ASSESSMENT REPORT

describing

GEOCHEMICAL SAMPLING, PROSPECTING, METALLURGICAL TESTING, AND GEOTECHNICAL ANALYSIS

at the Osiris and Orion Projects of the

RACKLA GOLD PROPERTY

AT 1-206; BOB 1-16; BT 1-192; Dale 1-12; EN 1-192, EX 1-18; IS 1-28; JAM 1-32; OS 1-576, 641-676, 749-770, 841-846, 913-1076; PH 1-22; Q 25-109, R1-60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 106, 108, RR 1-222; ST 1-517; Smac 1-3; STEN 1-142; T 1-3133 and WH 1-61

NTS 106C/01, 02, 03, 07, 08 and 106B/04
Latitude 64°01´N to 64°16´ N; Longitude 133°19´W to 131°54´W

in the

Mayo Mining District, Yukon Territory

Field work performed from June 5th to October 6th, 2019

prepared by

ATAC RESOURCES LTD.

By

A. O. Carne, M.Eng., P.Eng.
A. Schneebeli, B.Sc., G.I.T.

December 2020

CONTENTS

INTRODUCTION	1
PROPERTY LOCATION, CLAIM DATA, ACCESS AND INFRASTRUCTURE	1
HISTORY AND PREVIOUS WORK	7
GEOMORPHOLOGY AND CLIMATE	10
REGIONAL GEOLOGY	11
PROPERTY GEOLOGY	12
MINERALIZATION	16
ROCK GEOCHEMISTRY AND RESULTS	19
METALLURGICAL TESTING	20
GEOTECHNICAL ANALYSIS	21
DISCUSSION AND CONCLUSIONS	23
REFERENCES	24

APPENDICIES

I STATEMENTS OF QUALIFICATIONS
II STATEMENT OF EXPENDITURES
III ROCK SAMPLE DESCRIPTIONS
IV METALLURGICAL TESTWORK REPORT
V GEOTECHNICAL ANALYSIS REPORT
VI GEOCHEMICAL SAMPLING - CERTIFICATES OF ANALYSIS

FIGURES

No.	Description
1	Property Location
2A-D	Claims by Assessment Group
3	Showings, Camps, Airstrips
4	Tectonic Setting
5	Regional Stratigraphic Section
6	Regional Geology
7	Nadaleen Trend Geology
8	2019 Rock Sample Locations
9	Rock Sample Results – Silver
10	Rock Sample Results – Copper
11	Rock Sample Results – Lead
12	Rock Sample Results – Zinc

TABLES

		PAGE
I	Nadaleen Trend Claim Information	2
II	Annual ATAC Results Summary Table	9
III	Proterozoic to Lower Cambrian Rocks along the Nadaleen Trend	11
IV	Paleozoic Rocks along the Nadaleen Trend	12
V	Summary of Mineralized Zones along the Nadaleen Trend	17
VI	Highlight Val Rock Sample Results	20
VII	Metallurgical Composite Head Grades	21
VIII	Scoping-Level Pit Slope Design Recommendations	22

INTRODUCTION

The Rackla Gold Property comprises a 1700 km^2 area of highly prospective, platform to basin facies, sedimentary rocks located along the northern edge of the Tintina Gold Belt at the transition from the Selwyn Basin to the Mackenzie Platform in east-central Yukon Territory (Figure 1). Various commodities have been explored for and discovered both currently and historically within the claim block. Past exploration focused on base metal mineralization, while recently the emphasis has been directed towards gold potential. The property is wholly owned by ATAC Resources Ltd. (ATAC) and is comprised of three projects: the advanced Carlin-type gold Osiris Project, the early stage Carlin-type gold Orion Project and the advanced Rau Project which hosts the Tiger Gold Deposit.

This report describes the work completed, methods used and the results obtained from work completed in 2019 at the Osiris and Orion Projects including:

i) Geochemical sampling and prospecting at the Val target on the Orion Project;
ii) Metallurgical testwork on samples from the Osiris deposits; and
iii) Geotechnical evaluation of the Osiris deposits.

The authors supervised and participated in the program and interpreted all resulting data. The authors' Statements of Qualifications are listed in Appendix I; while Appendix II provides a Statement of Expenditures related to the program.

PROPERTY LOCATION, CLAIM DATA, ACCESS AND INFRASTRUCTURE

The Osiris and Orion Projects of the Rackla Gold Property consist of 5,768 contiguous mineral claims located from 64°01´N to 64°16′ N and stretching from 133°19´W to 131°54´W on NTS map sheets NTS 106C/01, 02, 03, 07, 08 and 106B/04 (Figure 1). The work presented in this report was filed for all 5,768 claims. Claim information for these claims is presented below in Table I. The claims are all registered with the Mayo Mining Recorder. The Smac claims are held 50% by Archer Cathro in trust for Strategic Metals Ltd. and 50% by ATAC, in accordance with a joint venture agreement. All other claims are held directly by ATAC. Specifics concerning claim registration are tabulated below while the locations of individual claims associated with this report are shown on Figures 2A-D.

The Osiris Project is made up of Claim Groups A and B and the Orion Project is made up of Claim Groups C through F (Figures 2A-D). The cluster of showings in the Osiris Project is known as the Osiris cluster and the cluster of showings in the Orion Project is known as the Anubis Cluster (Figure 3). The combination of the Osiris cluster and the Anubis cluster are referred to herein as the Nadaleen Trend.

TABLE I: NADALEEN TREND CLAIM INFORMATION

Claim	Numbers	Grants	Expiry
AT	1-206	YF44251-YF44456	April 28, 2039
Bob	1-10	YF44457-YF44466	April 28, 2028
Bob	11-16	YF44467-YF44472	April 28, 2027
BT	1-192	YF42501-YF42692	April 28, 2028
Dale	1-12	YD08533-YD08544	April 28, 2051
EN	1-192	YD01401-YD01592	April 28, 2040
EX	1-18	YD72482-YD72499	April 28, 2038
IS	1-28	YC99751-YC99778	April 28, 2040
Jam	1-32	YD08501-YD08532	April 28, 2030
OS	1-14	YD69731-YD69744	April 28, 2038
OS	15-36	YD69745-YD69766	April 28, 2040
OS	37-50	YD69767-YD69780	April 28, 2038
OS	51-78	YD69781-YD69808	April 28, 2040
OS	79-92	YD69809-YD69822	April 28, 2038
OS	93-126	YD69823-YD69856	April 28, 2040
OS	127-576	YD69857-YD70306	April 28, 2038
OS	641-676	YD70371-YD70406	April 28, 2040
OS	749-770	YD70479-YD70500	April 28, 2040
OS	841-846	YD70571-YD70576	April 28, 2040
OS	913-1076	YD70643-YD70806	April 28, 2040
PH	1-11	YE55701-YE55711	April 28, 2040
PH	12	YE55712	April 28, 2036
PH	13-20	YE55713-YE55720	April 28, 2040
PH	21-22	YE55721-YE55722	April 28, 2038
Q	25-26	YC92385-YC92386	April 28, 2041
Q	27-52	YC92387-YC92412	April 28, 2034
Q	53-58	YC92413-YC92418	April 28, 2038
Q	59-84	YC92419-YC92444	April 28, 2034
Q	85-88	YC92445-YC92448	April 28, 2038
Q	89	YC92449	April 28, 2034
Q	90	YC92450	April 28, 2038
Q	91-109	YC92451-YC92469	April 28, 2034
R	1-6	YC68334-YC68339	April 28, 2043
R	7-10	YC68340-YC68343	April 28, 2040
R	11-12	YC68344-YC68345	April 28, 2036
R	13-20	YC68346-YC68353	April 28, 2043
R	21-24	YC68354-YC68357	April 28, 2040
R	25-54	YC68358-YC68387	April 28, 2036
R	55-60	YC68388-YC68393	April 28, 2043
R	62	YC68395	April 28, 2043
R	64	YC68397	April 28, 2043
R	66	YC68399	April 28, 2043
R	68	YC68401	April 28, 2040
R	70	YC68403	April 28, 2040
R	72	YC68405	April 28, 2036
R	74	YC68407	April 28, 2036
R	76	YC68409	April 28, 2036

R	78	YC68411	April 28, 2036
R	80	YC68413	April 28, 2036
R	82	YC68415	April 28, 2036
R	84	YC68417	April 28, 2036
R	86	YC68419	April 28, 2036
R	88	YC68421	April 28, 2036
R	90	YC68423	April 28, 2036
R	92	YC68425	April 28, 2036
R	94	YC68427	April 28, 2036
R	96	YC68429	April 28, 2036
R	98	YC68431	April 28, 2036
R	100	YC68433	April 28, 2036
R	102	YC68435	April 28, 2036
R	106	YC68439	April 28, 2043
R	108	YC68441	April 28, 2043
RR	1-222	YC89701-YC89922	April 28, 2036
Smac	1	YD07302	March 1, 2033
Smac	2	YD07303	March 1, 2029
Smac	3	YD07301	March 1, 2029
ST	1-24	YD26901-YD26924	April 28, 2048
ST	25-86	YD26925-YD26986	April 28, 2044
ST	87-91	YD26987-YD26991	April 28, 2048
ST	92-431	YD26992-YD27331	April 28, 2044
ST	432-517	YD27332-YD27417	April 28, 2045
Sten	1-20	YC99501-YC99520	April 28, 2049
Sten	21-38	YC99523-YC99540	April 28, 2047
Sten	39-54	YD08485-YD08500	April 28, 2047
Sten	55-89	YD10405-YD10439	April 28, 2047
Sten	90	YD10440	April 28, 2051
Sten	91	YD10441	April 28, 2047
Sten	92	YD10442	April 28, 2051
Sten	93	YD10443	April 28, 2047
Sten	94	YD10444	April 28, 2051
Sten	95	YD10445	April 28, 2047
Sten	96	YD10446	April 28, 2051
Sten	97	YD10447	April 28, 2047
Sten	98	YD10448	April 28, 2051
Sten	99	YD10449	April 28, 2047
Sten	100	YD10450	April 28, 2051
Sten	101	YD10451	April 28, 2047
Sten	102-104	YD10452-YD10454	April 28, 2051
Sten	105-126	YD10455-YD10476	April 28, 2047
Sten	127-142	YD10477-YD10492	April 28, 2051
T	1-670	YD09731-YD10400	March 1, 2036
T	671-747	YD22801-YD22877	March 1, 2036
T	748-771	YD22878-YD22901	March 1, 2045
T	772-785	YD22902-YD22915	March 1, 2041
T	786-809	YD22916-YD22939	March 1, 2045
T	810-823	YD22940-YD22953	March 1, 2041
T	824-847	YD22954-YD22977	March 1, 2045

T	848-861	YD22978-YD22991	March 1, 2041
T	862-889	YD22992-YD23019	March 1, 2045
T	890-903	YD23020-YD23033	March 1, 2041
T	904-1071	YD23034-YD23201	March 1, 2045
T	1072-1521	YD23202-YD23651	March 1, 2032
T	1522-1549	YD23652-YD23679	March 1, 2028
T	1550-1567	YD23680-YD23697	March 1, 2027
T	1568-1596	YD23698-YD23726	March 1, 2028
T	1597-1614	YD23727-YD23744	March 1, 2027
T	1615-1644	YD23745-YD23774	March 1, 2028
T	1645-1662	YD23775-YD23792	March 1, 2027
T	1663-1694	YD23793-YD23824	March 1, 2028
T	1695-1712	YD23825-YD23842	March 1, 2027
T	1713-1746	YD23843-YD23876	March 1, 2028
T	1747-1764	YD23877-YD23894	March 1, 2027
T	1765-1769	YD23895-YD23899	March 1, 2031
T	1770-1803	YD23900-YD23933	March 1, 2028
T	1804-1821	YD23934-YD23951	March 1, 2027
T	1822-1827	YD23952-YD23957	March 1, 2031
T	1828-1853	YD23958-YD23983	March 1, 2028
T	1854-1857	YD23984-YD23987	March 1, 2029
T	1858-1861	YD23988-YD23991	March 1, 2028
T	1862-1879	YD23992-YD24009	March 1, 2027
T	1880-1885	YD24010-YD24015	March 1, 2031
T	1886-1911	YD24016-YD24041	March 1, 2028
T	1912-1915	YD24042-YD24045	March 1, 2029
T	1916-1919	YD24046-YD24049	March 1, 2028
T	1920-1937	YD24050-YD24067	March 1, 2027
T	1938-1943	YD24068-YD24073	March 1, 2031
T	1944-1949	YD24074-YD24079	March 1, 2028
T	1950-1973	YD24080-YD24103	March 1, 2029
T	1974-1977	YD24104-YD24107	March 1, 2028
T	1978-1995	YD24108-YD24125	March 1, 2027
T	1996-2001	YD24126-YD24131	March 1, 2031
T	2002-2007	YD24132-YD24137	March 1, 2028
T	2008-2011	YD24138-YD24141	March 1, 2029
T	2012-2035	YD24142-YD24165	March 1, 2028
T	2036-2053	YD24166-YD24183	March 1, 2027
T	2054-2059	YD24184-YD24189	March 1, 2031
T	2060-2065	YD24190-YD24195	March 1, 2028
T	2066-2069	YD24196-YD24199	March 1, 2029
T	2070-2073	YD24200-YD24203	March 1, 2028
T	2074-2111	YD24204-YD24241	March 1, 2027
T	2112-2117	YD24242-YD24247	March 1, 2031
T	2118-2123	YD24248-YD24253	March 1, 2028
T	2124-2127	YD24254-YD24257	March 1, 2029
T	2128-2131	YD24258-YD24261	March 1, 2028
T	2132-2157	YD24262-YD24287	March 1, 2027
T	2158	YD24288	March 1, 2032
T	2159	YD24289	March 1, 2031

T	2160	YD24290	March 1, 2032
T	2161	YD24291	March 1, 2031
T	2162	YD24292	March 1, 2032
T	2163-2164	YD24293-YD24294	March 1, 2031
T	2165	YD24295	March 1, 2028
T	2166	YD24296	March 1, 2031
T	2167	YD24297	March 1, 2028
T	2168	YD24298	March 1, 2031
T	2169	YD24299	March 1, 2028
T	2170	YD24300	March 1, 2031
T	2171	YD24301	March 1, 2029
T	2172	YD24302	March 1, 2031
T	2173	YD24303	March 1, 2029
T	2174	YD24304	March 1, 2031
T	2175	YD24305	March 1, 2028
T	2176	YD24306	March 1, 2031
T	2177	YD24307	March 1, 2028
T	2178	YD24308	March 1, 2031
T	2179	YD24309	March 1, 2027
T	2180	YD24310	March 1, 2031
T	2181	YD24311	March 1, 2027
T	2182	YD24312	March 1, 2031
T	2183	YD24313	March 1, 2027
T	2184	YD24314	March 1, 2031
T	2185	YD24315	March 1, 2027
T	2186	YD24316	March 1, 2031
T	2187	YD24317	March 1, 2027
T	2188	YD24318	March 1, 2031
T	2189	YD24319	March 1, 2027
T	2190	YD24320	March 1, 2031
T	2191	YD24321	March 1, 2027
T	2192	YD24322	March 1, 2031
T	2193	YD24323	March 1, 2027
T	2194	YD24324	March 1, 2031
T	2195	YD24325	March 1, 2027
T	2196	YD24326	March 1, 2031
T	2197	YD24327	March 1, 2027
T	2198	YD24328	March 1, 2031
T	2199	YD24329	March 1, 2027
T	2200	YD24330	March 1, 2031
T	2201	YD24331	March 1, 2027
T	2202	YD24332	March 1, 2031
T	2203	YD24333	March 1, 2027
T	2204-2209	YD24334-YD24339	March 1, 2032
T	2210-2249	YD24340-YD24379	March 1, 2031
T	2250-2255	YD24380-YD24385	March 1, 2032
T	2256-2295	YD24386-YD24425	March 1, 2031
T	2296	YD24426	March 1, 2045
T	2297	YD24427	March 1, 2032
T	2298	YD24428	March 1, 2045

T	2299-2301	YD24429-YD24431	March 1, 2032
T	2302-2341	YD24432-YD24471	March 1, 2031
T	2342-2348	YD24472-YD24478	March 1, 2045
T	2349-2387	YD24479-YD24517	March 1, 2031
T	2388-2397	YD24518-YD24527	March 1, 2045
T	2398-2427	YD24528-YD24557	March 1, 2031
T	2428-2437	YD24558-YD24567	March 1, 2045
T	2438-2467	YD24568-YD24597	March 1, 2031
T	2468-2477	YD24598-YD24607	March 1, 2045
T	2478-2507	YD24608-YD24637	March 1, 2031
T	2508-2517	YD24638-YD24647	March 1, 2045
T	2518-2547	YD24648-YD24677	March 1, 2031
T	2548-2557	YD24678-YD24687	March 1, 2045
T	2558-2570	YD24688-YD24700	March 1, 2031
T	2571-2587	YD11401-YD11417	March 1, 2031
T	2588-2597	YD11418-YD11427	March 1, 2045
T	2598-2627	YD11428-YD11457	March 1, 2031
T	2628-2637	YD11458-YD11467	March 1, 2045
T	2638-2667	YD11468-YD11497	March 1, 2031
T	2668-2677	YD11498-YD11507	March 1, 2045
T	2678-2707	YD11508-YD11537	March 1, 2031
T	2708-2717	YD11538-YD11547	March 1, 2045
T	2718-2747	YD11548-YD11577	March 1, 2031
T	2748-2757	YD11578-YD11587	March 1, 2045
T	2758-2771	YD11588-YD11601	March 1, 2031
T	2772	YD11602	March 1, 2045
T	2773	YD11603	March 1, 2031
T	2774	YD11604	March 1, 2045
T	2775	YD11605	March 1, 2031
T	2776	YD11606	March 1, 2045
T	2777	YD11607	March 1, 2031
T	2778	YD11608	March 1, 2045
T	2779	YD11609	March 1, 2031
T	2780	YD11610	March 1, 2045
T	2781	YD11611	March 1, 2031
T	2782	YD11612	March 1, 2045
T	2783	YD11613	March 1, 2031
T	2784	YD11614	March 1, 2045
T	2785	YD11615	March 1, 2031
T	2786	YD11616	March 1, 2045
T	2787	YD11617	March 1, 2031
T	2788-2807	YD11618-YD11637	March 1, 2045
T	2808-2814	YD11638-YD11644	March 1, 2031
T	2815-2850	YD11645-YD11680	March 1, 2045
T	2851-2858	YD11681-YD11688	March 1, 2031
T	2859-2870	YD11689-YD11700	March 1, 2045
T	2871-2894	YD32901-YD32924	March 1, 2045
T	2895-2902	YD32925-YD32932	March 1, 2031
T	2903-2938	YD32933-YD32968	March 1, 2045
T	2939-2949	YD32969-YD32979	March 1, 2031

T	2950-2957	YD32980-YD32987	March 1, 2045
T	2958	YD32988	March 1, 2048
T	2959	YD32989	March 1, 2045
T	2960	YD32990	March 1, 2048
T	2961	YD32991	March 1, 2045
T	2962-2971	YD32992-YD33001	March 1, 2048
T	2972-3004	YD33002-YD33034	March 1, 2044
T	3005	YD33035	March 1, 2045
T	3006	YD33036	March 1, 2044
T	3007	YD33037	March 1, 2045
T	3008-3125	YD33038-YD33155	March 1, 2044
T	3126-3131	YD33156-YD33161	March 1, 2036
T	3132-3133	YD33239-YD33240	March 1, 2031
WH	1-61	YF41901-YF41961	April 28, 2042

**Expiry dates include 2019 work which has been filed and has received assessment credit.*

The closest road access is to the community of Keno City, situated 60 km by road northeast of the town of Mayo. Access to the project in 2019 was routed via Mayo to the Stewart airstrip approximately 180 km east-northeast or directly from Whitehorse to the Stewart airstrip approximately 400 km north-northeast. The locations of the Stewart airstrip and Nadaleen camp are shown on Figure 3. Drill and equipment was demobilized and moved from the Nadaleen camp to ATAC's adjoining Rau project using a combination of fixed wing and rotary aircraft.

Geochemical sampling and prospecting was supported from the Rau Camp on ATAC's adjoining Rau Project. Daily access to work areas on the project was provided by Horizon Helicopters utilizing a Eurocopter AS350 SD2 (A-Star) helicopter.

HISTORY AND PREVIOUS WORK

The earliest recorded exploration in the area of the Nadaleen Trend occurred when McIntyre Mines staked the Birkeland claims, then called Tom and Mom, in 1974 approximately 205 km east-northeast of Mayo. Mapping, geochemical soil sampling, trenching and the drilling of 10 BQ and 22 Winkie holes were carried out in 1975. The most significant results achieved were 4.4% zinc, 0.5% lead and 2.7 g/t silver over 1.8 m in DDH75-31 (Shearer, 1975). In 1978, McIntyre Mines entered a joint venture with Canadian Superior Exploration Ltd. No further work was reported and the Birkeland claims expired.

In 1976 the Sian claims were staked approximately 37 km southwest of the Birkeland claims by McIntyre Mines following prospecting of geological targets. Mapping, geochemical soil sampling and EM, mag and SP geophysical surveys were carried out in 1977. Gold was tested for in four grab samples; however, results did not exceed the detection limit for gold (Birkeland, 1978). After entering a joint venture with Canadian Superior Exploration, detailed mapping, trenching and sampling was completed in 1979. Results of this work found low grade lead and zinc throughout a folded dolomite unit. One diamond drill hole was completed in 1980 but did not intersect any mineralization. No further work was recommended and in 1982 the Sian property

passed to Serem Ltd, after which the claims were voided and no further exploration was reported.

The Highhawk and Leah showings are situated approximately five and ten kilometres west of the Sian showing respectively. They occur within the Leah claims which adjoin the Star, Lee and Nod claims. The Leah claims were staked by a syndicate composed of Highhawk Mines Ltd, Envoy Resources Ltd, Sprott Silver Mines Ltd, Hecate Gold Corporation and Bow River Resources Ltd in 1976. The Star claims, which adjoined to the north, were staked by private prospectors and optioned to Prism Resources Ltd in 1977. Mapping and soil geochemical testing completed by Prism in 1977 returned disappointing results and all claims were dropped. The Lee and Nod claims were staked to the south of the Leah claims in December of 1976 and were optioned to Tay River Mines. No work is on record for these claims and they were allowed to lapse.

McIntyre Mines staked the Jam property in 1977, 4.2 km north of its Sian property. Soil and silt sampling in conjunction with mapping later that year found a favorable dolomite breccia host rock with associated zinc and lead sulphide mineralization. No further work was reported and the Jam claims lapsed.

In 1976, the Black, Ida, Red and Eira claims, located approximately 8 km east of the Sian claims, were staked by the Ortell Syndicate (Precambrian Shield Resources Ltd, Giant Yellowknife Mines Ltd, Nemco Resources Ltd and Highwood Resources Ltd). In 1977, the Black and Ida claims were optioned to a joint venture between DeJour Mines Limited and Nova-Co Exploration Limited (Thompson, 1977). Mapping and geochemical sampling on the Ida claims later that year returned moderately anomalous zinc values, with erratic lead and silver support.

Also in 1977, prospecting and stream sediment sampling carried out on the Eira property by the Ortell Syndicate returned anomalous silver and zinc results, up to 2.4 ppm and 680 ppm respectively (Curry, 1977). This led to more detailed grid soil sampling and geological mapping. This work returned a number of moderate, non-coincident silver, zinc and lead anomalies.

In 2001, the Geological Survey of Canada completed a regional stream sediment sampling program (Heon, 2003), which included coverage of the current Sten claims, in an area now referred to as the Nadaleen Trend. Creeks draining this area returned weak gold and strong arsenic anomalies.

ATAC's initial interest in the area was to follow up on an anomalous arsenic silt sample collected by the Geological Survey of Canada in 2001. Over a three day period in 2009, 89 stream sediment, 1 rock and 9 soil samples were collected on the Sten claims. These samples returned a string of moderately to very strongly anomalous results ranging from 12 to 1775 ppb gold and 123 to 155,000 ppm arsenic (Eaton, 2010). Additional claims were staked by ATAC as a result of this work. A summary of the work completed to date by ATAC is presented below in Table II. Locations of showings and historical work areas referred to in this report can be found on Figure 3.

TABLE II: ANNUAL ATAC RESULTS SUMMARY TABLE

Year	Work Completed	General Results	Highlight Results	Reference
2010	Mapping, prospecting, soil sampling and 1289.24 m of diamond drilling in 9 holes	Drilling defined three Carlin-type gold bearing zones – Osiris (5 holes), Conrad (2 holes) and Ibis (1 hole)	7 holes intersected significant mineralization. **Osiris** – OS-10-01 65.20 m of 4.65g/t Au. **Conrad** – OS-10-08 21.13 m of 8.03 g/t Au **Ibis** - OS-10-07 17.00 m of 0.92 g/t Au	Lane, 2011
2011	Diamond drill program (26,675 m in 89 holes), mapping, prospecting, airborne magnetic and radiometric geophysical survey	Mapping continued to refine the stratigraphic section, prospecting identified prospective anomalies. Targeted drilling at Osiris, Ibis and Conrad Zones and scout drilling at Atum, Amon, Dale, Ptah and Pyramid Zones	50 holes intersected significant mineralization. **Conrad** – OS-11-010 114.93 m of 3.15 g/t Au Ibis – OS-11-073 51.82 m of 3.13 g/t Au **Osiris** – OS-11-082 44.20 m of 4.41 g/t Au **Sunrise** – OS-11-053 30.98 m of 3.09 g/t Au	Lane and Carne, 2012 & McDivitt, 2012
2012	Diamond drill program (36,920 m in 116 holes) , soil sampling, mapping, auger sampling and geophysical surveys	Soil sampling and prospecting led to the discovery of gold mineralization at the Pharaoh and Anubis Zones. Detailed drilling at Conrad, Osiris, Ibis, Atum, Sunrise, Pyramid, Anubis and GT Zones	67 drill holes intersected significant mineralization. **Anubis** – AN-12-001 8.51 m of 19.85 g/t Au **Conrad** – OS-12-114 42.93 m of 18.44 g/t Au **Ibis** – OS-12-120 27.43 m of 6.28 g/t Au **Osiris** – OS-12-139 27.43 m of 2.00 g/t Au **Sunrise** – OS-12-173 14.86 m of 10.54 g/t Au	Lane et al., 2013
2013	Diamond drill program (7,303 m in 26 holes), soil sampling, prospecting, mapping, hand and excavator pit sampling	Discovery of six new targets including Lyra, Corona, Dorado, Draco, Columbia and Zodiac	15 drill holes intersected significant mineralization. **Conrad** – OS-13-219 68.58 m of 4.23 g/t Au **Ibis** – OS-13-207 21.87 m of 2.62 g/t Au **Sunrise** – OS-13-206 15.24 m of 9.83 g/t Au	Lane and Phillips, 2014)
2014	Diamond drill program (4,733 m in 10 holes), trenching, auger drilling and surface mapping	Extended known soil geochemical anomalies and improved geologic understanding of local units and structures	6 drill holes intersected significant mineralization. **Conrad** – OS-14-227 30.79 m of 9.50 g/t Au **Sunrise** – OS-14-225 12.19 m of 3.09 g/t Au	Lane and Phillips, 2015
2015	RAB drill program (482 m in 31 holes) and a diamond drill program (1,289 m in 1 hole)	Discovery of the Orion zone, tested continuity and between Conrad Upper and Middle zones	1 drill hole intersected significant mineralization. **Conrad** – OS-15-231 124.96 m of 3.02 g/t Au	Lane and Phillips, 2016

			1 RAB hole intersected significant mineralization **Orion** – ARB-15-026 47.24 m of 3.79 g/t Au	
2016	Diamond drill program (1,540 m in 10 holes) and RAB drill program (2,141 m in 42 holes)	Discovery of oxide gold mineralization in the Anubis Fault, confirmed RAB drill results in diamond drill core at Orion	6 drill holes intersected significant mineralization. **Orion** – AN-16-010 61.29 m of 2.75 g/t Au	Lane and Walsh, 2017
2017	Diamond drill program (15,088 m in 32 holes), RAB drill program (1,532 m in 32 holes), mapping, excavator trenching, soil sampling, ridge and spur sampling, gravity survey.	Discovered high-grade gold mineralization in the 650- and 850-faults at Conrad, expanded the Osiris and Sunrise Zones at depth and refined the stratigraphy of the Orion project	25 drill holes intersected significant mineralization. **Conrad** – OS-17-259 76.20m of 3.54 g/t Au **Sunrise** – OS-17-249 15.24 m of 13.52 g/t Au **Osiris** – OS-17-244 12.19 m or 9.60 g/t Au	Coulter and Lane, 2018
2018	Diamond drill program (15,193 m in 36 holes)	Step out drilling at Conrad, Osiris and Sunrise Zones outside the boundary of the 2018 resource estimate. Testing of multiple targets along the Anubis fault at the Orion Project.	19 drill holes intersected significant mineralization. **Conrad –** OS-18-266 52.91 m of 2.83 g/t Au **Sunrise** – OS-18-273 26.70 m of 12.95 g/t Au **Osiris** – OS-18-279 16.16 m of 6.46 g/t Au **Anubis** – BDO-18-017 7.61 m of 10.48 g/t Au	Coulter and Lane, 2019

GEOMORPHOLOGY AND CLIMATE

The Nadaleen Trend occurs on the eastern half of the 175 km east-west oriented Rackla Gold Property in the Selwyn and Wernecke Mountains and is drained by creeks that flow into the Nadaleen, Rackla and Stewart Rivers, all part of the Yukon River watershed. Local topography varies from low forested valleys to alpine terrain and features generally east-west to northwest trending broad glaciated valleys. Elevations range from approximately 600 to 2,000 m above sea level. Outcrop is most abundant near ridge crests and in actively eroding creek beds. Most hillsides are talus covered at slope breaks and are blanketed by glacial till at lower elevations. The region was glaciated in the Late Pleistocene, 22,000 years ago (Duk-Rodkin, 1999) with ice flow generally occurring from east to west.

