LUPIN MINE
NUNAVUT, CANADA

Water Licence No. 2AM-LUP1520

2019 Annual Report

to the Nunavut Water Board

Submitted by:
Lupin mines incorporated
[A Wholly owned independent Subsidiary of Mandalay Resources Corporation]
76 Richmond Street East, Suite 330
Toronto, ON, M5C 1P1, Canada

MANDALAY RESOURCES

LUPIN MINE, NUNAVUT

WATER LICENCE NO. 2AM-LUP1520

2019 ANNUAL REPORT

EXECUTIVE SUMMARY

The Lupin Mine was in care and maintenance throughout 2019 resulting in minimal water use. Waste deposit took place from the Sewage Lakes disposal Facility during open water in accordance with the Licence requirements. The site was occupied from January 1-March 5, 2019; May 30-June 11, 2019 April 26, 2019; June 24-July 20, 2019, and August 15-31, 2019.

During this period, care and maintenance, and closure activities included the following:

- camp opening and closing, utilizing freshwater and deposit of sewage to the Sewage Lakes Disposal Facility, and incineration of general camp wastes;
- general site maintenance including airstrip, roads;
- discharge of the Sewage Lakes Disposal Facility effluent (lower sewage lake). Approximately 234.505 m^3 of effluent was released to the environment, all within Licence discharge criteria;
- dewatering/transferring of water from the upper sewage lake to the lower sewage lake;
- removal of accumulated snow from the Bulk Fuel Storage (Main Tank Farm) prior to freshet resulted no discharge being required from the facilities;
- collection and pumping of TCA Dam 2 seepage back to the TCA Pond 2;
- transfer of water between cells and/or ponds at the TCA to maintain freeboard;
- general water quality monitoring;
- annual geotechnical inspection of engineered facilities; Tailings Containment Area, Sewage dam and fuel tank farm berm inspections;
- Golder carried our Phase 6 EEM Study to be submitted to ECCC as well as the HHERA study.
- Site planning with contractor for closure and reclamation work planned for 2020/2021
- collection and removal of various hazardous materials and other waste (shipped to Yellowknife, NT)

KAVAMALIQINIRMUT NAINAAQHIMAYUT NAUNAITKUTAT
2019 UKIUM NUNNGUTAANUT NAUNAITKUTAT

Awaiting translation

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Awaiting Translation

WATER LICENCE 2AM-LUP1520 - GENERAL CONDITIONS- SCHEDULE B

INTRODUCTION

The Lupin Mine is located approximately 285 km southeast of Kugluktuk in the Kitikmeot Region of Nunavut and is owned by Lupin Mines Incorporated (LMI), a wholly owned, indirect subsidiary of Mandalay Resources Corporation. The mine site is situated on the western shore of Contwoyto Lake, approximately 60 km south of the Arctic Circle. It is an underground gold mine that was in operation from 1982 to 2005 with temporary suspensions of activities between January 1998 and April 2000, and again between August 2003 and March 2004. The mine resumed production in March 2004 until February 2005. when the Site was placed into Care and Maintenance, and no active mining has taken place since.

On October 20 2017, Mandalay Resources Corporation, through its wholly owned, independent subsidiary Lupin Mines Incorporated (LMI), announced that the Lupin Mine will transition from care and maintenance to full closure and reclamation, beginning in 2018 through to 2020. An application for renewal and amendment of the current water licence (Application), as well as a Final Closure and Reclamation Plan (FCRP) was submitted to the Nunavut Water Board on July 27, 2018. The FCRP provides the necessary concepts, engineering background, and activities for the full closure and reclamation of the site, followed by a long-term monitoring program. The plan would supersede the most current Interim Closure and Reclamation Plan, approved by the NWB on July 20, 2018. The Application process has completed the Technical Review phase of the licensing process and is currently awaiting completion of commitments generated at the Technical Meeting and Pre-hearing Conference in preparation for the Public Hearing, which has been set for January 2020. Scheduling of final closure activities has been deferred one year due to winter road access requirements and delays in the security refund process, limiting financial commitments for the closure contract. Care and Maintenance of the Lupin Site will continue through 2019, with some preparation for closure activities, scheduled to commence in 2020.

Water Licence, No. 2AM-LUP1520 (Licence), a renewal of the previous licence, was issued to Lupin Mines Incorporated by the Nunavut Water Board (NWB or Board) and approved by the Minister of Aboriginal Affairs and Northern Development on October 5, 2015. Three amendments to Water Licence 2AM-LUP1520 have been issued since the Licence renewal, however these are limited in scope to the security requirements of the Licence, and do not affect the annual report. Under Part B, Item 2 of the Licence, an Annual Report is required to be submitted to the NWB prior to March 31 of the year following the calendar year being reported, and prepared in accordance with Schedule B of the Licence.

The following sections provide the information as required under Schedule B of Water Licence No. 2AM-LUP1520.

A. FRESH WATER INTAKE VOLUME (MONITORING STATION LUP-01)

The monthly and annual quantities in cubic metres of Water pumped from Contwoyto Lake at Station Number LUP-01.

The Lupin Mine camp opened on various dates throughout 2019. Pumping water from Contwoyto Lake utilizing a submersible pump, filling a 4,542 litre (1,200 usg) plastic tank within a water truck that is used to transport water to the camp's two (2) 4,542 litre storage tanks. The water is then run through a series of filters with disinfection provided by a flow-through Ultraviolet chamber prior to distribution in camp. The camp was open for 118 days in 2019, through December 31, 2018, using a total of 340.3 m^3 of freshwater, for an average water use of 2.88 m^3/day[1] for domestic purposes, well within the maximum authorized water use of 5,000 m^3/year. The following table summarizes the monthly and annual quantities in cubic metres of Water pumped from Contwoyto Lake at Monitoring Station LUP-01.

2018	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Water Use (m^3/day)	120.55	106.42	16.85		4.15	24.46	35.13	32.74					340.3

B. TAILINGS EFFLUENT DISCHARGE (MONITORING STATION LUP-10)

The monthly and annual quantities in cubic metres of treated Tailings Effluent discharged at Station Number LUP-10.

There were no TCA discharges during 2019.

C. MINEWATER (MONITORING STATION LUP-11)

The monthly and annual quantities in cubic metres of Minewater discharged at Station Number LUP-11.

There was no mine water pumped from the underground workings at the Lupin Mine Site in 2019 while under care and maintenance.

D. SEWAGE EFFLUENT (MONITORING STATION LUP-14)

The monthly and annual quantities in cubic metres of treated Sewage Effluent discharged at Station Number LUP-14.

