipping fee would represent a significant cost to the City of Winkler.

7.1.3.2 *GREENHOUSE GASES*

GHG emissions within the context of this residuals land application program are carbon dioxide, methane and nitrous oxide. The activities related to GHG contributions are limited to the equipment emissions that will be used to transport and direct inject residual materials as well as the natural decomposition of land applied organic matter in the soil. Land application of residuals provides significant benefits through the reduction of GHG production that occurs with landfill disposal, carbon sequestration in soil organic matter and reduced use of inorganic commercial fertilizers from petroleum-based sources within the LSA. These three benefits are reported to counterbalance the potential emissions due to mechanical needs for the land application program (CCME, 2012).

7.1.3.3 *HERITAGE RESOURCES EFFECTS AND MITIGATION*

Land application of residuals is an agricultural practice that is completed on existing agricultural fields with no new land disturbance thereby limiting the potential disturbance to heritage resources. The land application of residuals will be completed by direct soil injection. Direct soil injection is where the residuals slurry from the bottom of the lagoon cell is dredged and pumped to special equipment like an injection manure applicator. The applicator is attached to an agricultural tractor, and an umbilical pipe is dragged with the equipment supplying the liquid residual material. The liquid residual material is metered out at a prescribed rate to supply a known quantity per hectare based on nutrient values. The applicator is constructed with a disc that breaks the crop residual followed by the tine that is knifing through the soil surface and injecting the residual sludge between 10 to 15 cm below the soil surface. The applicator is constructed with 12 injection tines and causes minimal disturbance to the soil surface. This process is akin to that utilized by farm producers for annual fertilizer applications.

Mitigation Measures: Direct soil injection of residuals, setback distances, no change in land use and no new land under development.

7.1.3.4 *PUBLIC SAFETY AND HEALTH EFFECTS*

Land application of residuals is an agricultural practice that is completed on existing agricultural fields with no new land disturbance. Prospective agricultural lands are privately owned and have limited public exposure/access. The land application of residuals will be completed by direct soil injection to 15 cm soil depth, thereby limiting surface exposure and potential human interaction.

Mitigation Measures: Direct soil injection of residuals, setback distances, restricted access, separation in space and time to next harvest, 1.5 m clay underlay, cropping systems, soil monitoring and compliance with Manitoba Acts and Regulations.

7.1.3.5 *PATHOGENS*

Biological pathogens such as *E. coli* and fecal coliforms, as well as nuisance odour associated with land application of residuals may be considered to pose a public health and safety risk. However, the human health and safety risks will be managed through the application of the residuals onto private lands that have restricted public access. In addition, direct injection of the residuals into the soil will minimize odour and eliminate human exposure to pathogens. Pathogens from residuals are often killed by exposure to sunlight UV, drying conditions, unfavourable pH and other macro and micro environmental conditions. Lands that receive residuals will also be managed on a crop rotation system for three years, which includes non-root/vegetable crops and excludes livestock grazing.

As well, appropriate setback distances including 1,000 m from residential areas, 75 m from occupied residences (other than the residence occupied by the owner of the land on which the residuals are to be applied), 10 m from property lines with a residence and 1 m from property lines without a residence will be adhered to throughout the application program.

Mitigation Measures: Direct soil injection of residuals, climate exposure, setback distances, restricted access, separation in time between land application event (fall) and crop harvest (the next fall).

7.1.3.6 *ODOUR MANAGEMENT*

While it is not possible to eliminate odour as an effect from the program, mitigation measures that include the use of best management and good neighbour practices will be employed to minimize odour issues associated with the land application of residuals. Best management practices that will be employed include the direct injection of residuals into the soil to reduce odour as well as the establishment of applicable setback distances from residences. Examples of good neighbour practices are to respect complaints; this includes recording the complaint details, investigating the complaint, identifying corrective actions and responding back to the complainant about the findings and the corrections imposed.

Additional examples of odour management include addressing concerns within a short time frame, restricting delivery, handling and application of residuals to weekdays and providing a city contact for odour issues to neighbours.

Mitigation Measures: Good neighbour policy, complaint resolution procedures, city contact for odour issues, setback distances, direct injection.

7.1.3.7 *EMERGING SUBSTANCES OF CONCERN AND PFAS*

ESOC, EDCs, PPCPs and PFAS / PFOA continue to be studied in Canada and around the world to assure environmental and public safety (CCME, 2012). ESOC continues to emerge due to the development of new detection methods (e.g., culture and identification of pathogens) and changes in technologies (McCarthy, 2015). In general, most ESOCs are found in very low concentrations (nanograms) in wastewater residuals and do not necessarily imply risk to the environment or human health based on detection (CCME, 2012).

Mitigation Measures: Climate exposure, microbial degradation, photo-degradation, direct injection into soil, setback distances, restricted access, separation in time between land application event (fall) and crop harvest (the next fall) and land rotation.

7.1.3.8 *ACCIDENTS AND MALFUNCTIONS*

As part of the land application program, a spill response will be developed. The plan will include instructions to the land application contractor on what to do in the case of an accidental release of residuals during transport and at the field sites including reporting requirements to provincial regulators.

Mitigation Measures: Maintain equipment in good working order and develop a spill control/response plan.

7.1.3.9 *NOISE AND DUST*

As part of the land application program, noise and dust due to the operation of heavy equipment may occur. The plan will include instructions to the land application contractor on what to do to limit excessive noise and potential dust from the transport of residuals by transport truck.

Mitigation Measures: Maintain equipment in good working order, pump by umbilical pipe where possible, and select travel routes with least neighbour impacts.

8 MONITORING AND REPORTING

The following monitoring and reporting requirements are proposed for the program:

1. Completion of an on-site project start-up meeting between the proponent and the contracted land applicator to review the requirements of the EAL and procedure for the land application of the residuals prior to each application event. Participating agricultural producers will be engaged late winter/early spring to establish potential field sites for residuals land application.
2. At least two weeks prior to the commencement of the residuals land application each year, the City of Winkler will provide details of the residuals and field soil analysis as well as proposed prescription rates for residuals application to the Director of the MECC EAB.
3. Recording of residuals' percent solids, residual volumes, and the land application area during the land application process.
4. Completion of on-site observations and monitoring of residuals application, including:
   - Monitoring adherence by the Applicator to buffer zones.
   - Monitoring of application rates.
5. Providing a summary report to MECC EAB for the program by March 31 of each year following the application of residuals that includes:
   - Description of each land parcel on which the residuals were applied.
   - Pre-application soil parameters.
   - Dry weight of residuals applied per hectare of land.
   - Weight of each heavy metal (in mg/kg of soil) added to the receiving land parcels.
   - Cumulative weight (kg/ha) of each heavy metal for each land parcel as calculated by adding the amount of each heavy metal applied to the soil background level of the same metal.
   - Amount of nitrogen and phosphorus applied per hectare for each land parcel.
   - Copy of the residuals and soil sampling and analysis methods and results.
   - Type of crops grown on the land parcels in the program for the three years post-application.
6. Post-harvest soil monitoring of application fields for three (3) years post-application for residual nutrients including: nitrate-nitrogen (0-60 cm soil depth) and phosphorus (Olsen-P test 0-15 cm soil depth), as well as information relating to the amounts of nutrients from other sources that are being applied by the participating agricultural producer.

9 SUMMARY

When applied at balanced agronomic rates, the land application of residuals is a sustainable means to re-use nutrients within an agriculture system. The application of residuals enhances the water holding capacity, structure, and tilth of soils, thereby providing benefits to land utilized for agricultural production. The objective of this EAP is for the City of Winkler to implement an agronomically and environmentally sustainable, long-term land application program for residuals collected from the city's wastewater treatment lagoon. Applicable regulatory requirements, guidelines, and good neighbour policies and procedures will be adhered to for the City of Winkler's residuals land application program. With the employment of appropriate mitigation measures, potential negative effects associated with the land application can be minimized.

BIBLIOGRAPHY

- Canadian Council of Ministers of the Environment. 2012. Guidance Document for the Beneficial use of Municipal Biosolids, Municipal Sludge and Treated Septage. PN 1473 ISBN 978-896997-85-8 PDF.
- Centre for Sustainable Systems, University of Michigan. 2002. Greenhouse Gases Factsheet, Pub. No. CSS05-21. Retrieved online at: https://css.umich.edu/sites/default/files/2022-09/GHG_CSS05-21.pdf.
  Environment and Climate Change Canada. 2019. Recovery Strategy for the Red-headed Woodpecker (Melanerpes erythrocephalus) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. x + 120 pp.
- Environment and Natural Resources, Environmental Indicators. 2023. Greenhouse gas emissions. Retrieved online at: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html#transport.
- Fitzgerald, M.M. and Racz, G.J. 1999. The effect of biosolids on crops, soil and environmental quality, a summary of the search. Department of Soil Science, University of Manitoba.
- Fraser, W.R., Cyr, P., Eilers, R.G., & Lelyk, G.W. 2001. Technical Manual for Manitoba RM Soils and Terrain Information Bulletins. Winnipeg: Agriculture and Agri-Food Canada.
- Haluschak, P., Eilers, R.G., Mills, G.F., and Grift, S. 1998. Status of Selected Trace Elements in Agriculture Soils of Southern Manitoba. Soil Resources Section, Soils and Crops Branch, Manitoba Agriculture.
- Manitoba Mines Branch. n.d. Integrated Mining and Quarry System (iMaQs). Available online at: iMaQs | Integrated Mining and Quarrying System | Province of Manitoba (gov.mb.ca)
- McCarthy, L., Loyo-Rosales, J.E., 2015. Risks Associated with Municipal Biosolids Application to Agricultural Lands in Canada – Literature Review. Prepared for: Canadian Municipal Water Consortium, Canadian Water Network Prepared by: Ryerson University.
- McRichie, W.D., Norris, W., Scoates, R.F.J., and Weber, W. (1979). Precambrian Geology is a Digital Copy of: Manitoba Geological Services. *Geological Map of Manitoba, Map 79-2.*
- Milani, D.W. 2013. Fish community and fish habitat inventory of streams and constructed drains throughout agricultural areas of Manitoba (2002-2006). Can. Data Rep. Fish. Aquat. Sci. 1247:xvi + 6,153 p.
- Nutrient Management Regulation (62/2008) of *The Water Protection Act* (C.C.S.M. c. W65). Registered March 18, 2008 and available online at: https://web2.gov.mb.ca/laws/regs/
- Province of Manitoba, April 2007. Farm Practices Guidelines for Pig Producers in Manitoba. Agricultural Guidelines Development Committee. Available online at: farm-practices-guidelines_complete.pdf
- Racz, G.J. and Fitzgerald, M.M. 2001. Nutrient and heavy metal contents of hog manure – effect on soil quality and productivity. In *Livestock Options for the Future Conference.* Winnipeg, Manitoba, June 25-27.
- Render, F.W., 1990, The Water Supply Capacity of Winkler Aquifer, Presented at the International Coalition for Land/Water Stewardship in the Red River Basin Annual Conference, Winnipeg, MB, Manitoba Natural Resources, Water Resources Branch, Winnipeg, MB.
- Smith, R.E., Michalyna, W. and Wilson G. 1973, Soils of the Morden-Winkler Area. Manitoba Soil Survey, Canada Department of Agriculture, Manitoba Department of Agriculture, Manitoba Department of Mines and Natural Resources and Department of Soil Science, The University of Manitoba. Soil Report No. 18
- Smith, R.E., Velduis, H., Mills, G.F., Eilers, R.G., Fraser, W.R., and Lelyk, G.W. (1998). Terrestrial Ecozones, Ecoregions, and Ecodistricts of Manitoba, An Ecological Stratification of Manitoba's Natural Landscapes. Winnipeg, MB: Agriculture and Agri-Food Canada, Research Branch, Brand Research Centre, Land Resources Unit.

APPENDIX

A SUPPORTING DOCUMENTS

APPENDIX

A-1 AUTHORIZATION FOR EAP

May 12, 2025

Confidential

City of Winkler
185 Main Street
Winkler, MB R6W 1B4

Attention: Mr. Tim Wiebe

Subject: Authorization to draft a Environment Act Proposal for the land application of residuals from City of Winkler Wastewater Treatment Cell 1

This letter is to acknowledge that the City of Winkler is permitting WSP Canada Inc. to prepare an Environment Act Proposal of which the City of Winkler is the "Licensee". By signing this letter, City of Winkler consents to the preparation and submission of the Environment Act Proposal report on their behalf to Manitoba Environment and Climate Change, Environmental Approvals Branch for regulatory review as of the date this letter is signed.

Yours truly,
WSP CANADA INC.

[redacted]
Darren Keam, M.Sc., P.Ag.
Group Manager
Earth & Environment

Acknowledged and Accepted
City of Winkler

[redacted]
Signature

[redacted]
Name (please print)

[redacted]
Date

cc: Miguel Young (Penn-co)
WSP ref.: CA0045899.2099

1600 Buffalo Place
Winnipeg, MB, Canada R3T 6B8

T: F +1 204 474-2864

wsp.com

APPENDIX

A-2 MEMO SUMMARY OF FINDINGS

MEMO

TO: Robert Boswick, P.Eng.

FROM: Darren Keam, M.Sc., P.Ag.

SUBJECT: **City of Winkler, Cell 1 Foreign Object Sampling**

DATE: **January 7, 2025**

INTRODUCTION

WSP Canada Inc. (WSP) has been retained by Penn-co Construction Canada (2003) Ltd. (Penn-co) to complete an evaluation of the City of Winkler Wastewater Treatment lagoon Cell 1 biosolids with the objective of accomplishing a biosolids land application program, a sustainable practice for nutrient cycling.

The City of Winkler Environment Act Licence (EAL) #2525R, Clause 25 requires dewatered sludge (biosolids) from Cell 1 to be disposed of in a waste disposal facility. WSP understands that this clause was included in EAL# 2525R as there were suspicions of contamination in the residuals from plastics and other non-compostable materials, however the contamination has not been confirmed in the biosolids. The City of Winkler Wastewater treatment facility is in the S1/2 of 22-03-04WPM and SW23-03-04WPM within the Municipality of Stanley, Manitoba. With Cell 1 located in the legal subdivisions 1 and 2 of SE-22-03-04WPM, hereinafter referred to as the "Site".

WSP proposed to evaluate Cell 1 biosolids through observation of eight sample locations from the perimeter of the cell berms. At each of the sample locations, a track hoe bucket provided by Penn-co was used to collect a bucketful sample of the residuals which was then spread out on the inside berm of the cell. This permitted a WSP staff member to evaluate the biosolids for plastics and other foreign contaminants. The WSP staff member then utilized a shovel to further spread out the excavated biosolids to look for foreign objects. There was no sample collection for laboratory analysis. The observations were documented, and each sample excavation was photographed, and geolocation coordinates recorded.

Additionally, a conference call was conducted with City of Winkler representatives to permit WSP to obtain a further understanding of the wastewater treatment system process and the potential source for foreign objects to be deposited in Cell 1 from the treatment process. A call was held on December 19, 2024 with City of Winkler representatives (David Sawatzky, Tim Wiebe, Duane Falk and Jake Wiens).

SUMMARY OF FINDINGS

On December 5, 2024, WSP attended the site to complete observations of excavated biosolids from Cell 1. Eight locations were sampled with four along the south berm, three along the north berm and one along the west berm. Sample locations were situated where best access was permitted for the track hoe. Table 1 outlines the sample location, observation and corresponding photograph.