Treeline in the vicinity of the project is at about 1,500 m. Slopes above that elevation, especially steep north facing slopes, have little vegetation. Moderately steep, south facing slopes are well drained and are often lightly forested with poplar and spruce. The density and size of vegetation gradually increases on lower slopes, and the valley floors are well treed with mature black spruce. Understory vegetation typically consists of low shrubs and moss.

The climate in the Nadaleen Trend area is typical of northern continental regions with long, cold winters, truncated fall and spring seasons and short, mild summers. Although summers are relatively mild, arctic cold fronts often cover the area and snowfall can occur in any month. The property is mostly snow free from early June through late September.

REGIONAL GEOLOGY

The Geological Survey of Canada performed geological mapping in the vicinity of the Rackla Gold Property at 1:250,000 scale in the early 1970s (Blusson, 1974). In 1999, the Geological Survey of Canada (Gordey and Makepeace, 1999) completed a compilation of Yukon-wide geology and updated the lithological units named in the Rackla area. The Yukon Geological Survey conducted mapping on 106C/03 and 106C/04 1:50,000 map sheets in 2010 and 2011 (Colpron, 2012 and Chakungal and Bennett, 2010), completed map sheets 106D/01, 106C/01-04 in 2012 (Colpron et al., 2013), extended coverage to the east in 2013 on map sheet 106B/04 (Moynihan, 2014). In early 2016 the Yukon Geological Survey released a revised bedrock geology map for Yukon that built upon the previous compilations (Colpron, 2016).

The Rackla Gold Property straddles the boundary between deep water dominantly clastic rocks of the Selwyn Basin to the south and shallower water shelf strata of the Mackenzie platform to the north (Colpron and Nelson, 2011). The Dawson Fault, which juxtaposes rocks of Selwyn Basin against rocks of Mackenzie Platform, is a crustal break that may date back to late Neoproterozoic rifting and was reactivated as a north directed thrust in the Cretaceous (Macdonald et. al, 2010). The tectonic setting of the Rackla Gold Property is shown in Figure 4, while regional relationships and the importance of the Dawson Fault system are presented in Figure 5.

Recent mapping by the Yukon Geological Survey has refined the Proterozoic to Paleozoic sedimentary stratigraphy underlying the Nadaleen Trend as seen in Figure 6. A description of this revised mapping is outlined below, with Proterozoic to Lower Cambrian rocks described in Table III and Paleozoic rocks in Table IV. To date, mineralization along the Nadaleen Trend has dominantly been found between the Kathleen Lakes and Dawson Thrust Faults.

TABLE III: PROTEROZOIC TO LOWER CAMBRIAN ROCKS ALONG THE NADALEEN TREND

REGIONAL LOCATION	AGE	REGIONAL UNIT NAME
North of Kathleen Lakes fault	Neoproterozoic	Windermere Supergoup and Rapitan Group stratigraphy.
Hanging wall (south) of Dawson Thrust fault.	Neoproterozoic to Cambrian	Hyland Group, Earn Group, with south eastern areas dominated by Gull Lake Formation and volcanic rocks of the Old Cabin Formation.
Between Kathleen Lakes and Dawson Thrust faults		Nadaleen and Blueflower Assemblages correlative with the uppermost portion of the Windermere Supergroup overlain by upper Hyland Group stratigraphy.

TABLE IV: PALEOZOIC ROCKS ALONG THE NADALEEN TREND

FACIES	AGE	ROCK TYPE
Off Shelf Rocks	Ordovician to Lower Devonian	Black shale of the Road River Group
	Ordovician to Silurian	Limestone and calcareous sandstone
	Middle Devonian	Limestone
	Middle Devonian to Lower Mississippian	Silty-mudstone and limestone; and shale of the Earn Group
	Mississippian to Lower Devonian	Clastic rocks
Platform Rocks	Upper Cambrian to Devonian (?)	Limestone and Dolostone

PROPERTY GEOLOGY

The distribution of lithologies and regional scale structures defined to date along the Nadaleen Trend are shown in Figure 7. Stratigraphic relationships between the mapped units along the Nadaleen Trend are described below.

It is believed that the Nadaleen Trend area underwent extensive deformation as part of a Mesozoic to early Cretaceous fold and thrust event, followed by a transition into a probable strike slip regime. Two major regional structures transect the property: the Dawson Thrust and the Kathleen Lakes Faults. The Dawson Thrust, historically described as defining the northern edge of Selwyn basin, placed Precambrian slope and basinal sedimentary rocks over Paleozoic shelf carbonates during a Jurassic to Cretaceous compressional tectonic event. This fault is likely a much older structure, possibly dating back to Precambrian rifting, which was reactivated during a later compressional regime.

The Kathleen Lakes Fault marks the contact between Paleozoic platform rocks to the north and Paleozoic shelf to basin rocks to the south in the western part of the property. Both the Dawson Thrust Fault and Kathleen Lakes Faults become difficult to trace to the east as they move into broad valleys covered by a thick layer of glacial till. The Nadaleen Fault near the eastern end of the property appears to be a splay off the Kathleen Lakes Fault.

The prevalence of debrite and turbidite facies within almost all units, along with the highly variable stratigraphic thicknesses of units provides strong evidence for long lived syn-sedimentary tectonism.

ANUBIS AREA TO OSIRIS AREA – PROPERTY GEOLOGY

Lithologies of the Nadaleen Trend between the Anubis Area and Osiris Area have been divided into three groups: Paleozoic Rocks, Neoproterozoic to Cambrian Rocks, and Neoproterozoic Rocks. Descriptions of each of these are provided below, while maps outlining the distribution of these units are shown on Figures 6 and 7.

Paleozoic Rocks – Are exposed from the Pyramid Zone to just south and west of Nadaleen Camp. This group has been subdivided into nine lithologically distinct map units:

- **P**: Well bedded, typically yellow-orange weathered, likely reworked, sandy limestones (mudstones to predominately crinoidal wacke-packstones, to fossiliferous floatstones, in place with coarse lithic clasts), possibly calcareous sandstones to conglomerates; interbedded with non-calcareous shales.

- **PM**: Shale-siltstone interbeds of limestone (mostly crinoidal wacke-packstones and mudstones) and siliceous rocks, likely formed by diagentietc silicification of carbonate (limestone or calcarente) beds.

- **M**: Light grey, thick bedded spire-forming limestones, predominately crinoid packstones. Common presence of diagenetic(?) silicification in the form of bands, lenses and completely replaced beds up to several meters thick. Common karst features (caves, dissolution cavities with speleothems and infill breccia).

- **MD30**: Steel grey-black, laminated non-calcareous shale, calcareous shale and shaly mud limestone and discontinuous interlayered thin (1-5mm) bioclastic (crinoid fragments) and lithic (chert and shale) packstones.

- **MD20:** Steel grey-black, laminated non-calcareous shale with interlayered lithic (chert clast rich) arenite, gritstone and rarer conglomerate

- **MD10**: Carbonaceous non-calcareous and calcareous shales and siltstones, contain fossiliferous wackestone-rudstone debris flow beds with 2-hole crinoids.

- **D40**: Grey-tan, massive bedded (rare bedding surfaces) lime mudstone, bioclastic wackestone, packstone. Macro-fossils including rugose colonial coral (hexagonaria), brachiopods, bryozoans, single and 2-hole crinoids.

- **D30**: Grey-tan dolomite, burrows and fenestral fabric, low clastic input based on geochemistry.

- **D20**: Grey-tan dolomite, burrows and fenestral fabric higher clastic input based on the geochemistry.

- **D10**: Dark grey to black fossiliferous limestone wackestone, locally variably dolomitic with hexagonal corals rugose corals and brachiopods

- **S30**: Similar to S10, light-medium grey, coarse thick bedded bioclastic rudstone, locally graded beds and basal bed scours and flute casts. Coarse fossil debris includes whole and

broken rugose and colonial corals (halysites, syringoporella(?)), bryozoans, stromatoporoids, brachiopods, rare trilobites and crinoids (including 'star' crinoids)

- **S20**: Dark-medium grey couplets of 10-20 cm graded bed lime fine-grained wackestone-mudstone and laminated to cm-planar bedded lime mudstone.

- **S10:** Light-medium grey, coarse, thick bedded bioclastic rudstone, locally graded beds and basal bed scours, flute casts. Coarse fossil debris include whole and broken rugose and colonial coral (halysites, syringoporella (?), bryozoans, stromatoporoids, brachiopods, rare trilobites and crinoids (including 'star' crinoids).

- **O30:** Yellow-orange weathering, grey-brown laminated calcareous siltstone and planar cm-bedded lime mudstone. Locally includes coarse lithic-fragmental rudstone-floatstone (debris flow).

- **O20:** Black laminated carbaceous graptolitic shale and cm-bedded, siliceous mudstone. Graptolites include isograptus, tetragraptus, didymograptus, phyllograptus and dicanograptus.

- **O10:** Medium grey, generally massive bedded coarse lithic fragmental rudstone-floatstone. Mostly rounded lime mudstone clasts and brown-black laminated siliceous mudstone. Locally contains fine fossil fragments (crinoid, brachiopod shells).

Neoproterozoic to Cambrian Rocks - This stratigraphy is exposed across the entire length of the map area. It is divided into two lithologic map units as follows:

- **PCd**: Neoproterozoic (to Cambrian?) dolostone

- **PCs**: Neoproterozoic (to Cambrian?) black carbonaceous shales to siltstone at the south flank of the property.

- **D:** "Whitecliff" dolostone (to dolomitic limestone?); likely fault-bounded slice, stratigraphic setting unknown

    a. **Cs1:** Buff-brown, cm bedded fine-medium grained quartz sandstone. Bedding parallel burrows.

- **PCn:** Maroon-green shale with thin-interbedded fine-grained sandstone, prominent pencil cleavage

- **pC:** Angular dolomite fragment rudstone with a lime mud matrix, capped by black, crystalline limestone.

OSIRIS AREA – PROPERTY GEOLOGY

Lithologies in the Osiris Area have been subdivided from the regional lithologies due to the extensive detailed mapping and core logging that has taken place between 2010 and 2018. Detailed descriptions of each lithology are outlined below, while their distribution with respect to one another is displayed on Figure 7. From oldest to youngest, these include:

- **NONAD:** The North of Nadaleen mudstone is part of the upper Ice Brook Formation and is a light teal-green to maroon and brown mudstone with minor interbedded quartz pebble conglomerate. The mudstone displays distinctive rusty brown weathering.

- **C-LST1:** The Conrad limestone 1 is part of the lower Nadaleen Formation and is a light grey, silty laminated clastic limestone with cone in cone and beef calcite, and wispy fine quartz sand layers.

- **C-SLC**: The Conrad siliciclastic unit is part of the Nadaleen Formation and is a grey-green pyritic siltstone and mudstone, poorly sorted matrix-supported quartz pebble conglomerate with lesser grey, well sorted, weakly calcareous sandstone. The conglomerate, informally referred to as 'starry night', consists of rounded quartz pebbles floating in a mix of sand and silt with occasional larger clasts that appear to be rip up clasts of matrix material.

- **C-DST:** The Conrad dolostone is part of the Nadaleen Formation and is a finely crystalline hydrothermal dolostone with distinct black crackle breccia veinlets in the Conrad area. Further to the west, nearer to the Nadaleen fault, it is a non- to partially-dolomitized limestone.

- **C-SHL:** The Conrad shale is part of the Nadaleen Formation and is a black, laminated siltstone to shale with local intervals of sandstone associated with trace disseminated pyrite.

- **C-LST2**: The Conrad limestone (2) is part of the Nadaleen Formation and is a dark, crystalline lime mudstone, calc-arenite, and lensoidal pebble to boulder conglomerates. It is interpreted as debris flows with lesser interbedded siltstone and grey to black shale. Clast composition of the conglomerate is dominated by limestone and lesser dolostone.

- **O-MST**: The Osiris mudstone is part of the upper Nadaleen Formation and is a finely laminated maroon and green to greenish-grey siltstone. This unit can be subdivided into an overlying maroon and green siltstone and a lower greenish-grey siltstone.

- **O-LST1:** The Osiris limestone (1) is part of the lower Gametrail Formation and is a well bedded, tan and grey limestone with primary sedimentary structures. Monolithic, intraclast rudstone layers, averaging 0.5 - 2 m thick, are common throughout the unit.

They consist of randomly oriented to imbricated, tabular to equant clasts in a carbonate mudstone matrix. Clast composition is almost exclusively the same as the enclosing carbonate mudstones.

- **O-DST:** The Osiris dolostone is part of the middle Gametrail Formation and is a fine-grained diagenetic dolostone. The dolostone retains many of the original depositional fabrics identical to O-LST1 (see above for further description).

- **O-DMT:** The Osiris diamictite is part of the upper Gametrail Formation and is a limestone pebble to boulder conglomerate, predominantly matrix supported debrites. Clasts vary from centimeter- to meter-scale and comprise limestone that is similar to O-LST1. Matrix composition is variable comprising non to weakly calcareous green siltstone and shale and/or crystalline limestone. The bottom of the unit is consistently marked with a non-calcareous siltstone horizon that is approximately 5 m in true thickness.

- **O-LST2:** The Osiris limestone (2) is part of the lower Blueflower Formation and is a very dark grey-black, coarsely crystalline limestone. The base of the unit is often associated with beds of polymict floatstone containing clasts of orange-weathering dolostone, limestone, rounded quartz pebbles and minor shale.

- **O-GAB:** The 465.6 ± 4.4 Ma (Tucker, 2015) Osiris gabbro has a slight rusty coating on weathered surfaces and dark grey-green on fresh surfaces. The gabbro is composed of medium to coarse grained amphibole, plagioclase and clinopyroxene.

- **C-INT:** The 74.4 ± 1 Ma (Tucker, 2015) Conrad gabbroic dikes dip approximately 60° to the north, 2 sub-parallel dikes trend roughly east-west and are up to 20 m in true thickness. The dikes are generally competent in drill core, pale beige grey in colour and pervasively altered. The gabbro dikes are composed of coarse plagioclase, clinopyroxene and abundant secondary carbonate and pyrite.

MINERALIZATION

The focus of exploration along the Nadaleen Trend is for Carlin-type gold mineralization. Carlin-type deposits have been reported around the world, but to date, major economic occurrences have been restricted to the Great Basin of the southwestern United States. Recent discoveries along the Nadaleen Trend have many characteristics of Carlin-type deposits, and hold promise of great potential for new discoveries of economic importance (Arehart et al., 2013).

Carlin-type deposits are characterized as sediment-hosted micron-scale gold hosted within disseminated arsenian pyrite (Arehart, 1996). The deposits are typically found as replacement bodies in silty-carbonates within slope and basinal facies and have both structural and stratigraphic controls with a strong relationship to deep seated crustal-scale structures (Cline et al., 2005; Muntean et al., 2011). Carlin-type mineralizing fluids are typically weakly acidic, resulting in the dissolution of carbonate which is followed in the mineralization process by

precipitation of quartz and gold-bearing arsenian pyrite and trace metal enrichments of As-Sb-Hg-Tl (Muntean et al., 2011). Permeability is the key factor controlling the distribution of alteration and mineralization and features that control it include primary fluid conduits, such as fault and shear zones, as well as stylolites, veinlets and fold hinges (Tucker, 2015).

Along the Nadaleen Trend, Carlin-type mineralization has been drill-proven at the Osiris, Conrad, Sunrise, Ibis, Anubis and Orion Zones. Gold mineralization is best developed within limestone sequences where alteration, characterized by decalcification occurs in association with realgar mineralization peripheral to calcite flooding. Mineralization hosted within non-calcareous rocks generally occurs within brittle fractures and is directly associated with fault breccia and/or intense fracture development. Table V presents a summary of all significantly mineralized zones along the Nadaleen Trend.

TABLE V – SUMMARY OF MINERALIZED ZONES ALONG THE NADALEEN TREND

Area	Mineralized Zone	Year Discovered	Comments	Mineralization Type
Osiris Area	Osiris	2010	Original location of Carlin-type mineralization in 2010. Discovery hole OS-10-001 returned 65.20 m of 4.65 g/t gold. 67 drill holes have been completed and the zone remains open down dip and to the north. Osiris is part of the 2018 Resource Estimate.	Carlin-Type Au
	Conrad	2010	800 metres northeast of Osiris, Conrad is the most advanced Carlin-type gold zone with 134 holes drilled to date. It has a total strike length of 800 m and remains open in all directions. Highlight 2012 hole intersected 42.93 m of 18.44 g/t gold in hole OS-12-114. Conrad is part of the 2018 Resource Estimate.	Carlin-Type Au
	Atum	2010	Large gold in soil anomaly 600 m west of Osiris. Rock grab samples up to 28.9 g/t Au. To date, most significant mineralization encountered during drilling includes 17.00 m of 0.92 g/t Au in hole OS-10-07.	Carlin-Type Au
	Ibis	2011	Encouraging near surface gold zone directly south of Osiris with 26 drill holes. Highlight 2012 drill hole intersected 27.43 m of 6.28 g/t gold in OS-12-120. Mineralization remains open at depth. Ibis is part of the 2018 Resource Estimate.	Carlin-Type Au
	Sunrise	2012	Directly east of Osiris the true discovery of the Sunrise zone was uncovered during road building in 2012 and has been tested by 37 drill holes. Hole OS-17-249 intersected 15.24 m of 13.52 g/t gold. Sunrise Zone remains open at depth and along strike, and is part of the 2018 Resource Estimate.	Carlin-Type Au
Anubis Area	Pyramid	2011	4 by 0.6 km arsenic anomaly and orpiment/realgar boulder train about 10 km northwest of Anubis.	Carlin-Type Au
	Anubis	2012	Located 10 km west of Osiris, outcrop samples collected in 2012 returned up to 139 g/t Au. Hole	Carlin-Type Au

			AN-12-01 intersected 8.51 m of 19.85 g/t gold within strongly altered carbonate interbeds within an argillite package.	
	Ana	2012	550 m northwest of Anubis, grab samples from hand pits collected at the sites of anomalous gold-in-soil samples returned up to 5.59 g/t Au in clay rich fault breccia. Two drill holes targeted this fault zone at depth in 2012 though no significant mineralization was intersected.	Carlin-Type Au
	Hydra	2012	600 m north of Anubis, with a strong arsenic and thallium soil geochemical anomaly. Samples collected from hand pits returned up to 0.80 g/t Au within rubbly variably oxidized limestone. Hole BDO-18-008 intersected 4.66 m of 6.95 g/t Au.	Carlin-Type Au & earlier (?) Ag, Pb
	Draco	2013	1.4 km northwest of Anubis within a moderate silver, mercury and thallium geochemical anomaly. Excavator pits dug in 2013 in the vicinity of the soil anomaly returned rock samples yielding up to 1.57 g/t Au in moderately oxidized thickly bedded limestone.	Carlin-Type Au
	Columba	2013	1.8 km northwest of Anubis on a north facing thickly covered area within a strong mercury anomaly. Grab samples from excavator pits returned up to 0.52 g/t Au from altered argillite samples collected proximal to the Anubis Fault.	Carlin-Type Au
	Dorado	2013	2.2 km northwest of Anubis within a moderately strong mercury and thallium soil geochemical anomaly. Hole BDO-18-019 intersected 2.78 m of 9.49 g/t Au.	Carlin-Type Au
	Zodiac	2013	3.5 km northwest of Anubis within a strong mercury and thallium anomaly. Mineralization was confirmed through prospecting and hand pitting in 2013. Grab samples from hand pits returned up to 1.03 g/t Au within gouge material of the Anubis Fault. Samples mineralized in up to 900 g/t Ag, 11.75 % Pb and 28.99% Zn showed strong silica alteration of dolomitic limestone proximal to the Anubis fault.	Carlin-Type Au & earlier (?) Ag, Pb, Zn
	Corona	2013	400 m east-northeast of Anubis, within a moderately strong arsenic and strong thallium anomaly. Hole BDO-18-018 intersected 10.73 m of 7.20 g/t Au.	Carlin-Type Au & earlier (?) Ag, Pb
	Lyra	2013	2.95 km northwest of Anubis and associated with a strong thallium soil geochemical anomaly. Silver and lead mineralization occurs associated with galena veinlets up to 2 cm thick within strongly altered dolomite (?) with antimony and lead oxide coating.	Ag, Pb
	Orion	2015	300 metres northwest of the Anubis discovery outcrop. Hole AN-16-010 twinned the Orion discovery hole ARB-15-026, and returned 61.29 m of 2.75 g/t Au.	Carlin-Type Au

ATAC announced a maiden Mineral Resource estimate for the Osiris Project on June 18, 2018. The Mineral Resource estimate is based on diamond drilling completed between 2010 and 2017 at the Conrad, Osiris, Sunrise and Ibis zones. The Osiris Project Inferred Mineral Resource contains 1,685,000 ounces of gold at an average grade of 4.23 g/t in 12,380,000 tonnes, including a pit-constrained Mineral resource containing 1,055,000 ounces of gold at 4.08 g/t in 8,045,000 tonnes (Ristorcelli et al., 2018).

Exploration work in 2019 focused primarily on evaluation of the Val target, located in the west portion of the Orion Project. The Val target is a historic lead-zinc-silver occurrence which has seen limited exploration work by ATAC. Mineralization is characterized by high grade galena veins with significant amounts of associated silver, with variable zinc and copper, indicative of a Mississippi Valley Type deposit. A two-day prospecting program was conducted to follow up on historic data and evaluate the potential for bulk-tonnage style silver mineralization. Weathered surfaces of rock samples often contain varying smithsonite, jamesonite and cerussite. A total of 29 rock samples were collected.

Metallurgical testing and a geotechnical study were also completed in 2019 on the Osiris Project, further evaluating technical aspects of the resource areas.

ROCK GEOCHEMISTRY AND RESULTS

In 2019 crews performed prospecting and mapping at the Val target, with a total of 29 rock samples collected. The rock sampling was part of a program designed to re-evaluate this historical lead-zinc-silver target which has not seen recent work by ATAC. The locations of samples collected in 2019 are presented in Figure 8. Certificates of analysis for the samples are in Appendix VI and rock sample descriptions are presented in Appendix III.

Work at the Val target consisted of two days of preliminary sampling. Both the known high-grade veins were assessed, as well as sampling of peripheral float material intended to characterize bulk-tonnage potential from a broader halo around the high-grade galena veins. Prospecting returned rock samples with high lead and silver with variable amounts of zinc and copper (Figures 9-12). A roughly 400 m long north-easterly prospecting traverse to the south of Val, with rock samples comprised of float and outcrop dolostone, did not return any significant silver-lead-zinc ± copper results. Highlight rock samples are presented in Table VI, below.

TABLE VI – HIGHLIGHT VAL ROCK SAMPLE RESULTS

Sample ID	Silver (g/t)	Copper (%)	Lead (%)	Zinc (%)
W845260	613	-	**5.85**	**8.33**
W845264	-	-	0.51	**43.48**
W845265	321	-	**5.98**	**7.25**
W845266	**1,630**	-	**16.05**	**26.00**
W845308	**2,490**	0.18	**81.76**	1.29
W845309	**4,010**	0.79	**73.27**	**3.39**
W845310	**1,465**	0.13	**57.68**	**15.40**
W845311	**6,300**	**1.56**	**80.83**	0.27
W845312	**11,663**	**2.59**	**76.43**	0.85
W845313	**2,700**	**1.56**	**78.59**	0.06
W845314	**3,470**	**1.19**	**68.13**	**7.46**
W845315	876	0.13	**9.92**	**9.48**
W845327	-	-	1.60	**8.70**
W845328	904	-	**3.02**	**8.19**

**Note: dashes indicate no significant result for that element*

The rock sampling conducted in 2019 at Val confirmed historical high-grade samples from known galena veins, and provided further encouragement regarding bulk-tonnage potential across a broader area.

METALLURGICAL TESTING

Preliminary metallurgical testing on material from the Conrad and Osiris zones was conducted in 2019 by Blue Coast Research. Testwork included mineralogical analysis, flotation, gravity recovery, roasting and leaching. A copy of the detailed testwork report is included in Appendix IV.

Mineralization at Conrad and Osiris is Carlin-style in nature, and implies gold is refractory – either single or double. Single refractory ore refers to gold being contained within particles of sulphides in such a manner that the sulphides need to be completely destroyed in order to achieve liberation. Double refractory ore additionally contains organic carbon at levels which will interfere with leaching due to preg-robbing characteristics. Previous cyanide soluble and organic carbon assays have confirmed the material appears to be refractory, with all zones exhibiting solid-solution gold in fine, sooty pyrite. Organic carbon is also present in variable quantities, predominantly at Conrad. All zones additionally contain large amounts of barren arsenic sulphides (realgar and orpiment), which can pose metallurgical challenges.

The testwork program was conducted at a very preliminary scoping level. One composite each from Conrad and Osiris were assembled from assay coarse rejects, targeting the resource statement grade. Partway through the test program, a second Conrad composite at higher grade was assembled (Conrad 2). The head grade of all three composites is given below in Table VII.

TABLE VII – METALLURGICAL COMPOSITE HEAD GRADES

Composite	Au (g/t)	As (%)	Fe (%)	S (%)	C_{org} (%)	Preg Rob (%)
Osiris	4.46	2.42	1.25	1.91	0.06	4.37
Conrad	4.93	1.62	1.56	2.22	0.26	51.8
Conrad 2	9.11	5.97	1.82	4.59	0.26	25.8

Mineralogical analysis was conducted on the Osiris and Conrad composites and confirmed that the primary sulfide minerals present were pyrite and realgar, with minor orpiment and trace arsenopyrite. Liberation data showed 65% of the pyrite and arsenopyrite was liberated at Conrad, and 60% was liberated at Osiris. Arsenic sulphides were 92% liberated at Conrad and 90% liberated at Osiris. Pyrite was found in two forms, one was low arsenic and the second high arsenic. The high arsenic pyrite was observed to be very fine and intergrown with gangue minerals.