Four eight-inch syphon lines were installed at the Lower Sewage Lake discharge point on June 27, 2019. Effluent release from the Sewage Lakes Disposal Facilities began on June 29, 2019 and continued until July 10, 2019. Total volume of effluent discharged at Monitoring Station LUP-14 was approximately

[1] *A Blue-White Industries Model F-1000-RT Totalizer flow meter is used to calculate the daily freshwater consumption.*

234,050m^3. The following table illustrates the monthly and annual discharge quantity of Sewage Effluent at monitoring Station LUP-14 in 2019.

2018	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Sewage Effluent (m^3/day)						42,550	191,500						234,050

Following the discharge of the Sewage Lakes Disposal Facilities, transfer of water from the upper sewage lake and the Tailings Line Dump Pond No.1 to the lower sewage lake took place in order to lower water levels and provide for storage of spring freshet in 2019.

E. HAZARDOUS WASTE AND CHEMICALS

Details on the types and quantities of Hazardous Waste and chemicals stored on site.

The following table summarizes the types and approximate quantities of Hazardous Waste and chemicals remaining on site as of December 30, 2019, to be used or eventually transported off site.

Hazardous Waste and Chemicals Stored on Site	
Material	Amount
Waste Motor Oil	2000 litres (Powerhouse waste oil storage tanks 2(1,100L) oil cubes stored in the Powerhouse
Contaminated (old) Diesel Fuel	6,765 litres (33 drums in Third party Drum Storage - TPDS)
Contaminated (old) Jet Fuel	615 litres (3 drums in TPDS)
Oily Water	96,965 litres (473 drums in TPDS)
Acid Filled Batteries	36 count 12volt lead/acid Batteries (seacan)
Hydrated Lime	13,600 kg (680 - 20 kg bags, Cold Storage #2)
Portland Cement	3,000 kg (150 - 20 kg bags, Cold Storage #2)
Calcium Chloride	Approx. 20,000 kg (covered at laydown area #2)
Shotcrete Cement	30,000 kg (Cold Storage #4 near Winter Rd)

Since the Water Licence renewal in 2015, Hazardous Wastes and other waste materials have been characterized, consolidated and shipped off site. In 2019, a total of 394 kg (shipping weight) of Hazardous Wastes, chemicals and other materials were removed from the Lupin Mine site. The following table summarizes the types and quantities of Hazardous Waste, chemicals and materials that were packaged and shipped to Yellowknife, NT.

Waste , Hazardous Waste and Chemicals Shipped from Lupin in 2019	
Material	Amount
Incinerator Ash	1 drum; 145 kg
Propane Cylinders	4 empty cylinders, 181 kg
Recyclables	2 mega bags; 68 lbs
Total Materials Backhauled	394 kg

Fuel and Petroleum Products Inventory:

As of December 20, 2018, there was approximately 1024,547 litres of diesel fuel and 318,071 litres of jet fuel in storage in large fuel tanks within the Bulk Fuel Storage (Main Tank Farm). Within the Third-Party Drum Storage (TPDS) berm, stored in 205 Litre drums, there is approximately 2,460 Litres of gasoline in twelve (12) drums; 2,665 Litres of diesel fuel in thirteen (13) drums and approximately 6,253 litres in thirty-one (31) drums of jet-A and/or Av-gas.

Additionally, there are several empty 205 litre drums and three (3) empty 1,300 litre oil cubes on site available for spill contingency and/or temporary storage of hydrocarbons or hydrocarbon contaminated water.

F. MONITORING PROGRAM DATA

Tabular summaries of all data generated under the "Monitoring Program".

Water Quality Monitoring - Freshwater

Freshwater is obtained from Contwoyto Lake, pumphouse or causeway, as described in Section A above. A water sample is obtained from this location annually and submitted for physical and chemical analyses as per Licence monitoring requirements. The 2019 sample was obtained on July 04, 2019. See Appendix A, Certificate of Analysis Lab WO#: L2304109 which summarizes the Water quality analyses required under Schedule J, at the Freshwater Intake located at Contwoyto Lake, Monitoring Station LUP-01.

Water Quality Monitoring – Effluent

Discharge of Effluent at the Lupin Mine took place at the Sewage Lakes Disposal Facility. Discharge from the Tailings Containment Area did not occur in 2019. Discharge from the Bulk Fuel Storage Facility (including the Satellite Tank Farm and the Third-Party Drum Storage area) was not required in 2019 as accumulated snow was removed in May and June prior to spring melt, placed on the south facing downward slope of the mine site general area so that snow melt would be captured by the Upper Sewage Lake, and any contaminants would be remediated via the Sewage Lakes Disposal Facility prior to discharge. Effluent monitoring is summarized in the following sections.

Sewage Lakes Disposal Facilities

A request to discharge from the Sewage Lakes Disposal Facilities was sent to the Inspector on June 27, 2019, which included pre-discharge water quality data. Written approval for discharge was received from the Inspector on June 27, 2019 and discharge commenced on June 29, 2019, continuing through to July 10, 2019. Approximately 234,050 M^3 of Effluent was discharged from the facilities. The following table summarizes the Water quality analyses as required under Part E, Items 9 and 11 of the Licence, for discharge to the environment of the Sewage Lakes Disposal Facilities at Monitoring Station LUP-14, sampled June 7, 2019. See Appendix A for the attached Certificate of Analysis, Lab WO#: L2288175, Sample Label LSP (Lower Sewage Pond).

Station LUP-14		
Parameter	Result June 7, 2018	Maximum Concentration of Any Grab Sample (mg/L)
pH	6.84	6.0 - 9.5
Total Suspended Solids (TSS)	9.0	35
Biochemical Oxygen Demand (BOD_5)	4.0	30
Oil and Grease	NVS	No Visible Sheen
Fecal Coliforms (MPN/100mL)	<1.0	1000cfu/100mL
Arsenic (As)	0.00120	0.05
Copper (Cu)	0.00143	0.20
Lead (Pb)	0.000928	0.05
Nickel (Ni)	0.00680	0.30
Zinc (Zn)	0.0093	0.50

Bulk Fuel Storage (Main Tank Farm)

As mentioned above, there was no discharge of effluent in 2019 from the fuel storage areas, that include the Main Tank Farm, Satellite Tank Farm and the Third-Party Storage Area. During early June, accumulated snow was collected from the tank farm areas, removed and disposed of along the south bank of the main laydown area north of the Upper Sewage Lake, where spring melt and runoff would report to the Sewage Disposal Facilities and be managed through the treatment and discharge of the Lower Sewage Lake. Any remaining snow and future precipitation was minimal and managed through normal seasonal evaporation.

G. RESPONSE TO INSPECTION REPORTS AND COMPLIANCE REPORTS FILED BY AN INSPECTOR

A summary of actions taken to address concerns or deficiencies listed in the inspection reports and/or compliance reports filed by an Inspector.

Include a summary of each inspection report, including date of inspection, inspector and date of response provided (Appendix B).