1600 Buffalo Place
Winnipeg, MB
Canada R3T 6B8

T: +1 204 477-6650
F: +1 204 474-2864
wsp.com

Table 1. Summary of Findings for Each Sample Location, Cell 1, Winkler, MB

SAMPLE ID	GEO-REFERENCE COORDIANTES	OBSERVATION	CORRESPONDING PHOTO
1	578919.80 m E, 5452771.18 m N	No foreign objects identified	1
2	578961.32 m E, 5452773.41 m N	1 small, long plastic string	2, 3
3	579034.33 m E, 5452774.92 m N	No foreign objects identified	4
4	579200.72 m E, 5452775.88 m N	1 long metal pipe identified	5
5	579212.15 m E, 5452879.57 m N	No foreign objects identified	6
6	579194.47 m E, 5452879.71 m N	No foreign objects identified	7
7	578873.33 m E, 5452829.48 m N	No foreign objects identified	8
8	578892.20 m E, 5452876.31 m N	No foreign objects identified	9

Eight buckets of material were excavated from Cell 1 to view for foreign objects within the residuals. Within the biosolids at location 2, a plastic string was observed and at location 4 a metal pipe was observed.

On December 19, 2024, WSP held a conference call with City of Winkler representatives to further understand the history of their concerns for Clause 25 in EAL# 2525R. In general, the concern is with disposable flushable wipes through the wastewater treatment system. The operators have observed disposable wipes collecting in the gravity sewer system and collecting on Cell 1 aeration equipment. Periodically the operators are needing to clean the aeration system of Cell 1 and various other locations within the wastewater network of disposable wipes.

Foreign objects such as the observed plastic string does indicate that small plastic objects do enter the wastewater treatment system, however, plastic objects of this nature would not impede the land application process nor impede the pumping equipment. No flushable wipes were observed. It would be preferred not to have any plastic objects applied to the land; however, the limited findings (one plastic string) demonstrates that there appears to be limited potential environmental impact to agricultural land.

A foreign object such as the pipe or other larger metal objects would also not impede a land application program as they would be screened out before the material was drawn into the pumping equipment.

Further clarification was obtained from the land application contractor (Assiniboine Injections Ltd.) regarding their experience with foreign objects such as flushable wipes and plastics impacting on the dredging or agitating equipment for pumping. Assiniboine Injections indicated that with the equipment they have, the flushable wipes and other refuse are typically screened out prior to the pump and thus a limited volume of these materials actually makes it through to the agricultural land with direct injection of the biosolids.

CONCLUSION

Based on the observation of the biosolids on December 5, the discussion with the City of Winkler operation staff and additional discussion with Assiniboine Injections, it is WSP conclusion that the residuals from Cell 1 of the City of Winkler wastewater treatment system are suitable for land application.

CLOSING

Should there be any further questions regarding the findings or conclusions of this memo, please contact the undersigned at 204-259-1488 or Darren.keam@wsp.com.

Darren Keam, M.Sc., P.Ag.
Group Manager, Manitoba

Photo 1. Sample Location 1, no observed foreign objects

Photo 2. Sample Location 2.

wsp	Date Taken: Dec. 5, 2024	Client: Penn-co
	Taken by: WSP	Location: Winkler, MB
	Project No.: CA0045899.2099	

Photo 3. Sample Location 2, plastic object observed (plastic string)

Photo 4. Sample location 3, no observed foreign objects.

wsp	Date Taken: Dec. 5, 2024	Client: Penn-co
	Taken by: WSP	Location: Winkler, MB
	Project No.: CA0045899.2099	

Photo 5. Sample Location 4, metal pipe identified.

Photo 6. Sample location 5, no observed foreign objects.

wsp	Date Taken: Dec. 5, 2024	Client: Penn-co
	Taken by: WSP	Location: Winkler, MB
	Project No.: CA0045899.2099	

Photo 7. Sample Location 6, no observed foreign objects

Photo 8. Sample location 7, no observed foreign objects

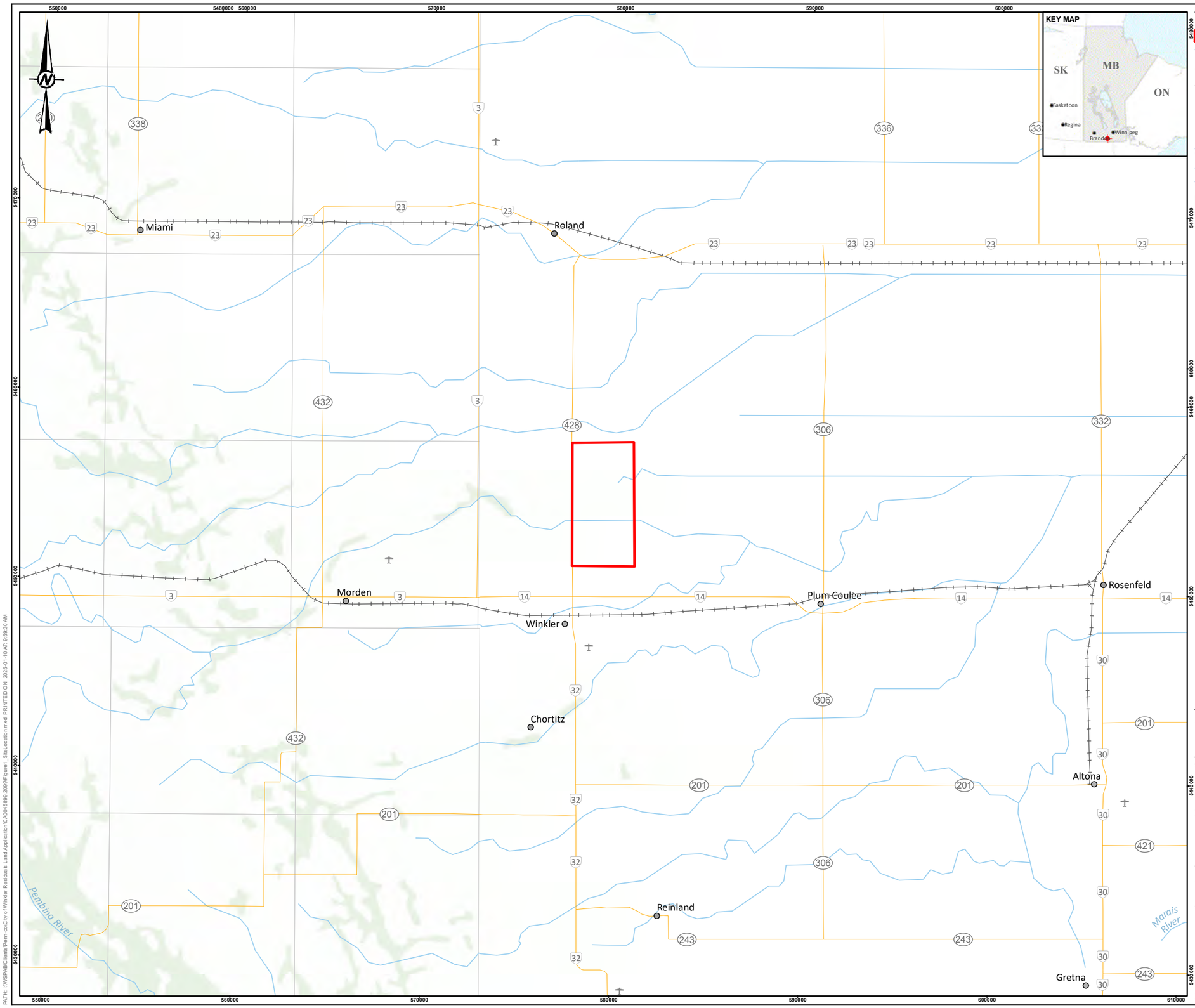
wsp	Date Taken: Dec. 5, 2024	Client: Penn-co
	Taken by: WSP	Location:
	Project No.: CA0045899.2099	

Photo 9. Sample Location 8, no observed foreign objects.

wsp	Date Taken: Dec. 5, 2024	Client: Penn-co
	Taken by: WSP	Location: Winkler, MB
	Project No.: CA0045899.2099	

APPENDIX

B FIGURES



LEGEND

- Local Study Area

Transportation

- Paved Roads
- Railways
- Airfield

Municipal

- Towns/City

Water Features

- Perennial Creeks/Streams

Vegetation & Parks

- Vegetation

0 2 4 6 8

1:200,000 Kilometers

Coordinate System: NAD 1983 UTM Zone 14N

REFERENCE(S)

1. DATA PROVIDED BY ALTALIS;NATURAL RESOURCE CANADA; ESRI BASEMAPS;GEOGRATIS

CLIENT

PENN-CO CONSTRUCTION / CITY OF WINKLER

PROJECT

CITY OF WINKLER RESIDUALS LAND APPLICATION
NOTICE OF ALTERATION
NEAR WINKLER, MANITOBA

TITLE

SITE LOCATION MAP

CONSULTANT

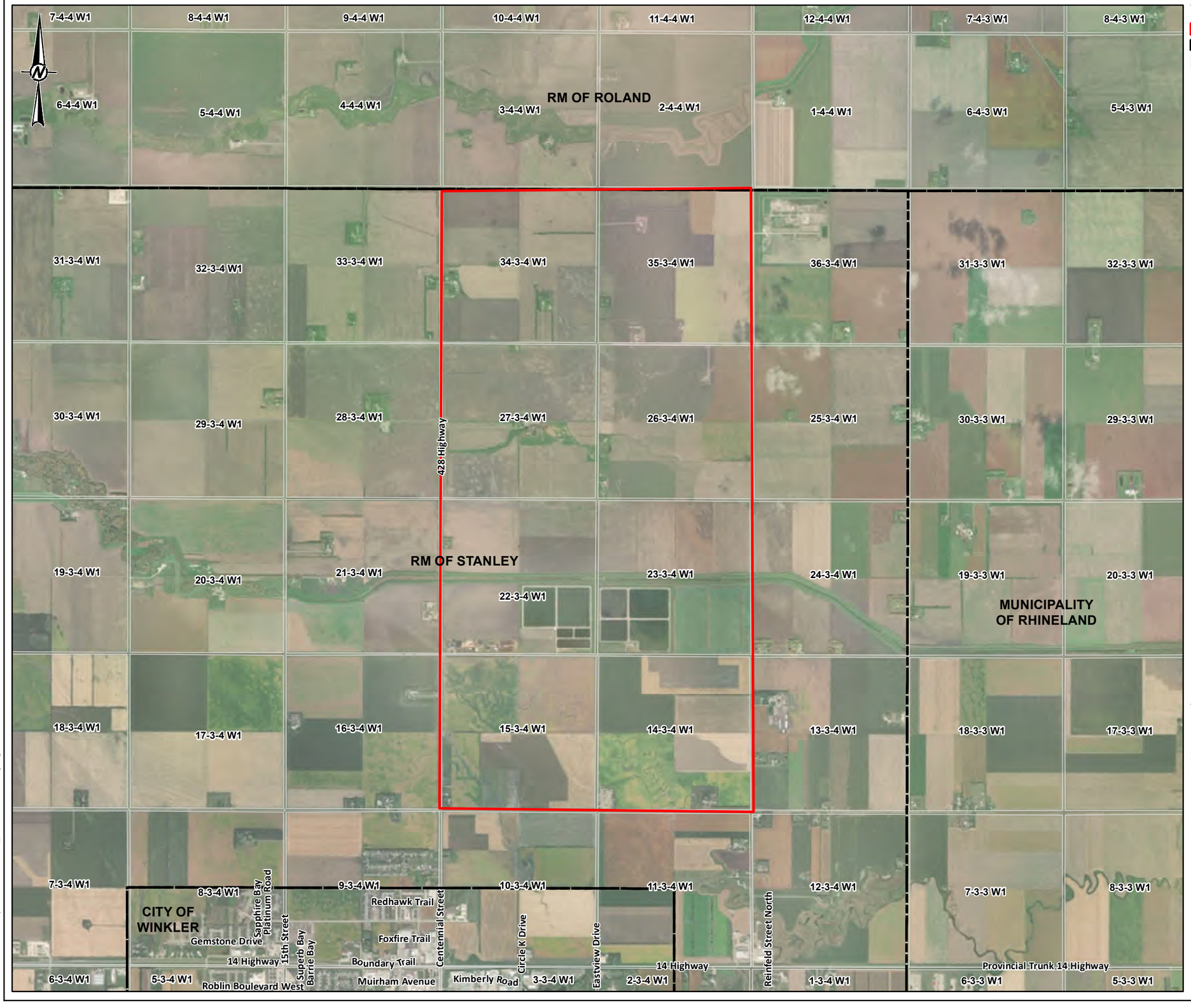
wsp

YYYY-MM-DD	2025-01-10
REPORT BY	D.KEAM
DRAWN BY	J.HECK
REVIEWED BY	D.KEAM
OFFICE	CALGARY

PROJECT NO. CA0045899.2099

FIGURE 1

PATH: I:\WSP\ABC lients\Penn-co\City of Winkler Residuals Land Application\CA0045899.2099\Figure 1_SiteLocation.mxd PRINTED ON: 2025-01-10 AT: 9:59:30 AM



LEGEND

- Local Study Area
- Municipal Boundary
- Manitoba Section Boundary

0 500 1,000 1,500 2,000

1:40,000 Meters

Coordinate System: NAD 1983 UTM Zone 14N

REFERENCE(S)

1. IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS

CLIENT

PENN-CO CONSTRUCTION / CITY OF WINKLER

PROJECT

CITY OF WINKLER RESIDUALS LAND APPLICATION
NOTICE OF ALTERATION
NEAR WINKLER, MANITOBA

TITLE

SITE LOCATION OVERVIEW

CONSULTANT

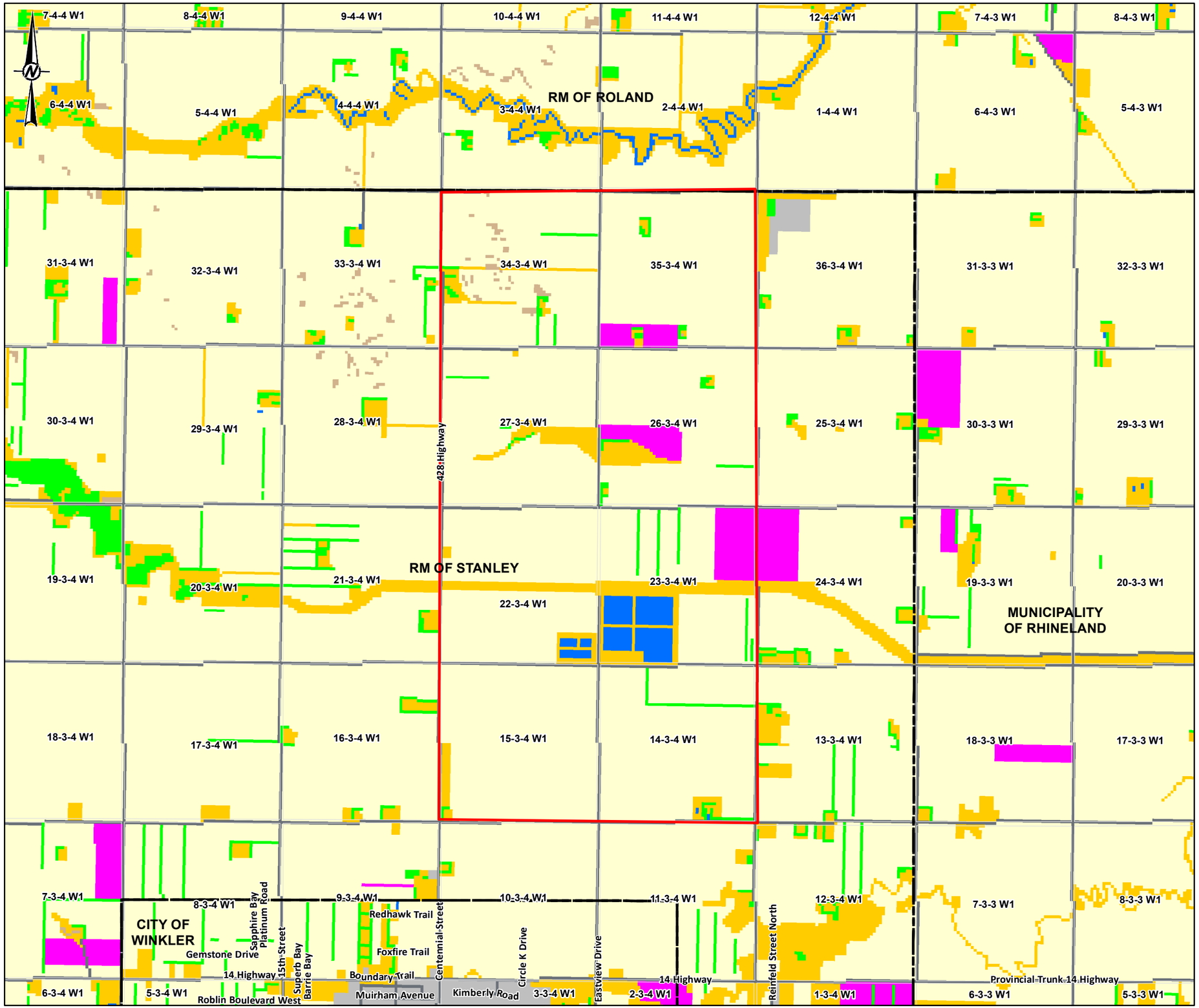
wsp

YYYY-MM-DD	2025-01-10
REPORT BY	D.KEAM
DRAWN BY	J.HECK
REVIEWED BY	D.KEAM
OFFICE	CALGARY

PROJECT NO. CA0045899.2099

FIGURE 2

PATH: I:\WSP\ABC\clients\Penn-co\City of Winkler Residuals Land Application\CA0045899.2099\Figure2_LocationOverview.mxd PRINTED ON: 2025-01-10 AT: 10:22:08 AM