Flotation tests examined both the separation of barren arsenic sulphides (realgar and orpiment) and separation of gold-rich pyrite into concentrates. Testwork was conducted on all three composites, with five tests conducted on the Osiris composite, four tests each on the Conrad and Conrad 2 composites. Flotation work demonstrated that it was possible to pull much of the arsenic into a concentrate, however pyrite and gold misplacement was significant.

Gravity recovery was tested on two arsenic flotation concentrates from the Osiris composite to evaluate if misplaced gold could be recovered. Gold recovery was low in both tests.
Three roasting and leaching tests were conducted on pyrite concentrates produced from the Conrad 2 composite. Good gold recoveries were achieved in all three roasting conductions, with results ranging from 89% to 91% extraction. These results and tests conditions suggest the material may be amenable to single stage direct roasting, however follow-up work has not yet been conducted to test this concept.

GEOTECHNICAL ANALYSIS

Golder Associates Ltd. (Golder) was contracted in 2018 to conduct a scoping level geotechnical analysis and preliminary pit slope design for the Osiris Deposits. Golder's work included both a site visit and detailed review of geotechnical, geological, and rock property data collected by ATAC. Golder also conducted preliminary structural analysis using available oriented core data. The study was complete in 2019. A copy of the full report is available in appendix V

Each of the deposits was subdivided into structural domains, based on the available structural data. Rock Mass Rating (RMR) values were also estimated by rock type for each deposit. While

there was some variability in RMR values, in general the units typically exhibited average RMR values between 40 and 60, or “fair” quality.

Following review of available data, and derivation of RMR values, geotechnical units were established for the project. Each of these units was assigned an average Rock Quality Designator (RQD), Unconfined Compressive Strength (UCS), and RMR value. RQD data was taken from ATAC’s core logging, and UCS data was derived from a combination of field strength estimates, and point load testing conducted on core samples.

Preliminary pit slope analyses were conducted for portions of the Osiris Deposits classified as potentially open-pittable. As no hydrological data was available, analyses were performed for scenarios ranging from fully-drained to fully-saturated conditions. In general, the analysis found that most units are expected to be stable from a rock mass perspective in the majority of hydrological conditions.

Golder noted that 45 degree pit slopes seem reasonable from a rock mass perspective in most units, with steeper slopes controlled by structural data. In weathered areas, a maximum slope of 39 degrees was recommended. In the Osiris Mudstone 1 unit, which makes up the majority of the proposed Conrad pit high wall, a 50 degree slope was permissible if the overall slope height is kept below 200 m. Table VIII, reproduced from Golder’s report, shows the pit slope recommendations.

TABLE VIII – SCOPING-LEVEL PIT SLOPE DESIGN RECOMMENDATIONS

Pit	Design Sector	Bench Height (m)	Bench Face Angle (degrees)	Bench Width (m)	Inter-ramp Angle (degrees)	Comments
All	Weathered Rock	10	60	6.5	39.2	Weak intact rock with poor rock mass quality
Conrad	North Wall Above NFZ	15	60	7.5	42.9	Cross-joints dip out of slope at 50° to 75°
	All Other Rock Units	15	70	7.5	49.2	Steep bedding
Osiris	All Rock Units	15	70	7.5	49.2	Steep bedding
Sunrise	East Pit	15	70	7.5	49.2	Steep bedding
	West Pit	15	70	7.5	49.2	Steep bedding
Ibis	Bedding dip less than 50°	Footwall slope (pit slope should be designed to follow the orientation of bedding)				Shallow bedding
	Bedding dip between 50° and 70°	15	60	7.5	42.9	Moderate bedding
	Steep bedding dip	15	70	7.5	49.2	Steep bedding

DISCUSSION AND CONCLUSIONS

The Rackla Gold Property lies at the boundary between Mackenzie Platform and Selwyn Basin, within geomorphological and geological settings similar to those at the Carlin gold district in northeast Nevada. At the eastern end of the 185 km long Rackla Gold Property, the Nadaleen Trend represents the first discovery of Carlin type gold mineralization in Canada. Progression of the property's known geochemical anomalies has resulted in the discovery of many significant gold zones, and delineation of a significant Mineral Resource at the Osiris Deposits.

Silver–lead–zinc ± copper hosted in carbonate rocks at Val is indicative of Mississippi Valley Type mineralization. Although Val has been underexplored by ATAC, 2019 prospecting confirmed historic work and demonstrated the target's potential for both high grade galena veins and bulk-tonnage style silver mineralization. Continued systematic exploration of the Val target and surrounding area is warranted in what is an exciting region.

Preliminary metallurgical work has confirmed that material from the Osiris Deposits is refractory in nature, and will require oxidation prior to leaching. Variability work has shown that some zones are more carbonaceous than others, and roasting will likely be required to passivate organic carbon and reduce preg-robbing characteristics. Results also show encouraging results for separation of barren arsenic sulphides and other gangue mineralization through conventional flotation. More work is required to further optimize the flotation circuits, evaluate variability, and confirm oxidation processes (both roasting and pressure oxidation).

Geotechnical work has confirmed the assumptions for 45° pit slopes used in the 2018 Osiris Resource were reasonable. Detailed scoping-level design values are now available for use in any future studies. In general, the data supports moderately steep pit slopes, with lower angles in weathered material. More information is required to further refine design recommendations, including hydrogeological data and additional rock strength measurements.

Respectfully submitted,

ATAC Resources Ltd.





Andrew Carne, M.Eng., P.Eng.

Austin Schneebeli, B.Sc., G.I.T.

REFERENCES

Arehart, G.B.

1996 Characteristics and origin of sediment-hosted disseminated gold deposits: a review. Ore Geology Reviews, vol 11, p. 383-403.

Arehart, G.B., Ressel, M., Carne, R.C., and Muntean J.L.

2013 A Comparison of Carlin-type Deposits in Nevada and Yukon. Society of Economic Geologists, Inc. Special Publication 17, p. 389-401.

Birkeland, A.O.

1978 Mcintyre Mines Ltd, Apr/78. Assessment Report *#090309

Blusson, S.

1974 Drafts of five geological maps of northern Selwyn basin (Operation Stewart), Yukon and District of Mackenzie, N.W.T. (includes NTS 106A, B, C and 105N, O). Geological Survey of Canada, Open File 205, Scale 1:250,000

Chakungal, J. and Bennett, V.

2010 New bedrock geology of Mount Mervyn map sheet (106C/04) and mineral potential for the South Wernecke mapping project. 2010 Yukon Exploration & Geology. Yukon Geological Survey.

Cline, J.S., Hofstra, A., Muntean, J.L., Tosdal, R.M., and Hickey, K.A.,

2005 Carlin-Type Gold Deposits in Nevada: Critical Geologic Characteristics and Viable Models. Economic Geology 100th Anniversary Volume, p. 451-484.

Colpron, M.

2012 Preliminary geological map of Mount Ferrell (106C/3), southern Nadaleen map area. Yukon Geological Survey. Posters - Roundup 2012.

Colpron, M., Moynihan, D., Israel, S. and Abbott, G.

2013 Geological map of the Rackla belt, east-central Yukon, NTS 106C/1-4 and 106D/1. YGS Open File 2013-13.

Colpron, M. and Nelson, J. L.

2011 A digital atlas of terranes for the Northern Cordillera; Yukon Geological Survey and British Columbia Geology Survey, BCGS GeoFile 2011-11 http://www.geology.gov.yk.ca/pdf/CanCord_terranes_2011.pdf

Colpron, M.,

2016. Yukon Bedrock Geology Map. Yukon Geological Survey, Open File 2016-01. View data on MapMaker Online

Coulter, A.B. and Lane, J.

2018 Assessment report describing diamond drilling at the Osiris and Orion projects of the Rackla Gold property; prepared for ATAC Resources Ltd. by Archer, Cathro & Associated (1981) Limited.

Curry, J.D.

1977 Geochemical survey and preliminary geology for parts of the Eira claim group; prepared for Ortell Syndicate.; Assessment Report #090254.

Duk-Rodkin, A.

1999 Glacial Limits Map of Yukon Territory; Geological Survey of Canada Open File 3694, Indian and Northern Affairs Canada Geoscience Map 1999-2, scale 1:1 000 000.

Eaton, S.

2010 Assessment report describing geochemical sampling at the Sten property; prepared for ATAC Resources Ltd. by Archer, Cathro & Associates (1981) Limited.

Gordey, S.P. and Makepeace, A.J. (compiler)

1999 Yukon bedrock geology in Yukon digital geology; Geological Survey of Canada Open File D3826 and Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Open File 1999-1(D).

Heon, D. (compiler)

2003 Yukon regional geochemical database 2003 – stream sediment analyses. Exploration and Geological Services Division, Yukon Region, Indian and Northern Affairs Canada.

Lane, J.

2011 Assessment report describing the geochemical sampling, geological mapping, diamond drilling and geophysical surveys at the Nadaleen Trend Project, Rackla Gold Property; prepared for ATAC Resources Ltd. by Archer, Cathro & Associates (1981) Limited.

Lane, J. and Carne, J.

2012 Assessment report describing geological mapping, diamond drilling and geophysical surveys at the Nadaleen Trend Project, Rackla Gold Property; prepared for ATAC Resources Ltd. by Archer, Cathro & Associates (1981) Limited.

Lane, J., McDivitt, J.A., Phillips, R., Carne. J.
2013 Assessment Report Describing Geochemical Sampling, Auger Sampling, Geological Mapping, Diamond Drilling, and Geophysical Surveys at the Rackla Gold Property; prepared for ATAC Resources Ltd. by Archer, Cathro & Associated (1981) Limited.

Lane, J., Phillips, R.
2014 Assessment Report Describing Geochemical Sampling, Excavator Pitting, Geological Mapping, and Diamond Drilling along the Nadaleen Trend of the Rackla Gold Property; prepared for ATAC Resources Ltd. by Archer, Cathro & Associated (1981) Limited.

Lane, J., Phillips, R.
2015 Assessment Report Describing Geochemical Sampling, Excavator Pitting, Geological Mapping, Auger and Diamond Drilling; prepared for ATAC Resources Ltd. by Archer, Cathro & Associated (1981) Limited.

Lane, J., Phillips, R.
2016 Assessment Report Describing Geochemical Sampling, Diamond Drilling and RAB drilling; prepared for ATAC Resources Ltd. by Archer, Cathro & Associated (1981) Limited.

Lane, J., Walsh, D.
2017 Assessment Report Describing Diamond Drilling and Rotary Air Blast (RAB) drilling at the Anubis Cluster; prepared for ATAC Resources Ltd. by Archer, Cathro & Associated (1981) Limited.

MacDonald, Francis A., Halverson, Galen P., Schmitz, Mark D., Crowley, J.L., Cox, Grant, Smith, Emily F., Strauss, Justin V., and Roots, Charles F.
2010 Timing and Geometry of the Multi-stage Breakup of Rodinia in the Yukon. (Abs). Paper No. 263-2. 2010 GSA Annual Meeting.

McDivitt, J.
2012 Assessment report describing geochemical sampling, geological mapping, and remote sensing surveys at the Rackla Gold Property; prepared for ATAC Resources Ltd. by Archer, Cathro & Associates (1981) Limited.

Moynihan, D.
2014 Bedrock Geology of NTS 106B/04, Eastern Rackla Belt. YGS Open File 2013-18.

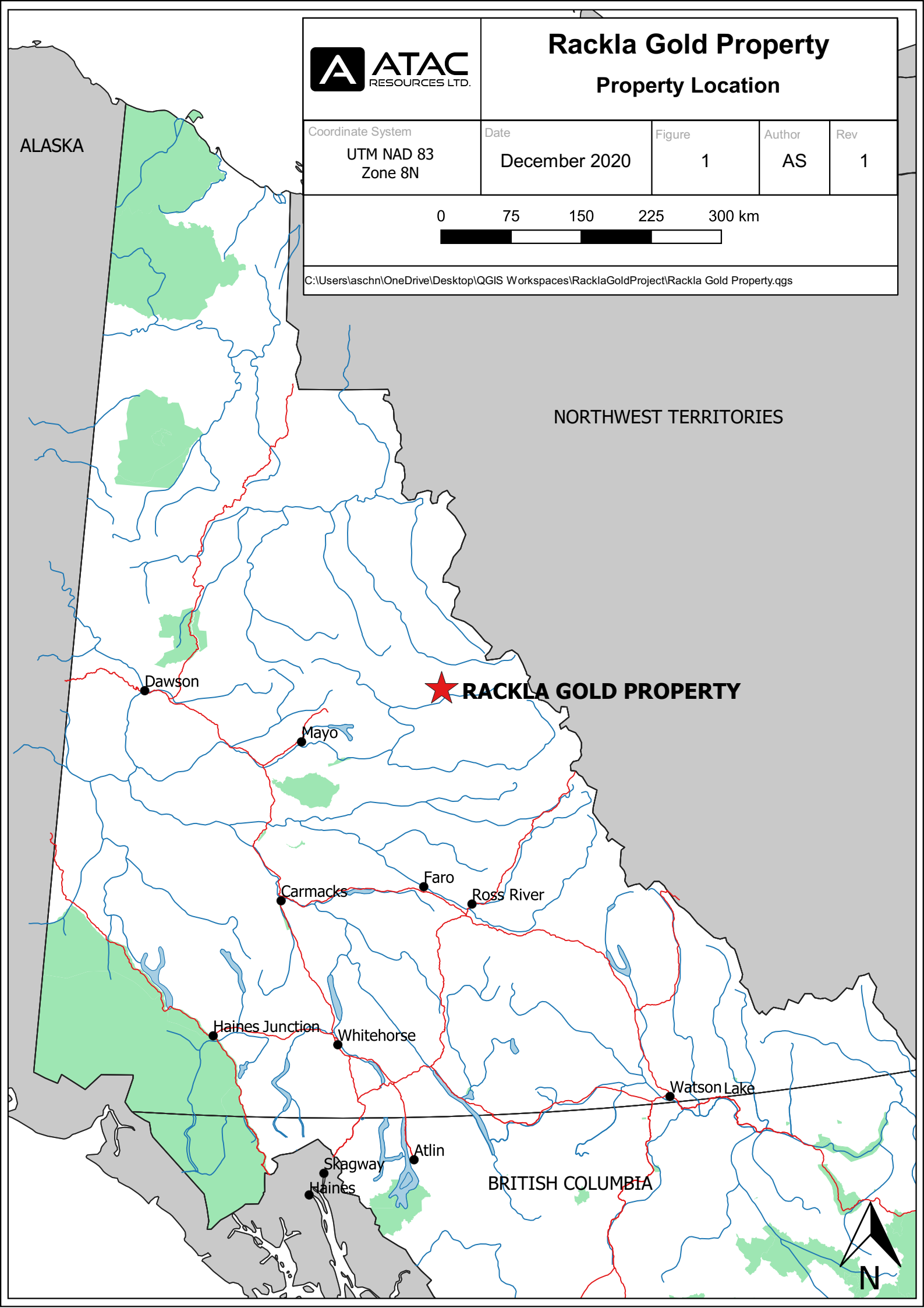
Muntean, J.L., Cline, J.S., Simon, A.C., and Longo, A.A.,
2011 Magmatic –hydrothermal origins of Nevada's Carlin-type gold deposits. Nature, vol. 4, p.122-127.

Ristorcelli, S., Ronning, P., Martin, C. and Christensen, O.
2018 Technical Report and Estimate of Mineral Resources for the Osiris Project, Yukon, Canada. Mine Development Associates.

Shearer, J.T.
1975 Mcintyre Mines Ltd, Assessment Report #090080

Thompson, I.S.
1977 Geochemical report on Black 1-32 and Ida 1-32 claims; prepared for Dejour Mines Ltd.; Assessment Report #090255.

Tucker, M.J.
2015 Geology, Mineralization and Geochronology of the Conrad Zone Carlin-type gold prospect, East-Central Yukon Terrirory, Canada. University of British Columbia, M.Sc Thesis, p. 1-235.


ATAC RESOURCES LTD.
Rackla Gold Property
Property Location
Coordinate System
UTM NAD 83
Zone 8N
Date
December 2020
Figure
1
Author
AS
Rev
1
0
75
150
225
300 km
C:\Users\aschn\OneDrive\Desktop\QGIS Workspaces\RacklaGoldProject\Rackla Gold Property.qgs
ALASKA
NORTHWEST TERRITORIES
BRITISH COLUMBIA
RACKLA GOLD PROPERTY
Dawson
Mayo
Carmacks
Faro
Ross River
Haines Junction
Whitehorse
Watson Lake
Atlin
Skagway
Haines
N

615,000 mE
620,000 mE
625,000 mE
630,000 mE
635,000 mE
640,000 mE
645,000 mE
650,000 mE

7,125,000 mN
7,120,000 mN
7,115,000 mN
7,110,000 mN
7,105,000 mN

N

Claim Groupings

- Group A
- Group B
- Group C
- Group D
- Group E
- Group F
- Group G
- Group H
- Group I
- Group J
- Group K
- Group L

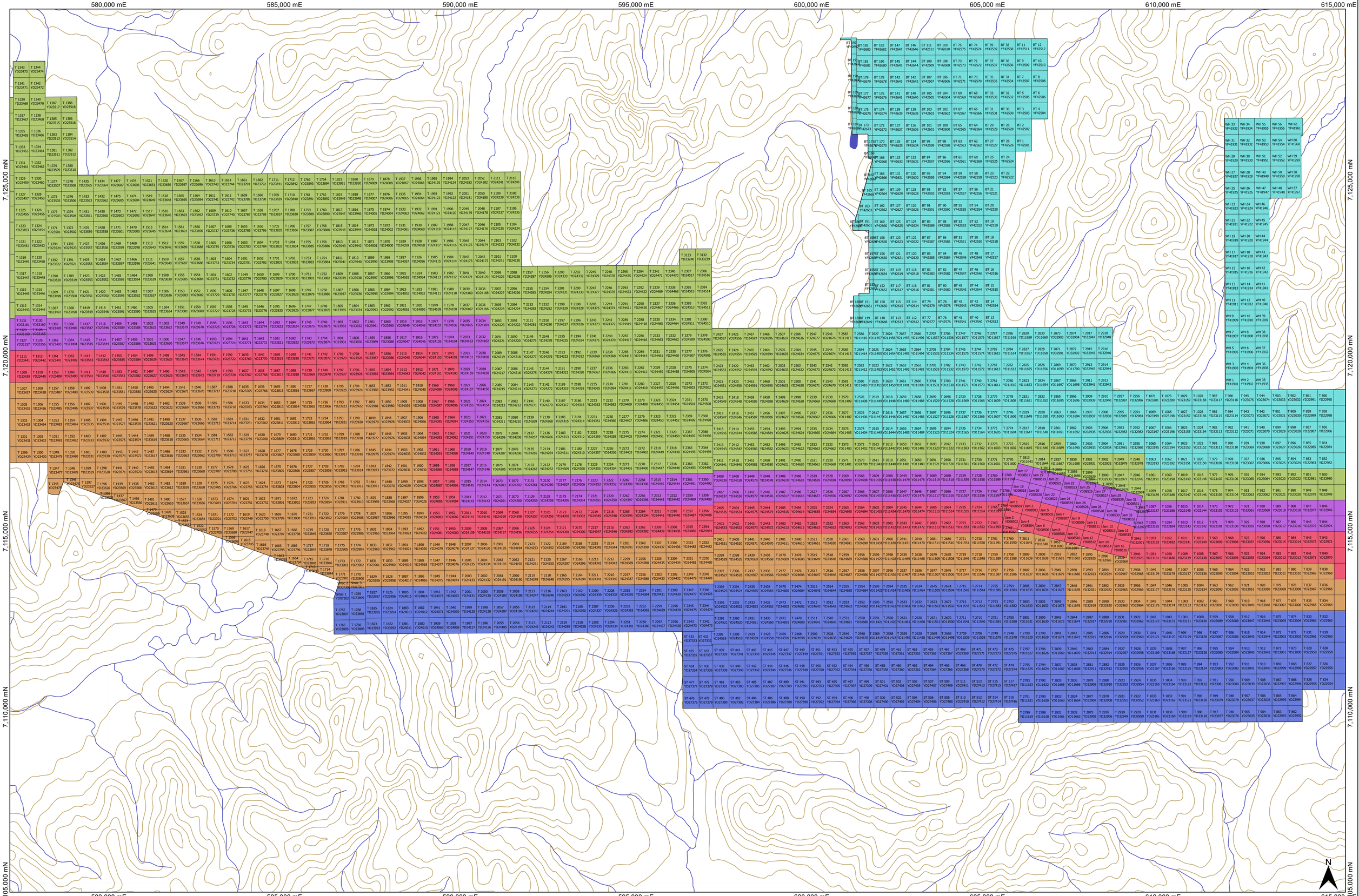
0 1 2 3 4 5 km

ATAC RESOURCES LTD.

Rackla Gold Property

Claims by Assessment Group
Osiris & Orion Projects

Coordinate Reference System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	December 8, 2020	2A	AC	A
Scale 1:65,000	P:\Rackla Gold\YEAR\2020\Assessment Report - 2019 Osiris and Orion Projects\Figures\Figure 2 - Claim Groupings\Figure 2 - 2020 Assessment Blocks -			



Claim Goupings

- Group C
- Group D
- Group E
- Group F
- Group G
- Group H

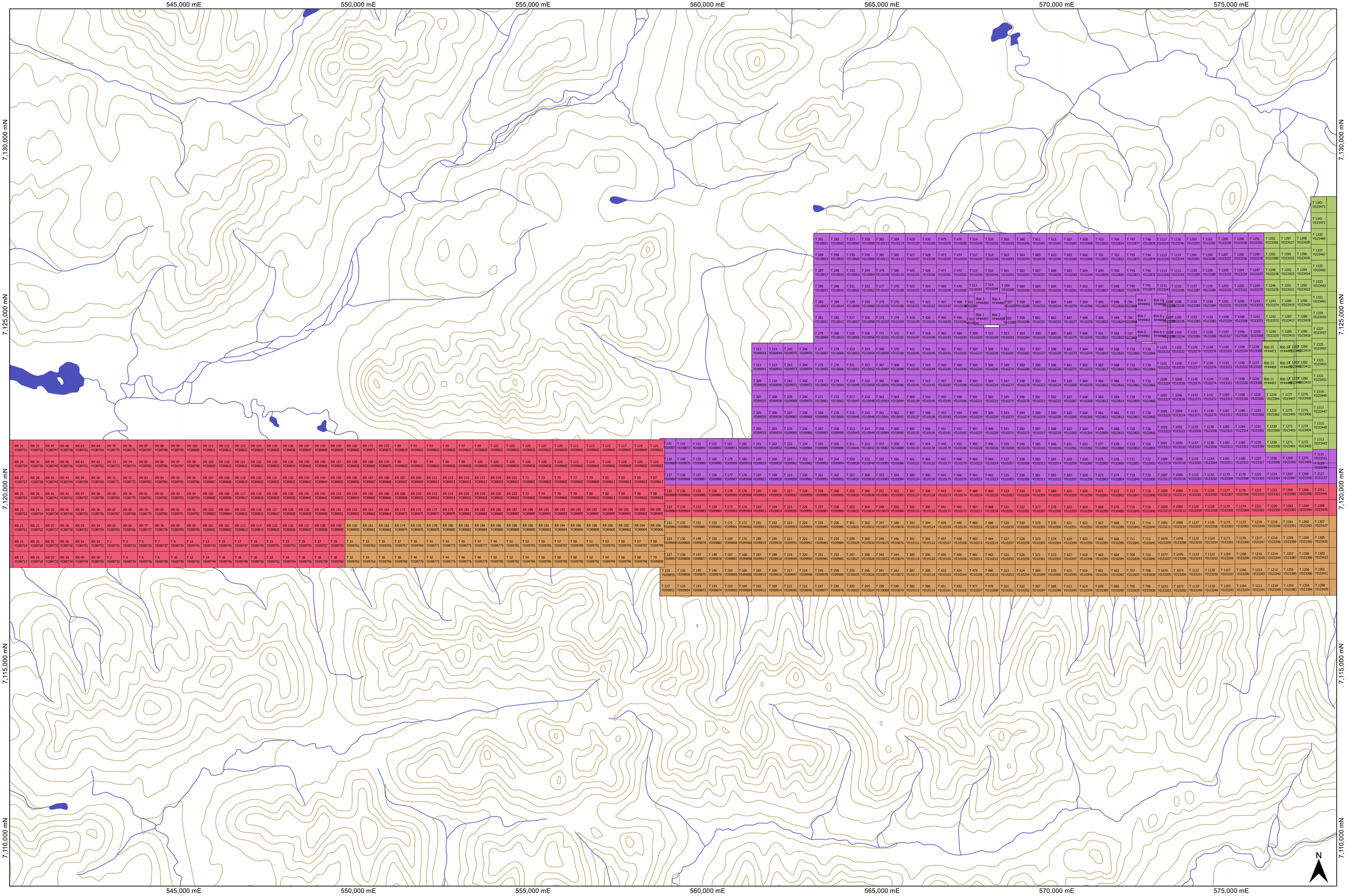
0 1 2 3 4 5 km

ATAC RESOURCES LTD.