Crown Indigenous Relations and Northern Affairs Canada (CIRNAC) conducted an inspection at the Lupin Mine site on June 9, 2019 for the Water Licence. The site conditions were discussed on-site with representatives of LMI during the inspection and an inspection report for the Water Licence was filed on August 19, 2019 by the Inspector. All items for conditions were "acceptable". LMI did not provide a response as there no items of concern to be addressed.

H. A SUMMARY OF MODIFICATION AND/OR MAJOR MAINTENANCE WORK CARRIED OUT ON THE WATER SUPPLY AND THE WASTE DISPOSAL FACILITIES, INCLUDING ALL ASSOCIATED STRUCTURES

The 2019 Lupin Mine Tailings Containment Area Geotechnical Inspection was conducted during the period of August 23-24, 2019 by Mr. Alvin Tong, PEng., Senior Geotechnical Engineer with Stantec. Detailed visual inspection was completed on all TCA components, along with readings of instrumentation. The Geotechnical Inspection report was finalized by Stantec, October 24, 2019 and submitted by LMI to the NWB on January 2, 2020, including a cover letter from LMI (see Appendix C). General observations indicated that the perimeter dams are in stable condition. Section 4.0 of the report provides the recommendations of the Engineer. The majority of the external dams require minor surface maintenance (grading and backfilling of minor erosion), although Dam J was noted to have over-steepened slope due to erosion and reduced crest width in some sections requiring repair. Internal dams were found to be in good condition, however several areas were in need of repair due to erosion, and Dam K was noted to have five large erosion gullies and a near vertical slope at the eroded toe requiring prioritized repair while Pond 2 water level is lowered for access. The Divider Dyke at Cell 4 was noted to have some sloughing requiring repairs. Section 4.2 provided a summary of repair priorities.

I. SUMMARY OF UNAUTHORIZED DISCHARGES

A list and description of all unauthorized discharges including volumes, spill report line identification number and summaries of follow-up action taken.

There were no unauthorised discharges or spills reported in 2019.

J. WHERE APPLICABLE, REVISIONS AS ADDENDUMS, WITH AN INDICATION OF WHERE CHANGES HAVE BEEN MADE, FOR PLANS, REPORTS, AND MANUALS

Previous operational plans were re-submitted during the 2018 Licence renewal/amendment process.

K. UPDATED STATUS OF ANY PROGRESSIVE RECLAMATION AS IT RELATES TO TAILINGS COVER REMEDIATION AND JUSTIFICATION FOR NOT PROCEEDING TO FULL RECLAMATION UNDER PART I, ITEM 7;

Progressive Reclamation

No progressive reclamation was carried out in 2019. Extensive planning at site for the final closure and reclamation work program was carried out with LMI and the contactor.

Repairs were made at Dam K and the Cell 4 divider dyke.

OTHER

Hazardous Materials

In 2019, approximately 394 kg of various material was removed from the Lupin site for disposal. A summary of materials removed from site and the volumes of materials remaining on site for either removal or consumption are included under section E above.

Full Reclamation

As noted above, Lupin Mines Incorporated, a wholly-owned, independent subsidiary of Mandalay Resources Corporation, plans to transition from care and maintenance to final closure and reclamation. Initial plans were started in 2018, and then in 2019 all work was carried out under the approved Interim Closure and Reclamation Plan, with further transitioning to completion under the Final Closure and Reclamation Plan, once approved during the current amendment and renewal process for Licence No. 2AM-LUP1520.

L. A SUMMARY OF PUBLIC CONSULTATION AND PARTICIPATION WITH LOCAL ORGANIZATIONS AND THE RESIDENTS OF THE NEARBY COMMUNITIES, INCLUDING A SCHEDULE OF UPCOMING COMMUNITY EVENTS AND INFORMATION SESSIONS.

Technical Meeting/Community Presentation held in Kugluktuk on June 6-7, 2019 where LMI presented to the community and was able to answer their questions and concerns about the Lupin Mine site. The KIA expressed at that the technical meeting that they would not be participating in the renewal/FCRP application process for LMI's water licence.

M. A SUMMARY OF ANY ABANDONMENT AND RECLAMATION WORK COMPLETED DURING THE YEAR AND AN OUTLINE OF ANY WORK ANTICIPATED FOR THE NEXT YEAR;

Progressive reclamation activities included the removal from site, of hazardous materials as summarized in section E. In addition, work continued on the removal of engine oils and glycol from the main

powerhouse generators as well as general removal of building contents including office furniture, electronics, paints and aerosols, cleaners/chemicals, placed in storage for future disposal.

LMI completed several studies in relation to proposed reclamation activities in support of its interim closure and reclamation plan, water licence requirements, and requirements of the Fisheries Act, Metal Mines Effluent Regulations. These were as follows:

- Completed Phase 6 (final phase) EEM studies under the Metal and Diamond Mining Effluent Regulations in August 2019.
- Completed the Human Health and Ecological Risk Assessment of the Lupin Mine site.

In addition, the following studies and activities are planned for 2019:

- Begin the planned Final Closure and Reclamation work program to be completed in 2021 with the final winter road to remove equipment in Q1 2022.
- Treatment and discharge of water in TCA Pond 2 (approximately 2 million cubic metres), as well as treat in-situ water;
- General maintenance and or repairs as identified in the 2019 Annual Geotechnical Inspection;
- Site visit for regulators and consultants for verification of completed progressive closure activities in support of reclamation security amount adjustments as well as providing supporting documentation of completed and planned site work during formal review of the application for amendment and review of the current water Licence.

N. ANY OTHER DETAILS ON WATER USE OR WASTE DISPOSAL REQUESTED BY THE BOARD BY THE BOARD BY NOVEMBER 1 OF THE YEAR BEING REPORTED.

Lupin Mines Incorporated did not receive additional requests for information from the Nunavut Water Board prior to November 1, 2019 for the 2019 annual reporting period.

APPENDIX A - COA

Nahanni Construction
ATTN: Dave Vokey
100 Nahanni Drive
Yellowknife NT X1A 2P6

Date Received: 07-JUN-19
Report Date: 24-JUN-19 14:06 (MT)
Version: FINAL

Client Phone: 780-667-5511

Certificate of Analysis

Lab Work Order #: L2288175

Project P.O. #: NOT SUBMITTED
Job Reference: NN907 LUPIN C&M
C of C Numbers:
Legal Site Desc:

Oliver Gregg
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2288175-1				
	Description	GRAB				
	Sampled Date	07-JUN-19				
	Sampled Time	11:00				
	Client ID	LOWER SEWAGE LAKE				
Grouping	**Analyte**					
WATER						
Physical Tests	pH (pH)	6.84				
	Total Suspended Solids (mg/L)	9.0				
Bacteriological Tests	MPN-Fecal Coliform (MPN/100mL)	<1				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0862				
	Antimony (Sb)-Total (mg/L)	0.00013				
	Arsenic (As)-Total (mg/L)	0.0120				
	Barium (Ba)-Total (mg/L)	0.00581				
	Beryllium (Be)-Total (mg/L)	<0.00010				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	0.0000283				
	Calcium (Ca)-Total (mg/L)	6.66				
	Cesium (Cs)-Total (mg/L)	0.000112				
	Chromium (Cr)-Total (mg/L)	0.00066				
	Cobalt (Co)-Total (mg/L)	0.00157				
	Copper (Cu)-Total (mg/L)	0.00143				
	Iron (Fe)-Total (mg/L)	0.302				
	Lead (Pb)-Total (mg/L)	0.000928				
	Lithium (Li)-Total (mg/L)	0.0044				
	Magnesium (Mg)-Total (mg/L)	1.57				
	Manganese (Mn)-Total (mg/L)	0.0842				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	0.000061				
	Nickel (Ni)-Total (mg/L)	0.00680				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	0.669				
	Rubidium (Rb)-Total (mg/L)	0.00181				
	Selenium (Se)-Total (mg/L)	0.000050				
	Silicon (Si)-Total (mg/L)	0.26				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	2.48				
	Strontium (Sr)-Total (mg/L)	0.0484				
	Sulfur (S)-Total (mg/L)	6.80				
	Tellurium (Te)-Total (mg/L)	<0.00020				
	Thallium (Tl)-Total (mg/L)	<0.000010				
	Thorium (Th)-Total (mg/L)	<0.00010				
	Tin (Sn)-Total (mg/L)	<0.00010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2288175-1				
	Description	GRAB				
	Sampled Date	07-JUN-19				
	Sampled Time	11:00				
	Client ID	LOWER SEWAGE LAKE				
Grouping	**Analyte**					
WATER						
Total Metals	Titanium (Ti)-Total (mg/L)	0.00408				
	Tungsten (W)-Total (mg/L)	<0.00010				
	Uranium (U)-Total (mg/L)	0.000056				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	0.0093				
	Zirconium (Zr)-Total (mg/L)	<0.00020				
Aggregate Organics	Biochemical Oxygen Demand (mg/L)	4.0				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Total	MS-B	L2288175-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L2288175-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2288175-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L2288175-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD5-TG	Water	Biochemical Oxygen Demand- 5 day (TAIGA)	SM5210B
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
FCOLI-MPN-YL	Water	Thermotolerant (Fecal) Coliforms	APHA 9223B, 2004 Enzyme Substrate Method
Analysis is carried out using procedures adapted from APHA 9223 "Enzyme Substrate Coliform Test". Fecal Coliform (Thermotolerant) bacteria are determined by mixing sample with a mixture of hydrolyzable substrates and then sealing in a multi-well packet. The packet is incubated for 18-24 hours and the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.			
HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)
Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value
This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode			
It is recommended that this analysis be conducted in the field.			
TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
TG	TAIGA ENVIRONMENTAL LABORATORY (INAC)
YL	ALS ENVIRONMENTAL -YELLOWKNIFE, NORTHWEST TERRITORIES CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Nahanni Construction
100 Nahanni Drive
Yellowknife NT X1A 2P6
Contact: Dave Vokey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
FCOLI-MPN-YL	**Water**							
Batch R4662733								
WG3072705-2 DUP		**L2288175-1**						
MPN-Fecal Coliform		<1	<1	RPD-NA	MPN/100mL	N/A	65	07-JUN-19
WG3072705-1 MB								
MPN-Fecal Coliform			<1		MPN/100mL		1	07-JUN-19
HG-T-CVAA-VA	**Water**							
Batch R4670752								
WG3078238-2 LCS								
Mercury (Hg)-Total			98.8		%		80-120	15-JUN-19
WG3078238-1 MB								
Mercury (Hg)-Total			<0.000005(		mg/L		0.000005	15-JUN-19
MET-T-CCMS-VA	**Water**							
Batch R4670647								
WG3074526-2 LCS								
Aluminum (Al)-Total			97.6		%		80-120	14-JUN-19
Antimony (Sb)-Total			102.0		%		80-120	14-JUN-19
Arsenic (As)-Total			97.7		%		80-120	14-JUN-19
Barium (Ba)-Total			99.1		%		80-120	14-JUN-19
Beryllium (Be)-Total			101.9		%		80-120	14-JUN-19
Bismuth (Bi)-Total			95.9		%		80-120	14-JUN-19
Boron (B)-Total			102.7		%		80-120	14-JUN-19
Cadmium (Cd)-Total			98.7		%		80-120	14-JUN-19
Calcium (Ca)-Total			100.6		%		80-120	14-JUN-19
Cesium (Cs)-Total			106.5		%		80-120	14-JUN-19
Chromium (Cr)-Total			97.4		%		80-120	14-JUN-19
Cobalt (Co)-Total			96.9		%		80-120	14-JUN-19
Copper (Cu)-Total			98.5		%		80-120	14-JUN-19
Iron (Fe)-Total			99.3		%		80-120	14-JUN-19
Lead (Pb)-Total			100.3		%		80-120	14-JUN-19
Lithium (Li)-Total			103.5		%		80-120	14-JUN-19
Magnesium (Mg)-Total			96.7		%		80-120	14-JUN-19
Manganese (Mn)-Total			97.2		%		80-120	14-JUN-19
Molybdenum (Mo)-Total			104.8		%		80-120	14-JUN-19
Nickel (Ni)-Total			97.6		%		80-120	14-JUN-19
Phosphorus (P)-Total			95.1		%		80-120	14-JUN-19
Potassium (K)-Total			94.7		%		80-120	14-JUN-19
Rubidium (Rb)-Total			100.6		%		80-120	14-JUN-19

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R4670647								
WG3074526-2 LCS								
Selenium (Se)-Total			96.4		%		80-120	14-JUN-19
Silicon (Si)-Total			106.2		%		80-120	14-JUN-19
Silver (Ag)-Total			103.4		%		80-120	14-JUN-19
Sodium (Na)-Total			98.8		%		80-120	14-JUN-19
Strontium (Sr)-Total			106.2		%		80-120	14-JUN-19
Sulfur (S)-Total			98.7		%		80-120	14-JUN-19
Tellurium (Te)-Total			104.3		%		80-120	14-JUN-19
Thallium (Tl)-Total			99.1		%		80-120	14-JUN-19
Thorium (Th)-Total			101.4		%		80-120	14-JUN-19
Tin (Sn)-Total			100.5		%		80-120	14-JUN-19
Titanium (Ti)-Total			96.1		%		80-120	14-JUN-19
Tungsten (W)-Total			104.6		%		80-120	14-JUN-19
Uranium (U)-Total			105.3		%		80-120	14-JUN-19
Vanadium (V)-Total			100.3		%		80-120	14-JUN-19
Zinc (Zn)-Total			96.4		%		80-120	14-JUN-19
Zirconium (Zr)-Total			103.2		%		80-120	14-JUN-19
WG3074526-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	14-JUN-19
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Arsenic (As)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Barium (Ba)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	14-JUN-19
Boron (B)-Total			<0.010		mg/L		0.01	14-JUN-19
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	14-JUN-19
Calcium (Ca)-Total			<0.050		mg/L		0.05	14-JUN-19
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	14-JUN-19
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Copper (Cu)-Total			<0.00050		mg/L		0.0005	14-JUN-19
Iron (Fe)-Total			<0.010		mg/L		0.01	14-JUN-19
Lead (Pb)-Total			<0.000050		mg/L		0.00005	14-JUN-19
Lithium (Li)-Total			<0.0010		mg/L		0.001	14-JUN-19
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	14-JUN-19