LEGEND

- Local Study Area
- Municipal Boundary
- Manitoba Section Boundary

Landuse/Landcover 2005-2006

- Agricultural Crop Land
- Deciduous Forest
- Water
- Grassland
- Mixedwood Forest
- Marsh/Fens
- Bogs
- Treed Rock
- Conifer Forest
- Burns
- Open Deciduous Forest
- Forage Crops
- Cultural
- Forest Cutblocks
- Bare Rock, Gravel and Sand
- Roads and Cutlines
- Fens

0 500 1,000 1,500 2,000

1:40,000 Meters

Coordinate System: NAD 1983 UTM Zone 14N

REFERENCE(S)

1. DATA SOURCE: MANITOBA AGRIMAPS (HTTPS://AGRIMAPS.GOV.MB.CA/AGRIMAPS/)
2. IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS

CLIENT
PENN-CO CONSTRUCTION / CITY OF WINKLER

PROJECT
CITY OF WINKLER RESIDUALS LAND APPLICATION
NOTICE OF ALTERATION
NEAR WINKLER, MANITOBA

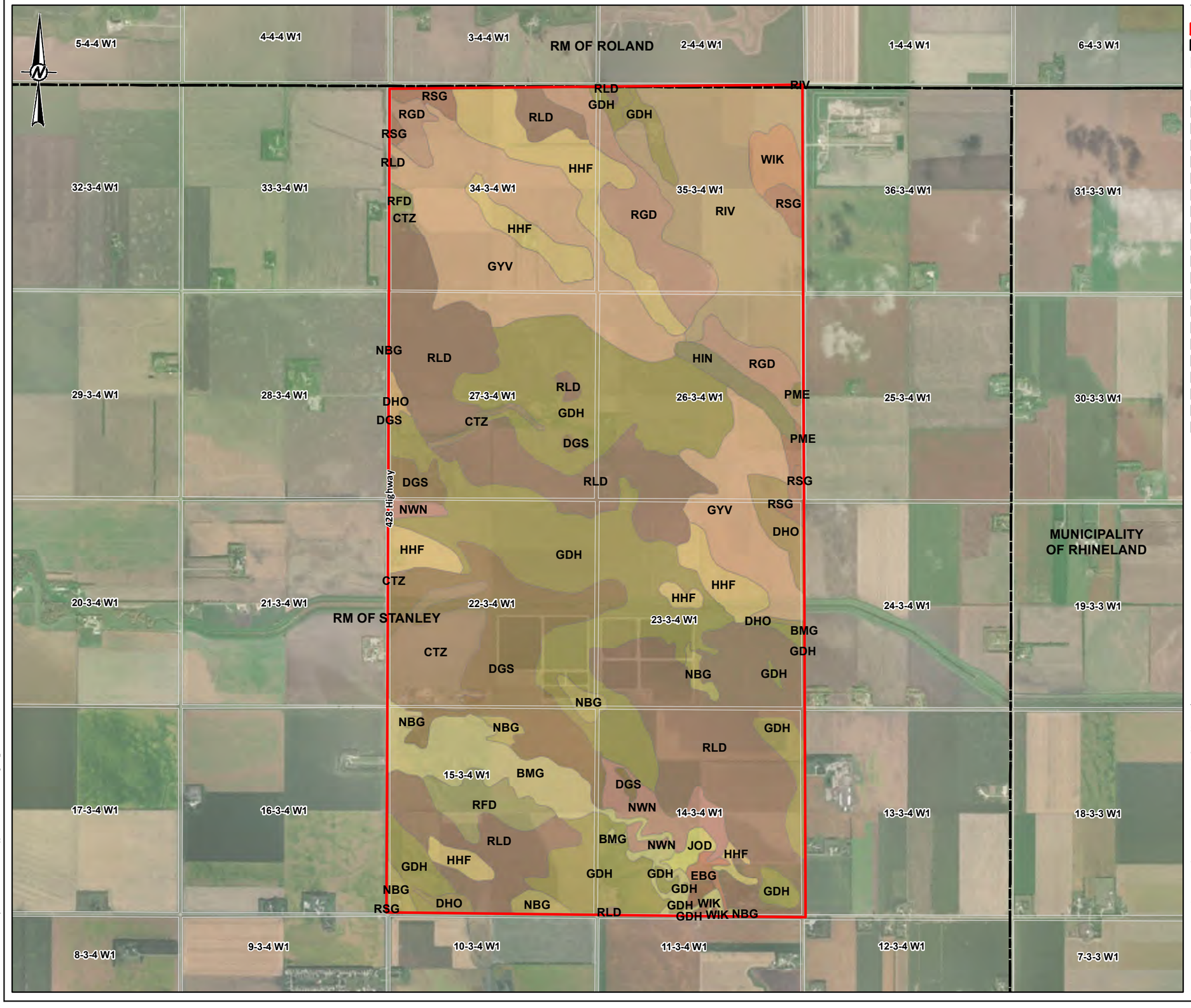
TITLE
LANDUSE MAP

CONSULTANT

YYYY-MM-DD	2025-01-10
REPORT BY	D.KEAM
DRAWN BY	J.HECK
REVIEWED BY	D.KEAM
OFFICE	CALGARY

PROJECT NO.
CA0045899.2099

FIGURE
3



LEGEND

- Local Study Area
- Municipal Boundary
- Manitoba Section Boundary

Soil Series

- Blumengart (BMG)
- Chortitz (CTZ)
- Deadhorse (DHO)
- Deadhorse, clay loam variant (DHO)
- Dugas (DGS)
- Edenburg (EBG)
- Gnadenthal (GDH)
- Graysville (GYV)
- Hibsin (HIN)
- Hochfeld (HHF)
- Jordan (JOD)
- Neuenberg (NBG)
- Newton Siding (NWN)
- Plum Coulee, clay loam variant (PME)
- Red River (RIV)
- Reinfeld (RFD)
- Reinland (RLD)
- Rignold (RGD)
- Rosengart (RSG)
- Winkler (WIK)
- Winkler, clay loam variant (WIK)

0 500 1,000 1,500 2,000

1:30,000 Meters

Coordinate System: NAD 1983 UTM Zone 14N

REFERENCE(S)

1. DATA SOURCE: MANITOBA AGRIMAPS (HTTPS://AGRIMAPS.GOV.MB.CA/AGRIMAPS/)
2. IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS

CLIENT

PENN-CO CONSTRUCTION / CITY OF WINKLER

PROJECT

CITY OF WINKLER RESIDUALS LAND APPLICATION
NOTICE OF ALTERATION
NEAR WINKLER, MANITOBA

TITLE

SOIL SERIES

CONSULTANT

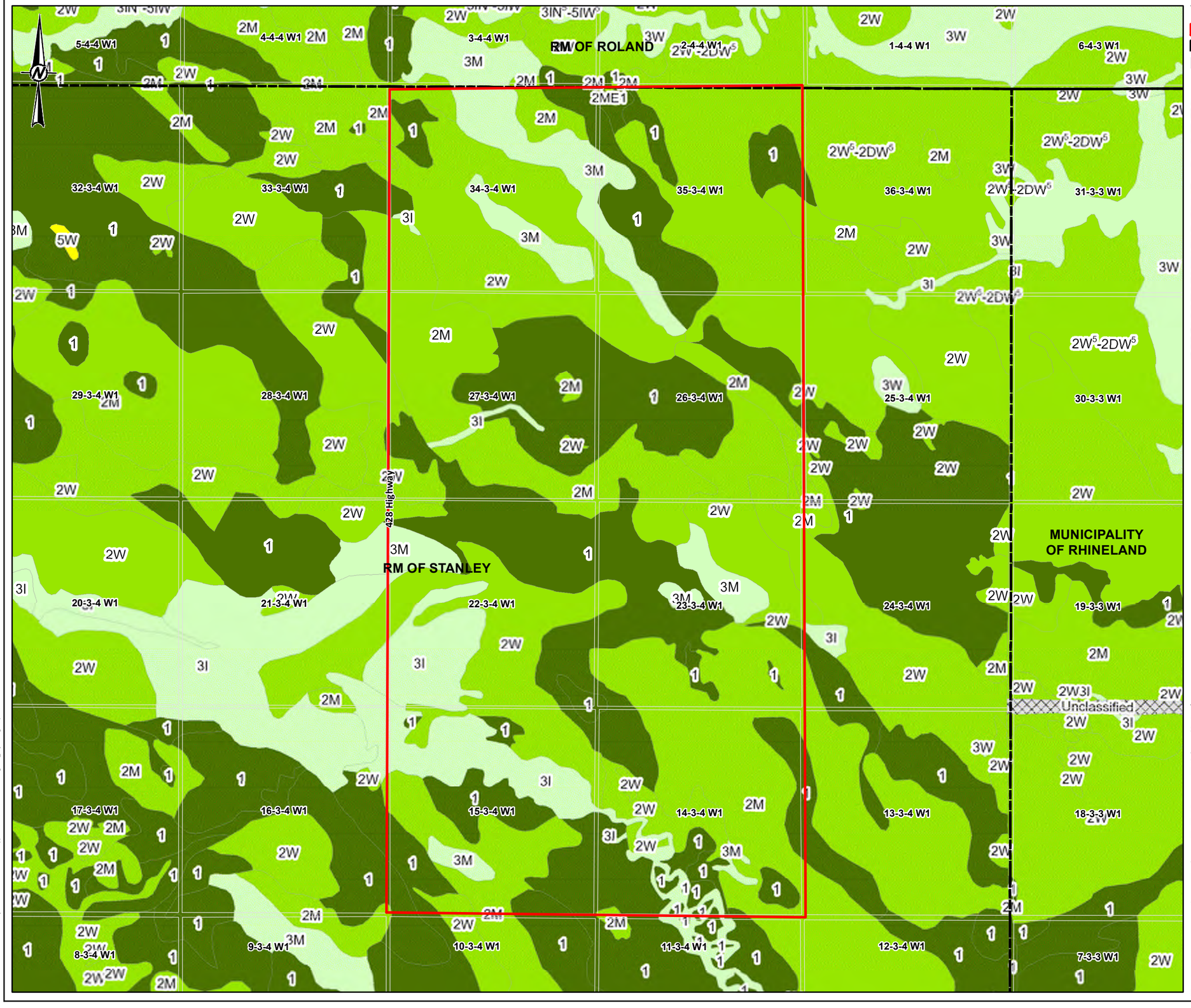
wsp

YYYY-MM-DD	2025-01-22
REPORT BY	D.KEAM
DRAWN BY	J.HECK
REVIEWED BY	D.KEAM
OFFICE	CALGARY

PROJECT NO. CA0045899.2099

FIGURE 4

PATH: I:\WSP\ABC\Clients\Penn-co\City of Winkler Residuals Land Application\CA0045899.2099\Figure4_SoilSeries.mxd PRINTED ON: 2025-01-22 AT: 10:09:15 AM



LEGEND

- Local Study Area
- Municipal Boundary
- Manitoba Section Boundary

Dryland Agricultural Capability

- Class 1 (Most Capable)
- Class 2
- Class 3
- Class 4
- Class 5
- Class 6
- Class 7 (Least Capable)
- Water
- Organic
- Unclassified land
- Modified land
- Urban land

0 500 1,000 1,500 2,000

1:30,000 Meters

Coordinate System: NAD 1983 UTM Zone 14N

REFERENCE(S)

1. DATA SOURCE: MANITOBA AGRIMAPS (HTTPS://AGRIMAPS.GOV.MB.CA/AGRIMAPS/)
2. IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS

CLIENT

PENN-CO CONSTRUCTION / CITY OF WINKLER

PROJECT

CITY OF WINKLER RESIDUALS LAND APPLICATION
NOTICE OF ALTERATION
NEAR WINKLER, MANITOBA

TITLE

DRYLAND AGRICULTURE CAPABILITY

CONSULTANT

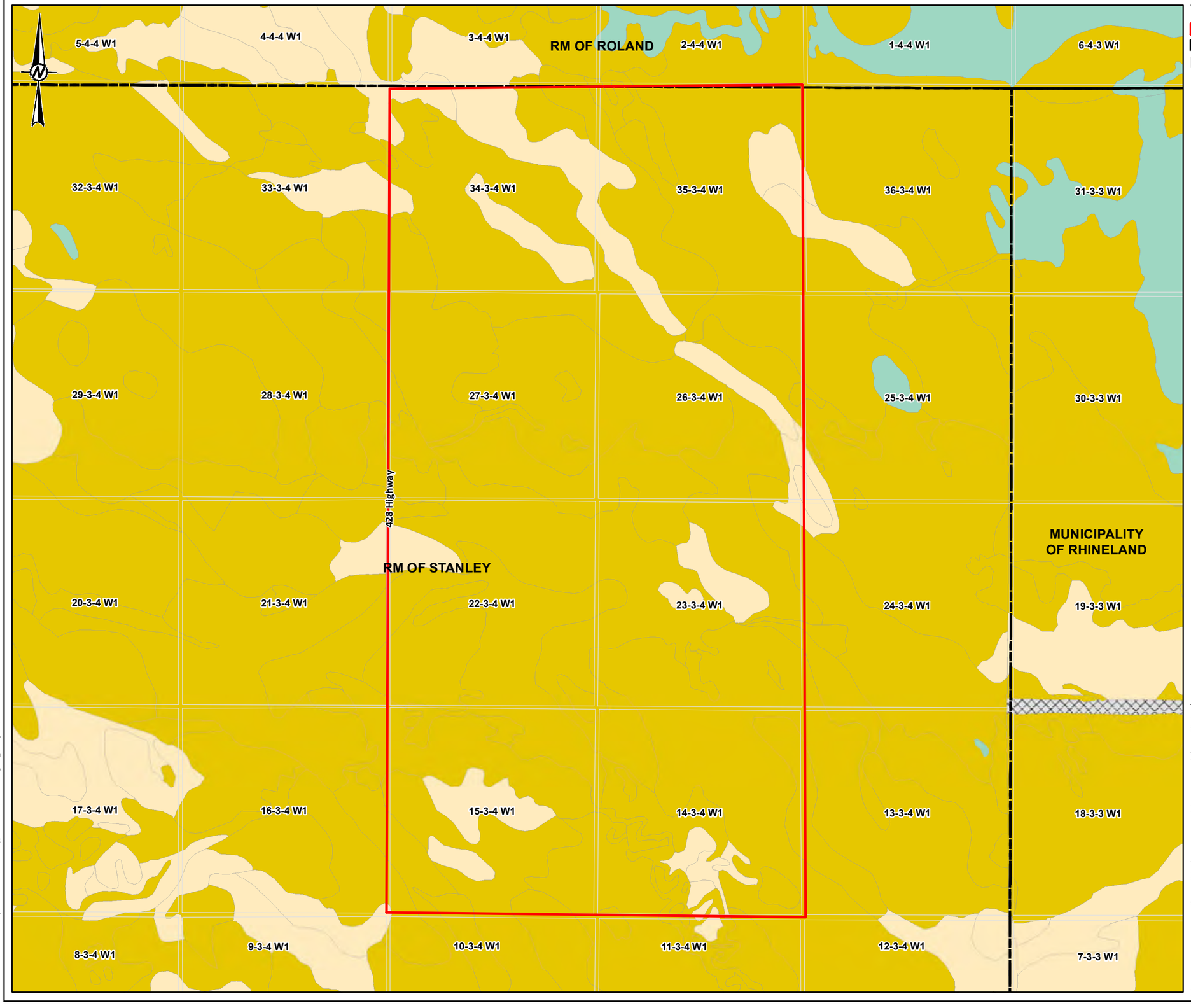
wsp

YYYY-MM-DD	2025-01-10
REPORT BY	D.KEAM
DRAWN BY	J.HECK
REVIEWED BY	D.KEAM
OFFICE	CALGARY

PROJECT NO. CA0045899.2099

FIGURE 5

PATH: I:\WSP\ABC\Clients\Penn-co\City of Winkler Residuals Land Application\CA0045899.2099\Figure5_DrylandAgriCap.mxd PRINTED ON: 2025-01-10 AT: 11:04:04 AM