Rackla Gold Property

Claims by Assessment Group
Osiris & Orion Projects

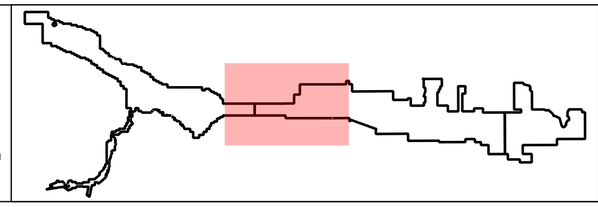
Coordinate Reference System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	December 8, 2020	2B	AC	A
Scale 1:65,000	P:\Rackla Gold\YEAR\2020\Assessment Report - 2019 Osiris and Orion Projects\Figures\Figure 2 - Claim Groupings\Figure 2 - 2020 Assessment Blocks -			



Claim Groupings

- Group E
- Group F
- Group G
- Group H

0 1 2 3 4 5 km



Rackla Gold Property **Claims by Assessment Group** **Osiris & Orion Projects**			
Coordinate Reference System UTM NAD 83 Zone 8N	Date December 8, 2020	Fig. # 2C	Author AC	Rev A
Scale 1:65,000	P:\Rackla Gold\YEAR\2020\Assessment Report - 2019 Osiris and Orion Projects\Figures\Figure 2 - Claim Groupings\Figure 2 - 2020 Assessment Blocks -			

505,000 mE | 510,000 mE | 515,000 mE | 520,000 mE | 525,000 mE | 530,000 mE | 535,000 mE | 540,000 mE

7,130,000 mN | 7,125,000 mN | 7,120,000 mN | 7,115,000 mN | 7,110,000 mN

N

Claim Goupings

- Group G
- Rau Project Claims

0 1 2 3 4 5 km

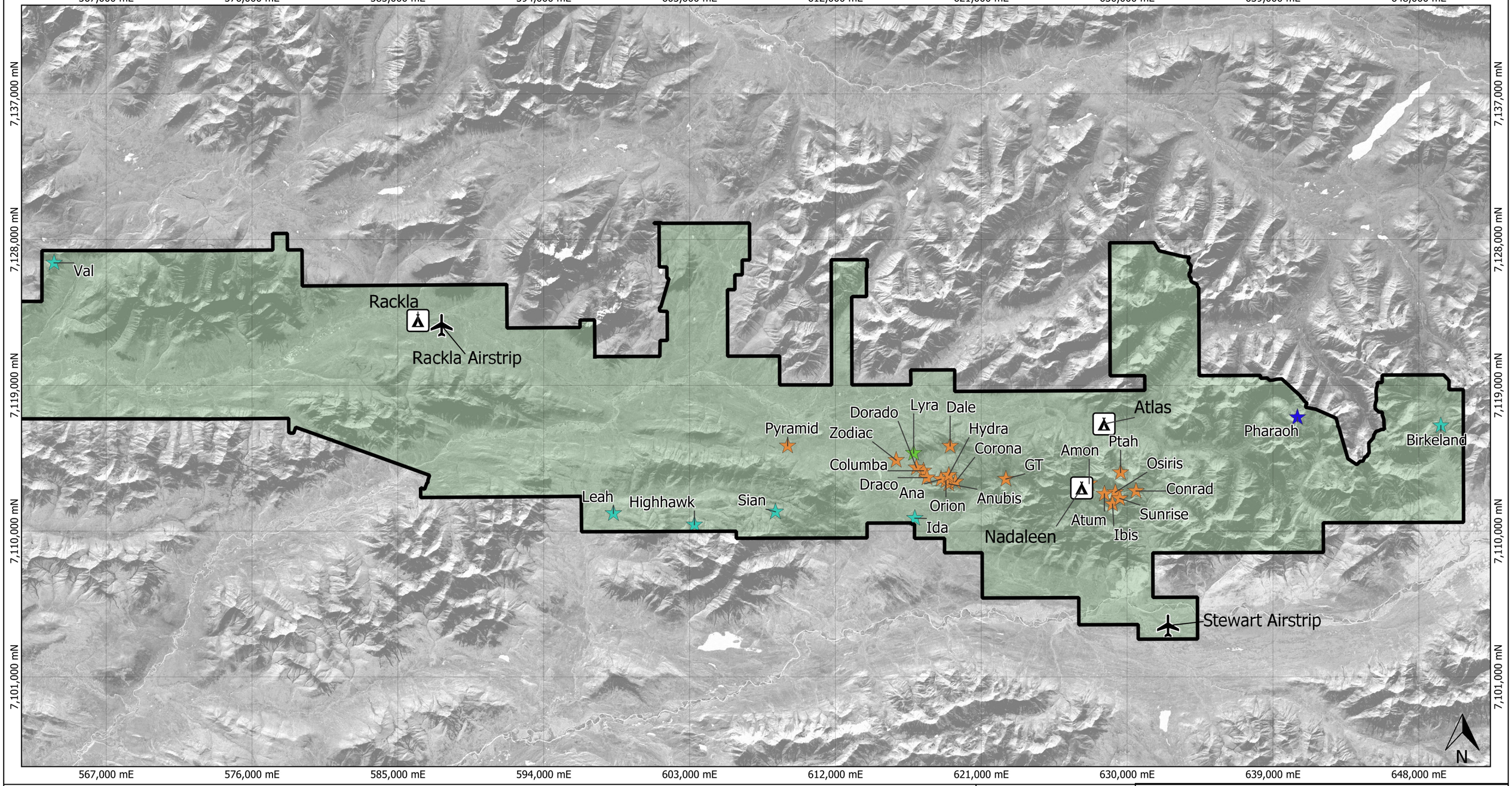
Rackla Gold Property

Claims by Assessment Group
Osiris & Orion Projects

Coordinate Reference System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	December 8, 2020	2D	AC	A

Scale: 1:65,000

P:\Rackla Gold\YEAR\2020\Assessment Report - 2019 Osiris and Orion Projects\Figures\Figure 2 - Claim Groupings\Figure 2 - 2020 Assessment Blocks -



Legend

- Carlin
- Carlin overprint Manto?
- MVT
- Orogenic

0 2 4 6 8 10 km

Scale 1:220,000

ATAC RESOURCES LTD.

Rackla Gold Property

Showings, Camps, Airstrips

Coordinate System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	November 2020	3	AS	1

C:\Users\aschn\OneDrive\Desktop\QGIS Workspaces\RacklaGoldProject\Rackla Gold Property.qgs

ATAC RESOURCES LTD.

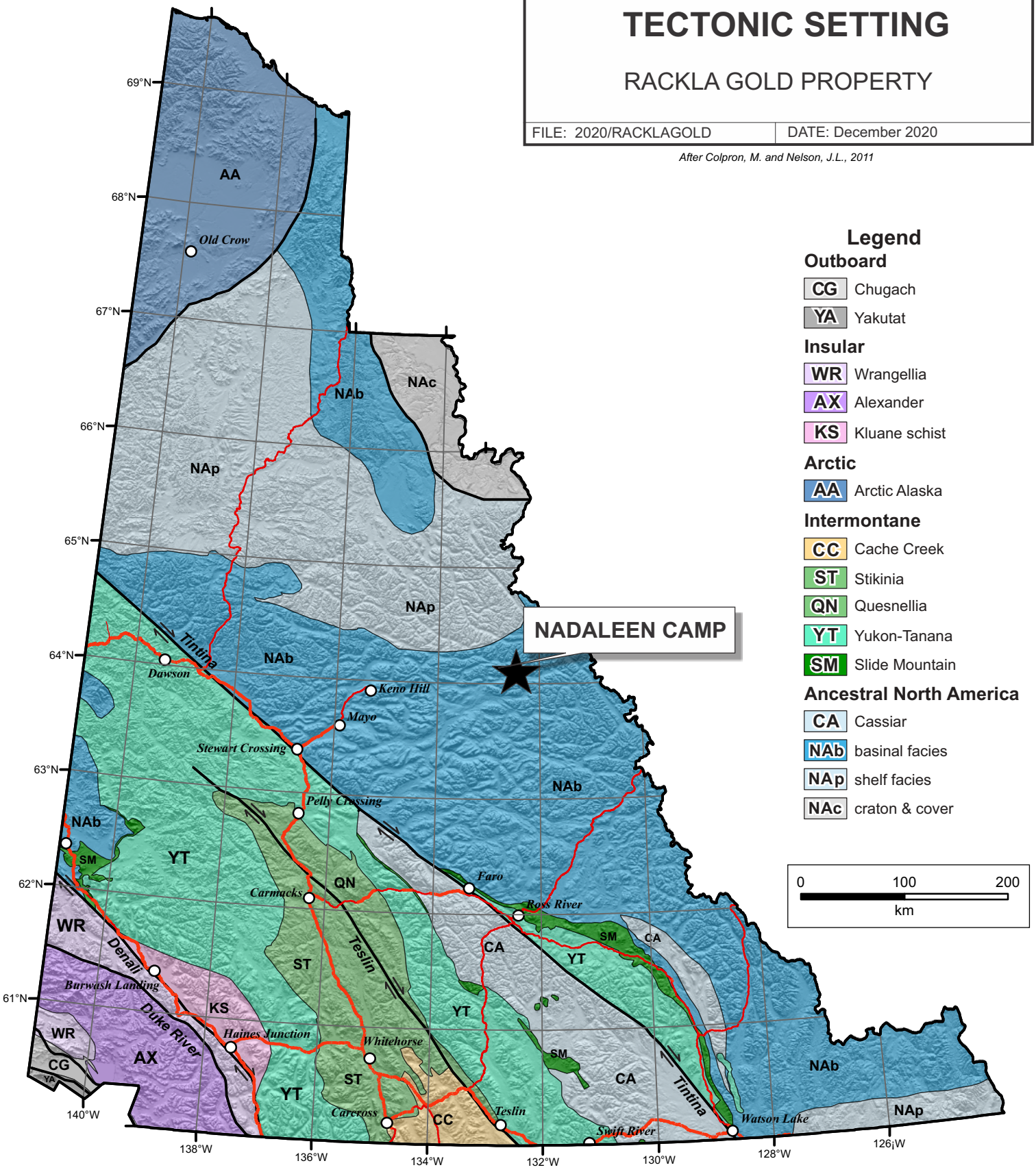
FIGURE 4

TECTONIC SETTING

RACKLA GOLD PROPERTY

FILE: 2020/RACKLAGOLD | DATE: December 2020

After Colpron, M. and Nelson, J.L., 2011



Legend

Outboard

- CG Chugach
- YA Yakutat

Insular

- WR Wrangellia
- AX Alexander
- KS Kluane schist

Arctic

- AA Arctic Alaska

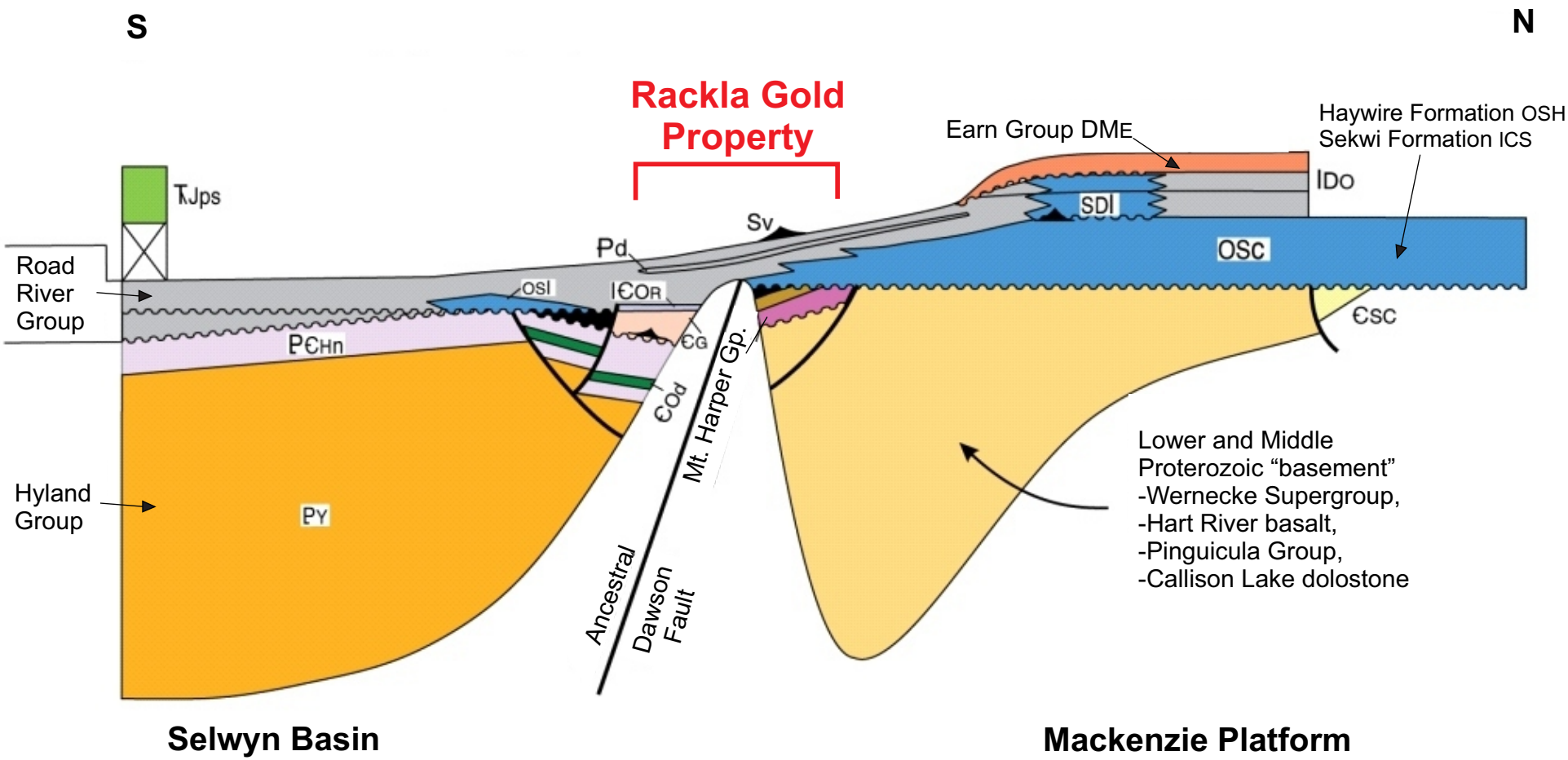
Intermontane

- CC Cache Creek
- ST Stikinia
- QN Quesnellia
- YT Yukon-Tanana
- SM Slide Mountain

Ancestral North America

- CA Cassiar
- NAb basinal facies
- NAp shelf facies
- NAc craton & cover

after Abbott (1997)



ATAC RESOURCES LIMITED

FIGURE 5

REGIONAL STRATIGRAPHIC SECTION

RACKLA GOLD PROPERTY

FILE: F5_RegionalStratigraphicSection

DATE: December 2020

Rackla Gold Property

Regional Geology

ATAC RESOURCES LTD

Coordinate Reference System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	December 2020	6	AS	1

Scale 1:95,000

0 1 2 3 4 5 km

C:\Users\aschn\OneDrive\Desktop\QGIS Workspaces\RacklaGoldProject\Rackla Gold Property.qgz

600,000 mE 605,000 mE 610,000 mE 615,000 mE 620,000 mE 625,000 mE 630,000 mE 635,000 mE 640,000 mE 645,000 mE 650,000 mE

7,130,000 mN 7,125,000 mN 7,120,000 mN 7,115,000 mN 7,110,000 mN 7,105,000 mN 7,100,000 mN 7,095,000 mN 7,090,000 mN

Legend

- **CH: Hart River Formation:** thinly laminated, cherty spiculite and spicule lime packstone with subordinate sandstone, siltstone and calcareous shale; local lime grainstrone; local members of lenticular to shoe-string sandstone grading into chert rich conglomerate
- **DB: Grizzly Bear Formation:** limestone, white grey weathering, cliff forming, blocky partings, massive, fine to medium crystalline; scattered coral, brachiopods, bryozoans and twin canal echinoderm ossicles
- **CDB: Bouvette Formation:** resistant, generally well-bedded to massive, grey weathering variably dolotomized carbonate; locally fossiliferous; locally contains black diagenetic chert
- **OSK: Mount Kindle Formation:** thick-bedded, dark grey to black and minor light grey weathering dolomite; locally massive, vuggy and reefoid; minor chert
- **CPMC: Mount Cristie Formation:** greenish-grey, pink and dark grey shale; light grey-green to black chert; minor sandstone, limestone
- **CT: Keno Hill Formation:** light to dark grey, thick bedded to massive, vitreous quartzite; black shale
- **DME: Earn Group:** Brown-weathering, dark grey to black, chert, minor sandstone, siltstone; minor limestone; chert-pebble conglomerate and sandstone; locally bedded barite
- **ODR: Road River Group:** black shale, locally graphitic; black limestone
- **CSM: Marmot Formation:** dark green to black volcaniclastic sandstone and cobble to boulder conglomerate; dark brownish-grey weathering basalt, locally pillowed; black hyaloclastic breccia
- **IGS: Gull Lake Formation:** brown weathering, green volcanic sandstone, siltstone; locally gritty; conglomerate; local orange weathering dolostone bands
- **ICS: Seqwi Formation:** limestone, locally wavy bedded and nodular; limestone conglomerate slope breccia; massive grey dolostone; medium- to thick-bedded quartz sandstone; purple siltstone; bright orange weathering, fine crystalline dolostone
- **PCH: Hyland Group:** thin to thick bedded, brown to pale green shale, with sandstone, grit and conglomerate (Yusezyu); grey weathering, bedded, crystalline limestone, locally sandy (Algae Lake); distinctive, interbedded maroon and apple-green slate (Narchilla)
- **uPB: Blueflower Formation:** shale, siltstone and sandstone, rhythmically bedded mudstone; pale yellow weathering cross bedded limestone interbedded with green shale
- **uPG: Gametrail Formation:** grey, yellow and orange weathering dolostone, dolomitic siltstone/sandstone and limestone, commonly planar and/or cross laminated; calcareous shale and siltstone; maroon shale; carbonate clast breccia and conglomerate
- **uPN: Nadaleen Formation:** grey to greenish-brown rhythmically bedded fine-grained sandstone, siltstone, mudstone; mariib siltstone-mudstone; limestone; limestone conglomerate; calcareous grit and sandstone
- **uPS: Sheepbed Formation:** recessive, black weathering shale and siltstone; minor quartzite and limestone
- **uPHC: Hay Creek Group:** orange and brown weathering, commonly silty and sandy dolomite, in part well-laminated and flaggy; limestone, cross-bedded pebbly quartzite and conglomerate; local minor brown weathering diamictite at base; distinct white dolostone member at top
- **uPR: Rapitian Group:** maroon mudstone with interbeds of sandy mud-matrix-conglomerate and pebbles of limestone, mudstone, sandstone and chert; thick bedded to massive, sandstone and pebble to boulder conglomerate with clasts of carbonate, siltstone and quartz arenite
- **uPHC: Mt. Harper Group:** grey dolostone, dolostone conglomerate and dolomitic mudstone redbeds; and, volcanic and carbonate clast conglomerate, rare basalt, volcanic tuff, and pyroclastic bombs, intercalated dolomitic mudstone and dolostone conglomerate
- normal
- strike slip
- thrust

N

620,000 mE

625,000 mE

7,115,000 mN

7,110,000 mN

N

N-MST

C-SLC

O-MST

O-LST1

O-LST2

A-SLT

A-DST

A-MST

GL

O

S

D

MD10

MD20

MD30

M

Legend

Mississipian

- M — Thick bedded bioclastic limestone

Devonian-Mississipian

- MD30 — Laminated non-calcareous shale
- MD20 — Grey-black, laminted shale
- MD10 — Variably calcareous shales and siltstones

Middle Devonian

- D — Gray tan dolostone

Silurian

- S — Thick bedded bioclastic rudstone

Ordovician-Devonian

- ODRR — Black shale with local limestone layers

Ordovician

- O — Grey massive bedded rudstone-floatstone
- O-GAB — Osiris Gabbro 465.66±4.4 Ma (Tucker, 2015)

Neoproterozoic-Cambrian

- GL — Gull Lake Sandstone and Siltstone

Neoproterozoic-Cambrian

- Amon Mudstone
- Atum Dolostone
- Atum Siltstone
- Osiris Limestone 2
- Osiris Diamictite
- Osiris Dolostone
- Osiris Limestone 1
- Osiris Mudstone
- Conrad Limestone 2
- Conrad Shale
- Conrad Dolostone
- Conrad Siliciclastic
- Conrad Limestone 1
- NONAD Mudstone
- Diamond Drill Hole

ATAC RESOURCES LTD.

FIGURE 7

NADALEEN TREND GEOLOGY

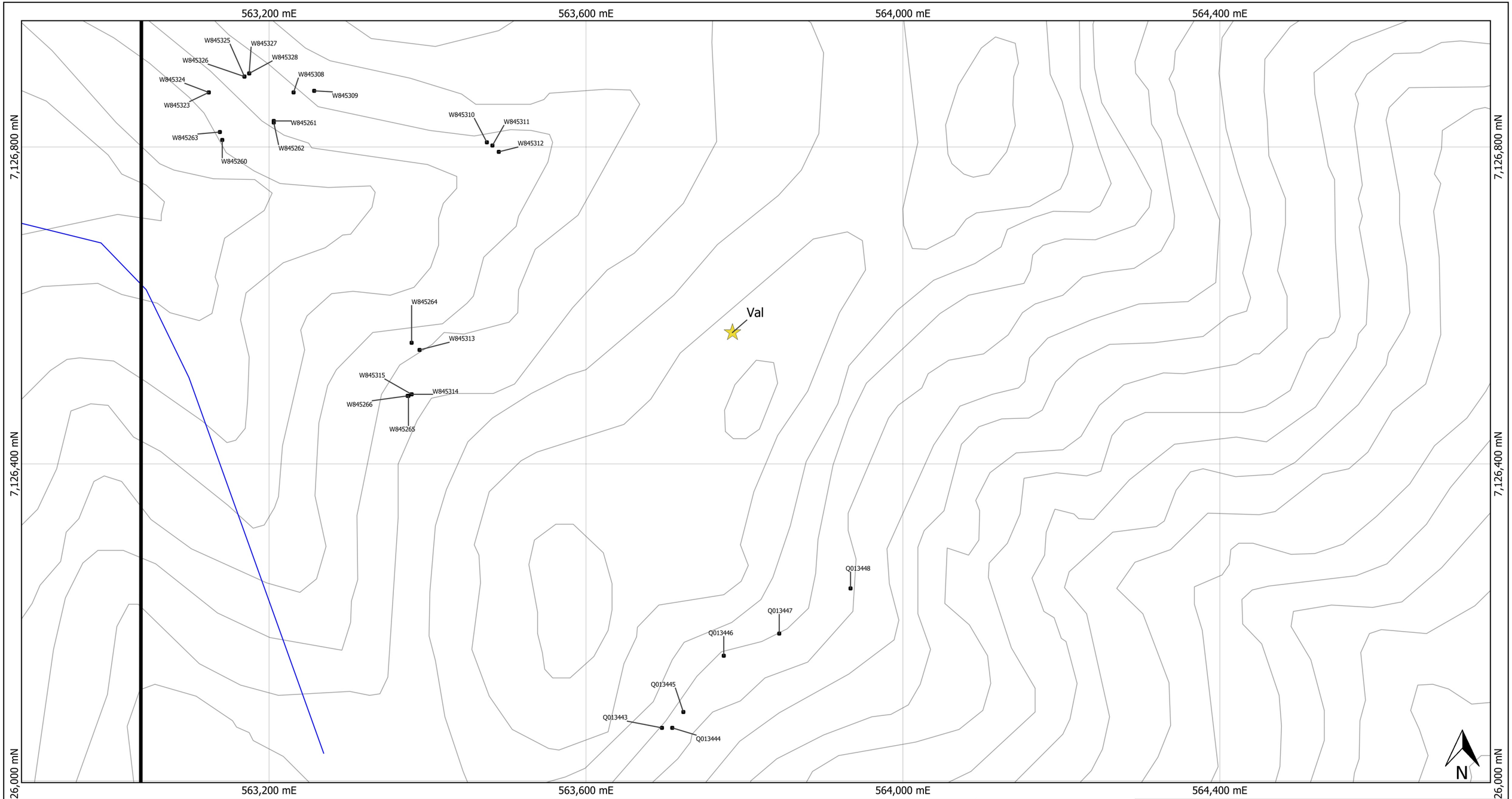
RACKLA GOLD PROPERTY

0 1 2 km

UTM Zone 8, NAD 83, Contour Interval 100 ft, Scale 1:40,000

FILE: F7_NadaleenTrendGeology

Date: December 2020

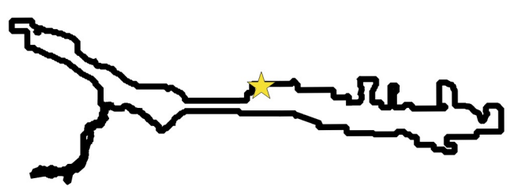


Legend

- Rock Sample

0 100 200 300 m

Scale 1:4,500



ATAC RESOURCES LTD.

Rackla Gold Property

2019 Rock Sample Locations

Coordinate System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	November 2020	8	AS	1

C:\Users\aschn\OneDrive\Desktop\QGIS Workspaces\RacklaGoldProject\Rackla Gold Property.qgz

563,200 mE | 563,600 mE | 564,000 mE | 564,400 mE

7,126,800 mN

7,126,400 mN

1175
2490
4010
1465
6300
11663
Val
2700
1630
3470

N

Legend

2019 Rock Samples (Ag - g/t)

- <10
- 10 - 50
- 50 - 100
- 100 - 500
- 500 - 11663

Labelled values are > 1000 g/t silver

0 100 200 300 m

Scale 1:4,500

ATAC RESOURCES LTD.

Rackla Gold Property

Rock Sample Results - Silver

Coordinate System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	November 2020	9	AS	1

C:\Users\aschn\OneDrive\Desktop\QGIS Workspaces\RacklaGoldProject\Rackla Gold Property.qgz

563,200 mE | 563,600 mE | 564,000 mE | 564,400 mE

7,126,800 mN

7,126,400 mN

1.55

2.59

1.56

1.19

Val

N

Legend

2019 Rock Samples (Cu - %)

- <0.05
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 2.59

Labelled values are > 1.00% copper

0 100 200 300 m

Scale 1:4,500

ATAC RESOURCES LTD.

Rackla Gold Property

Rock Sample Results - Copper

Coordinate System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	November 2020	10	AS	1

C:\Users\aschn\OneDrive\Desktop\QGIS Workspaces\RacklaGoldProject\Rackla Gold Property.qgz

563,200 mE | 563,600 mE | 564,000 mE | 564,400 mE

7,126,800 mN

7,126,400 mN

1.75
3.02
1.60
6.46
81.76
73.27
1.64
57.68
80.83
1.64
1.23
76.43
5.85
Val
78.59
68.13
16.05
5.98
9.92

N

Legend

2019 Rock Samples (Pb - %)

- <0.005
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 81.76

Labelled values are > 1.00% lead

0 100 200 300 m

Scale 1:4,500

ATAC RESOURCES LTD.

Rackla Gold Property

Rock Sample Results - Lead

Coordinate System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	November 2020	11	AS	1

C:\Users\aschn\OneDrive\Desktop\QGIS Workspaces\RacklaGoldProject\Rackla Gold Property.qgz

563,200 mE | 563,600 mE | 564,000 mE | 564,400 mE

7,126,800 mN

7,126,400 mN

1.40
5.34
8.70
8.19
1.54
1.28
3.39
1.46
1.41
15.40
6.46
9.93
8.33
43.48
Val
26.00
9.48
7.46
7.25

N

Legend

2019 Rock Samples (Zn - %)

- <0.05
- 0.05 - 0.10
- 0.10 - 0.50
- 0.50 - 1.00
- 1.00 - 43.48

Labelled values are > 1.00% zinc

0 100 200 300 m

Scale 1:4,500

ATAC RESOURCES LTD.

Rackla Gold Property

Rock Sample Results - Zinc

Coordinate System	Date	Fig. #	Author	Rev
UTM NAD 83 Zone 8N	November 2020	12	AS	1

C:\Users\aschn\OneDrive\Desktop\QGIS Workspaces\RacklaGoldProject\Rackla Gold Property.qgz

APPENDIX I

STATEMENTS OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

I, Andrew Carne, engineer, with business address in Vancouver, British Columbia and residential address in Vancouver, British Columbia, hereby certify that:

1. I graduated from the University of British Columbia in 2010 with a B.A.Sc. in Materials Engineering and in 2012 with an M.Eng. in Civil Engineering.

2. From 2006 to present, I have been actively engaged in mineral exploration and development in Yukon Territory and British Columbia.

3. I am a registered Professional Engineer with Engineers and Geoscientists of British Columbia (License Number 50754).

4. I am the Vice-President of Corporate and Project Development for ATAC Resources Ltd.

5. I have personally participated in the work reported herein and have interpreted data resulting from this work.



Andrew Carne, M.Eng., P.Eng.

I, Austin Schneebeli, geologist, with business address in Vancouver, British Columbia and residential address in Victoria, British Columbia, hereby certify that:

1. I graduated from the University of Victoria in 2020 with a B.Sc. in Earth Sciences.

2. From 2018 to present, I have been actively engaged in mineral exploration in Yukon Territory.

3. I am a Geoscientist-In-Training (G.I.T.) with the Association of Professional Engineers and Geoscientists of British Columbia (Member Number 214745).

4. I have participated in the interpretation of data resulting from the fieldwork reported herein.



Austin Schneebeli, B.Sc., G.I.T.