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R4670647								
WG3074526-1 MB								
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	14-JUN-19
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	14-JUN-19
Phosphorus (P)-Total			<0.050		mg/L		0.05	14-JUN-19
Potassium (K)-Total			<0.050		mg/L		0.05	14-JUN-19
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	14-JUN-19
Selenium (Se)-Total			<0.000050		mg/L		0.00005	14-JUN-19
Silicon (Si)-Total			<0.10		mg/L		0.1	14-JUN-19
Silver (Ag)-Total			<0.000010		mg/L		0.00001	14-JUN-19
Sodium (Na)-Total			<0.050		mg/L		0.05	14-JUN-19
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	14-JUN-19
Sulfur (S)-Total			<0.50		mg/L		0.5	14-JUN-19
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	14-JUN-19
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	14-JUN-19
Thorium (Th)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Tin (Sn)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	14-JUN-19
Tungsten (W)-Total			<0.00010		mg/L		0.0001	14-JUN-19
Uranium (U)-Total			<0.000010		mg/L		0.00001	14-JUN-19
Vanadium (V)-Total			<0.00050		mg/L		0.0005	14-JUN-19
Zinc (Zn)-Total			<0.0030		mg/L		0.003	14-JUN-19
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	14-JUN-19
PH-PCT-VA	**Water**							
Batch R4665396								
WG3074859-2 CRM		**VA-PH7-BUF**						
pH			6.98		pH		6.9-7.1	12-JUN-19
TSS-VA	**Water**							
Batch R4669916								
WG3076483-5 LCS								
Total Suspended Solids			93.9		%		85-115	14-JUN-19
WG3076483-4 MB								
Total Suspended Solids			<3.0		mg/L		3	14-JUN-19

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH by Meter (Automated)							
	1	07-JUN-19 11:00	12-JUN-19 08:30	0.25	118	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2288175 were received on 07-JUN-19 17:00.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.: 190328

- FINAL REPORT -

Prepared For: ALS Environmental

Address: 314 Old Airport Road
Unit 116
Yellowknife,NT
X1A 2R1

Attn: **Oliver Gregg** **Facsimile:**

Final report has been reviewed and approved by:

Bruce Stuart
Manager

NOTES:

- Test methods and data are validated by the laboratory's Quality Assurance Program. Taiga Environmental Laboratory is accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) to ISO/IEC 17025 as a testing laboratory for specific tests registered with CALA.
- Routine methods are based on recognized procedures from sources such as
  - Standard Methods for the Examination of Water and Wastewater APHA AWWA WEF;
  - Environment Canada
  - USEPA
- Samples shall be kept for thirty (30) days after the final report is issued. All microbiological samples shall be disposed of immediately upon completion of analysis to minimize biohazardous risks to laboratory personnel. Please contact the laboratory if you have any special requirements.
- Final results are based on the specific tests at the time of analysis and do not represent the conditions during sampling.

ReportDate: June 20, 2019
Print Date: *June 20, 2019*

Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.: 190328

- CERTIFICATE OF ANALYSIS -

Client Sample ID: L2288175-1 LOWER SEWAGE LAKE **Taiga Sample ID:** 001

Client Project:
Sample Type: Water
Received Date: 10-Jun-19
Sampling Date: 07-Jun-19
Sampling Time: 11:00
Location:
Report Status: **Final**

Test Parameter	Result	Detection Limit	Units	Analysis Date	Analytical Method *	Qualifer
Inorganics - Nutrients						
Biochemical Oxygen Demand	4	2	mg/L	10-Jun-19	SM5210:B	

ReportDate: June 20, 2019
Print Date: *June 20, 2019*

Taiga Environmental Laboratory
4601-52nd Ave., Box 1320, Yellowknife, NT. X1A 2L9
Tel: (867)-767-9235 Fax: (867)-920-8740

Taiga Batch No.: 190328

- CERTIFICATE OF ANALYSIS -

Client Sample ID: L2288175-1 LOWER SEWAGE LAKE **Taiga Sample ID:** 001

*** Taiga analytical methods are based on the following standard analytical methods**

SM - Standard Methods for the Examination of Water and Wastewater

EPA - United States Environmental Protection Agency

ReportDate: June 20, 2019

Print Date: *June 20, 2019*

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	Nahanni Construction Ltd. - Lupin Mine Site	Select Report Format: ☑ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Dave Vokey	Quality Control (QC) Report with Report ☐ ☐ NO	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)] ☐
Phone:	604-900-1813	☐ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Street:	100 Nahanni Drive	Email 1 or Fax lupinmanager@nahannincl.com	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
City/Province:	Northwest Territories	Email 2 lupinengineer@nahannincl.com	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:	X1A 2P6	Email 3 mikkel@nahannincl.com	
Invoice To	Same as Report To ☐ ☑ NO	Invoice Distribution	Analysis Request
	Copy of Invoice with Report ☐ ☐ NO	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Company:	Nahanni Construction Ltd	Email 1 or Fax ap@nahannincl.com	
Contact:	Accounts Payable 867- 873-2975	Email 2	
Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center: PO#	
Job #:	NN907 Lupin C&M	Major/Minor Code: Routing Code:	
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	L2288175	ALS Contact: Sampler:	

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	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
						BOD	Routine	Total Metals	Mercury / Iron	Fecal Coliforms									
	Lower Sewage Lake	7-Jun-19	11:00	Grab		R	R	R	R	R									

L2288175-COFC

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? ☐ ☐ NO	
Are samples for human consumption/ use? ☐ ☐ NO	

(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
3.4	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Marty Jones	Date: June 7-19	Time:	Received by: NC	Date: 07/06/19	Time: 1700	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NOV 2018 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

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

Nahanni Construction
ATTN: Dave Vokey
100 Nahanni Drive
Yellowknife NT X1A 2P6

Date Received: 04-JUL-19
Report Date: 10-JUL-19 16:09 (MT)
Version: FINAL

Client Phone: 867-873-2975

Certificate of Analysis

Lab Work Order #: L2304109

Project P.O. #: NOT SUBMITTED
Job Reference: LUPIN MINE
C of C Numbers: 17-817572
Legal Site Desc:

Oliver Gregg
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2304109-1				
	Description	WATER				
	Sampled Date	04-JUL-19				
	Sampled Time	09:00				
	Client ID	LUP-01				
Grouping	**Analyte**					
WATER						
Physical Tests	Conductivity (uS/cm)	6.6				
	Hardness (as CaCO3) (mg/L)	2.29 HTC				
	pH (pH)	6.24				
	Total Suspended Solids (mg/L)	<3.0				
Anions and Nutrients	Alkalinity, Bicarbonate (as CaCO3) (mg/L)	1.2				
	Alkalinity, Carbonate (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Hydroxide (as CaCO3) (mg/L)	<1.0				
	Alkalinity, Total (as CaCO3) (mg/L)	1.2				
Bacteriological Tests	MPN-Fecal Coliform (MPN/100mL)	<1				
Total Metals	Aluminum (Al)-Total (mg/L)	0.0042				
	Antimony (Sb)-Total (mg/L)	<0.00010				
	Arsenic (As)-Total (mg/L)	0.00018				
	Barium (Ba)-Total (mg/L)	0.00113				
	Beryllium (Be)-Total (mg/L)	<0.00010				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	<0.010				
	Cadmium (Cd)-Total (mg/L)	<0.0000050				
	Calcium (Ca)-Total (mg/L)	0.542				
	Cesium (Cs)-Total (mg/L)	<0.000010				
	Chromium (Cr)-Total (mg/L)	0.00010				
	Cobalt (Co)-Total (mg/L)	<0.00010				
	Copper (Cu)-Total (mg/L)	<0.00050				
	Iron (Fe)-Total (mg/L)	<0.010				
	Lead (Pb)-Total (mg/L)	<0.000050				
	Lithium (Li)-Total (mg/L)	<0.0010				
	Magnesium (Mg)-Total (mg/L)	0.227				
	Manganese (Mn)-Total (mg/L)	0.00063				
	Mercury (Hg)-Total (mg/L)	<0.0000050				
	Molybdenum (Mo)-Total (mg/L)	<0.000050				
	Nickel (Ni)-Total (mg/L)	<0.00050				
	Phosphorus (P)-Total (mg/L)	<0.050				
	Potassium (K)-Total (mg/L)	0.173				
	Rubidium (Rb)-Total (mg/L)	0.00050				
	Selenium (Se)-Total (mg/L)	<0.000050				
	Silicon (Si)-Total (mg/L)	<0.10				
	Silver (Ag)-Total (mg/L)	<0.000010				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2304109-1				
	Description	WATER				
	Sampled Date	04-JUL-19				
	Sampled Time	09:00				
	Client ID	LUP-01				
Grouping	**Analyte**					
WATER						
Total Metals	Sodium (Na)-Total (mg/L)	0.252				
	Strontium (Sr)-Total (mg/L)	0.00250				
	Sulfur (S)-Total (mg/L)	<0.50				
	Tellurium (Te)-Total (mg/L)	<0.00020				
	Thallium (Tl)-Total (mg/L)	<0.000010				
	Thorium (Th)-Total (mg/L)	<0.00010				
	Tin (Sn)-Total (mg/L)	<0.00010				
	Titanium (Ti)-Total (mg/L)	<0.00030				
	Tungsten (W)-Total (mg/L)	<0.00010				
	Uranium (U)-Total (mg/L)	<0.000010				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	<0.0030				
	Zirconium (Zr)-Total (mg/L)	<0.00020				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Total	MS-B	L2304109-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L2304109-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L2304109-1
Matrix Spike	Sodium (Na)-Total	MS-B	L2304109-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L2304109-1
Matrix Spike	Sulfur (S)-Total	MS-B	L2304109-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
HTC	Hardness was calculated from Total Ca and/or Mg concentrations and may be biased high (dissolved Ca/Mg results unavailable).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity

This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.

EC-PCT-VA	Water	Conductivity (Automated)	APHA 2510 Auto. Conduc.

This analysis is carried out using procedures adapted from APHA Method 2510 "Conductivity". Conductivity is determined using a conductivity electrode.

EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510

Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.

FCOLI-MPN-YL	Water	Thermotolerant (Fecal) Coliforms	APHA 9223B, 2004 Enzyme Substrate Method

Analysis is carried out using procedures adapted from APHA 9223 "Enzyme Substrate Coliform Test". Fecal Coliform (Thermotolerant) bacteria are determined by mixing sample with a mixture of hydrolyzable substrates and then sealing in a multi-well packet. The packet is incubated for 18-24 hours and the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

HARDNESS-CALC-VA	Water	Hardness	APHA 2340B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-T-CVAA-VA	Water	Total Mercury in Water by CVAAS or CVAFS	EPA 1631E (mod)

Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS or CVAFS.

MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

PH-PCT-VA	Water	pH by Meter (Automated)	APHA 4500-H pH Value

This analysis is carried out using procedures adapted from APHA Method 4500-H "pH Value". The pH is determined in the laboratory using a pH electrode

It is recommended that this analysis be conducted in the field.

TSS-VA	Water	Total Suspended Solids by Gravimetric	APHA 2540 D - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, TSS is determined by drying the filter at 104 degrees celsius. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
YL	ALS ENVIRONMENTAL -YELLOWKNIFE, NORTHWEST TERRITORIES CANADA
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Reference Information

Chain of Custody Numbers:

17-817572

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour 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.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2304109 Report Date: 10-JUL-19

Client: Nahanni Construction
100 Nahanni Drive
Yellowknife NT X1A 2P6
Contact: Dave Vokey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-TITR-VA	**Water**							
Batch R4696300								
WG3097623-3 CRM		**VA-ALK-TITR-CONTROL**						
Alkalinity, Total (as CaCO3)			100.2		%		85-115	08-JUL-19
WG3097623-1 MB								
Alkalinity, Total (as CaCO3)			<1.0		mg/L		1	08-JUL-19
EC-PCT-VA	**Water**							
Batch R4696300								
WG3097623-4 CRM		**VA-EC-PCT-CONTROL**						
Conductivity			101.5		%		90-110	08-JUL-19
WG3097623-1 MB								
Conductivity			<2.0		uS/cm		2	08-JUL-19
FCOLI-MPN-YL	**Water**							
Batch R4696160								
WG3096713-1 MB								
MPN-Fecal Coliform			<1		MPN/100mL		1	04-JUL-19
HG-T-CVAA-VA	**Water**							
Batch R4701329								
WG3100300-2 LCS								
Mercury (Hg)-Total			90.6		%		80-120	09-JUL-19
WG3100300-1 MB								
Mercury (Hg)-Total			<0.000005(		mg/L		0.000005	09-JUL-19
MET-T-CCMS-VA	**Water**							
Batch R4702754								
WG3099431-2 LCS								
Aluminum (Al)-Total			106.4		%		80-120	09-JUL-19
Antimony (Sb)-Total			97.0		%		80-120	09-JUL-19
Arsenic (As)-Total			105.7		%		80-120	09-JUL-19
Barium (Ba)-Total			111.5		%		80-120	09-JUL-19
Beryllium (Be)-Total			99.1		%		80-120	09-JUL-19
Bismuth (Bi)-Total			100.4		%		80-120	09-JUL-19
Boron (B)-Total			106.9		%		80-120	09-JUL-19
Cadmium (Cd)-Total			104.7		%		80-120	09-JUL-19
Calcium (Ca)-Total			102.6		%		80-120	09-JUL-19
Cesium (Cs)-Total			101.9		%		80-120	09-JUL-19
Chromium (Cr)-Total			104.4		%		80-120	09-JUL-19
Cobalt (Co)-Total			105.9		%		80-120	09-JUL-19