LEGEND

- Local Study Area
- Municipal Boundary
- Manitoba Section Boundary

Drainage

- Rapid
- Well
- Imperfect
- Poor
- Very Poor
- Water
- Unclassified land
- Modified land
- Urban land

0 500 1,000 1,500 2,000

1:30,000 Meters

Coordinate System: NAD 1983 UTM Zone 14N

REFERENCE(S)

1. DATA SOURCE: MANITOBA AGRIMAPS (HTTPS://AGRIMAPS.GOV.MB.CA/AGRIMAPS/)
2. IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS

CLIENT

PENN-CO CONSTRUCTION / CITY OF WINKLER

PROJECT

CITY OF WINKLER RESIDUALS LAND APPLICATION
NOTICE OF ALTERATION
NEAR WINKLER, MANITOBA

TITLE

SOIL DRAINAGE

CONSULTANT

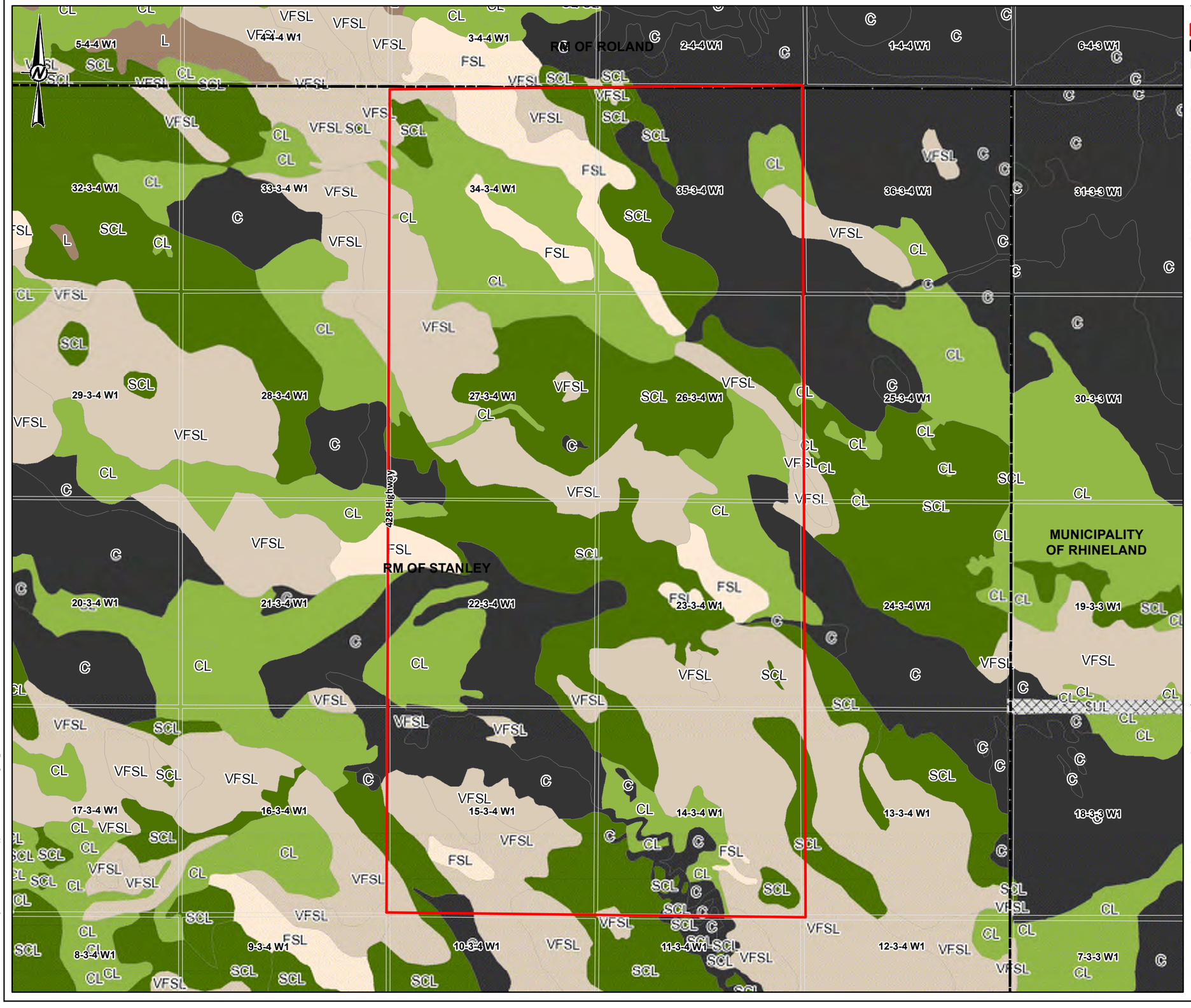
wsp

YYYY-MM-DD	2025-01-10
REPORT BY	D.KEAM
DRAWN BY	J.HECK
REVIEWED BY	D.KEAM
OFFICE	CALGARY

PROJECT NO. CA0045899.2099

FIGURE 6

PATH: I:\WSP\ABC\lients\Penn-co\City of Winkler Residuals Land Application\CA0045899.2099\Figure6_Drainage.mxd PRINTED ON: 2025-01-10 AT: 10:41:51 AM



LEGEND

- Local Study Area
- Municipal Boundary
- Manitoba Section Boundary

Surface Texture

- Fine sandy loam (FSL)
- Very fine sandy loam (VFSL)
- Loam (L)
- Clay loam (CL)
- Sandy clay loam (SCL)
- Clay (C)
- Unclassified land

0 500 1,000 1,500 2,000

1:30,000 Meters

Coordinate System: NAD 1983 UTM Zone 14N

REFERENCE(S)

1. DATA SOURCE: MANITOBA AGRIMAPS (HTTPS://AGRIMAPS.GOV.MB.CA/AGRIMAPS/)
2. IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS

CLIENT
PENN-CO CONSTRUCTION / CITY OF WINKLER

PROJECT
CITY OF WINKLER RESIDUALS LAND APPLICATION
NOTICE OF ALTERATION
NEAR WINKLER, MANITOBA

TITLE
SURFACE TEXTURE

CONSULTANT

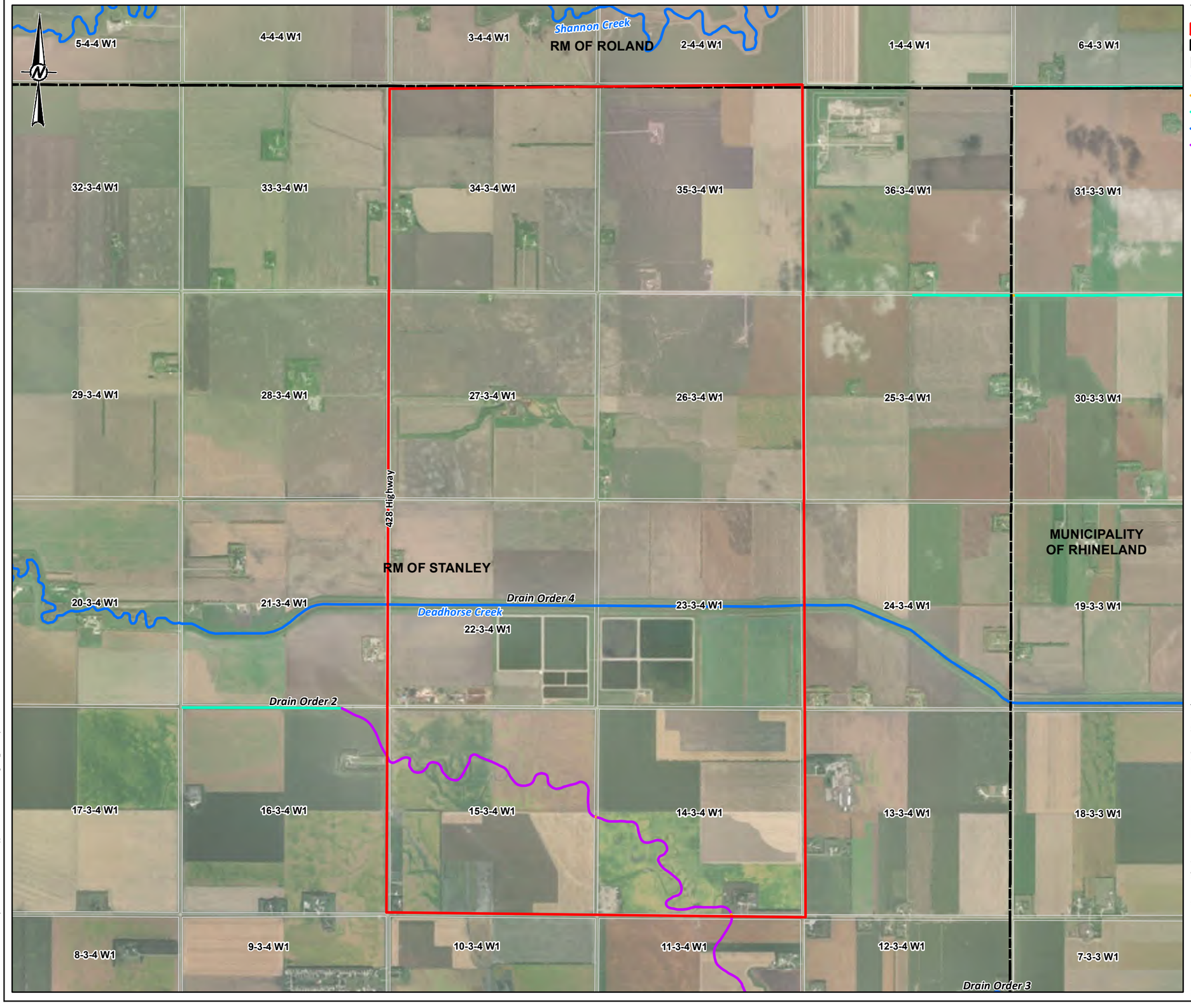
wsp

YYYY-MM-DD	2025-01-10
REPORT BY	D.KEAM
DRAWN BY	J.HECK
REVIEWED BY	D.KEAM
OFFICE	CALGARY

PROJECT NO.
CA0045899.2099

FIGURE
7

PATH: I:\WSP\ABC\Clients\Penn-co\City of Winkler Residuals Land Application\CA0045899.2099\Figure7_SurfaceTexture.mxd PRINTED ON: 2025-01-10 AT: 10:47:08 AM



LEGEND

- Local Study Area
- Municipal Boundary
- Manitoba Section Boundary

Water Ways

- Culvert (Roadway, Railway)
- Ditch
- River/Stream
- Stream Intermittent

0 500 1,000 1,500 2,000

1:30,000 Meters

Coordinate System: NAD 1983 UTM Zone 14N

REFERENCE(S)

1. DATA SOURCE: MANITOBA AGRIMAPS (HTTPS://AGRIMAPS.GOV.MB.CA/AGRIMAPS/)
2. IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS

CLIENT

PENN-CO CONSTRUCTION / CITY OF WINKLER

PROJECT

CITY OF WINKLER RESIDUALS LAND APPLICATION
NOTICE OF ALTERATION
NEAR WINKLER, MANITOBA

TITLE

WATER WAYS

CONSULTANT

wsp

YYYY-MM-DD	2025-01-10
REPORT BY	D.KEAM
DRAWN BY	J.HECK
REVIEWED BY	D.KEAM
OFFICE	CALGARY

PROJECT NO. CA0045899.2099

FIGURE 8

PATH: I:\WSP\ABC\tents\Penn-co\City of Winkler Residuals Land Application\CA0045899.2099\Figure8_Waterways.mxd PRINTED ON: 2025-01-10 AT: 11:00:56 AM

APPENDIX

C PUBLIC RESOURCES

APPENDIX

C-1 GWDRILL GROUNDWATER LOGS

GWDrill Database Well Search Results

Project: CA0045899.2099 NOA Biosolids Land Application, Winkler, MB
Site Location: 22 & 23-03-04WPM

Domestic Wells:	11
Test Wells:	0
Observation Wells:	0
Livestock Wells:	2

Well PID	UTM X (m)	UTM Y (m)	Year of Registration	Drill Date	Well Depth (m)	Aquifer	Well Use	Usage	Well Status	UTM X and Y Accuracy	Well Location	Contractor Name
9294	579646	5457223	1967	01-01-1967	130.759	nd and Gra	Test Well	Unknown	Unknown	Unknown	NW35-03-4W	Unknown
160855	578015	5456390	1900	01-01-1900	0	Unknown	Production	Domestic	Sealed	LKM-8KM] [Within	SW34-03-04W	Unknown
28381	578014	5456394	1976	23-10-1976	44.196	nd and Gra	Production	Domestic	Unknown	Unknown	SW34-03-04W	Portadrill Wells
178715	580474	5455587	1950	01-01-1950	2.44	Unknown	Production	Domestic	Sealed	50-350m] [Within	NE26-03-04W	Unknown
62183	577191	5455547	1988	09-08-1988	39.624	nd and Gra	Production	Livestock	Unknown	Unknown	NE28-03-04W	Echo Drilling Ltd.
38375	577191	5455547	1980	07-10-1980	64.008	Shale	Production	Domestic	Unknown	Unknown	NE28-03-04W	Watkins & Argue Well Drilling
26775	578847	5454766	1976	04-11-1976	60.35	nd and Gra	Production	Domestic	Unknown	Unknown	SE27-03-04W	Ransom Drilling Ltd.
65958	578847	5454766	1989	23-08-1989	60.96	nd and Gra	Production	Livestock	Unknown	Unknown	SE27-03-04W	Echo Drilling Ltd.
47562	577227	5453102	1983	21-10-1983	42.062	nd and Gra	Production	Domestic	Unknown	Unknown	SE21-03-04W	Watkins & Argue Well Drilling
65423	577227	5453102	1989	17-08-1989	29.261	nd and Gra	Production	Domestic	Unknown	Unknown	SE21-03-04W	Watkins & Argue Well Drilling
47561	577227	5453102	1983	17-10-1983	46.634	nd and Gra	Test Well	Unknown	Unknown	Unknown	SE21-03-04W	Watkins & Argue Well Drilling
47560	577227	5453102	1983	19-09-1983	59.436	Dry Well	Test Well	Unknown	Unknown	Unknown	SE21-03-04W	Watkins & Argue Well Drilling
9295	577227	5453102	1967	15-07-1967	40.843	nd and Gra	Production	Domestic	Unknown	Unknown	SE21-03-04W	Wall, Abram S
77551	579711	5453137	1993	25-10-1993	6.096	Other	Observation	Unknown	Unknown	Unknown	SW23-03-04W	Friesen Drillers Ltd.
77550	579711	5453137	1993	25-10-1993	6.096	Other	Observation	Unknown	Unknown	Unknown	SW23-03-04W	Friesen Drillers Ltd.
5247	576844	5451853	1964	18-01-1964	33.528	nd and Gra	Production	Domestic	Unknown	LKM-8KM] [Within	NW16-03-04W	Friesen Drillers Ltd.
26115	577733	5451190	1976	11-06-1976	53.375	nd and Gra	Production	Domestic	Active	1 Exact [<5m]	SW15-03-04W	Ransom Drilling Ltd.
78536	580537	5451507	1994	10-11-1994	55.169	nd and Gra	Production	Domestic	Unknown	Unknown	SW14-03-04W	Watkins & Argue Well Drilling