APPENDIX II

STATEMENT OF EXPENDITURES

Statement of Expenditures
Rackla Gold Property
GROUP A - HM03304
GROUP B - HM03268

Expenses

Blue Coast Metallurgy	Invoice	2019-035	$ 945.00
Blue Coast Metallurgy	Invoice	2019-043	$ 1,470.00
Blue Coast Metallurgy	Invoice	2019-050	$ 315.00
Blue Coast Research	Invoice	BCR2019-131	$ 3,231.00
Blue Coast Research	Invoice	BCR2019-161	$ 16,045.80
Golder	Invoice	1026498	$ 7,728.76
Golder	Invoice	1043127	$ 9,643.06
Golder	Invoice	1058895	$ 2,265.90
			$ 41,644.52

Total Expenditures Group A	$ 20,822.26
Total Expenditures Group B	$ 20,822.26

Statement of Expenditures
Rackla Gold Property
Group C - HM03303
Group F - HM03307

Employee	Job Description	Hours	Time Period	Rate/hr	Total
Wayne Schneider	Demobe Labour	23	June 2019	$ 99.00	$ 2,277.00
					$ 2,277.00

Expenses

Room and Board	20 Mandays @ $100/ day	$ 2,000.00
Alkan Air - Demobe legs	Invoice 9330	$ 6,216.38
Nomad Air - Demobe legs	Invoice 2124	$ 6,669.75
Nomad Air - Demobe legs	Invoice 2125	$ 8,642.00
Nomad Air - Demobe legs	Invoice 2126	$ 2,710.00
Nomad Air - Demobe legs	Invoice 2143	$ 11,398.00
Nomad Air - Demobe legs	Invoice 2144	$ 3,518.00
AC Loader Rental @ Stewart Strip		$ 600.00
Crane Scale Rental @ Stewart Strip		$ 20.00
		$ 41,774.13

Total 2019 expenditures	$ 44,051.13
Total Expenditures Group C	$ 22,025.57
Total Expenditures Group F	$ 22,025.57

Statement of Expenditures
Rackla Gold Property
Group G - HM03308

Employee	Job Description	Hours	Time Period	Rate/hr	Total
Adam Coulter	Sr. Geologist	4	June 2019-October 2019	$ 85.00	$ 340.00
Andrew Carne	Sr. Engineer	8	June 2019-October 2019	$ 96.00	$ 768.00
Jessie Thomson-Gladish	Field Labour	10	June 2019-October 2019	$ 66.00	$ 660.00
Thomas Rozsypalek	Field Labour	10	June 2019-October 2019	$ 49.00	$ 490.00
Taylor Quack	Field Labour	10	June 2019-October 2019	$ 51.00	$ 510.00
Tyson Brulette	Field Labour	4	June 2019-October 2019	$ 55.00	$ 220.00
Hailey Mintz	Cook	4	June 2019-October 2019	$ 85.00	$ 340.00
Julia Lane	Project Manager	4	June 2019-July 2019	$ 113.00	$ 452.00
					$ 3,780.00
Expenses					
Room and Board	5 mandays @ $100/day				$ 500.00
Horizon Helicopters					$ 2,287.50
Alkan Air, one round trip flight					$ 1,526.50
ALS					$ 3,721.66
					$ 8,035.66
			Total 2019 expenditures		$ 11,815.66

February 2020

Statement of Expenditures
Rackla Gold Property
Group H - HM03309

Employee	Job Description	Hours	Time Period	Rate/hr	Total
Andrew Carne	Prospecting and sampling	20	September 2019	$ 96.00	$ 1,920.00
Adam Coulter	Prospecting and sampling	10	September 2019	$ 85.00	$ 850.00
Austin Schneebeli	Prospecting and sampling	10	September 2019	$ 62.00	$ 620.00
					$ 3,390.00
Expenses					
Room and Board	3 mandays @ $100/day				$ 300.00
Horizon Helicopters					$ 2,287.50
ALS					$ 2,131.84
					$ 4,719.34
			Total 2019 expenditures		$ 8,109.34

APPENDIX III

ROCK SAMPLE DESCRIPTIONS

Rock Sample Descriptions Property: Val

Sample Number:	Q013441	Date Collected:	2019-08-05	UTM:	563721	mE	Nad83, Zone 8
Elevation:	1322 m	Sampler:	Adam Coulter	UTM:	7125954	mN	

Comments: Dolostone float from small pit at anomalous Ag-Pb-Zn soil location. Contains thicker ~5mm thick white calcite vein and thin ~2mm quartz-calcite veins. Moderate HCL reaction when scratched. Non-mag.

Sample Number:	Q013442	Date Collected:	2019-08-05	UTM:	563712	mE	Nad83, Zone 8
Elevation:	1331 m	Sampler:	Adam Coulter	UTM:	7125960	mN	

Comments: Dark blue dolostone float with stockwork dolomite veins up to 1cm thick. Moderate HCL reaction when scratched. Non-magnetic.

Sample Number:	Q013443	Date Collected:	2019-08-05	UTM:	563696	mE	Nad83, Zone 8
Elevation:	1392 m	Sampler:	Adam Coulter	UTM:	7126067	mN	

Comments: Dark grey-blue dolostone outcrop with 2% coarse oxidized pyrite. 5mm thick bladed calcite vein. Moderate HCL reaction when scratched. Non-magnetic.

Sample Number:	Q013444	Date Collected:	2019-08-05	UTM:	563709	mE	Nad83, Zone 8
Elevation:	1383 m	Sampler:	Adam Coulter	UTM:	7126067	mN	

Comments: Light grey dolostone outcrop with 2% coarse dodecahdral rusty pyrite. Weak HCL when powdered. Non-magnetic.

Sample Number:	Q013445	Date Collected:	2019-08-05	UTM:	563723	mE	Nad83, Zone 8
Elevation:	1385 m	Sampler:	Adam Coulter	UTM:	7126087	mN	

Comments: Intense dolomite veining in dolostone outcrop with ~3% coarse dodecahedral pyrite. Bladed calcite in open spaces in places. Moderate HCL reaction when scratched. Non-magnetic.

Sample Number:	Q013446	Date Collected:	2019-08-05	UTM:	563774	mE	Nad83, Zone 8
Elevation:	1398 m	Sampler:	Adam Coulter	UTM:	7126158	mN	

Comments: Large 3cm bladed calcite vein in outcrop with ~5% 5mm dodedecahdral pyrite in the vein. Moderate HCL reaction. Non-magnetic.

Rock Sample Descriptions Property: Val

Sample Number:	Q013447	Date Collected:	2019-08-05	UTM:	563844 mE	Nad83, Zone 8
Elevation:	1386 m	Sampler:	Adam Coulter	UTM:	7126186 mN	

Comments: Dark grey dolosotne with ~60% calcite veining and ~2% coarse dodecahdral pyrite. Strong HCL reaction in veins and moderate HCL reaction in dolostone when scratched…duh. Non-mag.

Sample Number:	Q013448	Date Collected:	2019-08-05	UTM:	563934 mE	Nad83, Zone 8
Elevation:	1341 m	Sampler:	Adam Coulter	UTM:	7126243 mN	

Comments: Dark grey dolosotne with ~30% calcite veining and ~2% coarse dodecahdral pyrite. Strong HCL reaction in veins and moderate HCL reaction in dolostone when scratched…duh. Non-mag.

Sample Number:	W845260	Date Collected:	2019-09-16	UTM:	563141 mE	Nad83, Zone 8
Elevation:	1090 m	Sampler:	Rob Carne	UTM:	7126809 mN	

Comments: Big Red Zone. Non-calcareous dark grey siltstone brecciated and partially replaced by QZ and small irregular GN masses. Both cross-cut by oxidized brown SL.

Sample Number:	W845261	Date Collected:	2019-09-16	UTM:	563206 mE	Nad83, Zone 8
Elevation:	1277 m	Sampler:	Rob Carne	UTM:	7126833 mN	

Comments: Big Red Zone. Dark brown oxide with as much as 40% very fine QZ needles. Minor relict honey coloured SL.

Sample Number:	W845262	Date Collected:	2019-09-16	UTM:	563206 mE	Nad83, Zone 8
Elevation:	1272 m	Sampler:	Rob Carne	UTM:	7126831 mN	

Comments: Dark brn oxide with small QZ needles throughout. Bands of partially oxidized honey coloured SL.

Sample Number:	W845263	Date Collected:	2019-09-16	UTM:	563138 mE	Nad83, Zone 8
Elevation:	1346 m	Sampler:	Rob Carne	UTM:	7126819 mN	

Comments: Big Red Zone. Smithsonite with minor relict SL and v. minor PY, GN and purple fluorite hosted in recrystallized LST

Sample Number:	W845264	Date Collected:	2019-09-16	UTM:	563380 mE	Nad83, Zone 8
Elevation:	1334 m	Sampler:	Rob Carne	UTM:	7126553 mN	

Comments: Big Red Zone; brecciated texture, mostly smithsonite in matrix and as fragments. Minor LST fragments. Tr. SL and GN

Rock Sample Descriptions Property: Val

Sample Number:	W845265	Date Collected:	2019-09-16	UTM:	563376	mE	Nad83, Zone 8
Elevation:	1362 m	Sampler:	Rob Carne	UTM:	7126486	mN	

Comments: South Hill Zone. Non-calcareous dark siltstone, partially replaced by QZ with oxidized SL and <1% GN on frx

Sample Number:	W845266	Date Collected:	2019-09-16	UTM:	563375	mE	Nad83, Zone 8
Elevation:	1440 m	Sampler:	Rob Carne	UTM:	7126486	mN	

Comments: South Hill Zone. Banded SL>>TTGN. TT in green fluorite bands < 4 cm

Sample Number:	W845301	Date Collected:	2019-09-15	UTM:	563011	mE	Nad83, Zone 8
Elevation:	1335 m	Sampler:	Adam Coulter	UTM:	7127106	mN	

Comments: Massive smithsonite, cerrusite, galena and partially oxidized sphalerite.

Sample Number:	W845302	Date Collected:	2019-09-15	UTM:	562836	mE	Nad83, Zone 8
Elevation:	1239 m	Sampler:	Adam Coulter	UTM:	7127018	mN	

Comments: Feathery, sheared galena with irregular masses of smithsonite and clots of tetrahedrite.

Sample Number:	W845303	Date Collected:	2019-09-15	UTM:	562836	mE	Nad83, Zone 8
Elevation:	1239 m	Sampler:	Adam Coulter	UTM:	7127018	mN	

Comments: Feathery, sheared galena; minor smithsonite.

Sample Number:	W845304	Date Collected:	2019-09-15	UTM:	562849	mE	Nad83, Zone 8
Elevation:	1246 m	Sampler:	Adam Coulter	UTM:	7127017	mN	

Comments: Dark rusty brown weathering smithsonite.

Sample Number:	W845305	Date Collected:	2019-09-15	UTM:	562849	mE	Nad83, Zone 8
Elevation:	1246 m	Sampler:	Adam Coulter	UTM:	7127017	mN	

Comments: Brown weathering smithsonite with discontinuous bands of Galena

Rock Sample Descriptions Property: Val

Sample Number:	W845306	Date Collected:	2019-09-15	UTM:	562842	mE	Nad83, Zone 8
Elevation:	1238 m	Sampler:	Adam Coulter	UTM:	7127001	mN	

Comments: Rusty brown weathering smithsonite <5% small irregular masses of galena.

Sample Number:	W845307	Date Collected:	2019-09-15	UTM:	562823	mE	Nad83, Zone 8
Elevation:	1224 m	Sampler:	Adam Coulter	UTM:	7126982	mN	

Comments: Tan brown weathering smithsonite.

Sample Number:	W845308	Date Collected:	2019-09-15	UTM:	563231	mE	Nad83, Zone 8
Elevation:	1322 m	Sampler:	Adam Coulter	UTM:	7126869	mN	

Comments: Galena with moderately curved cleavage, incipiently foliaform; minor small terahedrite masses

Sample Number:	W845309	Date Collected:	2019-09-15	UTM:	563257	mE	Nad83, Zone 8
Elevation:	1337 m	Sampler:	Adam Coulter	UTM:	7126871	mN	

Comments: Cubiform galena; malachite coatings; fine grained tetrahedrite(?) masses.

Sample Number:	W845310	Date Collected:	2019-09-15	UTM:	563475	mE	Nad83, Zone 8
Elevation:	1331 m	Sampler:	Adam Coulter	UTM:	7126806	mN	

Comments: Feathery, sheared galena, tetrahedrite in between 'feather' xtal forms, smithsonite in earlier irregular cavities

Sample Number:	W845311	Date Collected:	2019-09-15	UTM:	563482	mE	Nad83, Zone 8
Elevation:	1335 m	Sampler:	Adam Coulter	UTM:	7126802	mN	

Comments: Feathery to steely sheared galena with malachite; ~ 1cm clots of oxidized tetrahedrite; shear texture wraps around tetrahedrite.

Sample Number:	W845312	Date Collected:	2019-09-15	UTM:	563490	mE	Nad83, Zone 8
Elevation:	1329 m	Sampler:	Adam Coulter	UTM:	7126794	mN	

Comments: Cubiform galena with minor curved cleavage; malachite and azurite coatings; minor smithsonite in oxidized cavities.

Rock Sample Descriptions Property: Val

Sample Number:	W845313	Date Collected:	2019-09-15	UTM:	563390	mE	Nad83, Zone 8
Elevation:	1328 m	Sampler:	Adam Coulter	UTM:	7126544	mN	

Comments: Cubiform galena with minor curved cleavage; malachite and azurite coatings; ~15% smithsonite in oxidized cavities; 1-4mm clot of tetrahedrite on sawn surface.

Sample Number:	W845314	Date Collected:	2019-09-15	UTM:	563380	mE	Nad83, Zone 8
Elevation:	1356 m	Sampler:	Adam Coulter	UTM:	7126488	mN	

Comments: Cubiform galena with minor curved cleavage; malachite and acurite coatings; minor smithsonite in oxidized cavities

Sample Number:	W845315	Date Collected:	2019-09-15	UTM:	563380	mE	Nad83, Zone 8
Elevation:	1356 m	Sampler:	Adam Coulter	UTM:	7126488	mN	

Comments: Reddish brown, dark brown weathering oxide with trace galena; oxide mostly smithsonite?

Sample Number:	W845316	Date Collected:	2019-09-15	UTM:	561651	mE	Nad83, Zone 8
Elevation:	1411 m	Sampler:	Adam Coulter	UTM:	7131466	mN	

Comments: Dark brown weathering oxide and brown smithsonite (~40%)

Sample Number:	W845317	Date Collected:	2019-09-15	UTM:	561651	mE	Nad83, Zone 8
Elevation:	1411 m	Sampler:	Adam Coulter	UTM:	7131466	mN	

Comments: Grey and brown sphalerite remnants in brown smithsonite-rich oxide

Sample Number:	W845318	Date Collected:	2019-09-15	UTM:	561273	mE	Nad83, Zone 8
Elevation:	1266 m	Sampler:	Adam Coulter	UTM:	7130920	mN	

Comments: Recrystallized limestone with smithsonite after honey-coloured sphalerite and earlier dark brown sphalerite

Sample Number:	W845319	Date Collected:	2019-09-15	UTM:	560961	mE	Nad83, Zone 8
Elevation:	1211 m	Sampler:	Adam Coulter	UTM:	7130857	mN	

Comments: Large masses of Ppritein white quartz-calcite vein; azurite and malachite coating calcite sections of vein

Rock Sample Descriptions Property: Val

Sample Number:	W845320	Date Collected:	2019-09-15	UTM:	560961	mE	Nad83, Zone 8
Elevation:	1211 m	Sampler:	Adam Coulter	UTM:	7130857	mN	

Comments: White vein quartz vein replacing rusty brown weathering iron carbonate; trace <2mm black oxidized sulphide or sulfosalt and <1mm ovoids of galena

Sample Number:	W845321	Date Collected:	2019-09-15	UTM:	560959	mE	Nad83, Zone 8
Elevation:	1228 m	Sampler:	Adam Coulter	UTM:	7130833	mN	

Comments: Rusty quartz vein, blade-shaped Kspar(?) crystals; minor sphalerite in irregular cross-cutting fractures

Sample Number:	W845322	Date Collected:	2019-09-15	UTM:	560978	mE	Nad83, Zone 8
Elevation:	1249 m	Sampler:	Andrew Carne	UTM:	7130816	mN	

Comments: Quartz vein with rusty oxide coating and possible arsenopyrite.

Sample Number:	W845323	Date Collected:	2019-09-15	UTM:	563124	mE	Nad83, Zone 8
Elevation:	1340 m	Sampler:	Andrew Carne	UTM:	7126869	mN	

Comments: very dark brown oxide with porous silica mesh; clean vuggy cavities

Sample Number:	W845324	Date Collected:	2019-09-15	UTM:	563124	mE	Nad83, Zone 8
Elevation:	1340 m	Sampler:	Andrew Carne	UTM:	7126869	mN	

Comments: similar to above, but dark brown oxide forms breccia fragments; matrix is quartz needle mesh with interstitial sphalerite

Sample Number:	W845325	Date Collected:	2019-09-15	UTM:	563169	mE	Nad83, Zone 8
Elevation:	1338 m	Sampler:	Andrew Carne	UTM:	7126889	mN	

Comments: Dark brown and rusty red oxide; dark brown oxide as cubes up to 8mm across, probably after pyrite. Rusty oxide is in between cubes and includes abundant quartz needles.

Sample Number:	W845326	Date Collected:	2019-09-15	UTM:	563169	mE	Nad83, Zone 8
Elevation:	1338 m	Sampler:	Andrew Carne	UTM:	7126889	mN	

Comments: Similar to above, but quartz needle mesh >> dark bron oxide; very porous and vuggy; no sulphide

Rock Sample Descriptions Property: Val

Sample Number:	W845327	Date Collected:	2019-09-15	UTM:	563175 mE	Nad83, Zone 8
Elevation:	1335 m	Sampler:	Andrew Carne	UTM:	7126893 mN	

Comments: Medium brown oxide, high density (smithsonite?), minor blebs of galena; cut by 5-8mm vein of light brown, partially oxidized sphalerite - ~50% quartz

Sample Number:	W845328	Date Collected:	2019-09-15	UTM:	563175 mE	Nad83, Zone 8
Elevation:	1335 m	Sampler:	Andrew Carne	UTM:	7126893 mN	

Comments: Med to dark brown weathering oxide and fine quartz crystal mesh with interrstitial partially oxidized sphalerite and smithsonite

APPENDIX IV

METALLURGICAL TESTWORK REPORT

Blue Coast Research Ltd | Unit 2, 1020 Herring Gull Way | Parksville | British Columbia | V9P 1R2 | Canada | Tel: +1 250 586 0600 | Fax +1 250 586 0445

PJ5270 ATAC – Osiris

Metallurgical Testwork Report

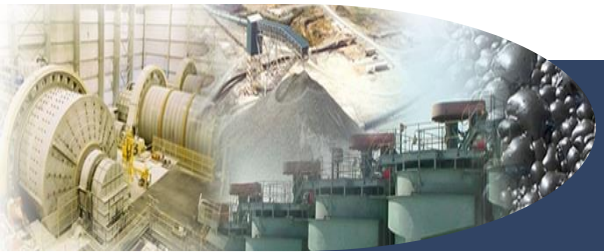
Prepared for ATAC Resources Ltd.

Vancouver, B.C.

Date: 28 November 2019

Authors: Alexandria Hall, B.A.Sc., Shane Williams, B.A.Sc.

Experimental Testwork: Jay Fitzsimmons



DISCLAIMER

The data provided in this report and the associated interpretations offered are based on the laboratory testwork performed by Blue Coast Research Ltd. No assurances can be made by Blue Coast Research Ltd on the representivity of the samples tested.

EXECUTIVE SUMMARY

ATAC Resources (c/o Blue Coast Metallurgy) requested that Blue Coast Research conduct a scoping level metallurgical testwork program on samples from the Osiris project, located in the Yukon Territory. Samples from the Osiris project were subjected to arsenic and pyrite flotation. Samples were received at the Blue Coast Research metallurgical testwork facility in January and April 2019.

The head assays for the composites are summarized in Table 1.

Table 1: Summary of Head Assays

Composite	Au (g/t)	Ag (g/t)	As (%)	Fe (%)	Sb (%)	S total (%)	S sulphide (%)	C total (%)	C org (%)	Preg Rob (%)
Osiris Average	4.46	1.69	2.42	1.25	0.02	1.91	1.63	7.14	0.06	4.37
Conrad Average	4.93	0.60	1.62	1.56	0.02	2.22	2.21	7.86	0.26	51.8
Conrad 2 Average	9.11	1.65	5.97	1.82	0.02	4.59	4.34	6.85	0.26	25.8

The samples were ground in a laboratory rod mill to a particle size of 80% passing 75µm, and a subsample was taken, screened at three size fractions, and submitted for QEMSCAN mineralogical analysis. The sample is primarily composed of carbonates, quartz, illite and muscovite. Sulphides consist of pyrite, realgar, and orpiment. Only trace quantities of arsenopyrite were detected. Modal mineralogy of the Osiris material is summarized in Figure 1.

The pyrite/arsenopyrite liberation indicates that Conrad is 65% liberated, and Osiris is 60% liberated. The arsenic sulphide liberation indicates that Conrad is 92% liberated, and Osiris is 90% liberated.

The arsenic deportment indicates that the arsenic in both samples is primarily realgar, with orpiment representing a major component in Osiris and a minor component in Conrad. Pyrite and arsenopyrite contain only trace levels of arsenic.

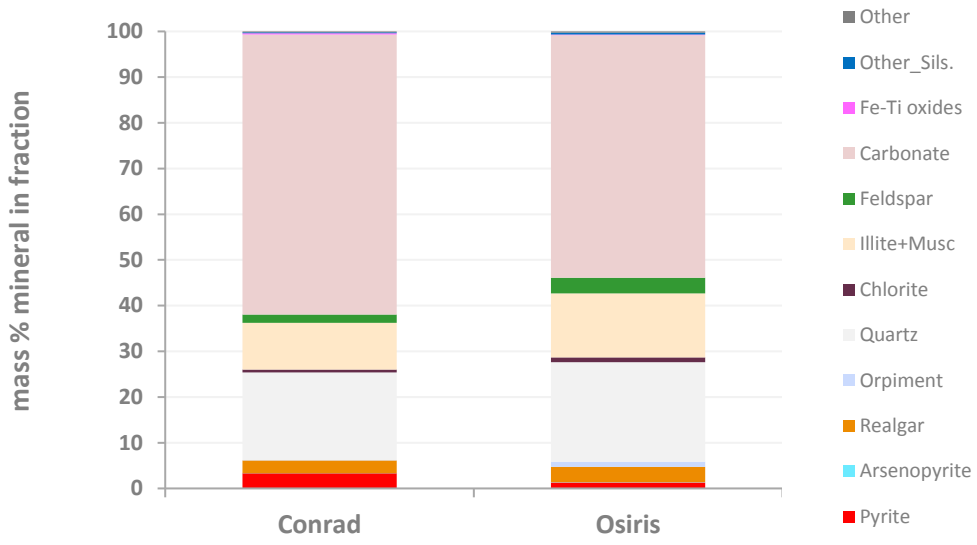


Figure 1: Modal mineralogy of Osiris composites

Rougher and cleaner flotation tests were conducted on all three composites, with a focus on producing an arsenic concentrate which contained minimal gold, and a pyrite concentrate with low arsenic grades. Diesel was used as the collector and MIBC as the frother. Highlights of the flotation program follow:

- **Osiris Flotation:** A fine grind size of 34 µm, with the addition of lime and sodium cyanide to the mill produced the best As selectivity against pyrite.
- **Conrad Flotation:** A three-stage cleaner flotation test was conducted with the purpose of producing a high-grade arsenic concentrate. A grade of 46.3% As was obtained.
- **Conrad 2 Flotation:** A four-stage As cleaner demonstrated that high arsenic recovery was achievable, albeit with significant pyrite misplacement.

Two Osiris flotation products were tested for amenability to gold recovery by super-panner. On both tests gold recovery to the super-panner tip was low, with the majority of the gold reporting to the tails.

Three roasting tests were performed on flotation concentrate, varying the quantity of oxygen in the heating phase (0%, 5%, 13%). Overall, all three roast conditions resulted in good Au recovery, with results ranging from 89% to 91% of Au extraction.

The following items are recommended for study as part of future phases of testwork:

- Further flotation work optimizing particle grind size, cleaning stages, kinetics, and reagent schemes.
- Complete a locked cycle test on the composites to investigate the impact of recycled process water and recirculating process streams, achieving a projection of continuous circuit behavior.
- Conduct a comminution testwork program on several samples of material. The test program should include:
    - Bond Ball Work Index Tests
    - SMC Tests
    - Abrasion Index Tests
- Conduct a variability program including grindability and flotation testwork covering varying areas, depths, lithologies and grades of the deposits.

CONTENTS

EXECUTIVE SUMMARY iii

LIST OF FIGURES v

LIST OF TABLES v

1 INTRODUCTION 10

2 SAMPLE PREPARATION & CHARACTERISATION 11

2.1 Sample Receipt & Inventory 11

2.2 Sample Preparation 11

2.3 Head Assay Characterisation 11

2.4 Mineralogy 11

3 METALLURGICAL TESTWORK & RESULTS 16

3.1 Flotation 16

3.1.1 Osiris 16

3.1.2 Conrad 18

3.1.3 Conrad 2 19

3.2 Gravity 22

3.3 Roasting Testwork 22

4 CONCLUSIONS 24

5 RECOMMENDATIONS 26

APPENDIX A - SAMPLE PREPARATION & HEAD ASSAYS 27

APPENDIX B – MINERALOGY 29

APPENDIX C – FLOTATION 52

APPENDIX D – GRAVITY 66

APPENDIX E – ROASTING..... 68

LIST OF FIGURES

Figure 1: Modal mineralogy of Osiris composites 4

Figure 2: Modal Mineralogy 13

Figure 3: Pyrite and Arsenopyrite Liberation 13

Figure 4: Arsenic Sulphide Liberation 14

Figure 5: Arsenic Deportment 15

Figure 6: Osiris Arsenic Flotation - Arsenic Recovery vs. Mass Pull 16

Figure 7: Osiris Arsenic Flotation - Pyrite Misplacement vs. Arsenic Recovery 17

Figure 8: Osiris Pyrite Flotation - Gold Recovery vs. Mass Pull 17

Figure 9: Conrad Arsenic Flotation - Arsenic Grade vs. Arsenic Recovery 18

Figure 10: Conrad Arsenic Flotation - Pyrite Mineral Misplacement vs. Arsenic Mineral Recovery 19

Figure 11: Conrad Pyrite Flotation - Gold Recovery vs. Mass Pull 19

Figure 12: Conrad 2 Arsenic Flotation – Arsenic Recovery vs. Mass Pull 20

Figure 13: Conrad 2 Arsenic Flotation - Pyrite Mineral Misplacement vs. Arsenic Mineral Recovery 21

Figure 14: Conrad 2 Pyrite Flotation - Gold Recovery vs. Mass Pull 21

LIST OF TABLES

Table 1: Summary of Head Assays 3

Table 2: Head Assays 11

Table 3: Modal Mineralogy 12

Table 4: Super-Panner Results 22

Table 5: Roasting Test Conditions 23

Table 6: Fire Assay and Cyanidation Results 23

1 INTRODUCTION

ATAC Resources' wholly owned Osiris project is located at the eastern end of the Rackla Gold Property, in the Yukon Territory. The Osiris cluster is a Carlin-type gold deposit, and consists of four zones: Conrad, Osiris, Sunrise and Ibis. The inferred mineral resource is 1,685,000 oz gold (in 12.4 Mt) at an average grade of 4.23 g/t Au (www.atacresources.com).

Testwork conducted in 2014/2015 at SGS, on samples from the Conrad zone, included gold deportment and mineralogy, sulphide rougher and cleaner flotation, and cyanidation. Mineralogy data indicated poor liberation of the realgar and pyrite (5% and 17% respectively, at 75µm), and found that the majority of the gold occurs as sub-microscopic, within pyrite. Flotation results indicate potential for gold recovery by flotation (up to 87%), however high mass pulls (~50%) were associated with these recoveries. A cleaner flotation test produced an arsenic rich concentrate, however high gold losses and high pyrite misplacement were observed. A cyanidation test conducted on flotation tails showed poor gold recovery, and potential preg-robbing.