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R4702754								
WG3099431-2 LCS								
Copper (Cu)-Total			102.7		%		80-120	09-JUL-19
Iron (Fe)-Total			103.3		%		80-120	09-JUL-19
Lead (Pb)-Total			102.6		%		80-120	09-JUL-19
Lithium (Li)-Total			94.7		%		80-120	09-JUL-19
Magnesium (Mg)-Total			105.6		%		80-120	09-JUL-19
Manganese (Mn)-Total			101.5		%		80-120	09-JUL-19
Molybdenum (Mo)-Total			97.7		%		80-120	09-JUL-19
Nickel (Ni)-Total			106.6		%		80-120	09-JUL-19
Phosphorus (P)-Total			110.4		%		80-120	09-JUL-19
Potassium (K)-Total			107.9		%		80-120	09-JUL-19
Rubidium (Rb)-Total			101.7		%		80-120	09-JUL-19
Selenium (Se)-Total			104.7		%		80-120	09-JUL-19
Silicon (Si)-Total			112.4		%		80-120	09-JUL-19
Silver (Ag)-Total			97.6		%		80-120	09-JUL-19
Sodium (Na)-Total			111.9		%		80-120	09-JUL-19
Strontium (Sr)-Total			104.1		%		80-120	09-JUL-19
Sulfur (S)-Total			110.3		%		80-120	09-JUL-19
Tellurium (Te)-Total			100.3		%		80-120	09-JUL-19
Thallium (Tl)-Total			101.0		%		80-120	09-JUL-19
Thorium (Th)-Total			101.2		%		80-120	09-JUL-19
Tin (Sn)-Total			99.4		%		80-120	09-JUL-19
Titanium (Ti)-Total			106.2		%		80-120	09-JUL-19
Tungsten (W)-Total			104.8		%		80-120	09-JUL-19
Uranium (U)-Total			106.1		%		80-120	09-JUL-19
Vanadium (V)-Total			106.5		%		80-120	09-JUL-19
Zinc (Zn)-Total			101.6		%		80-120	09-JUL-19
Zirconium (Zr)-Total			91.7		%		80-120	09-JUL-19
WG3099431-1 MB								
Aluminum (Al)-Total			<0.0030		mg/L		0.003	09-JUL-19
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Arsenic (As)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Barium (Ba)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	09-JUL-19

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-VA	**Water**							
Batch R4702754								
WG3099431-1 MB								
Boron (B)-Total			<0.010		mg/L		0.01	09-JUL-19
Cadmium (Cd)-Total			<0.000005C		mg/L		0.000005	09-JUL-19
Calcium (Ca)-Total			<0.050		mg/L		0.05	09-JUL-19
Cesium (Cs)-Total			<0.000010		mg/L		0.00001	09-JUL-19
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Copper (Cu)-Total			<0.00050		mg/L		0.0005	09-JUL-19
Iron (Fe)-Total			<0.010		mg/L		0.01	09-JUL-19
Lead (Pb)-Total			<0.000050		mg/L		0.00005	09-JUL-19
Lithium (Li)-Total			<0.0010		mg/L		0.001	09-JUL-19
Magnesium (Mg)-Total			<0.0050		mg/L		0.005	09-JUL-19
Manganese (Mn)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	09-JUL-19
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	09-JUL-19
Phosphorus (P)-Total			<0.050		mg/L		0.05	09-JUL-19
Potassium (K)-Total			<0.050		mg/L		0.05	09-JUL-19
Rubidium (Rb)-Total			<0.00020		mg/L		0.0002	09-JUL-19
Selenium (Se)-Total			<0.000050		mg/L		0.00005	09-JUL-19
Silicon (Si)-Total			<0.10		mg/L		0.1	09-JUL-19
Silver (Ag)-Total			<0.000010		mg/L		0.00001	09-JUL-19
Sodium (Na)-Total			<0.050		mg/L		0.05	09-JUL-19
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	09-JUL-19
Sulfur (S)-Total			<0.50		mg/L		0.5	09-JUL-19
Tellurium (Te)-Total			<0.00020		mg/L		0.0002	09-JUL-19
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	09-JUL-19
Thorium (Th)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Tin (Sn)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	09-JUL-19
Tungsten (W)-Total			<0.00010		mg/L		0.0001	09-JUL-19
Uranium (U)-Total			<0.000010		mg/L		0.00001	09-JUL-19
Vanadium (V)-Total			<0.00050		mg/L		0.0005	09-JUL-19
Zinc (Zn)-Total			<0.0030		mg/L		0.003	09-JUL-19
Zirconium (Zr)-Total			<0.00020		mg/L		0.0002	09-JUL-19
PH-PCT-VA	**Water**							

Quality Control Report

Workorder: L2304109 Report Date: 10-JUL-19

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH-PCT-VA	**Water**							
Batch R4696300								
WG3097623-2 CRM		**VA-PH7-BUF**						
pH			7.01		pH		6.9-7.1	08-JUL-19
TSS-VA	**Water**							
Batch R4700651								
WG3099325-8 LCS								
Total Suspended Solids			95.8		%		85-115	09-JUL-19
WG3099325-7 MB								
Total Suspended Solids			<3.0		mg/L		3	09-JUL-19

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Quality Control Report

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
pH by Meter (Automated)							
	1	04-JUL-19 09:00	08-JUL-19 09:14	0.25	96	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L2304109 were received on 04-JUL-19 13:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes 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 pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC # 17-817572