APPENDIX

C-2 *MANITOBA CONSERVATION DATA CENTRE*

Manitoba Conservation Data Centre Search Results
Request: D D Keam WSP 250107 Winkler EAP
Location: 30 quarter section between Winkler and Kane (List provided)

SEARCH CRITERIA	SITE	SCINAME	COMNAME	S_RANK	ESEA	SARA	COSEWIC	FIRSTOBS	LASTOBS	EO_RANK	REPACC
Within	14-003-04W1	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within	14-003-04W1	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within 2km radius of site boundary of	14-003-04W1	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 2km radius of site boundary of	14-003-04W1	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within 5km radius of site boundary of	14-003-04W1	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 5km radius of site boundary of	14-003-04W1	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	22-06-2010	22-06-2010	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	14-003-04W1	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within	15-003-04W1	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within	15-003-04W1	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within 2km radius of site boundary of	15-003-04W1	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 2km radius of site boundary of	15-003-04W1	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within 5km radius of site boundary of	15-003-04W1	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 5km radius of site boundary of	15-003-04W1	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	22-06-2010	22-06-2010	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	15-003-04W1	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within	26-004-03W1	No listed or tracked species occurrences found at this time									
Within 2km radius of site boundary of	26-004-03W1	Dolichonyx oryzivorus	Bobolink	S3S4B		Threatened	Special Concern	19-06-2011	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within 2km radius of site boundary of	26-004-03W1	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	13-06-2013	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	26-004-03W1	Dolichonyx oryzivorus	Bobolink	S3S4B		Threatened	Special Concern	19-06-2011	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	26-004-03W1	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	13-06-2013	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within	27-003-04W1	No listed or tracked species occurrences found at this time									
Within 2km radius of site boundary of	27-003-04W1	No listed or tracked species occurrences found at this time									
Within 5km radius of site boundary of	27-003-04W1	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 5km radius of site boundary of	27-003-04W1	Contopus virens	Eastern Wood-pewee	S3B		Special Concern	Special Concern	22-06-2010	22-06-2010		High
Within 5km radius of site boundary of	27-003-04W1	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	22-06-2010	22-06-2010	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	27-003-04W1	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within	34-004-03W1	No listed or tracked species occurrences found at this time									
Within 2km radius of site boundary of	34-004-03W1	No listed or tracked species occurrences found at this time									
Within 5km radius of site boundary of	34-004-03W1	Dolichonyx oryzivorus	Bobolink	S3S4B		Threatened	Special Concern	19-06-2011	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	34-004-03W1	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	13-06-2013	13-06-2013	E - Verified extant (viability not assessed)	Medium

Manitoba Conservation Data Centre Search Results
Request: D D Keam WSP 250107 Winkler EAP
Location: 30 quarter section between Winkler and Kane (List provided)

SEARCH CRITERIA	SITE	SCINAME	COMNAME	S_RANK	ESEA	SARA	COSEWIC	FIRSTOBS	LASTOBS	EO_RANK	REPACC
Within	35-004-03W1	No listed or tracked species occurrences found at this time									
Within 2km radius of site boundary of	35-004-03W1	Dolichonyx oryzivorus	Bobolink	S3S4B		Threatened	Special Concern	19-06-2011	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within 2km radius of site boundary of	35-004-03W1	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	13-06-2013	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	35-004-03W1	Dolichonyx oryzivorus	Bobolink	S3S4B		Threatened	Special Concern	19-06-2011	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	35-004-03W1	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	13-06-2013	13-06-2013	E - Verified extant (viability not assessed)	Medium
Within	NWNESE-23-003	No listed or tracked species occurrences found at this time									
Within 2km radius of site boundary of	NWNESE-23-003	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 2km radius of site boundary of	NWNESE-23-003	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within 5km radius of site boundary of	NWNESE-23-003	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 5km radius of site boundary of	NWNESE-23-003	Contopus virens	Eastern Wood-pewee	S3B		Special Concern	Special Concern	22-06-2010	22-06-2010		High
Within 5km radius of site boundary of	NWNESE-23-003	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	22-06-2010	22-06-2010	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	NWNESE-23-003	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within	NWNESW-22-00	No listed or tracked species occurrences found at this time									
Within 2km radius of site boundary of	NWNESW-22-00	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 2km radius of site boundary of	NWNESW-22-00	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low
Within 5km radius of site boundary of	NWNESW-22-00	Bombus terricola	Yellow-banded Bumble Bee	S3S5		Special Concern	Special Concern	09-08-1951	09-08-1951	H - Historical	Very Low
Within 5km radius of site boundary of	NWNESW-22-00	Contopus virens	Eastern Wood-pewee	S3B		Special Concern	Special Concern	22-06-2010	22-06-2010		High
Within 5km radius of site boundary of	NWNESW-22-00	Hirundo rustica	Barn Swallow	S4B		Threatened	Special Concern	22-06-2010	22-06-2010	E - Verified extant (viability not assessed)	Medium
Within 5km radius of site boundary of	NWNESW-22-00	Parietaria pensylvanica	American Pellitory	S3S4				03-07-1953	03-07-1953	H - Historical	Very Low

APPENDIX

C-3 CANADA LAND INVENTORY

CANADA LAND INVENTORY

The class descriptions are as follows:

- Class 1 – Soils in this class have no significant limitations in use when used for irrigation with a fine sandy loam to clay loam texture. The soils have good water retention capacity, good permeability, low salt content, good drainage and satisfactory gradient of land.
- Class 2 – Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices. The soils are deep and hold moisture well. The limitations are moderate, and the soils can be managed and cropped with little difficulty. Under good management, they are moderately high to high in productivity for a fairly wide range of crops.
- Class 3 – Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices. The limitations are more restrictive that affect timing and ease of tillage, planting and harvesting, and the choice of crops and maintenance of conservation practices. One or more of the following limitations may include: moderate climatic limitation, erosion, structure, permeability, low fertility, topography, overflow, wetness, low water holding capacity or slowness in release of water of plants, stoniness, and depth of soil to consolidated bedrock. Under good management, they are fair to moderately high in productivity for a wide range of field crops.

The subclass descriptions are as follows: M, E, W, and I.

- “M” – Moisture Limitations - this consists of soils where crops are affected by drought owing to inherent soil characteristics. These soils usually have low water-holding capacity.
- “E” – Erosion - this subclass includes soils where damage from erosion is a limitation to agricultural use. Damage is assessed on loss of productivity and on the difficulties in farming land with gullies.
- “W” – Excess Water – this subclass includes soils where excess water other than brought about by inundation is a limitation to agricultural use. Excess water may result from inadequate soil drainage, a high-water table, seepage or from runoff from surrounding areas.
- “I” - Inundation by streams or lakes - this subclass includes soils subjected to inundation causing crop damage or restricting agricultural use.

APPENDIX

D TABLES

Table D.1 - Plant Available Nutrients (N,P,K,S), Physical Tests, Organic and Inorganic Carbon and Salinity Sample Results for Cell 1 Winkler, MB (May 27, 2024)

Analyte	Units	Detection Limit	Sample ID
			Cell 1
Physical Tests			
Moisture	%	0.25	85
pH (1:2 soil:water)		0.1	7.14
Nutrients			
Nitrogen, total	%	0.02	1.63
Total Kjeldahl Nitrogen	%	0.02	1.99
Ammonium, available (as N)	mg kg^{-1}	1.0	1530
Nitrite, available (as N)	mg kg^{-1}	0.4	<1.96
Phosphate, available (as P)	mg kg^{-1}	1.0	111
Potassium, available	mg kg^{-1}	20.0	
Sulfate, available (as S)	mg kg^{-1}	3.0	
Organic / Inorganic Carbon			
Carbon, total	%	0.05	
Carbon, inorganic	%	0.05	
Carbon, inorganic, ($CaCO_3$ equivalent)	%	0.4	
Carbon, total organic	%	0.05	
Organic Matter (loss on ignition)	%	0.1	39.7
Salinity			
Conductivity (1:2 leachate)	mS cm^{-1}	0.01	3.44
Calcium, soluble Ion content	mg L^{-1}	0.5	
Magnesium, soluble ion content	mg L^{-1}	0.5	
Sodium, soluble ion content	mg L^{-1}	0.5	
Sodium adsoption ratio (SAR)	mg L^{-1}	0.1	

Please refer to the ALS Certificate of Analysis for result qualifiers detected.

Table D.2 - Residuals Trace Elements (Metals) Sample Results for Aeration Cell, Winkler, MB (May 27, 2024)

Analyte	Units	Detection Limit	Sample ID
			Aeration Cell
Metals			
Aluminum	mg kg^{-1}	50.0	9900
Antimony	mg kg^{-1}	0.1	1.05
Arsenic	mg kg^{-1}	0.1	15.8
Barium	mg kg^{-1}	0.5	177
Beryllium	mg kg^{-1}	0.1	0.59
Bismuth	mg kg^{-1}	0.2	5.68
Boron	mg kg^{-1}	5.0	30
Cadmium	mg kg^{-1}	0.02	0.895
Calcium	mg kg^{-1}	50.0	29200
Chromium	mg kg^{-1}	0.5	33.6
Cobalt	mg kg^{-1}	0.1	7.1
Copper	mg kg^{-1}	0.5	179
Iron	mg kg^{-1}	50.0	19900
Lead	mg kg^{-1}	0.5	11.9
Lithium	mg kg^{-1}	2.0	10.8
Magnesium	mg kg^{-1}	20.0	10800
Manganese	mg kg^{-1}	1.0	346
Mercury	mg kg^{-1}	0.005	0.11
Molybdenum	mg kg^{-1}	0.1	27.5
Nickel	mg kg^{-1}	0.5	28.8
Phosphorus	mg kg^{-1}	50.0	3020
Potassium	mg kg^{-1}	100.0	2920
Selenium	mg kg^{-1}	0.2	3.43
Silver	mg kg^{-1}	0.1	0.54
Sodium	mg kg^{-1}	50.0	1950
Strontium	mg kg^{-1}	0.5	95.1
Sulfur	mg kg^{-1}	1000	9100
Thallium	mg kg^{-1}	0.05	0.231
Tin	mg kg^{-1}	2.0	6.4
Titanium	mg kg^{-1}	1.0	87.3
Tungsten	mg kg^{-1}	0.5	0.57
Uranium	mg kg^{-1}	0.05	9.58
Vanadium	mg kg^{-1}	0.2	39.9
Zinc	mg kg^{-1}	2.0	370
Zironium	mg kg^{-1}	1.00	4.0

Please refer to the ALS Certificate of Analysis for result qualifiers detected.

Table D.3 Estimated Residual Land Application Parameters, Winkler, MB

			Sample ID
Parameter Name	**Parameter Description**	**Unit**	**Cell 1**
Estimated Biosolid Volume + 15% Contingency	In-field	m^3	31,700
Specific Gravity - Estimated		$g\ cm^{-1}$	1.00
Estimated Biosolids		tonnes	31,700
Dry tonnes biosolids available (=wet tonnes x %solids)	Dried Basis	tonnes	1,030
Moisture	As Received	**%**	85.0
Total Solids (Assumed Average)	As Received	**%**	3.25
Organic Matter	Dry Basis	%	39.7
Inorganic Content	Dry Basis	%	
Total Organic Carbon	Dry Basis	%	
C:N Ratio	Dry Basis	x:1	-
C:P Ratio	Dry Basis	x:1	-
N:P Ratio	Dry Basis	x:1	6.59
pH	Saturated Paste		7.41
Total Kjeldahl N	Dried Basis	%	1.99
	Dried Basis	$mg\ kg^{-1}$	19,900
	Dried Basis	$kg\ Tonne^{-1}$	19.9
Ammonium - N (NH4-N)	Dried Basis	$mg\ kg^{-1}$	1530
	Dried Basis	$kg\ Tonne^{-1}$	1.53
Available Nitrate-N	Dried Basis	$mg\ kg^{-1}$	-
Available Nitrate-N		$kg\ Tonne^{-1}$	-
Total Phosphorous	Dried Basis	$mg\ kg^{-1}$	3020

Amount of Biosolids Nutrient Available to Crop

Total Organic N (=TKN - Ammonium N)	Dried Basis	$mg\ kg^{-1}$	18,370
Organic N	Dried Basis	$kg\ Tonne^{-1}$	18.4
Method of Application:			Injected
Anticipated Weather			Cool/dry
Anticipated Volatilization (%)	within 1 day		0.0
Available Organic N (@ 25%)	Dried Basis	$kg\ Tonne^{-1}$	4.6
Ammonium-nitrogen Available	Dried Basis	$kg\ Tonne^{-2}$	1.53
Plant Available Nitrogen (PAN) (Year 1)	Dried Basis	$kg\ Tonne^{-1}$	6.1
PAN Year 2 (@12% mineralization)	Dried Basis	$kg\ Tonne^{-1}$	2.2
PAN Year 3 (@6% mineralization)	Dried Basis	$kg\ Tonne^{-1}$	1.1
Phosphorous	Dried Basis	$kg\ Tonne^{-1}$	3.02
$P_2O_{5\ equivalent}$	Dried Basis	$kg\ Tonne^{-1}$	6.95
Total Available P_2O_5 (@50% available)	Dried Basis	$kg\ Tonne^{-1}$	3.47

Table D.3 Estimated Residual Land Application Parameters, Winkler, MB

Application Rate based on Nitrogen			
Nitrogen Based Application Rate	Dried Basis	tonnes ha^{-1}	34
Amount of Available P2O5 applied	Dried Basis	kg ha^{-1}	119
P_2O_5 Application check		%	235
Land Area Required		Hectares	30
		Acres	75
Application Rate based on Phosphorous (1xCR)			
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	15
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	89
		lb ac^{-1}	79
Additional Nitrogen required		kg ha^{-1}	68
		lb ac-1	60
Land Area Required		Hectares	71
		Acres	175
Application Rate based on Phosphorous (2xCR)			
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	29
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	133
Additional Nitrogen required		kg ha^{-1}	24
Land Area Required		Hectares	35
		Acres	88
Application Rate based on Phosphorus (3x CR)			
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	44
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	200
Additional Nitrogen required		kg ha^{-1}	- 43
Land Area Required		Hectares	24
		Acres	58

Cropping Assumptions		
2025	Canola	
2025 Target Yield:	45 bu/ac	
	lb/ac	kg/ha
Estimated Target Nitrogen Total:	140	157
Estimated Fertilizer Phosphate (P2O5) Target:	45	50
1 x P2O5 Crop Removal @ target Yield:	45	50
2 x P2O5 Crop Removal @ target Yield:	90	101
3 x P2O5 Crop Removal @ target Yield:	135	151

Notes:

Available Ammonium N - Volatilization loss associated with different application methods (0% with Injection)

Organic N - TKN - Ammonium N

Available Organic N - Organic N x 0.20 year 1 (Ross and Racz, 2003)

Mineralization of Year 2 = 12%, Year 3 = 6%

Plant Available Nitrogen= (NO3-N)+Volatilization factor (NH4-N)+Organic N Mineralization

Estimated P2O5 Available based on 25% of total Phosphorus as directed by MSD.