All testwork and analysis was conducted at Blue Coast Research's metallurgical testwork facility located in Parksville, BC unless otherwise stated.

2 SAMPLE PREPARATION & CHARACTERISATION

2.1 Sample Receipt & Inventory

A total of ~250 kg of material was received at the BCR metallurgical testwork facility in Parksville, BC in January and April 2019. The sample inventory is shown in Appendix A.

2.2 Sample Preparation

Three composites were prepared according to recipes provided by ATAC resources. Full details of composite makeup are shown in Appendix A. Composites were stage crushed to 100% -10 M, and were homogenized, split into 2 kg testwork charges, and subsampled for head assays.

2.3 Head Assay Characterisation

Each composite was assayed in triplicate for gold, silver, arsenic, iron, antimony and total sulphur. Singleton sulphur and carbon speciation assays were conducted. Additionally, preg-rob assays were conducted on each composite. Gold was measured via fire assay with an atomic adsorption finish. Silver, arsenic, iron and antimony were measured with an aqua regia digest followed by an atomic adsorption finish. Sulphur and carbon were measured through a direct read on an ELTRA carbon-sulphur analyzer. Sulphide sulphur and organic carbon were determined by first pre-treating the sample with 20% HCl for 1 hour at 75°C. This removed any sulphates and carbonates that may be present. The remaining residue is then analysed the ELTRA with any sulphur and carbon present being attributed as sulphide sulphur and organic carbon.

Table 2: Head Assays

Composite	Au (g/t)	Ag (g/t)	As (%)	Fe (%)	Sb (%)	S total (%)	S sulphide (%)	C total (%)	C org (%)	Preg Rob (%)
Osiris	4.46	1.69	2.42	1.25	0.02	1.91	1.63	7.14	0.06	4.37
Conrad	4.93	0.60	1.62	1.56	0.02	2.22	2.21	7.86	0.26	51.8
Conrad 2	9.11	1.65	5.97	1.82	0.02	4.59	4.34	6.85	0.26	25.8

2.4 Mineralogy

The Osiris and Conrad composites were submitted for mineralogical analysis. The samples were ground to a p80 of ~75µm, and a subsample was taken, screened at three size fractions, and submitted to XPS. Mineralogical

analysis for modal mineralogy, liberation and mineral associations of sulphide, arsenic-bearing minerals and non-sulphide minerals, arsenic deportment, and EMPA analysis was conducted. The full mineralogical report may be found in Appendix B.

Both the Conrad and Osiris samples are primarily composed of carbonates, quartz, illite and muscovite. Sulphides consist of pyrite, realgar, and orpiment. Only trace quantities of arsenopyrite were detected.

Table 3: Modal Mineralogy

		Conrad	Osiris
Mineral Mass (% in sample)	Pyrite	3.33	1.31
	Arsenopyrite	0.01	0.02
	Realgar	2.78	3.36
	Orpiment	0.05	1.18
	Total Sulphides	***6.18***	***5.87***
	Quartz	19.20	21.72
	Chlorite	0.65	1.06
	Illite+Musc	10.18	13.99
	Feldspar	1.87	3.49
	Carbonate	61.24	53.08
	Fe-Ti oxides	0.29	0.09
	Other_Sils.	0.19	0.47
	Other	0.21	0.23
	Total NSG	***93.82***	***94.13***
	Total	***100.00***	***100.00***

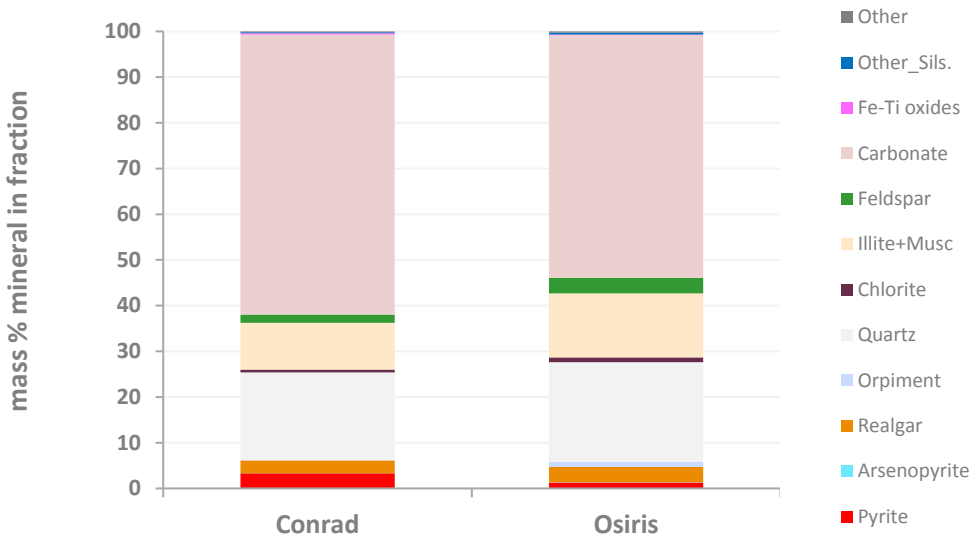


Figure 2: Modal Mineralogy

The pyrite/arsenopyrite liberation indicates that Conrad is 65% liberated (>50% of surface area), and Osiris is 60% liberated (>50% of surface area). The arsenic sulphide liberation indicates that Conrad is 92% liberated (>50% of surface area), and Osiris is 90% liberated (>50% of surface area).

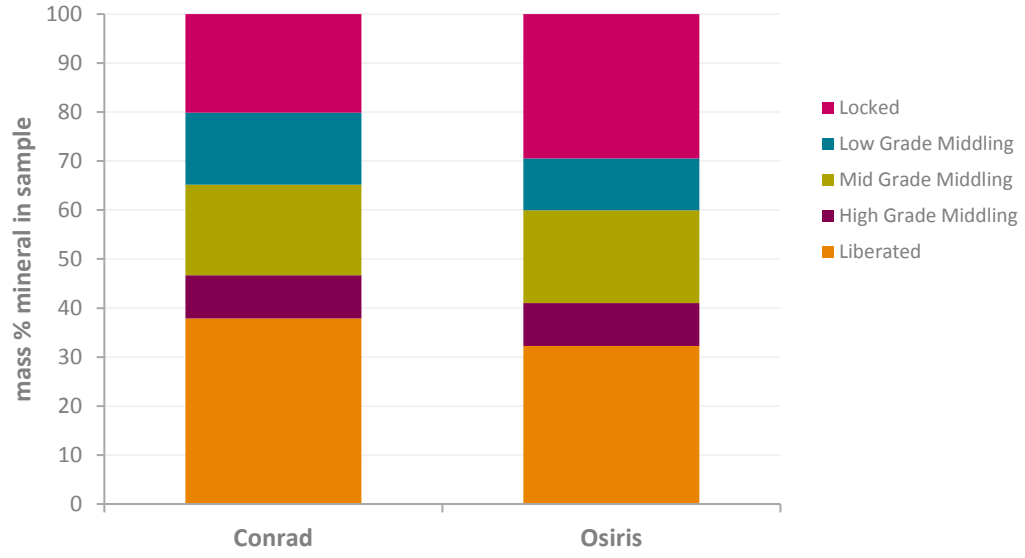


Figure 3: Pyrite and Arsenopyrite Liberation

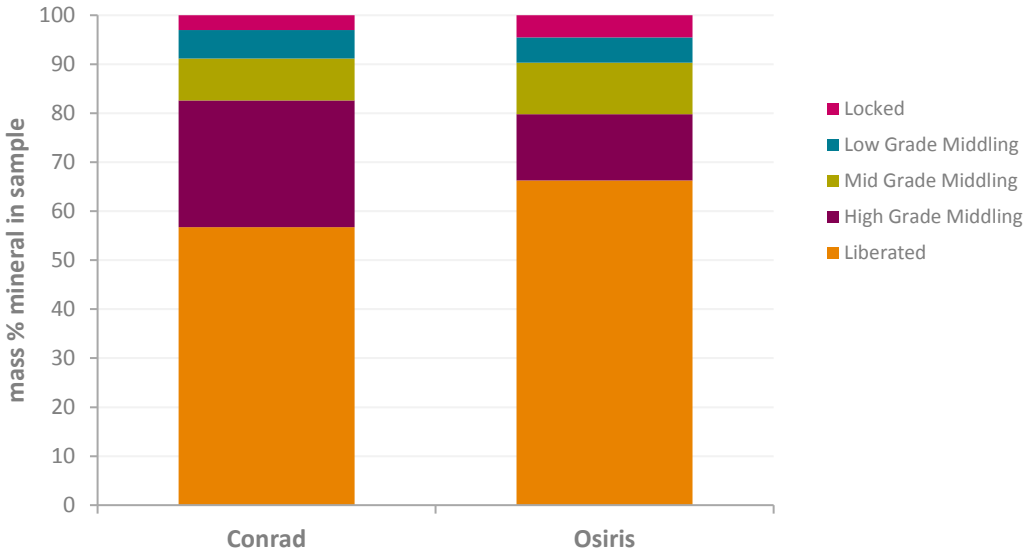


Figure 4: Arsenic Sulphide Liberation

The arsenic deportment indicates that the arsenic in both samples is primarily realgar, with orpiment representing a major component in Osiris and a minor component in Conrad. Pyrite and arsenopyrite represent only trace levels of arsenic deportment.

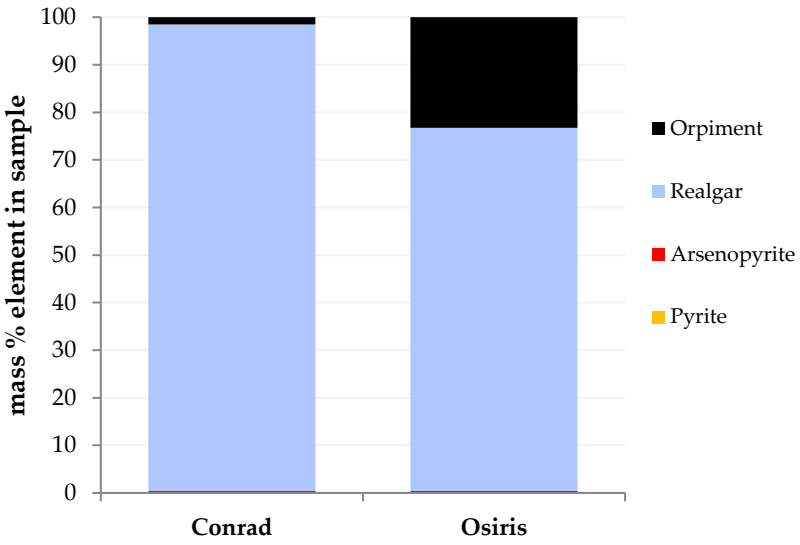


Figure 5: Arsenic Deportment

The mineralogist noted that there appears to be two types of pyrite; one pyrite has low arsenic, and a second pyrite has high arsenic. The high arsenic pyrite indicates some amount of alteration assemblage being sampled by the EMPA analysis. This high arsenic pyrite grains are generally very fine and intergrown with NSG.

3 METALLURGICAL TESTWORK & RESULTS

3.1 Flotation

3.1.1 Osiris

A total of five flotation tests were conducted on the Osiris composite. An initial scoping test (F-1) was conducted with arsenic roughers (reagents were MIBC & Diesel), followed by pyrite roughers (reagents were PAX & MIBC). The primary grind size was 47µm. A second flotation test (F-4) repeated the F-1 test at a finer grind size of 34 µm. The F-4 test achieved better selectivity against pyrite in the arsenic circuit, however mass pull was increased. The F-4 test achieved the highest gold recovery (40%) compared to the other tests.

A third flotation test (F-6) explored pyrite depression in the arsenic circuit by bringing the pH up to 10, followed by reducing the pH to 8 with sulphuric acid in the pyrite circuit to achieve conditions favourable to floating pyrite. This test was repeated in F-7, with an increase to lime in the mill and the addition of sodium cyanide in the mill. The F-7 arsenic cirucit results showed the best selectivity against pyrite, and the best arsenic recovery vs. mass pull.

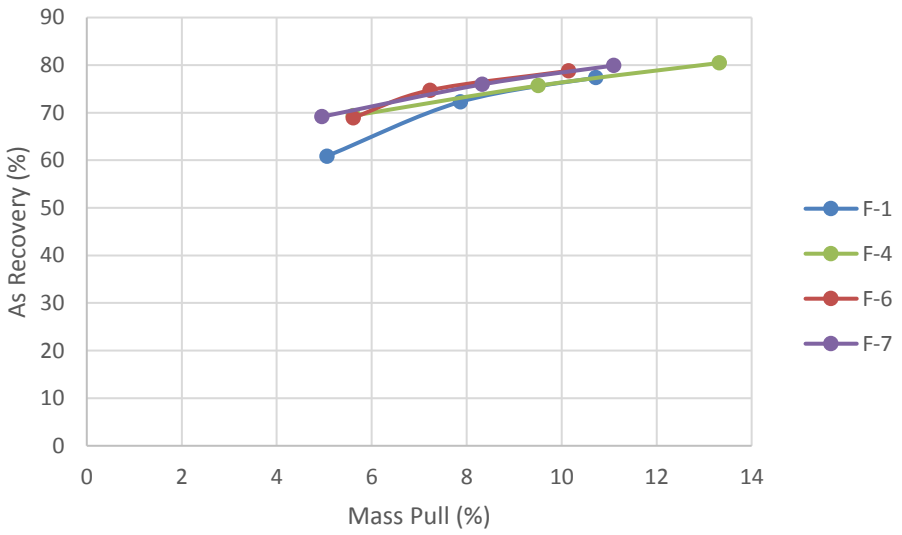


Figure 6: Osiris Arsenic Flotation - Arsenic Recovery vs. Mass Pull

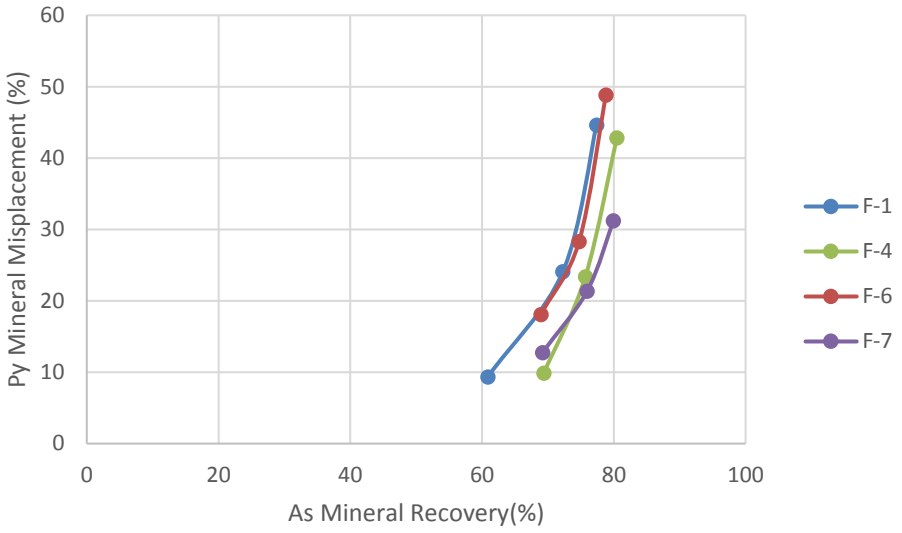


Figure 7: Osiris Arsenic Flotation - Pyrite Misplacement vs. Arsenic Recovery

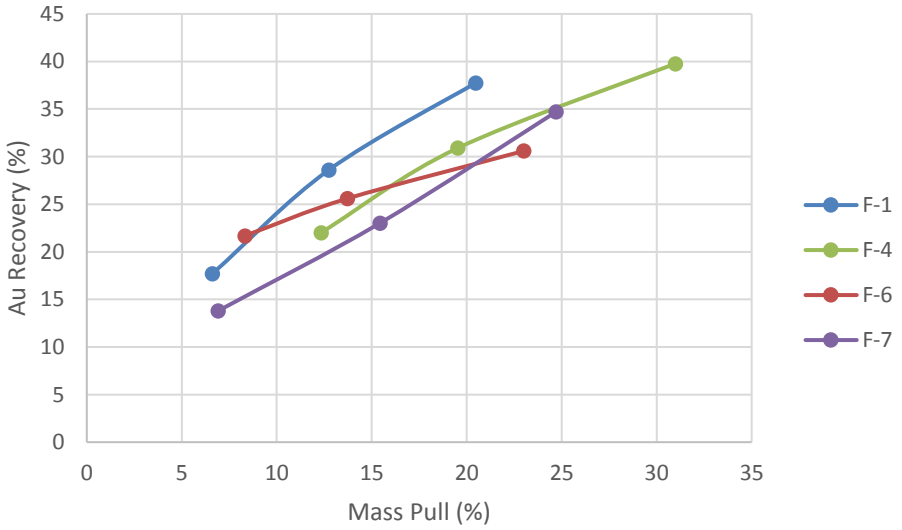


Figure 8: Osiris Pyrite Flotation - Gold Recovery vs. Mass Pull

A final flotation test (F-8) followed the F-7 conditions, and included only the arsenic circuit which was taken to cleaner 1. The arsenic cleaner 1 concentrate was forwarded to the super-panner. Arsenic rougher concentrate results were comparable to F-7.

Full test details and results may be found in Appendix C.

3.1.2 Conrad

A total of four flotation tests were conducted on the Conrad composite. An initial scoping test (F-2) was conducted with arsenic roughers (reagents were MIBC & Diesel), followed by pyrite roughers (reagents were PAX & MIBC). The primary grind size was 76µm. A second flotation test (F-3) repeated the F-2 test with the PAX dosage increased by 50%.

A third flotation test (F-5) was conducted with the purpose of producing a high grade (~50%) arsenic concentrate. This test consisted of the arsenic circuit only, and was taken to cleaner 3.

A final flotation test (F-9) was conducted with the purpose of producing a clean pyrite concentrate. The arsenic circuit was taken to cleaner 3, and the cleaner tails were recycled to the pyrite rougher stage. The pyrite circuit was taken to a kinetic cleaner 3.

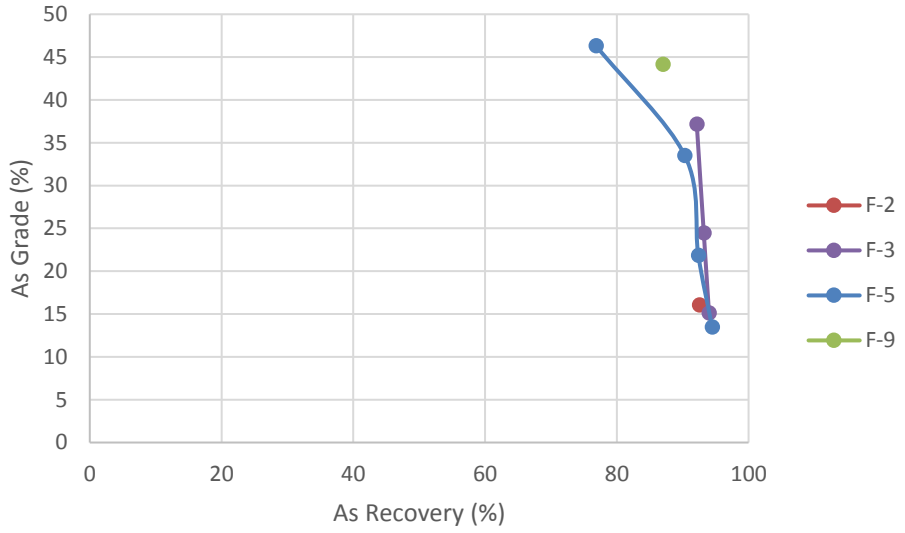


Figure 9: Conrad Arsenic Flotation - Arsenic Grade vs. Arsenic Recovery

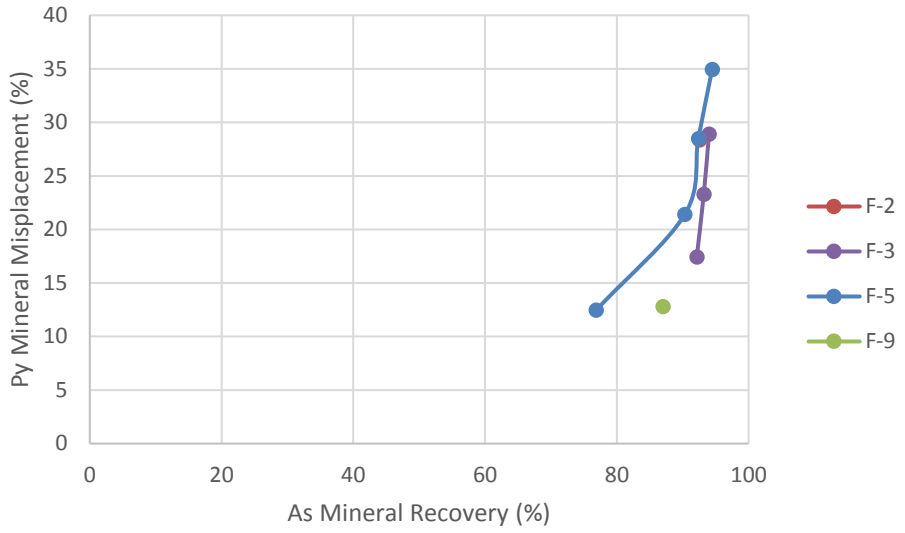


Figure 10: Conrad Arsenic Flotation - Pyrite Mineral Misplacement vs. Arsenic Mineral Recovery

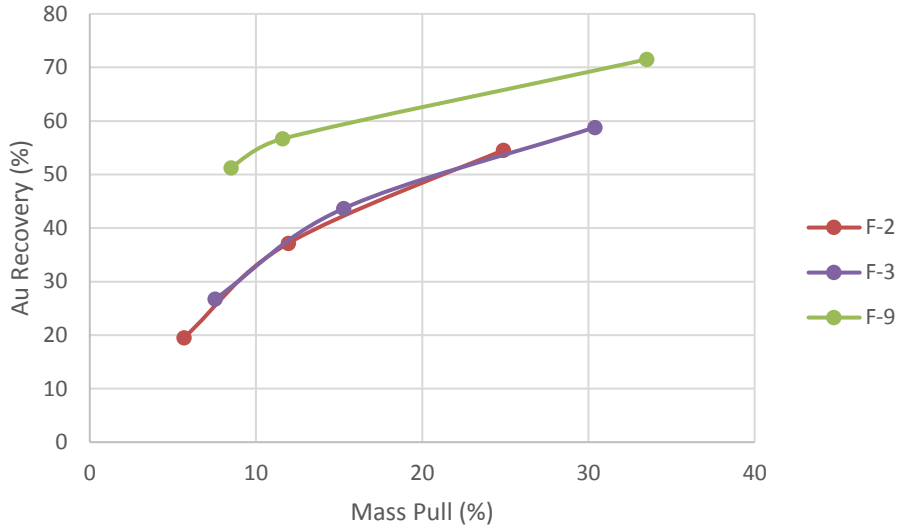


Figure 11: Conrad Pyrite Flotation - Gold Recovery vs. Mass Pull

Full test details and results may be found in Appendix C.

3.1.3 Conrad 2

A total of four flotation tests were conducted on the Conrad 2 composite. The initial test (F-10) followed the Conrad flowsheet, with the Arsenic circuit taken to cleaner 3, and tails recycled to the pyrite rougher. A second

test (F-11) repeated the F-10 conditions, with the addition of a 4th arsenic cleaner stage and the addition of 3 stages of pyrite cleaning. F-12 was conducted with a lower mass pull target for the arsenic cleaner 4 con, and returned to pyrite roughers only. A final test, F-13, was conducted under the same conditions as F-12, however the arsenic cleaner tails were not forwarded to the pyrite circuit in order to reduce the arsenic content of the pyrite concentrates. Overall, very high arsenic recovery was achievable, however pyrite misplacement is significant.

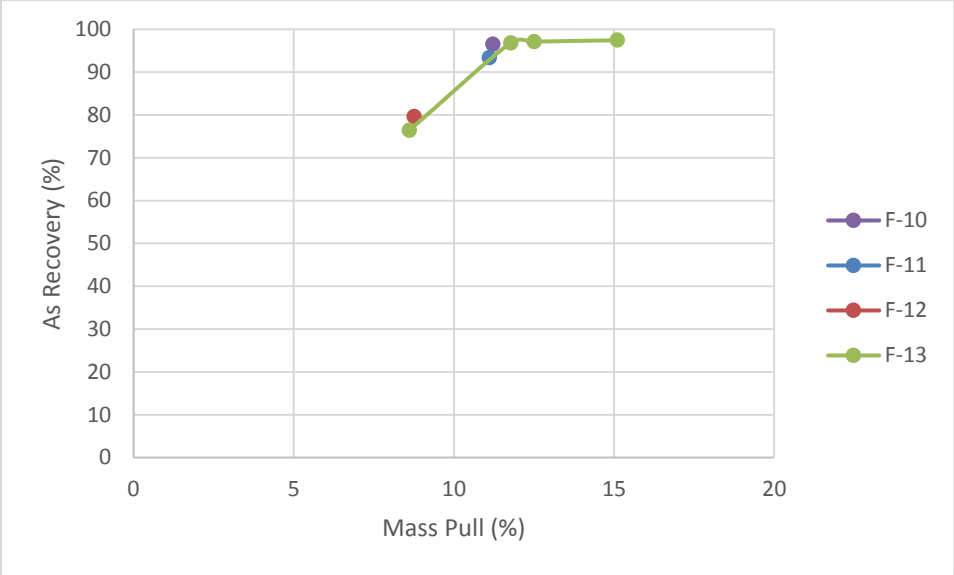


Figure 12: Conrad 2 Arsenic Flotation – Arsenic Recovery vs. Mass Pull

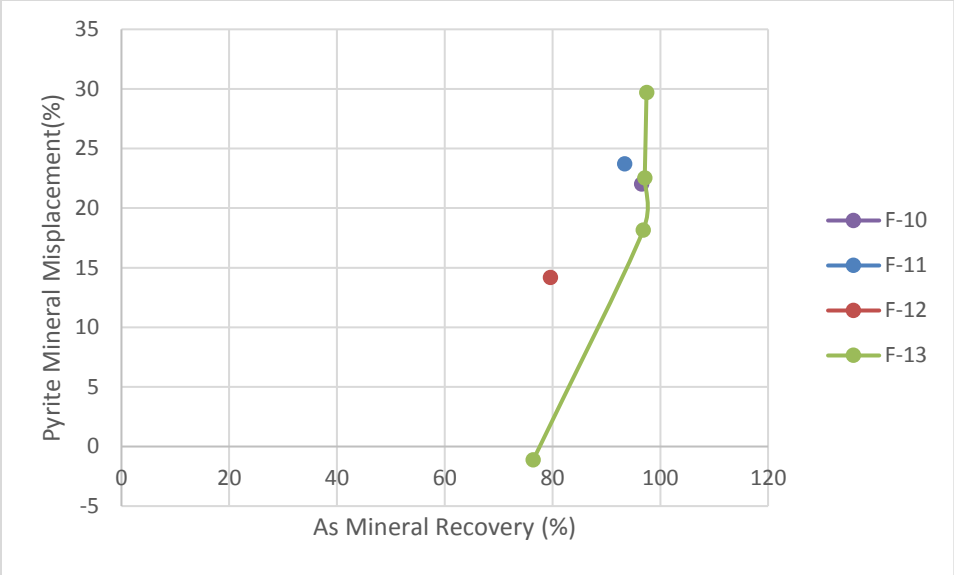


Figure 13: Conrad 2 Arsenic Flotation - Pyrite Mineral Misplacement vs. Arsenic Mineral Recovery

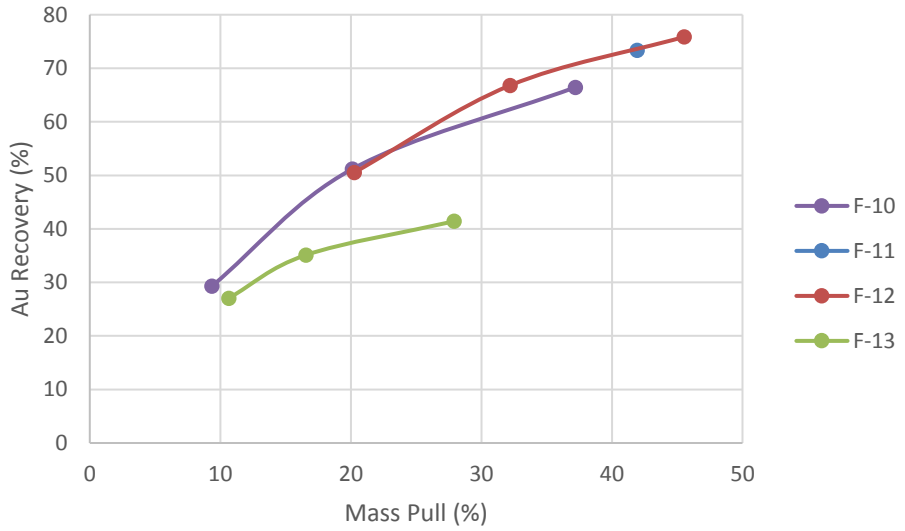


Figure 14: Conrad 2 Pyrite Flotation - Gold Recovery vs. Mass Pull

Full test details and results may be found in Appendix C.