Page 1 of 1

Report To		Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company:	Nahanni Construction Ltd.	☑ Standard ☐ Other	◉ Regular (Standard Turnaround Times - Business Days)
Contact:	Dave Vokey	☑ PDF ☑ Excel ☐ Digital ☐ Fax	○ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	100 Nahanni Drive	Email 1: lupinmanager@NahanniNCL.com	○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	Yellowknife, NT	Email 2: klewis@mandalayresources.com	○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	867-873-2975 Fax:	Email 3: lupinengineer@NahanniNCL.com	
Invoice To	Same as Report ? ☑ Yes ☐ No	**Client / Project Information**	**Analysis Request**
Hardcopy of Invoice with Report?	☑ Yes ☐ No	Job #: Lupin Mine	Please indicate below Filtered, Preserved or both (F, P, F/P)
Company:	Nahanni Construction Ltd.	PO / AFE:	
Contact:	AP@NahanniNCL.com	LSD:	
Address:	100 Nahanni Drive, Yellowknife, NT		
Phone:	867-873-2975 Fax:	Quote #:	
Lab Work Order # (lab use only)	L2304109	ALS Contact:	Sampler: D. Vokey

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	pH, alkalinity, hardness	TSS	Conductivity	T-Metals (ICP Metals Scan)	T- Mercury	Fecal coliforms	Number of Containers
	LUP-01	04-Jul-19	9:00	Water	X	X	X	X	X	X	5

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
D. Vokey	4-Jul-19	11:30		4-July-19	13:30	11.1 °C				

GENF 20.00 Front

APPENDIX B– INSPECTION REPORTS

WATER LICENCE INSPECTION FORM

☒ **Original**
☐ **Follow-Up Report**

Licensee	**Licensee Representative**
Lupin Mines Inc	Karyn Lewis
Licence No. / Expiry	**Representative's Title**
2AM-LUP1520	Project Manager
Land / Other Authorizations	**Land / Other Authorizations**
Date of Inspection	**Inspector**
2019 June 9	Baba Pedersen

Activities Inspected

☒ Camp ☐ Drilling ☐ Mining ☐ Construction ☒ Reclamation ☒ Fuel Storage
☐ Roads/Hauling ☐ Other: ☒ Other: Care & Maintenance

Conditions: **A - Acceptable** **C - Concern** **U - Unacceptable** **NA – Not Applicable** **NI – Not Inspected**

Water Use	Condition	Comment	**Site Conditions**	Condition	Comment	**Haz/Mat Management**	Condition	Comment
Intake/Screen	A	1	Water Management Structures			Storage	A	4
Flow Measure. Device	A	1	Culverts / Bridges			Spills		
Source:	A	1	Drainage			Spill Plan		
Water Use:			Erosion / Sediment					
Recirculation (y /n)			Mitigation Measures			**Administrative**		
			Reclamation Activities	A	3	Records	A	
			Materials Storage			Reports		
Waste Disposal			Signage	A		Plans		
Waste Water	A	5				Notifications		
Solid Waste			**Monitoring**			**Other**		
Hazardous Waste			Sample Collection / Analysis	A	5	Quarry	A	2

**The number in the comments field will correspond with specific comments provided below.*

Samples taken by Inspector:	Location(s):
☐ Yes ☒ No	

SECTION 1 ☒ **Comments** (s.__) ☐ **Non-Compliance with Act or Licence** (s.__) ☐ **Action Required** (s.__)

I Inspected the Lupin Mine Site (Photo 6) on June 9, 2019. I was accompanied by Karyn Lewis, Project Manager and Dave Vokey, Mine Manager, both with LMI and also Clell Crook with Nahanni Construction as well as Candice Pedersen from CIRNAC. I was Inspecting Water License 2AM-LUP1520.

SECTION 2 ☒ **Comments** ☐ **Non-Compliance with Act or Licence** ☐ **Action Required**

The Camp just opened up on May 30th, they have 14 people in Camp right now and are currently using flown in bottled water for consumption. The 2019 Plans are to do mostly Care & Maintenance Activities, haul in Gear and Equipment via Ice Road in early 2020 and start the Reclamation Project in the summer of 2020. 1. They have just started getting water from the Raw Water Intake (Photos 1 & 2), 2. I saw the Fingers Lake Quarry (Photos 3 & 4), 3. The Liming Station on Dam 1 @ Pond 2, 4. The Bulk Fuel Storage Tanks, and 5. The Sewage Decant Area (Photo 5).

SECTION 3 ☐ **Comments** ☐ **Non-Compliance with Act or Licence** ☒ **Action Required**

I was not able to see as much as I planned because the ground was still covered with snow in a lot of places and LMI had not been able to start much of their plans due to this. 1. As they have just opened for the season, Water Consumption is well within allowable limits, 2. The Fingers Lake Quarry Area is in a Clean, Organized and Acceptable State, 3. The Liming Station is in Care & Maintenance and is an acceptable state, 4. Only Tank #13 and Tank #15 have any Product in them with a combined total of 869,510 Litres, all other Tanks on Site are now empty. 5. LMI/Nahanni will be requesting permission to Decant as soon as possible. Samples have already been taken and sent to the Lab.

Licensee or Representative	**Inspector's Name**
	Baba Pedersen
Signature	**Signature**
	Signed Original on File
Date	**Date**
	2019 Aug 19

Office Use Only: Follow-up report to be issued by Inspector ☐ Yes ☒ No

cc. CIRNAC, Manager Field Operations, Iqaluit, justin.hack@canada.ca

Nunavut Water Board, Manager of Licensing, Gjoa Haven, licensing@nwb-oen.ca

PHOTO LOG

Date	Camera	Inspector	Authorization
2019 June 9	Sony DSC-HX50V	Baba Pedersen	2AM-LUP1520

Photo Log # DSC04319

Photo 1

Description: Raw Water Intake Location through the Ice

Photo Log # DSC04326

Photo 2

Description: LUP-01 Signage on Raw Water Intake Pump House Building

Photo Log # DSC04331

Photo 3

Description: View #1 of the Fingers Lake Quarry Area

Photo Log # DSC04333

Photo 4

Description: View #2 of the Fingers Lake Quarry Area

Photo Log # DSC04366

Photo 5

Description: Sample Station LUP-14 and the Sewage Decant Area

Photo Log # DSC04318

Photo 6

Description: View of the Lupin Mine Site as seen from the North

APPENDIX C – GEOTECHNCIAL

Geotechnical Cover Letter Located on the NWB FTP site

ftp://ftp.nwb-oen.ca/registry/2%20MINING%20MILLING/2A/2AM%20-%20Mining/2AM-LUP2032%20LMI/3%20TECH/J%20MONITORING/J12%20Annual%20Geotechnical%20Inspection/2019/200102%202AM-LUP1520%202019%20Cover%20Letter%20Geotech%20Inspection-IMLE.pdf

2019 Geotechnical Report located on the NWB FTP site

ftp://ftp.nwb-oen.ca/registry/2%20MINING%20MILLING/2A/2AM%20-%20Mining/2AM-LUP2032%20LMI/3%20TECH/J%20MONITORING/J12%20Annual%20Geotechnical%20Inspection/2019/200102%202AM-LUP1520%202019%20Lupin%20DSI%20Report_FINAL-IMLE.pdf