Note: the biosolids are FeCl treated and fixes the majority of the total P.

Soil Phosphorous Olsen method.

Table D.4 Cell 1 Trace Element Sample Results (2024), Mean Soil Series Trace Elements and Cumulative Metal Concentrations Based on Land Application Loading Rate

Trace Element	Sample ID	Cell 1		Soil Series (Mean Trace Elements by Soil Series)**						Soil Trace Elements	Aeration Cell Loading Rate		Cumulative Weight Allowed by Guideline[1]		Applications Events Permitted before meeting applied Criteria based on Average Metal Concentrations
				Reinland		Gnadenthal		Graysville		Mean	Application Rate (T ha^{-1} [dry])	Cumulative Metal Concentration			
	Detection Limit	mg kg^{-1}	kg tonne^{-1}	mg kg^{-1}	kg ha^{-1}	mg kg^{-1}	kg ha^{-1}	mg kg^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	mg kg^{-1}	kg ha^{-1}	Count
Arsenic (As)	0.1	15.8	0.016	-	-	7.0	12.6	20.0	36	48.6	0.459	36.46	12.0	21.6	47
Cadmium (Cd)	0.02	0.89	0.001	0.1	0.18	0.2	0.36	0.2	0.36	0.900	0.026	0.39	1.4	2.5	98
Chromium (Cr)	1	33.6	0.034	-	-	41.0	73.8	70.0	126	199.8	0.975	126.98	64.0	115.2	118
Copper (Cu)	1	179	0.179	10.0	18	19.0	34.2	27.0	48.6	100.8	5.195	53.80	63.0	113.4	22
Lead (Pb)	0.2	11.9	0.012	16.0	28.8	16.0	28.8	13.0	23.4	81.0	0.345	23.75	70.0	126	365
Mercury (Hg)	0.05	0.11	0.000	25.0	45	32.0	57.6	60.0	108	210.6	0.003	108.00	6.6	11.9	3721
Nickel (Ni)	0.5	28.8	0.029	14.0	25.2	18.0	32.4	39.0	70.2	127.8	0.836	71.04	50.0	90	108
Zinc (Zn)	10	370	0.370	39.0	70.2	84.0	151.2	123.0	221.4	442.8	10.739	232.14	200.0	360	34

Notes:

[1] Cumulative Weight Allowed by Guideline includes the metals in soils.

* Detection Limit adjusted due to sample matrix effects.

** Mean Trace Elements by Soil Series Source: P. Haluschak, R.G.Eilers, G.F. Mills and S. Grift. 1998. Status of Selected Trace Elements in Agricultural Soils of Southern Manitoba. Technical Report 1998-6E Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada.

Arsenic (As)

Soil Bulk Density	1,200	kg/m^3
Sample Depth	0.15	m
Hectare	10,000	m^2/ha
Soil Mass	1,000,000	mg/kg
Land Application Rate:	29	

Copper sample calculation for soil concentraiton (kg/ha):

= (Copper mg/kg) x (Bulk Density x Sample Depth x hectare) / (Soil Mass)

Table D.3 Estimated Residual Land Application Parameters, Winkler, MB

			Sample ID
Parameter Name	**Parameter Description**	**Unit**	**Cell 1**
Estimated Biosolid Volume + 15% Contingency	In-field	m^3	31,700
Specific Gravity - Estimated		$g\ cm^{-1}$	1.00
Estimated Biosolids		tonnes	31,700
Dry tonnes biosolids available (=wet tonnes x %solids)	Dried Basis	tonnes	1,030
Moisture	As Received	**%**	85.0
Total Solids (Assumed Average)	As Received	**%**	3.25
Organic Matter	Dry Basis	%	39.7
Inorganic Content	Dry Basis	%	
Total Organic Carbon	Dry Basis	%	
C:N Ratio	Dry Basis	x:1	-
C:P Ratio	Dry Basis	x:1	-
N:P Ratio	Dry Basis	x:1	6.59
pH	Saturated Paste		7.41
Total Kjeldahl N	Dried Basis	%	1.99
	Dried Basis	$mg\ kg^{-1}$	19,900
	Dried Basis	$kg\ Tonne^{-1}$	19.9
Ammonium - N (NH4-N)	Dried Basis	$mg\ kg^{-1}$	1530
	Dried Basis	$kg\ Tonne^{-1}$	1.53
Available Nitrate-N	Dried Basis	$mg\ kg^{-1}$	-
Available Nitrate-N		$kg\ Tonne^{-1}$	-
Total Phosphorous	Dried Basis	$mg\ kg^{-1}$	3020

Amount of Biosolids Nutrient Available to Crop

Total Organic N (=TKN - Ammonium N)	Dried Basis	$mg\ kg^{-1}$	18,370
Organic N	Dried Basis	$kg\ Tonne^{-1}$	18.4
Method of Application:			Injected
Anticipated Weather			Cool/dry
Anticipated Volatilization (%)	within 1 day		0.0
Available Organic N (@ 25%)	Dried Basis	$kg\ Tonne^{-1}$	4.6
Ammonium-nitrogen Available	Dried Basis	$kg\ Tonne^{-2}$	1.53
Plant Available Nitrogen (PAN) (Year 1)	Dried Basis	$kg\ Tonne^{-1}$	6.1
PAN Year 2 (@12% mineralization)	Dried Basis	$kg\ Tonne^{-1}$	2.2
PAN Year 3 (@6% mineralization)	Dried Basis	$kg\ Tonne^{-1}$	1.1
Phosphorous	Dried Basis	$kg\ Tonne^{-1}$	3.02
$P_2O_{5\ equivalent}$	Dried Basis	$kg\ Tonne^{-1}$	6.95
Total Available P_2O_5 (@50% available)	Dried Basis	$kg\ Tonne^{-1}$	3.47

Table D.3 Estimated Residual Land Application Parameters, Winkler, MB

Application Rate based on Nitrogen			
Nitrogen Based Application Rate	Dried Basis	tonnes ha^{-1}	34
Amount of Available P2O5 applied	Dried Basis	kg ha^{-1}	119
P_2O_5 Application check		%	235
Land Area Required		Hectares	30
		Acres	75
Application Rate based on Phosphorous (1xCR)			
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	15
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	89
		lb ac^{-1}	79
Additional Nitrogen required		kg ha^{-1}	68
		lb ac-1	60
Land Area Required		Hectares	71
		Acres	175
Application Rate based on Phosphorous (2xCR)			
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	29
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	133
Additional Nitrogen required		kg ha^{-1}	24
Land Area Required		Hectares	35
		Acres	88
Application Rate based on Phosphorus (3x CR)			
Total Phosphorus Based Application Rate	Dried Basis	tonnes ha^{-1}	44
Amount of Nitrogen applied	Dried Basis	kg ha^{-1}	200
Additional Nitrogen required		kg ha^{-1}	- 43
Land Area Required		Hectares	24
		Acres	58

Cropping Assumptions		
2025	Canola	
2025 Target Yield:	45 bu/ac	
	lb/ac	kg/ha
Estimated Target Nitrogen Total:	140	157
Estimated Fertilizer Phosphate (P2O5) Target:	45	50
1 x P2O5 Crop Removal @ target Yield:	45	50
2 x P2O5 Crop Removal @ target Yield:	90	101
3 x P2O5 Crop Removal @ target Yield:	135	151

Notes:

Available Ammonium N - Volatilization loss associated with different application methods (0% with Injection)

Organic N - TKN - Ammonium N

Available Organic N - Organic N x 0.20 year 1 (Ross and Racz, 2003)

Mineralization of Year 2 = 12%, Year 3 = 6%

Plant Available Nitrogen= (NO3-N)+Volatilization factor (NH4-N)+Organic N Mineralization

Estimated P2O5 Available based on 25% of total Phosphorus as directed by MSD.

Note: the biosolids are FeCl treated and fixes the majority of the total P.

Soil Phosphorous Olsen method.

Table D.4 Cell 1 Trace Element Sample Results (2024), Mean Soil Series Trace Elements and Cumulative Metal Concentrations Based on Land Application Loading Rate

Trace Element	Sample ID	Cell 1		Soil Series (Mean Trace Elements by Soil Series)**						Soil Trace Elements	Aeration Cell Loading Rate		Cumulative Weight Allowed by Guideline[1]		Applications Events Permitted before meeting applied Criteria based on Average Metal Concentrations
				Reinland		Gnadenthal		Graysville		Mean	Application Rate (T ha^{-1} [dry])	Cumulative Metal Concentration			
	Detection Limit	mg kg^{-1}	kg tonne^{-1}	mg kg^{-1}	kg ha^{-1}	mg kg^{-1}	kg ha^{-1}	mg kg^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	kg ha^{-1}	mg kg^{-1}	kg ha^{-1}	Count
Arsenic (As)	0.1	15.8	0.016	-	-	7.0	12.6	20.0	36	48.6	0.459	36.46	12.0	21.6	47
Cadmium (Cd)	0.02	0.89	0.001	0.1	0.18	0.2	0.36	0.2	0.36	0.900	0.026	0.39	1.4	2.5	98
Chromium (Cr)	1	33.6	0.034	-	-	41.0	73.8	70.0	126	199.8	0.975	126.98	64.0	115.2	118
Copper (Cu)	1	179	0.179	10.0	18	19.0	34.2	27.0	48.6	100.8	5.195	53.80	63.0	113.4	22
Lead (Pb)	0.2	11.9	0.012	16.0	28.8	16.0	28.8	13.0	23.4	81.0	0.345	23.75	70.0	126	365
Mercury (Hg)	0.05	0.11	0.000	25.0	45	32.0	57.6	60.0	108	210.6	0.003	108.00	6.6	11.9	3721
Nickel (Ni)	0.5	28.8	0.029	14.0	25.2	18.0	32.4	39.0	70.2	127.8	0.836	71.04	50.0	90	108
Zinc (Zn)	10	370	0.370	39.0	70.2	84.0	151.2	123.0	221.4	442.8	10.739	232.14	200.0	360	34

Notes:

[1] Cumulative Weight Allowed by Guideline includes the metals in soils.

* Detection Limit adjusted due to sample matrix effects.

** Mean Trace Elements by Soil Series Source: P. Haluschak, R.G.Eilers, G.F. Mills and S. Grift. 1998. Status of Selected Trace Elements in Agricultural Soils of Southern Manitoba. Technical Report 1998-6E Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada.

Arsenic (As)

Soil Bulk Density	1,200	kg/m^3
Sample Depth	0.15	m
Hectare	10,000	m^2/ha
Soil Mass	1,000,000	mg/kg
Land Application Rate:	29	

Copper sample calculation for soil concentraiton (kg/ha):

= (Copper mg/kg) x (Bulk Density x Sample Depth x hectare) / (Soil Mass)

APPENDIX

E CERTIFICATE OF ANALYSIS

ALS Canada Ltd.

CERTIFICATE OF ANALYSIS

Work Order	: **WP2413268**	Page	: 1 of 5
Client	: **Penn-Co Construction Canada (2003) Ltd.**	Laboratory	: ALS Environmental - Winnipeg
Contact	: Jonah Keith	Account Manager	: Janani Mudiyanselage
Address	: 1A Langill Way Steinbach MB Canada R5G 2T1	Address	: 1329 Niakwa Road East, Unit 12 Winnipeg MB Canada R2J 3T4
Telephone	: 204 326 1341	Telephone	: +1 204 255 9720
Project	: 202467 CITY OF WINKLER - LAGOON SLUDGE	Date Samples Received	: 27-May-2024 15:34
PO	: 202467-240527-MYZ	Date Analysis Commenced	: 30-May-2024
C-O-C number	: ----	Issue Date	: 10-Jun-2024 16:29
Sampler	: ----		
Site	: ----		
Quote number	: 202467 City of Winkler Lagoon Sludge		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Laboratory Supervisor	Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Laboratory Supervisor	Sask Soils, Saskatoon, Saskatchewan
Jeremy Greuel	Laboratory Assistant	Sask Soils, Saskatoon, Saskatchewan
Justin Kuzek	Team Leader - Organics	Organics, Saskatoon, Saskatchewan
Maria Painchaud	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan
Milad Khani	Laboratory Analyst	Metals, Saskatoon, Saskatchewan
Milad Khani	Laboratory Analyst	Sask Soils, Saskatoon, Saskatchewan
Nancy Cruse	Laboratory Assistant	Sask Soils, Saskatoon, Saskatchewan

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
°C	degrees celsius
mg/kg	milligrams per kilogram
mS/cm	millisiemens per centimetre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
FR5	*As per applicable reference method(s), soil:water ratio for Fixed Ratio Leach was modified to 1:5 due to high soil organic content*

Analytical Results

Sub-Matrix: **Sludge**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: SLUDGE SAMPLE #1	----	----	----	----
					Client sampling date / time: 27-May-2024 08:15	----	----	----	----
					WP2413268-001	--------	--------	--------	--------
					Result	----	----	----	----
Sample Preparation									
Temperature, oven	----	EPP441/SK	1	°C	<38	----	----	----	----
Physical Tests									
Conductivity (1:2 leachate)	----	E100/SK	0.010	mS/cm	3.44 FR5	----	----	----	----
Loss on ignition @ 550°C	----	E205D/SK	1.0	%	39.7	----	----	----	----
Moisture	----	E144/SK	0.25	%	85.0	----	----	----	----
pH (1:2 soil:water)	----	E108/SK	0.10	pH units	7.14 FR5	----	----	----	----
Ash content @ 550°C	----	E205D/SK	1.0	%	60.3	----	----	----	----
Anions and Nutrients									
Nitrogen, total	7727-37-9	E366/SK	0.020	%	1.63	----	----	----	----
Nitrogen, total organic	----	EC363/SK	0.020	%	1.84	----	----	----	----
Plant Available Nutrients									
Ammonium, available (as N)	14798-03-9	E312A/SK	1.0	mg/kg	1530	----	----	----	----
Nitrate + Nitrite, available (as N)	----	E269.N+N/SK	1.0	mg/kg	<4.9 DLM	----	----	----	----
Nitrite, available (as N)	14797-65-0	E269.NO2/SK	0.40	mg/kg	<1.96 DLM	----	----	----	----
Phosphate, available (as P)	14265-44-2	E385/SK	1.0	mg/kg	111	----	----	----	----
Nitrate, available (as N)	14797-55-8	EC269.NO3/SK	2.0	mg/kg	<4.9	----	----	----	----
Metals									
Aluminum	7429-90-5	E440/SK	50	mg/kg	9900	----	----	----	----
Antimony	7440-36-0	E440/SK	0.10	mg/kg	1.05	----	----	----	----
Arsenic	7440-38-2	E440/SK	0.10	mg/kg	15.8	----	----	----	----
Barium	7440-39-3	E440/SK	0.50	mg/kg	177	----	----	----	----
Beryllium	7440-41-7	E440/SK	0.10	mg/kg	0.59	----	----	----	----
Bismuth	7440-69-9	E440/SK	0.20	mg/kg	5.68	----	----	----	----
Boron	7440-42-8	E440/SK	5.0	mg/kg	30.0	----	----	----	----
Cadmium	7440-43-9	E440/SK	0.020	mg/kg	0.890	----	----	----	----
Calcium	7440-70-2	E440/SK	50	mg/kg	29200	----	----	----	----
Chromium	7440-47-3	E440/SK	0.50	mg/kg	33.6	----	----	----	----
Cobalt	7440-48-4	E440/SK	0.10	mg/kg	7.10	----	----	----	----