3.2 Gravity

Two Osiris flotation products were tested for amenability to gold recovery by super-panner. From F-4 arsenic rougher concentrate was deslimed and passed over the super-panner. From F-8 arsenic cleaner 1 concentrate was deslimed and passed over the super-panner. On both tests gold recovery to the super-panner tip was low, and the majority of the gold reported to the tails. Summaries of test results are shown in Table 4; full test details and results may be found in Appendix D.

Table 4: Super-Panner Results

Test ID	Product	Weight %	Assays (g/t) Au	Distribution (%) Au
F-4 As Ro Con	Sp Tip	1.10	137.0	9.87
	Sp Mid	24.46	24.1	38.6
	Sp Tails	65.27	12.1	51.5
	Sp Slimes	9.17		0.00
	Calculated Head	**100.00**	**15.26**	**100.00**
F-8 As Cln Con	Sp Tip	0.29	176.8	2.04
	Sp Mid	10.12	42.6	17.0
	Sp Tails	65.89	23.1	59.9
	Sp Slimes	23.69	22.6	21.1
	Calculated Head	**100.00**	**25.37**	**100.00**

3.3 Roasting Testwork

Pyrite rougher concentrate from tests F-10, F-11, and F-13 were blended and submitted to Kingston Process Metallurgy for three 2-stage mini-kiln roasting tests to determine the effect of roasting and the impact of various atmospheric conditions on the metallurgy. The test conditions are summarized in Table 5.

Table 5: Roasting Test Conditions

Test #	Stage 1					Stage 2				
	Description	Temp (°C)	Inlet O2%	Duration (min)	Flow Rate (L/min)	Description	Temp (°C)	Inlet O2%	Duration (min)	Flow Rate (L/min)
1	Partial roast to FeS Heat and hold under N2	525	5%	60	1.1	Dead roast FeS to Fe2O3	650	21%	60	1.1
2	Partial roast to FeS Heat under 5% O2	525	5%	60	1.1	Dead roast FeS to Fe2O3	650	21%	60	1.1
3	Partial roast to Fe3O4 Heat under 13% O2	525	13%	60	1.1	Dead roast Fe3O4 to Fe2O3	650	21%	45	1.1

Conditions for Test 1 and Test 2 were defined to try to keep the oxygen partial pressure in the kiln low. This was done to try to prevent the arsenic in the concentrate from oxidizing to As^{5+}, which is much more likely to form iron arsenate and fix the arsenic in the calcine. Test 1 and Test 2 were the same conditions, except that in Test 1, heating to the Stage 1 target temperature was done under inert conditions, allowing time for As compounds to be released, while in Test 2 was heated with the same inlet O2 as was used in Stage 1 (5%). Test 3 used higher oxygen in the inlet gas, to see if it was detrimental to the gold recovery.

Following roasting, the samples were subjected to cyanidation and fire assay to ascertain gold extraction. Four Carbon in Leach (CIL) bottle rolls were performed, the results are summarized in Table 6.

Table 6: Fire Assay and Cyanidation Results

Sample	Au Assay (g/t)	Au CIL Extraction	CIL Mass Balance	NaCN Consumption (kg/t)
Feed	15.20	6%	97%	1.79
Roast 1	15.68	89%	92%	1.38
Roast 2	15.96	89%	98%	1.23
Roast 3	16.06	91%	97%	1.57

Overall, all three roast conditions resulted in good Au recovery, with results reaching from 89% to 91% of Au extraction. It appears that roasting of the concentrate allows amenable access to the gold, with the concentrate not overly sensitive to the roasting conditions. The study suggested that a single stage, direct roasting could provide good recovery while reducing capital and operation costs. Full details are available in Appendix E.

4 CONCLUSIONS

- Three composites from ATAC's Osiris asset were assembled from submitted material. They had the following head grade characterization:

Composite	Au (g/t)	Ag (g/t)	As (%)	Fe (%)	Sb (%)	S total (%)	S sulphide (%)	C total (%)	C org (%)	Preg Rob (%)
Osiris Average	4.46	1.69	2.42	1.25	0.02	1.91	1.63	7.14	0.06	4.37
Conrad Average	4.93	0.60	1.62	1.56	0.02	2.22	2.21	7.86	0.26	51.8
Conrad 2 Average	9.11	1.65	5.97	1.82	0.02	4.59	4.34	6.85	0.26	25.8

- QEMSCAN modal mineralogy identified that the sample was primarily composed of carbonates, quartz, illite and muscovite. Sulphides consist of pyrite, realgar, and orpiment. Only trace quantities of arsenopyrite were detected.
- The pyrite/arsenopyrite liberation indicates that Conrad is 65% liberated, and Osiris is 60% liberated. The arsenic sulphide liberation indicates that Conrad is 92% liberated, and Osiris is 90% liberated.
- **Osiris Flotation:**
    - An initial scoping test was conducted with arsenic roughers, followed by pyrite roughers, with a grind size of 47µm. A second flotation at a finer grind size of 34 µm demonstrated improved selectivity against pyrite in the arsenic circuit.
    - A flotation test exploring pyrite depression in the arsenic circuit by bringing the pH up to 10, followed by reducing the pH to 8 with sulphuric acid in the pyrite circuit did not substantially improve selectivity against pyrite.
    - Increasing lime in the mill and the addition of sodium cyanide to the mill showed the best selectivity against pyrite, and the best arsenic recovery vs. mass pull.
- **Conrad Flotation:**
    - An initial scoping test was conducted with arsenic roughers, followed by pyrite roughers. The primary grind size was 76µm. A second flotation test was performed with the collector dosage (diesel) increased by 50%.
    - A third cleaner flotation test was conducted with the purpose of producing a high grade arsenic concentrate. A grade of 46.3% As was obtained.
    - A final flotation test was conducted with the purpose of producing a clean pyrite concentrate. The arsenic circuit was taken to cleaner 3, and the cleaner tails were recycled to the pyrite rougher stage. The pyrite circuit was taken to a kinetic cleaner 3. Concentrate gold recovery was 42.7% at a grade of 32.4 g/t.

- **Conrad 2 Flotation:**
  - The initial test Conrad 2 test followed the Conrad flowsheet, with the Arsenic circuit taken to cleaner 3, and tails recycled to the pyrite rougher.
  - A second test repeated the initial conditions, with the addition of a 4th arsenic cleaner stage and the addition of 3 stages of pyrite cleaning.
  - A third test was conducted with a lower mass pull target for the arsenic cleaner 4 con, and returned to pyrite roughers only.
  - A final test was conducted under the same conditions as the third test; however the arsenic cleaner tails were not forwarded to the pyrite circuit in order to reduce the arsenic content of the pyrite concentrates.
  - Overall, very high arsenic recovery was achievable, however pyrite misplacement was significant.
- **Super-Panner:**
  - Two Osiris flotation products were tested for amenability to gold recovery by super-panner. On both tests gold recovery to the super-panner tip was low, and the majority of the gold reported to the tails.
- **Roasting:**
  - Three roasting tests were performed on flotation concentrate, varying the quantity of oxygen in the heating phase (0%, 5%, 13%). Overall, all three roast conditions resulted in good Au recovery, with results reaching from 89% to 91% of Au extraction.

5 RECOMMENDATIONS

The following items are recommended for study as part of future phases of testwork:

- Further flotation work optimizing particle grind size and reagent schemes.
- Complete a locked cycle test on the composites to investigate the impact of recycled process water and recirculating process streams, achieving a projection of continuous circuit behavior.
- Conduct a comminution testwork program on several samples of material. The test program should include:
    - Bond Ball Work Index Tests
    - SMC Tests
    - Abrasion Index Tests
- Conduct a variability program including grindability and flotation testwork covering varying areas, depths, lithologies and grades of the deposit.

APPENDIX A - SAMPLE PREPARATION & HEAD ASSAYS

Zone	HoleName	BatchNam	SampleID	SampleFr	SampleTo	Total Wei	Bag Tare (	Weight Re
Conrad	OS -18-262	N18-007	S049638	350.9	353.32	2.575	0	2.575
Conrad	OS -18-262	N18-007	S049656	382.8	384.3	3.34	0.22	3.12
Conrad	OS -18-262	N18-007	S049657	384.3	385.8	3.466	0.22	3.246
Conrad	OS -18-262	N18-007	S049658	385.8	387.3	4.032	0.2	3.832
Conrad	OS -18-263	N18-009	S048396	309.37	312.42	9.826	0.2	9.626
Conrad	OS -18-263	N18-009	S048397	312.42	315.47	11.265	0.2	11.065
Conrad	OS -18-263	N18-009	S048398	315.47	318.52	11.162	0.2	10.962
Conrad	OS -18-263	N18-009	S048399	318.52	319.52	3.403	0.2	3.203
Conrad	OS -18-267	N18-030	S048762	402.03	404.36	8.673	0.18	8.493
Conrad	OS -18-267	N18-030	S048763	404.36	405.65	4.481	0.18	4.301
Conrad	OS -18-268	N18-029	s050154	307.6	309	3.622	0.2	3.422
Conrad	OS -18-268	N18-029	s050157	315.1	316.1	2.338	0.2	2.138
Conrad	OS -18-268	N18-029	s050159	319	320.65	3.879	0.2	3.679
Conrad	OS -18-278	N18-062	S050857	314.47	316.34	4.362	0.18	4.182
Conrad	OS -18-278	N18-062	S050859	316.34	317.87	2.889	0.18	2.709
Conrad	OS -18-278	N18-063	S050861	317.87	319.41	3.714	0.18	3.534
Conrad	OS -18-278	N18-063	S050865	324.31	327.36	7.207	0.18	7.027
Conrad	OS -18-278	N18-063	S050866	327.36	330.4	7.34	0.18	7.16
Conrad	OS -18-278	N18-063	S050867	330.4	333.45	6.847	0.18	6.667
Conrad	OS -18-278	N18-063	S050868	333.45	336.5	7.288	0.18	7.108
Conrad	OS -18-278	N18-063	S050869	336.5	339.55	6.822	0.18	6.642
Conrad Composite								**114.691**

Zone	HoleName	BatchNam	SampleID	SampleFr	SampleTo	Total Wei	Bag Tare (	Weight Re
Osiris	OS -18-275	N18-052	S049142	244.1	245.97	5.988	0.2	5.788
Osiris	OS -18-275	N18-052	S049145	248	250.67	10.175	0.18	9.995
Osiris	OS -18-279	N18-064	S049374	185.92	188.93	10.77	0.18	10.59
Osiris	OS -18-279	N18-064	S049381	199.03	202.08	10.119	0.18	9.939
Osiris	OS -18-280	N18-070	S050990	337.38	338.89	2.923	0.18	2.743
Osiris	OS -18-280	N18-070	S050993	341.38	344.42	10.857	0.18	10.677
Osiris	OS -18-280	N18-070	S050994	344.42	347.47	11.589	0.18	11.409
Osiris	OS -18-280	N18-070	S050996	347.47	350.52	11.054	0.18	10.874
Sunrise	OS -18-273	N18-045	S050422	293.1	295.66	5	0.18	4.82
Sunrise	OS -18-273	N18-045	S050424	295.66	298.7	11.139	0.18	10.959
Sunrise	OS -18-274	N18-047	S050534	251.59	253.47	6.641	0.18	6.461
Osiris Composite								**94.255**

Zone	HoleName	BatchNam	SampleID	SampleFr	SampleTo	WeightRe	WeightRe	BCR Weigl
Conrad	OS -18-262	N18-007	S049644	363.71	365.72	5.26	5.01	5.02
Conrad	OS -18-262	N18-007	S049645	365.72	367.3	4.62	4.37	4.35
Conrad	OS -18-262	N18-007	S049647	367.3	370.2	7.3	7.05	7.06
Conrad	OS -18-262	N18-007	S049651	376.8	378.3	4.4	4.15	4.15
Conrad	OS -18-262	N18-007	S049652	378.3	379.8	3.6	3.35	3.36
Conrad	OS -18-262	N18-007	S049653	379.8	381.3	3.92	3.67	3.47
Conrad	OS -18-262	N18-007	S049655	381.3	382.8	3.43	3.18	3.14
Conrad	OS -18-263	N18-009	S048400	319.52	320.42	3.61	3.36	3.09
Conrad	OS -18-263	N18-009	S048402	320.42	321.56	4.82	4.57	4.48
Conrad 2 Composite								**38.12**

Osiris Composite	Au (g/t)	Ag (g/t)	As (%)	Fe (%)	Sb (%)	S total (%)	S sulphide (%)	C total (%)	C org (%)	Preg Rob (%)
Head Cut A	4.15	1.6	2.39	1.25	0.019	1.88	1.626	7.136	0.055	4.4
Head Cut B	4.41	1.7	2.44	1.26	0.020	1.92				
Head Cut C	4.60	1.7	2.42	1.25	0.019	1.92				
Osiris Average	**4.39**	**1.67**	**2.41**	**1.25**	**0.019**	**1.91**	**1.63**	**7.14**	**0.06**	**4.37**
Drill Core	4.46	1.78	2.46	1.42	0.013	2.02				

Conrad Composite	Au (g/t)	Ag (g/t)	As (%)	Fe (%)	Sb (%)	S total (%)	S sulphide (%)	C total (%)	C org (%)	Preg Rob (%)
Head Cut A	4.98	0.5	1.61	1.54	0.017	2.17	2.206	7.855	0.255	51.8
Head Cut B	4.96	0.6	1.62	1.57	0.017	2.22				
Head Cut C	4.84	0.7	1.64	1.57	0.017	2.26				
Conrad Average	**4.93**	**0.60**	**1.62**	**1.56**	**0.017**	**2.22**	**2.21**	**7.86**	**0.26**	**51.83**
Drill Core	5.16	0.62	1.64	1.78	0.008	2.44				

Conrad 2 Composite	Au (g/t)	Ag (g/t)	As (%)	Fe (%)	Sb (%)	S total (%)	S sulphide (%)	C total (%)	C org (%)	Preg Rob (%)
Head Cut A	9.13	1.6	6.02	1.822	0.025	4.67	4.344	6.853	0.265	25.8
Head Cut B	9.08	1.7	5.97	1.832	0.025	4.56				
Head Cut C	9.11	1.65	5.91	1.813	0.024	4.54				
Conrad 2 Average	**9.11**	**1.65**	**5.97**	**1.822**	**0.0245**	**4.59**	**4.34**	**6.85**	**0.26**	**25.79**
Drill Core										

			Baseline			Preg Rob			
		Feed Au (g/t)	Au (PPM, mg/L)	Baseline Au (g/t)	Au CN Sol (%)	Spike (g/t)	Au (PPM, mg/L)	Spike Au (mg/L)	% Preg
Osisris	Head A	4.39	0.061	0.12	**2.78**	3.00	1.491	2.982	**4.4**
Conrad	Head A	4.93	0.061	0.12	**2.48**	3.00	0.751	1.502	**51.8**
Conrad 2	Head A	9.11	0.108	0.22	**2.37**	3.01	1.198	2.396	**25.8**

APPENDIX B – MINERALOGY

XPS | EXPERT PROCESS SOLUTIONS

Blue Coast Research - PJ5270, Conrad & Osiris Samples: QEMSCAN Mineralogy

Prepared For:

Blue Coast Reseach

Project Number:
5019811.00

Submitted On:
6/27/2019

Submitted by:
B. Vanden Berg

XPS | EXPERT PROCESS SOLUTIONS

Table of Contents

Summary

Data

Assay and Assay Reconciliation
Size by Size Modal Mineralogy
Average Grain Sizes and Grain Size Distributions
Liberation
Locking
Elemental Deportment
EPMA -Mineral Compositions

Definitions

XPS | EXPERT PROCESS SOLUTIONS

Blue Coast Research - PJ5270, Conrad & Osiris Samples: QEMSCAN Mineralogy

Two feed samples from project 5270 described as "Conrad" and "Osiris" were submitted to XPS for QEMSCAN mineral characterization. The samples were received as 3 size fractions: -25µm, +25µm/-75µm and +75µm. Assay data and size distribution for each size fraction was submitted by Blue Coast Research. The objective of the project was to determine modal mineralogy, liberation and mineral associations of sulphide, arsenic-bearing minerals and non-sulphide minerals and arsenic deportment. Pyrite, arsenic sulphides, carbonates and an alteration assemblage predominantly composed of clay minerals were measured by EMPA. Mineral compositions were included in the QEMSCAN database to produce arsenic deportments.

A list of mineral groupings, a description of EMPA and QEMSCAN analyses, liberation and locking criteria can be found in the definitions section. Modal mineralogy, grain size, liberation and locking data can be found in the respective sections. Metal deportment and mineral compositions are located on the Deportments and EMPA sections.

Mineralogy

The Conrad and Osiris samples are broadly similar and essentially composed of carbonates, quartz, a mixture of clays (illite), muscovite and trace feldspar. Traces gangue minerals include, Fe-Ti- oxides (ilmenite, rutile, magnetite), biotite, actinolite and rare apatite, barite, zircon, sphalerite and stibnite. The sulphide assemblage consists of pyrite, realgar, orpiment and trace arsenopyrite. A summary of modal mineralogy is shown in Figure 1.

Arsenic is found in all sulphide phases. 2 types of pyrite are apparent and contain slightly different arsenic contents. One type is essentially Fe and S and has low arsenic (0.11% As), the 2nd type is deficient in Fe and S and contains slightly more (0.33% As). The second type of pyrite typically forms fine intergrowths with the alteration assemblage (clays); analyses of these pyrite particles often have contribution from the silicate phases and thus lower F and S.

Realgar is the most significant arsenic-sulphide phase found, in the Conrad sample realgar is predominant while the Osiris sample contains a mixture of realgar and orpiment. Arsenic appears to be overestimated by QEMSCAN. A number of very coarse grains of realgar and orpiment were measured and likely account for the overestimate. Moreover orpiment grains appear to have high aspect ratios and show preferential orientation that may also contribute to the overestimation of these particles and the arsenic value. An example from the Osiris sample showing the coarse orpiment grains is featured in Figure 2.

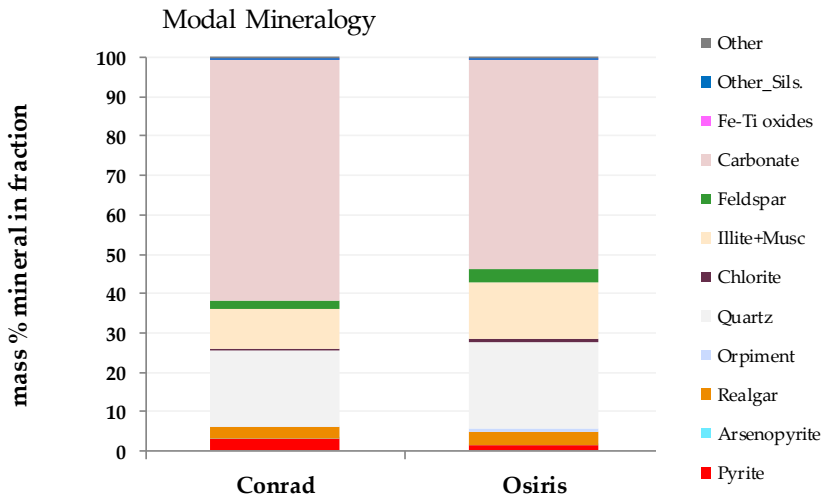


Figure 1: Modal mineralogy, Conrad and Osiris samples.

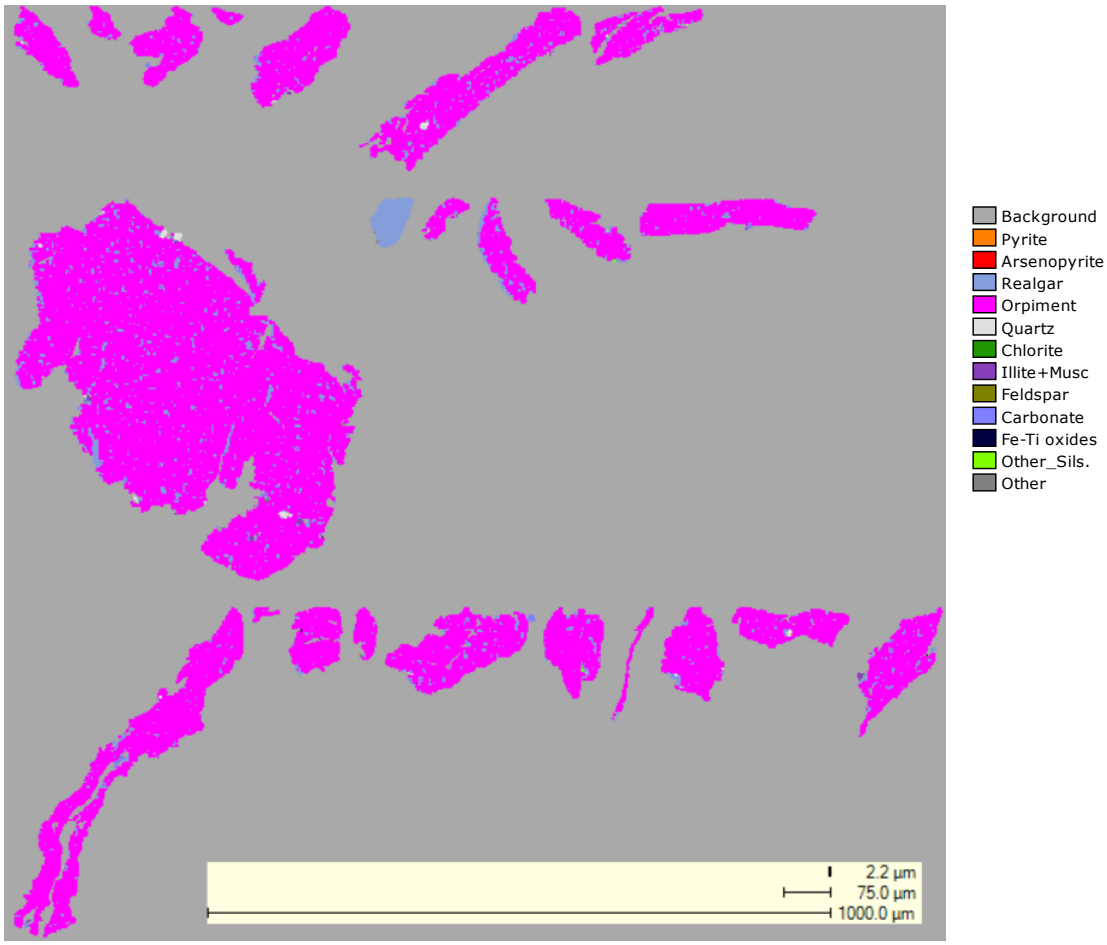


Figure 2: Selected, coarse elongated particles of orpiment, Osiris sample.

Liberation and Locking

Pyrite + arsenopyrite and realgar + orpiment were grouped together for liberation and locking analysis as Py+Apy and As-sulphide. Py+Apy shows moderately low liberation at Conrad measuring 38% and 32% at Osiris. Py+Apy grains are intergrown with NSG particles that are typically combinations of quartz-carbonate-clay and account for ~58% of pyrite in each sample. Py+Apy grains within these binaries are on average <11um in size for both samples.

As-sulphide grains, on the other hand, are well liberated showing 57% and 66% liberation at Conrad and Osiris respectively. As-sulphide binaries also predominantly occur with NSG accounting for 38% of As-sulphide in Conrad and 31% in Osiris. As-sulphide grains contained in NSG binaries average 18µm or finer in Conrad and finer than 12um in the Osiris sample.

Liberated particles are represented by those with greater than 95% by area, the combined liberation for pyrite+asenopyrite and As-sulphide particles are shown in Figure 3. A summary of mineral associations/locking is shown in Figure 4.

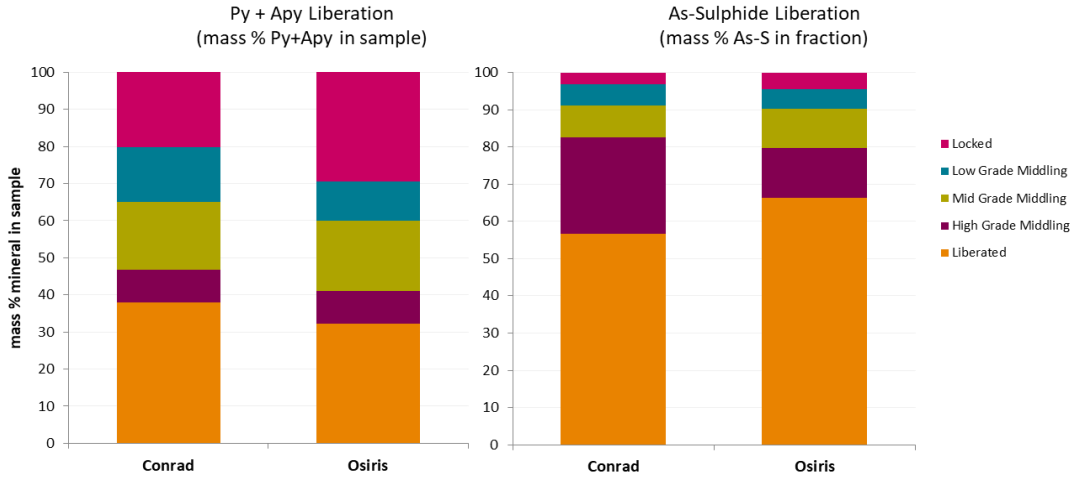


Figure 3: Pyrite-Arsenopyrite and As-Sulphide liberation, Conrad and Osiris.