Analytical Results

Sub-Matrix: Sludge (Matrix: Soil/Solid)					Client sample ID	SLUDGE SAMPLE #1	----	----	----	----
					Client sampling date / time	27-May-2024 08:15	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		WP2413268-001	--------	--------	--------	--------
						Result	----	----	----	----
Metals										
Copper	7440-50-8	E440/SK	0.50	mg/kg		179	----	----	----	----
Iron	7439-89-6	E440/SK	50	mg/kg		19900	----	----	----	----
Lead	7439-92-1	E440/SK	0.50	mg/kg		11.9	----	----	----	----
Lithium	7439-93-2	E440/SK	2.0	mg/kg		10.8	----	----	----	----
Magnesium	7439-95-4	E440/SK	20	mg/kg		10800	----	----	----	----
Manganese	7439-96-5	E440/SK	1.0	mg/kg		346	----	----	----	----
Mercury	7439-97-6	E510/SK	0.0050	mg/kg		0.110	----	----	----	----
Molybdenum	7439-98-7	E440/SK	0.10	mg/kg		27.5	----	----	----	----
Nickel	7440-02-0	E440/SK	0.50	mg/kg		28.8	----	----	----	----
Phosphorus	7723-14-0	E440/SK	50	mg/kg		3020	----	----	----	----
Potassium	7440-09-7	E440/SK	100	mg/kg		2920	----	----	----	----
Selenium	7782-49-2	E440/SK	0.20	mg/kg		3.43	----	----	----	----
Silver	7440-22-4	E440/SK	0.10	mg/kg		0.54	----	----	----	----
Sodium	7440-23-5	E440/SK	50	mg/kg		1950	----	----	----	----
Strontium	7440-24-6	E440/SK	0.50	mg/kg		95.1	----	----	----	----
Sulfur	7704-34-9	E440/SK	1000	mg/kg		9100	----	----	----	----
Thallium	7440-28-0	E440/SK	0.050	mg/kg		0.231	----	----	----	----
Tin	7440-31-5	E440/SK	2.0	mg/kg		6.4	----	----	----	----
Titanium	7440-32-6	E440/SK	1.0	mg/kg		87.3	----	----	----	----
Tungsten	7440-33-7	E440/SK	0.50	mg/kg		0.57	----	----	----	----
Uranium	7440-61-1	E440/SK	0.050	mg/kg		9.58	----	----	----	----
Vanadium	7440-62-2	E440/SK	0.20	mg/kg		39.9	----	----	----	----
Zinc	7440-66-6	E440/SK	2.0	mg/kg		370	----	----	----	----
Zirconium	7440-67-7	E440/SK	1.0	mg/kg		4.0	----	----	----	----
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319/SK	0.020	%		1.99	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WP2413268**	Page	: 1 of 10
Client	: **Penn-Co Construction Canada (2003) Ltd.**	Laboratory	: ALS Environmental - Winnipeg
Contact	: Jonah Keith	Account Manager	: Janani Mudiyanselage
Address	: 1A Langill Way Steinbach MB Canada R5G 2T1	Address	: 1329 Niakwa Road East, Unit 12 Winnipeg, Manitoba Canada R2J 3T4
Telephone	: 204 326 1341	Telephone	: +1 204 255 9720
Project	: 202467 CITY OF WINKLER - LAGOON SLUDGE	Date Samples Received	: 27-May-2024 15:34
PO	: 202467-240527-MYZ	Issue Date	: 10-Jun-2024 16:28
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: 202467 City of Winkler Lagoon Sludge		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	Boron	7440-42-8	E440	30.9 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	Chromium	7440-47-3	E440	48.4 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	Nickel	7440-02-0	E440	33.5 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	Mercury	7439-97-6	E510	70.1 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E366	27-May-2024	03-Jun-2024	28 days	7 days	✓	03-Jun-2024	28 days	7 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E319	27-May-2024	03-Jun-2024	365 days	7 days	✓	04-Jun-2024	365 days	8 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E510	27-May-2024	04-Jun-2024	28 days	8 days	✓	04-Jun-2024	28 days	8 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E440	27-May-2024	04-Jun-2024	180 days	8 days	✓	04-Jun-2024	180 days	8 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E100	27-May-2024	03-Jun-2024	30 days	7 days	✓	03-Jun-2024	30 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E205D	27-May-2024	----	----	----		01-Jun-2024	365 days	5 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E144	27-May-2024	----	----	----		30-May-2024	----	3 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E108	27-May-2024	03-Jun-2024	30 days	7 days	✓	03-Jun-2024	30 days	7 days	✓
Plant Available Nutrients : Available Ammonium by Colourimetry (2N Potassium Chloride Ext.)										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E312A	27-May-2024	31-May-2024	----	----		31-May-2024	0 days	0 days	✓
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E269.N+N	27-May-2024	03-Jun-2024	180 days	7 days	✓	03-Jun-2024	3 days	0 days	✓
Plant Available Nutrients : Available Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E269.NO2	27-May-2024	03-Jun-2024	180 days	7 days	✓	03-Jun-2024	3 days	0 days	✓
Plant Available Nutrients : Available Phosphorus by Colourimetry (Olsen)										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	E385	27-May-2024	04-Jun-2024	----	----		04-Jun-2024	0 days	0 days	✓
Sample Preparation : Dry and Grind in Soil/Solid <38°C										
Glass soil jar/Teflon lined cap										
SLUDGE SAMPLE #1	EPP441	27-May-2024	30-May-2024	----	----		----	3 days	3 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Available Ammonium by Colourimetry (2N Potassium Chloride Ext.)	E312A	1467590	1	2	50.0	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	1471303	1	19	5.2	5.0	✓
Available Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.NO2	1471302	1	7	14.2	5.0	✓
Available Phosphorus by Colourimetry (Olsen)	E385	1471419	1	7	14.2	5.0	✓
Conductivity in Soil (1:2 Soil:Water Extraction)	E100	1467661	1	3	33.3	5.0	✓
Loss On Ignition (550°C)	E205D	1471422	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	1474554	1	6	16.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	1474555	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	1467817	1	4	25.0	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	1467660	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	1472886	1	13	7.6	5.0	✓
Total Nitrogen by Combustion	E366	1472622	1	1	100.0	5.0	✓
Laboratory Control Samples (LCS)							
Available Ammonium by Colourimetry (2N Potassium Chloride Ext.)	E312A	1467590	2	2	100.0	10.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	1471303	2	19	10.5	10.0	✓
Available Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.NO2	1471302	2	7	28.5	10.0	✓
Available Phosphorus by Colourimetry (Olsen)	E385	1471419	2	7	28.5	10.0	✓
Conductivity in Soil (1:2 Soil:Water Extraction)	E100	1467661	2	3	66.6	10.0	✓
Loss On Ignition (550°C)	E205D	1471422	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	1474554	2	6	33.3	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	1474555	2	20	10.0	10.0	✓
Moisture Content by Gravimetry	E144	1467817	1	4	25.0	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	1467660	2	20	10.0	10.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	1472886	2	13	15.3	10.0	✓
Total Nitrogen by Combustion	E366	1472622	2	1	200.0	10.0	✓
Method Blanks (MB)							
Available Ammonium by Colourimetry (2N Potassium Chloride Ext.)	E312A	1467590	1	2	50.0	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	1471303	1	19	5.2	5.0	✓
Available Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.NO2	1471302	1	7	14.2	5.0	✓
Available Phosphorus by Colourimetry (Olsen)	E385	1471419	1	7	14.2	5.0	✓
Conductivity in Soil (1:2 Soil:Water Extraction)	E100	1467661	1	3	33.3	5.0	✓
Loss On Ignition (550°C)	E205D	1471422	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	1474554	1	6	16.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	1474555	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	1467817	1	4	25.0	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Total Kjeldahl Nitrogen by Colourimetry	E319	1472886	1	13	7.6	5.0	✓
Total Nitrogen by Combustion	E366	1472622	1	1	100.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction)	E100 ALS Environmental - Saskatoon	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:Water Extraction)	E108 ALS Environmental - Saskatoon	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 ALS Environmental - Saskatoon	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Loss On Ignition (550°C)	E205D ALS Environmental - Saskatoon	Soil/Solid	CSSS (2008) 28.3 (mod)	Loss On Ignition (LOI) is determined by drying a portion of an air dried and ground sample at 105°C overnight, then igniting at 550°C for 16-20 hours. The weight loss after ignition is reported as % loss on ignition. LOI is reported on a dry weight basis. LOI at 550°C can be used as an estimation of Organic Matter (CSSS 2008).
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N ALS Environmental - Saskatoon	Soil/Solid	Alberta Agriculture/APHA 4500-NO3 I (mod)	Plant available nitrate and nitrite are analyzed by colourimetry using a flow injection analyzer on a soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Available Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.NO2 ALS Environmental - Saskatoon	Soil/Solid	Alberta Agriculture/APHA 4500-NO2 B (mod)	Plant available nitrite is analyzed by colourimetry using a flow injection analyzer on a soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Available Ammonium by Colourimetry (2N Potassium Chloride Ext.)	E312A ALS Environmental - Saskatoon	Soil/Solid	CSSS (2008) 6.2/Comm Soil Sci 19(6) (mod)	Plant available ammonium is analyzed by colourimetry on a soil sample extract that has been extracted using 2N Potassium Chloride, then shaken well and filtered prior to analysis.
Total Kjeldahl Nitrogen by Colourimetry	E319 ALS Environmental - Saskatoon	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colourimetrically at 660 nm.
Total Nitrogen by Combustion	E366 ALS Environmental - Saskatoon	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Available Phosphorus by Colourimetry (Olsen)	E385 ALS Environmental - Saskatoon	Soil/Solid	Carter CSSS (2008) 8.3	Plant available phosphorus is extracted from air dried soil using a fixed ratio bicarbonate extraction. Phosphorus is determined by colorimetry.
Metals in Soil/Solid by CRC ICPMS	E440 ALS Environmental - Saskatoon	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Soil/Solid by CVAAS	E510 ALS Environmental - Saskatoon	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Available Nitrate by Difference (0.01M Calcium Chloride Ext.)	EC269.NO3 ALS Environmental - Saskatoon	Soil/Solid	Alberta Agriculture/APHA 4500-NO3 I (mod)	Available Nitrate is determined by difference between Nitrate+Nitrite-N and Nitrite-N. A soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Total Organic Nitrogen (Calculation)	EC363 ALS Environmental - Saskatoon	Soil/Solid	APHA 4500-NORG	Total Organic Nitrogen is a calculated parameter. Total Organic Nitrogen = Total Kjeldahl Nitrogen - Ammonia.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Saskatoon	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Fixed ratio 0.01M Calcium Chloride extraction for plant available nutrients	EP269 ALS Environmental - Saskatoon	Soil/Solid	Alberta Agriculture	Plant available nutrients (N&S) extracted using 0.01M calcium chloride, then shaken well and filtered prior to analysis.
2N Potassium Chloride extraction for available nutrients	EP269A ALS Environmental - Saskatoon	Soil/Solid	CSSS (2008) 6.2	A soil sample extract is generated by fixed ratio extraction using 2N Potassium Chloride, then shaken well and filtered prior to analysis.
Kjeldahl Digestion for soils	EP319 ALS Environmental - Saskatoon	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Bicarbonate extraction for soil	EP385 ALS Environmental - Saskatoon	Soil/Solid	CSSS (2008) 8.2	Plant available phosphorus is extracted using fixed ratio sodium bicarbonate solution (Olsen method).
Digestion for Metals and Mercury	EP440 ALS Environmental - Saskatoon	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind in Soil/Solid <38°C	EPP441 ALS Environmental - Saskatoon	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of coarse fragments a portion of homogenized sample is set in a tray and dried at less than 38°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.
Dry and Grind in Soil/Solid <60°C	EPP442 ALS Environmental - Saskatoon	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **WP2413268**	Page	: 1 of 10
Client	: Penn-Co Construction Canada (2003) Ltd.	Laboratory	: ALS Environmental - Winnipeg
Contact	: Jonah Keith	Account Manager	: Janani Mudiyanselage
Address	: 1A Langill Way Steinbach MB Canada R5G 2T1	Address	: 1329 Niakwa Road East, Unit 12 Winnipeg, Manitoba Canada R2J 3T4
Telephone	: 204 326 1341	Telephone	: +1 204 255 9720
Project	: 202467 CITY OF WINKLER - LAGOON SLUDGE	Date Samples Received	: 27-May-2024 15:34
PO	: 202467-240527-MYZ	Date Analysis Commenced	: 30-May-2024
C-O-C number	: ----	Issue Date	: 10-Jun-2024 16:34
Sampler	: ----		
Site	: ----		
Quote number	: 202467 City of Winkler Lagoon Sludge		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Laboratory Supervisor	Saskatoon Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Laboratory Supervisor	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Jeremy Greuel	Laboratory Assistant	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Justin Kuzek	Team Leader - Organics	Saskatoon Organics, Saskatoon, Saskatchewan
Maria Painchaud	Laboratory Assistant	Saskatoon Inorganics, Saskatoon, Saskatchewan
Milad Khani	Laboratory Analyst	Saskatoon Metals, Saskatoon, Saskatchewan
Milad Khani	Laboratory Analyst	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Nancy Cruse	Laboratory Assistant	Saskatoon Sask Soils, Saskatoon, Saskatchewan

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 1467660)											
KS2401872-001	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	8.05	8.11	0.742%	10%	----
Physical Tests (QC Lot: 1467661)											
KS2401872-001	Anonymous	Conductivity (1:2 leachate)	----	E100	10	µS/cm	2.37 mS/cm	2380	0.421%	20%	----
Physical Tests (QC Lot: 1467817)											
SK2402409-021	Anonymous	Moisture	----	E144	0.25	%	12.8	13.0	1.90%	20%	----
Physical Tests (QC Lot: 1471422)											
VA24B2175-001	Anonymous	Loss on ignition @ 550°C	----	E205D	1.0	%	1.6	1.5	0.03	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1472622)											
WP2413268-001	SLUDGE SAMPLE #1	Nitrogen, total	7727-37-9	E366	0.020	%	1.63	1.60	1.46%	20%	----
Plant Available Nutrients (QC Lot: 1467590)											
VA24B1673-001	Anonymous	Ammonium, available (as N)	14798-03-9	E312A	2.0	mg/kg	24.5	23.9	2.53%	20%	----
Plant Available Nutrients (QC Lot: 1471302)											
CG2407258-005	Anonymous	Nitrite, available (as N)	14797-65-0	E269.NO2	0.40	mg/kg	0.62	0.44	0.18	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 1471303)											
CG2407258-005	Anonymous	Nitrate + Nitrite, available (as N)	----	E269.N+N	1.0	mg/kg	23.0	23.2	0.802%	30%	----
Plant Available Nutrients (QC Lot: 1471419)											
VA24B2175-001	Anonymous	Phosphate, available (as P)	14265-44-2	E385	1.0	mg/kg	5.8	6.0	0.2	Diff <2x LOR	----
Metals (QC Lot: 1474554)											
RG2400809-001	Anonymous	Mercury	7439-97-6	E510	0.0050	mg/kg	0.0885	0.0426	70.1%	40%	DUP-H
Metals (QC Lot: 1474555)											
RG2400809-001	Anonymous	Aluminum	7429-90-5	E440	50	mg/kg	10900	11600	5.87%	40%	----
		Antimony	7440-36-0	E440	0.10	mg/kg	0.93	0.94	1.10%	30%	----
		Arsenic	7440-38-2	E440	0.10	mg/kg	6.43	6.42	0.147%	30%	----
		Barium	7440-39-3	E440	0.50	mg/kg	580	684	16.4%	40%	----
		Beryllium	7440-41-7	E440	0.10	mg/kg	0.93	0.96	3.85%	30%	----
		Bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Boron	7440-42-8	E440	5.0	mg/kg	51.2	69.9	30.9%	30%	DUP-H
		Cadmium	7440-43-9	E440	0.020	mg/kg	0.241	0.240	0.218%	30%	----
		Calcium	7440-70-2	E440	50	mg/kg	34600	42100	19.7%	30%	----
		Chromium	7440-47-3	E440	0.50	mg/kg	74.1	122	48.4%	30%	DUP-H

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 1474555) - continued											
RG2400809-001	Anonymous	Cobalt	7440-48-4	E440	0.10	mg/kg	8.04	8.52	5.84%	30%	----
		Copper	7440-50-8	E440	0.50	mg/kg	17.4	18.1	3.98%	30%	----
		Iron	7439-89-6	E440	50	mg/kg	17800	18600	4.37%	30%	----
		Lead	7439-92-1	E440	0.50	mg/kg	18.1	24.4	29.9%	40%	----
		Lithium	7439-93-2	E440	2.0	mg/kg	12.1	11.7	0.4	Diff <2x LOR	----
		Magnesium	7439-95-4	E440	20	mg/kg	11200	12300	9.43%	30%	----
		Manganese	7439-96-5	E440	1.0	mg/kg	546	555	1.57%	30%	----
		Molybdenum	7439-98-7	E440	0.10	mg/kg	5.57	7.70	32.1%	40%	----
		Nickel	7440-02-0	E440	0.50	mg/kg	53.8	75.4	33.5%	30%	DUP-H
		Phosphorus	7723-14-0	E440	50	mg/kg	486	439	10.1%	30%	----
		Potassium	7440-09-7	E440	100	mg/kg	1180	1190	1.39%	40%	----
		Selenium	7782-49-2	E440	0.20	mg/kg	0.36	0.52	0.16	Diff <2x LOR	----
		Silver	7440-22-4	E440	0.10	mg/kg	0.10	0.10	0.002	Diff <2x LOR	----
		Sodium	7440-23-5	E440	50	mg/kg	2650	3340	23.0%	40%	----
		Strontium	7440-24-6	E440	0.50	mg/kg	238	302	23.6%	40%	----
		Sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440	0.050	mg/kg	0.126	0.128	0.002	Diff <2x LOR	----
		Tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		Titanium	7440-32-6	E440	1.0	mg/kg	308	289	6.37%	40%	----
		Tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		Uranium	7440-61-1	E440	0.050	mg/kg	1.43	1.57	9.68%	30%	----
		Vanadium	7440-62-2	E440	0.20	mg/kg	25.7	24.6	4.30%	30%	----
		Zinc	7440-66-6	E440	2.0	mg/kg	46.8	45.0	3.90%	30%	----
		Zirconium	7440-67-7	E440	1.0	mg/kg	11.0	12.7	14.1%	30%	----
Leachable Anions & Nutrients (QC Lot: 1472886)											
VA24B2175-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E319	650	mg/kg	<0.066 %	<650	10	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1467661)						
Conductivity (1:2 leachate)	----	E100	10	µS/cm	<10	----
Physical Tests (QCLot: 1467817)						
Moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 1472622)						
Nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Plant Available Nutrients (QCLot: 1467590)						
Ammonium, available (as N)	14798-03-9	E312A	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 1471302)						
Nitrite, available (as N)	14797-65-0	E269.NO2	0.4	mg/kg	<0.40	----
Plant Available Nutrients (QCLot: 1471303)						
Nitrate + Nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 1471419)						
Phosphate, available (as P)	14265-44-2	E385	1	mg/kg	<1.0	----
Metals (QCLot: 1474554)						
Mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 1474555)						
Aluminum	7429-90-5	E440	50	mg/kg	<50	----
Antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
Arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
Barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
Beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
Bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
Boron	7440-42-8	E440	5	mg/kg	<5.0	----
Cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
Calcium	7440-70-2	E440	50	mg/kg	<50	----
Chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
Cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
Copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
Iron	7439-89-6	E440	50	mg/kg	<50	----
Lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
Lithium	7439-93-2	E440	2	mg/kg	<2.0	----
Magnesium	7439-95-4	E440	20	mg/kg	<20	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 1474555) - continued						
Manganese	7439-96-5	E440	1	mg/kg	<1.0	----
Molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
Nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
Phosphorus	7723-14-0	E440	50	mg/kg	<50	----
Potassium	7440-09-7	E440	100	mg/kg	<100	----
Selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
Silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
Sodium	7440-23-5	E440	50	mg/kg	<50	----
Strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
Sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
Thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
Tin	7440-31-5	E440	2	mg/kg	<2.0	----
Titanium	7440-32-6	E440	1	mg/kg	<1.0	----
Tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
Uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
Vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
Zinc	7440-66-6	E440	2	mg/kg	<2.0	----
Zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Leachable Anions & Nutrients (QCLot: 1472886)						
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	<200	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1467660)									
pH (1:2 soil:water)	----	E108	----	pH units	7 pH units	100	97.0	103	----
Physical Tests (QCLot: 1467661)									
Conductivity (1:2 leachate)	----	E100	10	µS/cm	1000 µS/cm	95.7	80.0	120	----
Physical Tests (QCLot: 1467817)									
Moisture	----	E144	0.25	%	50 %	102	90.0	110	----
Anions and Nutrients (QCLot: 1472622)									
Nitrogen, total	7727-37-9	E366	0.02	%	22.4 %	101	90.0	110	----
Plant Available Nutrients (QCLot: 1467590)									
Ammonium, available (as N)	14798-03-9	E312A	1	mg/kg	10 mg/kg	97.9	80.0	120	----
Plant Available Nutrients (QCLot: 1471302)									
Nitrite, available (as N)	14797-65-0	E269.NO2	0.4	mg/kg	20 mg/kg	98.7	70.0	130	----
Plant Available Nutrients (QCLot: 1471303)									
Nitrate + Nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 1471419)									
Phosphate, available (as P)	14265-44-2	E385	1	mg/kg	20 mg/kg	105	80.0	120	----
Metals (QCLot: 1474554)									
Mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	95.1	80.0	120	----
Metals (QCLot: 1474555)									
Aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	110	80.0	120	----
Antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	111	80.0	120	----
Arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	106	80.0	120	----
Barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	107	80.0	120	----
Beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	103	80.0	120	----
Bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	99.6	80.0	120	----
Boron	7440-42-8	E440	5	mg/kg	100 mg/kg	97.6	80.0	120	----
Cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	104	80.0	120	----
Calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	101	80.0	120	----
Chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	105	80.0	120	----
Cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	105	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1474555) - continued									
Copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	104	80.0	120	----
Iron	7439-89-6	E440	50	mg/kg	100 mg/kg	101	80.0	120	----
Lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	100	80.0	120	----
Lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	102	80.0	120	----
Magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	112	80.0	120	----
Manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	110	80.0	120	----
Molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	107	80.0	120	----
Nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	105	80.0	120	----
Phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	112	80.0	120	----
Potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	104	80.0	120	----
Selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	103	80.0	120	----
Silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	96.8	80.0	120	----
Sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	107	80.0	120	----
Strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	104	80.0	120	----
Sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	108	80.0	120	----
Thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	98.5	80.0	120	----
Tin	7440-31-5	E440	2	mg/kg	50 mg/kg	105	80.0	120	----
Titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	103	80.0	120	----
Tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	98.9	80.0	120	----
Uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	98.3	80.0	120	----
Vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	108	80.0	120	----
Zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	102	80.0	120	----
Zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	93.8	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1472886)									
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	1000 mg/kg	108	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 1467660)									
QC-1467660-002	RM	pH (1:2 soil:water)	----	E108	8.13 pH units	100	96.0	104	----
Physical Tests (QCLot: 1467661)									
QC-1467661-003	RM	Conductivity (1:2 leachate)	----	E100	273 µS/cm	94.9	80.0	120	----
Physical Tests (QCLot: 1471422)									
QC-1471422-002	RM	Loss on ignition @ 550°C	----	E205D	10.3 %	108	80.0	120	----
Anions and Nutrients (QCLot: 1472622)									
QC-1472622-003	RM	Nitrogen, total	7727-37-9	E366	0.11 %	89.8	80.0	120	----
Plant Available Nutrients (QCLot: 1467590)									
QC-1467590-003	RM	Ammonium, available (as N)	14798-03-9	E312A	70.1 mg/kg	99.3	80.0	120	----
Plant Available Nutrients (QCLot: 1471302)									
QC-1471302-003	RM	Nitrite, available (as N)	14797-65-0	E269.NO2	0.1 mg/kg	44.8	0	570	----
Plant Available Nutrients (QCLot: 1471303)									
QC-1471303-003	RM	Nitrate + Nitrite, available (as N)	----	E269.N+N	11.3 mg/kg	107	70.0	130	----
Plant Available Nutrients (QCLot: 1471419)									
QC-1471419-003	RM	Phosphate, available (as P)	14265-44-2	E385	15.3 mg/kg	103	80.0	120	----
Metals (QCLot: 1474554)									
QC-1474554-003	RM	Mercury	7439-97-6	E510	0.068 mg/kg	97.2	70.0	130	----
Metals (QCLot: 1474555)									
QC-1474555-003	RM	Aluminum	7429-90-5	E440	22500 mg/kg	110	70.0	130	----
QC-1474555-003	RM	Antimony	7440-36-0	E440	24.8 mg/kg	103	70.0	130	----
QC-1474555-003	RM	Arsenic	7440-38-2	E440	21.2 mg/kg	102	70.0	130	----
QC-1474555-003	RM	Barium	7440-39-3	E440	788 mg/kg	106	70.0	130	----
QC-1474555-003	RM	Beryllium	7440-41-7	E440	1.82 mg/kg	96.3	70.0	130	----
QC-1474555-003	RM	Bismuth	7440-69-9	E440	1.78 mg/kg	87.3	70.0	130	----
QC-1474555-003	RM	Cadmium	7440-43-9	E440	2.15 mg/kg	103	70.0	130	----
QC-1474555-003	RM	Calcium	7440-70-2	E440	4900 mg/kg	97.0	70.0	130	----
QC-1474555-003	RM	Chromium	7440-47-3	E440	56.9 mg/kg	100	70.0	130	----
QC-1474555-003	RM	Cobalt	7440-48-4	E440	32 mg/kg	102	70.0	130	----
QC-1474555-003	RM	Copper	7440-50-8	E440	969 mg/kg	104	70.0	130	----
QC-1474555-003	RM	Iron	7439-89-6	E440	32700 mg/kg	99.3	70.0	130	----
QC-1474555-003	RM	Lead	7439-92-1	E440	919 mg/kg	96.2	70.0	130	----
QC-1474555-003	RM	Lithium	7439-93-2	E440	47.3 mg/kg	98.7	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 1474555) - continued									
QC-1474555-003	RM	Magnesium	7439-95-4	E440	7780 mg/kg	106	70.0	130	----
QC-1474555-003	RM	Manganese	7439-96-5	E440	8640 mg/kg	107	70.0	130	----
QC-1474555-003	RM	Molybdenum	7439-98-7	E440	25.1 mg/kg	97.5	70.0	130	----
QC-1474555-003	RM	Nickel	7440-02-0	E440	1000 mg/kg	101	70.0	130	----
QC-1474555-003	RM	Phosphorus	7723-14-0	E440	660 mg/kg	107	70.0	130	----
QC-1474555-003	RM	Potassium	7440-09-7	E440	10800 mg/kg	103	70.0	130	----
QC-1474555-003	RM	Selenium	7782-49-2	E440	1.04 mg/kg	109	60.0	140	----
QC-1474555-003	RM	Silver	7440-22-4	E440	8.98 mg/kg	100	70.0	130	----
QC-1474555-003	RM	Sodium	7440-23-5	E440	1770 mg/kg	118	70.0	130	----
QC-1474555-003	RM	Strontium	7440-24-6	E440	41 mg/kg	93.7	70.0	130	----
QC-1474555-003	RM	Sulfur	7704-34-9	E440	3940 mg/kg	99.1	50.0	150	----
QC-1474555-003	RM	Thallium	7440-28-0	E440	0.907 mg/kg	95.6	70.0	130	----
QC-1474555-003	RM	Tin	7440-31-5	E440	3.79 mg/kg	103	40.0	160	----
QC-1474555-003	RM	Titanium	7440-32-6	E440	2790 mg/kg	103	70.0	130	----
QC-1474555-003	RM	Tungsten	7440-33-7	E440	6.99 mg/kg	99.7	70.0	130	----
QC-1474555-003	RM	Uranium	7440-61-1	E440	3.97 mg/kg	92.9	70.0	130	----
QC-1474555-003	RM	Vanadium	7440-62-2	E440	66.2 mg/kg	103	70.0	130	----
QC-1474555-003	RM	Zinc	7440-66-6	E440	828 mg/kg	99.6	70.0	130	----
QC-1474555-003	RM	Zirconium	7440-67-7	E440	6.91 mg/kg	78.3	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1472886)									
QC-1472886-003	RM	Kjeldahl nitrogen, total [TKN]	----	E319	1040 mg/kg	87.4	80.0	120	----

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 875015

Page of

Report To	Contact and company name below will appear on the final report
Company:	PENN-CO CONSTRUCTION
Contact:	MIGUEL YOUNG
Phone:	431 371 3850
	Company address below will appear on the final report
Street:	1A LANGILL WAY
City/Province:	STEINBACH, MB
Postal Code:	R5G 2Z1

Report Format / Distribution	
Select Report Format:	☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☐ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	MIGUEL.YOUNG@PENN-CO.COM
Email 2	LUKE.MICHALUK@PENN-CO.COM
Email 3	JONAH.KEITH@PENN-CO.COM

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Regular [R]	☑ Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days)	4 day [P4-20%] ☐
	3 day [P3-25%] ☐
	2 day [P2-50%] ☐
EMERGENCY	1 Business day [E - 100%] ☐
	Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)] ☐
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.	

Invoice To		
	Same as Report To	☑ YES ☐ NO
	Copy of Invoice with Report	☑ YES ☐ NO
Company:		
Contact:		

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	MIGUEL.YOUNG@PENN-CO.COM
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	PCCC100-8790 WP2413268 PCCC100-0001	AFE/Cost Center:	PO#
Job #:	202467	Major/Minor Code:	Routing Code:
PO / AFE:	202467-240527-MTZ	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

NUMBER OF CONTAINERS

SAMPLES ON HOLD

SUSPECTED HAZARD (see Special Instructions)

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type
	SLUDGE SAMPLE #1	MAY 27	8:15AM	

Environmental Division
Winnipeg
Work Order Reference
WP2413268

Telephone : +1 204 255 9720

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No	☐
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No	☐
Cooling Initiated ☐					

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
20.8	

SHIPMENT RELEASE (client use)		
Released by:	Date:	Time:

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by: MO	Date: MAY 27/24	Time: 1534

FINAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2018 FRONT

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 875015

Page of

Report To	Contact and company name below will appear on the final report
Company:	PENN-CO CONSTRUCTION
Contact:	[redacted]
Phone:	
	Company address below will appear on the final report
Street:	1A LANGILL WAY
City/Province:	STEINBACH, MB
Postal Code:	R5G 2T1
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☐ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	[redacted]
Email 2	[redacted]
Email 3	[redacted]

Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	[redacted]
Email 2	

Project Information	Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	PCCC100-8790 WP2024PCCC100-0001	AFE/Cost Center: PO#:
Job #:	202467	Major/Minor Code: Routing Code:
PO / AFE:	202467-240527-MYZ	Requisitioner:
LSD:		Location:
ALS Lab Work Order # (lab use only):		ALS Contact: Sampler:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)	EMERGENCY
4 day [P4-20%] ☐	1 Business day [E - 100%] ☐
3 day [P3-25%] ☐	Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐
2 day [P2-50%] ☐	

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	SLUDGE SAMPLE #1	MAY 27	8:15AM				

Environmental Division
Winnipeg
Work Order Reference
WP2413268
[redacted]
Telephone : +1 204 255 9720

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐		SIF Observations	Yes ☐	No ☐	
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐	
Cooling Initiated ☐					

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
20.8					

SHIPMENT RELEASE (client use)		
Released by:	Date:	Time:

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by: [redacted]	Date: May 27/24	Time: 1534

FINAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JUNE 2014 FRONT

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.