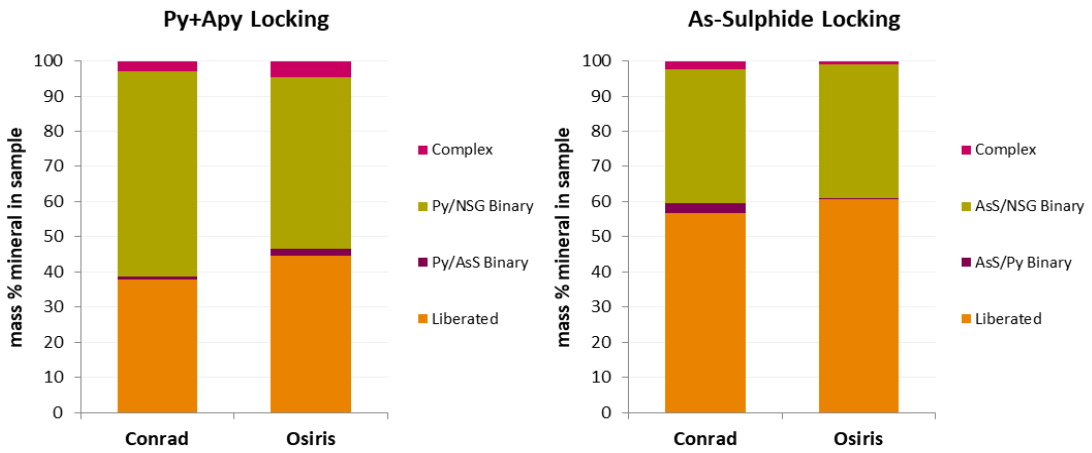


Figure 4: Pyrite-Arsenopyrite and As-Sulphide locking, Conrad and Osiris.

Metal Deportments

Arsenic metal deportment data were gathered by combining QEMSCAN mineralogy and EMPA mineral chemistry through analysis of relevant minerals. Over 99.5% of As as calculated by QEMSCAN is contained in As-sulphides (realgar and orpiment) with the remainder contained in arsenopyrite and pyrite for both samples. At Conrad realgar is the predominant arsenic bearing mineral (98%) while in Osiris realgar accounts for 76% of all arsenic and orpiment contains 23% of the As. Arsenic was below detection in

Complete arsenic deportment and mineral chemistry can be found on the deportments and EMPA sections.

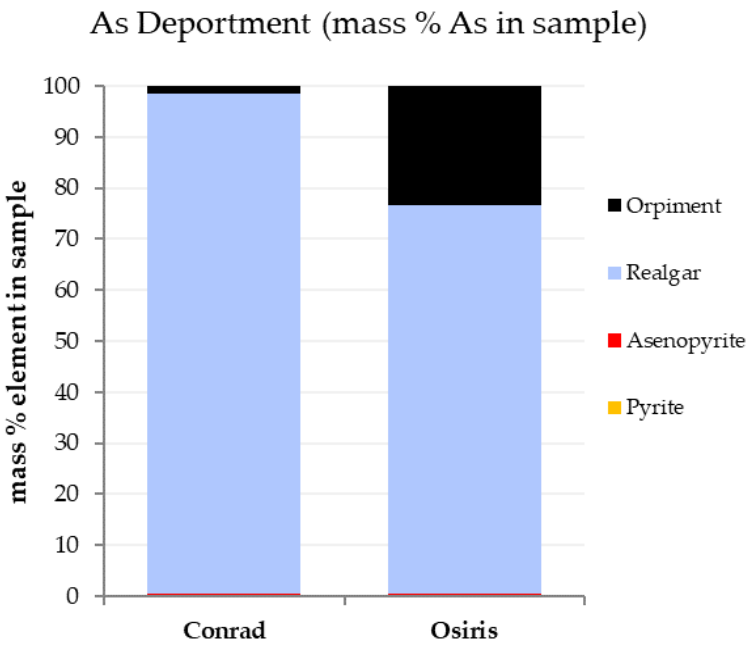


Figure 5: As deportment Conrad and Osiris samples.

XPS EXPERT PROCESS SOLUTIONS

Assay and Assay Reconciliation

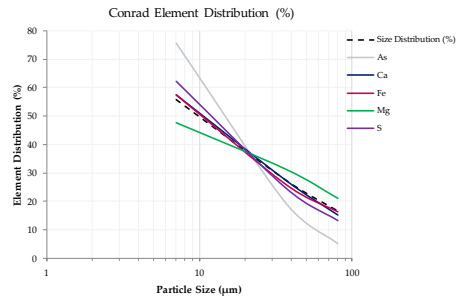
Shows the size by size assays provided by Blue Coast Research compared to assays based on QEMSCAN mineralogy using standard mineral compositions and EPMA data.
The element distribution for each stream is also shown and compared to the size distribution to observe any preferential partitioning to particular particle size class.

		Conrad	Osiris
Assay (element %)	As	1.99	3.08
	(Chemical)	*1.55*	*2.14*
	Ca	24.10	18.30
	(Chemical)	*24.76*	*18.93*
	Fe	2.03	2.01
	(Chemical)	*1.71*	*1.39*
	Mg	0.54	1.87
	(Chemical)	*0.57*	*2.54*
	S	2.62	2.17
	(Chemical)	*2.33*	*1.83*

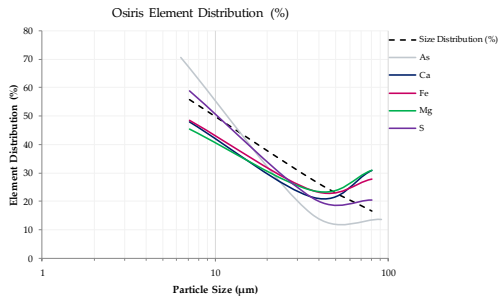
Conrad					
	Mass Flow	100			
			Combined	-25	+25/-75	+75
	Min Size			3	25	75
	Max Size			25	75	1000
	Average Particle Size (µm)			7	37	81
	Size Distribution (%)		**100.00**	55.68	27.57	16.75
	Mass Flow		**100.00**	55.68	27.57	16.75
	Number Particles Measured			9,094	20,943	13,386
		Head	Combined	-25	+25/-75	+75
Assay (element %)	As		**1.99**	2.38	1.84	0.94
	(Chemical)	*1.62*	***1.55***	*2.11*	*1.09*	*0.47*
	Ca		**24.10**	25.17	23.21	21.97
	(Chemical)		***24.76***	*25.56*	*24.58*	*22.38*
	Fe		**2.03**	2.21	1.75	1.91
	(Chemical)	*1.56*	***1.71***	*1.77*	*1.62*	*1.68*
	Mg		**0.54**	0.48	0.56	0.72
	(Chemical)		***0.57***	*0.49*	*0.65*	*0.72*
	S		**2.62**	3.00	2.28	1.94
	(Chemical)		**2.33**	*2.60*	*2.08*	*1.83*
Element Distribution	As		100.00	75.62	19.34	5.03
	Ca		100.00	57.49	27.37	15.14
	Fe		100.00	57.51	26.07	16.42
	Mg		100.00	47.65	31.30	21.06
	S		100.00	62.20	24.64	13.17

Osiris					
	Mass Flow	100			
			Combined	-25	+25/-75	+75
	Min Size			3	25	75
	Max Size			25	75	1000
	Average Particle Size (µm)			6	36	92
	Size Distribution (%)		**100.00**	48.50	22.24	29.25
	Mass Flow		**100.00**	48.50	22.24	29.25
	Number Particles Measured			9,744	20,380	12,818
		Head	Combined	-25	+25/-75	+75
Assay (element %)	As		**3.08**	4.17	2.06	2.05
	(Chemical)	*2.41*	***2.14***	*3.12*	*1.51*	*1.00*
	Ca		**18.30**	17.96	18.12	19.00
	(Chemical)		***18.93***	*18.70*	*18.12*	*19.93*
	Fe		**2.01**	1.95	2.19	1.98
	(Chemical)	*1.25*	***1.39***	*1.39*	*1.48*	*1.32*
	Mg		**1.87**	1.82	1.93	1.91
	(Chemical)		***2.54***	*2.38*	*2.70*	*2.68*
	S		**2.17**	2.60	1.91	1.66
	(Chemical)		***1.83***	*2.21*	*1.72*	*1.27*
Element Distribution (%)	As		100.00	70.70	15.69	13.61
	Ca		100.00	47.91	21.29	30.80
	Fe		100.00	48.52	23.69	27.79
	Mg		100.00	45.47	23.66	30.88
	S		100.00	58.70	20.95	20.34

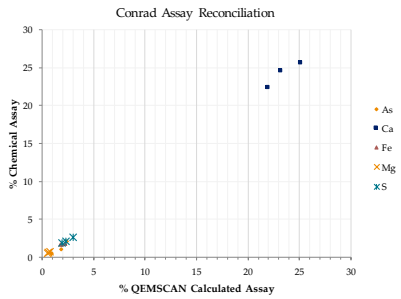
Conrad Element Distribution (%)



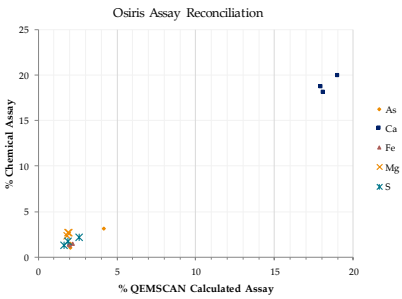
Osiris Element Distribution (%)



Conrad Assay Reconciliation



Osiris Assay Reconciliation

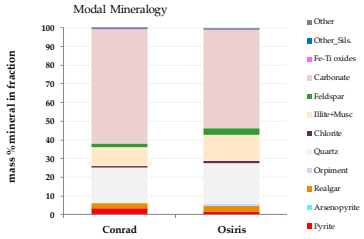


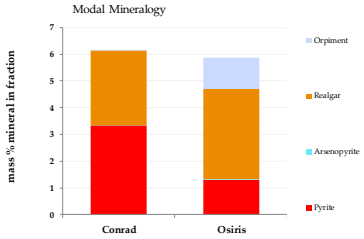
XPS EXPERT PROCESS SOLUTIONS

Mineralogy

Shows the size-by-size mineralogy for all samples as mineral mass % in fraction, mass % in sample (using size distribution for weighting). The mineral distribution for key minerals in each stream is also shown and compared to the size distribution to observe any preferential partitioning to particular particle size class.

		Conrad	Osiris
Mineral Mass (% in sample)	Pyrite	3.33	1.31
	Arsenopyrite	0.01	0.02
	Realgar	2.78	3.36
	Orpiment	0.05	1.18
	Total Sulphides	***6.18***	***5.87***
	Quartz	19.20	21.72
	Chlorite	0.65	1.06
	Illite+Musc	10.18	13.99
	Feldspar	1.87	3.49
	Carbonate	61.24	53.08
	Fe-Ti oxides	0.29	0.09
	Other_Sils.	0.19	0.47
	Other	0.21	0.23
	Total NSG	***93.82***	***94.13***
	Total	***100.00***	***100.00***



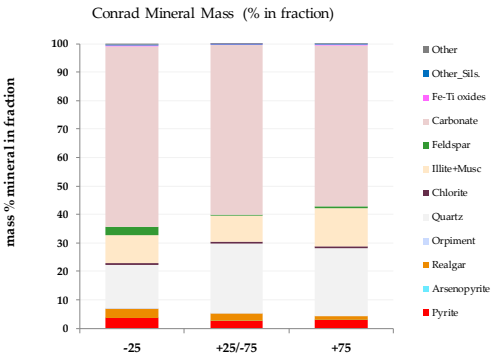


		Conrad				
	Mass Flow	100				
			Combined	-25	+25/-75	+75
	Min Size			3	25	75
	Max Size			25	75	1000
	Average Particle Size (µm)			7	37	81
	Size Distribution (%)		**100.00**	55.68	27.57	16.75
	Mass Flow		**100.00**	55.68	27.57	16.75
	No. Particles Measured			9094	20943	13386
		Head	Combined	-25	+25/-75	+75
Mineral Mass (% in fraction)	Pyrite	**3.33**	**3.33**	3.72	2.80	2.91
	Arsenopyrite	**0.01**	**0.01**	0.02	0.01	0.01
	Realgar	**2.78**	**2.78**	3.33	2.58	1.32
	Orpiment	**0.05**	**0.05**	0.07	0.04	0.01
	Total Sulphides	***6.18***	***6.18***	***7.13***	***5.42***	***4.25***
	Quartz	**19.20**	**19.20**	15.18	24.46	23.90
	Chlorite	**0.65**	**0.65**	0.78	0.43	0.57
	Illite+Musc	**10.18**	**10.18**	9.68	9.19	13.50
	Feldspar	**1.87**	**1.87**	3.00	0.44	0.49
	Carbonate	**61.24**	**61.24**	63.35	59.64	56.87
	Fe-Ti oxides	**0.29**	**0.29**	0.32	0.24	0.25
	Other_Sils.	**0.19**	**0.19**	0.27	0.09	0.11
	Other	**0.21**	**0.21**	0.31	0.08	0.07
	Total NSG	***93.82***	***93.82***	***92.87***	***94.58***	***95.75***
	Total	***100.00***	***100.00***	***100.00***	***100.00***	***100.00***
Mineral Mass (% in sample)	Pyrite	**3.33**	**3.33**	2.07	0.77	0.49
	Arsenopyrite	**0.01**	**0.01**	0.01	0.00	0.00
	Realgar	**2.78**	**2.78**	1.85	0.71	0.22
	Orpiment	**0.05**	**0.05**	0.04	0.01	0.00
	Total Sulphides	***6.18***	***6.18***	***3.97***	***1.50***	***0.71***
	Quartz	**19.20**	**19.20**	8.45	6.74	4.00
	Chlorite	**0.65**	**0.65**	0.43	0.12	0.10
	Illite+Musc	**10.18**	**10.18**	5.39	2.53	2.26
	Feldspar	**1.87**	**1.87**	1.67	0.12	0.08
	Carbonate	**61.24**	**61.24**	35.27	16.44	9.52
	Fe-Ti oxides	**0.29**	**0.29**	0.18	0.07	0.04
	Other_Sils.	**0.19**	**0.19**	0.15	0.03	0.02
	Other	**0.21**	**0.21**	0.17	0.02	0.01
	Total NSG	***93.82***	***93.82***	***51.71***	***26.08***	***16.04***
	Total	***100.00***	***100.00***	***55.68***	***27.57***	***16.75***
Mineral Distribution	Pyrite		**100.00**	62.21	23.16	14.63
	Realgar		**100.00**	66.56	25.52	7.92
	Orpiment		**100.00**	73.06	22.06	4.87
	Total NSG		**100.00**	55.11	27.79	17.09

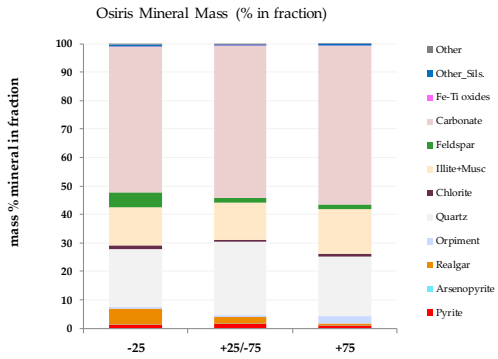
		Osiris				
	Mass Flow	100				
			Combined	-25	+25/-75	+75
	Min Size			3	25	75
	Max Size			25	75	1000
	Average Particle Size (µm)			6	36	92
	Size Distribution (%)		**100.00**	48.50	22.24	29.25
	Mass Flow		**100.00**	48.50	22.24	29.25
	No. Particles Measured			9744	20380	12818
		Head	Combined	-25	+25/-75	+75
Mineral Mass (% in fraction)	Pyrite	**1.31**	**1.31**	1.37	1.72	0.90
	Arsenopyrite	**0.02**	**0.02**	0.03	0.02	0.01
	Realgar	**3.36**	**3.36**	5.38	2.20	0.90
	Orpiment	**1.18**	**1.18**	0.64	0.84	2.32
	Total Sulphides	***5.87***	***5.87***	***7.42***	***4.78***	***4.13***
	Quartz	**21.72**	**21.72**	20.26	25.63	21.16
	Chlorite	**1.06**	**1.06**	1.38	0.73	0.78
	Illite+Musc	**13.99**	**13.99**	13.33	13.09	15.79
	Feldspar	**3.49**	**3.49**	5.44	1.56	1.70
	Carbonate	**53.08**	**53.08**	51.20	53.58	55.82
	Fe-Ti oxides	**0.09**	**0.09**	0.08	0.10	0.11
	Other_Sils.	**0.47**	**0.47**	0.51	0.39	0.45
	Other	**0.23**	**0.23**	0.36	0.14	0.07
	Total NSG	***94.13***	***94.13***	***92.58***	***95.22***	***95.87***
	Total	***100.00***	***100.00***	***100.00***	***100.00***	***100.00***
Mineral Mass (% in sample)	Pyrite	**1.31**	**1.31**	0.67	0.38	0.26
	Arsenopyrite	**0.02**	**0.02**	0.02	0.01	0.00
	Realgar	**3.36**	**3.36**	2.61	0.49	0.26
	Orpiment	**1.18**	**1.18**	0.31	0.19	0.68
	Total Sulphides	***5.87***	***5.87***	***3.60***	***1.06***	***1.21***
	Quartz	**21.72**	**21.72**	9.83	5.70	6.19
	Chlorite	**1.06**	**1.06**	0.67	0.16	0.23
	Illite+Musc	**13.99**	**13.99**	6.46	2.91	4.62
	Feldspar	**3.49**	**3.49**	2.64	0.35	0.50
	Carbonate	**53.08**	**53.08**	24.84	11.92	16.33
	Fe-Ti oxides	**0.09**	**0.09**	0.04	0.02	0.03
	Other_Sils.	**0.47**	**0.47**	0.25	0.09	0.13
	Other	**0.23**	**0.23**	0.17	0.03	0.02
	Total NSG	***94.13***	***94.13***	***44.90***	***21.18***	***28.04***
	Total	***100.00***	***100.00***	***48.50***	***22.24***	***29.25***
Mineral Distribution	Pyrite		**100.00**	50.77	29.11	20.12
	Arsenopyrite		**100.00**	68.65	21.36	10.00
	Realgar		**100.00**	77.61	14.57	7.82
	Total NSG		**100.00**	47.70	22.50	29.79

BLUE COAST RESEARCH PASSION · CREATIVITY · EXPERIENCE

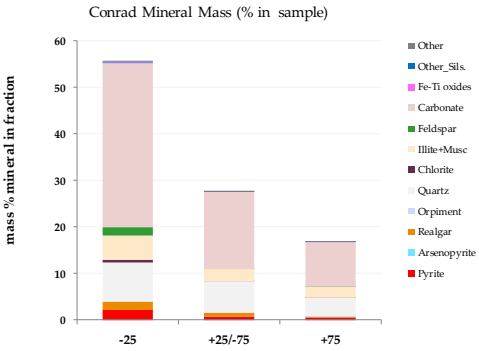
Conrad Mineral Mass (% in fraction)



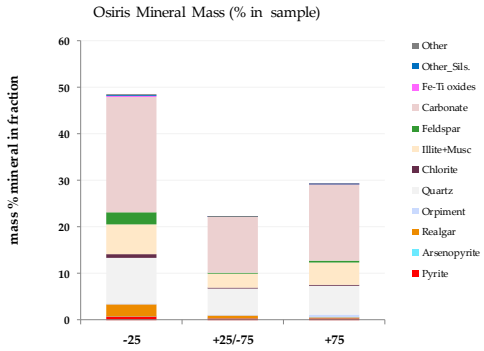
Osiris Mineral Mass (% in fraction)



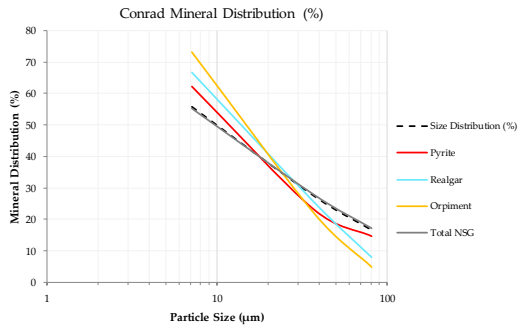
Conrad Mineral Mass (% in sample)



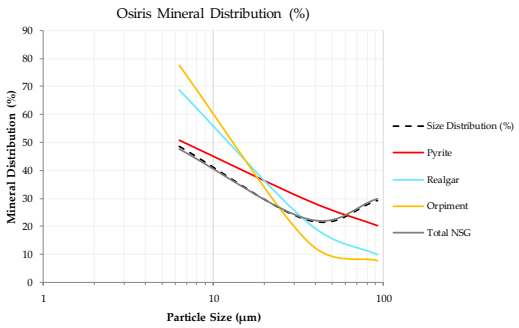
Osiris Mineral Mass (% in sample)



Conrad Mineral Distribution (%)



Osiris Mineral Distribution (%)



XPS EXPERT PROCESS SOLUTIONS

Average Grain Size and Estimated Grain Size Distributions

These data show the average particle size and average mineral grain size for each stream and fraction.

Grain size distribution is provided for pyrite + arsenopyrite, As-sulphide and non-sulphide gangue. These measurements are estimates only due to artefacts of measuring size in 2 dimensions. Distributions are calculated by digitally extracting individual mineral grains from the host particles and calculating the mass of the mineral in each size class. Size increments of 5µm were used for these distributions.

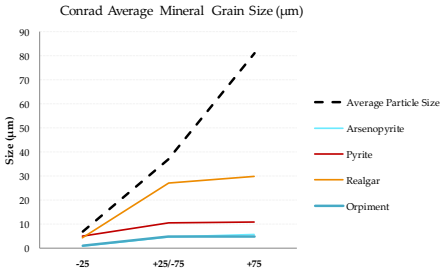
	Conrad			
Mass Flow	100			
	Combined	-25	+25/-75	+75
Min Size		3	25	75
Max Size		25	75	1000
Average Particle Size (µm)		7	37	81
Size Distribution (%)	**100.00**	55.68	27.57	16.75
Mass Flow	**100.00**	55.68	27.57	16.75
No. Particles Measured		9094	20943	13386
	Combined	-25	+25/-75	+75
Average Particle Size	***11***	*7*	*37*	*81*
Pyrite	**6**	*5*	11	11
Arsenopyrite	**1**	*1*	5	6
Realgar	**6**	*4*	27	30
Orpiment	**1**	*1*	5	5
Total Sulphides	***7***	*5*	*15*	*14*
Quartz	**10**	*6*	22	26
Chlorite	**2**	*1*	4	5
Illite+Musc	**5**	*3*	12	16
Feldspar	**2**	*2*	4	5
Carbonate	**9**	*6*	29	46
Fe-Ti oxides	**3**	*2*	5	5
Other_Sils.	**2**	*2*	5	5
Other	**2**	*1*	6	6
Total NSG	***11***	*7*	*34*	*66*

Average Mineral Grain Size (µm)

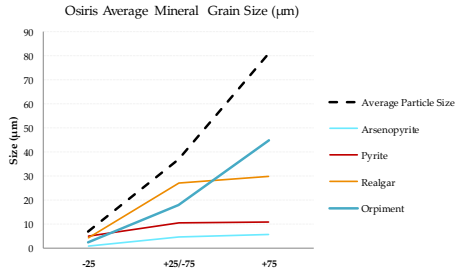
	Osiris			
Mass Flow	100			
	Combined	-25	+25/-75	+75
Min Size		3	25	75
Max Size		25	75	1000
Average Particle Size (µm)		6	36	92
Size Distribution (%)	**100.00**	48.50	22.24	29.25
Mass Flow	**100.00**	48.50	22.24	29.25
No. Particles Measured		9744	20380	12818
	Combined	-25	+25/-75	+75
Average Particle Size	***12***	*6*	*36*	*92*
Pyrite	**6**	*4*	11	10
Arsenopyrite	**2**	*2*	4	5
Realgar	**5**	*4*	17	12
Orpiment	**7**	*3*	18	45
Total Sulphides	***7***	*5*	*16*	*23*
Quartz	**8**	*5*	16	16
Chlorite	**2**	*1*	4	5
Illite+Musc	**4**	*2*	8	10
Feldspar	**2**	*1*	4	5
Carbonate	**7**	*4*	18	24
Fe-Ti oxides	**2**	*1*	4	4
Other_Sils.	**2**	*1*	4	4
Other	**1**	*1*	6	5
Total NSG	***11***	*6*	*34*	*81*

Average Mineral Grain Size (µm)

Conrad Average Mineral Grain Size (µm)



Osiris Average Mineral Grain Size (µm)

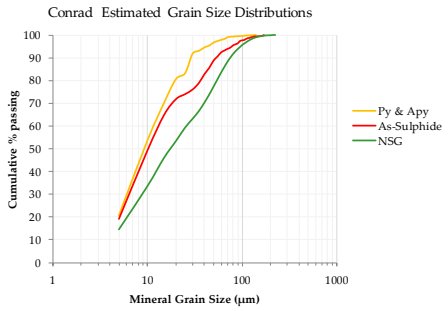


BLUE COAST RESEARCH PASSION · CREATIVITY · EXPERIENCE

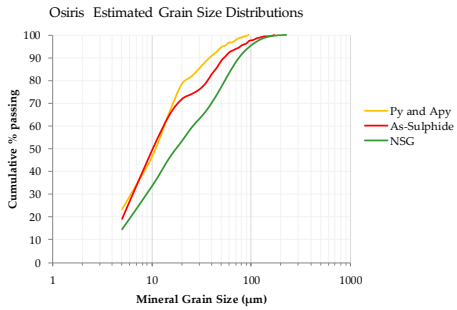
	Passing Size (µm)	Cumulative % passing	Combined	-25	+25/-75	+75
Estimated Grain Size Distribution Pyrite +Arsenopyrite	5	20.81	**20.81**	19.50	1.04	0.28
	10	53.71	**32.90**	21.48	6.50	4.91
	15	70.27	**16.56**	8.64	4.31	3.61
	20	80.65	**10.37**	6.46	2.41	1.50
	25	83.21	**2.56**	0.00	1.80	0.76
	30	91.81	**8.59**	6.13	1.77	0.69
	35	93.03	**1.23**	0.00	1.01	0.21
	40	94.55	**1.51**	0.00	1.26	0.25
	45	95.37	**0.82**	0.00	0.48	0.34
	50	96.68	**1.32**	0.00	1.02	0.29
	55	97.33	**0.65**	0.00	0.50	0.14
	60	97.84	**0.51**	0.00	0.40	0.11
	65	98.24	**0.40**	0.00	0.26	0.14
	70	98.98	**0.74**	0.00	0.37	0.37
	75	99.21	**0.23**	0.00	0.00	0.23
	80	99.27	**0.06**	0.00	0.00	0.06
	85	99.40	**0.13**	0.00	0.00	0.13
	100	99.57	**0.17**	0.00	0.00	0.17
	105	99.66	**0.10**	0.00	0.00	0.10
	115	99.79	**0.13**	0.00	0.00	0.13
	135	99.90	**0.11**	0.00	0.00	0.11
	140	100.00	**0.10**	0.00	0.00	0.10
	Total		***100.00***	*62.22*	*23.15*	*14.63*
Estimated Grain Size Distribution As-Sulphide	5	19.26	**19.26**	19.03	0.15	0.08
	10	49.26	**30.01**	28.79	0.84	0.38
	15	64.88	**15.62**	13.75	1.45	0.42
	20	71.79	**6.91**	5.02	1.51	0.38
	25	74.01	**2.22**	0.00	1.94	0.27
	30	76.05	**2.04**	0.00	1.86	0.18
	35	78.93	**2.88**	0.00	2.55	0.33
	40	82.79	**3.86**	0.00	3.32	0.54
	45	85.55	**2.77**	0.00	2.59	0.18
	50	88.75	**3.19**	0.00	3.06	0.14
	55	90.53	**1.78**	0.00	1.58	0.19
	60	92.33	**1.81**	0.00	1.60	0.20
	65	93.15	**0.82**	0.00	0.34	0.47
	70	93.86	**0.72**	0.00	0.48	0.23
	75	94.42	**0.55**	0.00	0.32	0.23
	80	95.37	**0.95**	0.00	0.57	0.38
	85	95.89	**0.52**	0.00	0.45	0.06
	90	96.31	**0.42**	0.00	0.19	0.23
	95	97.34	**1.04**	0.00	0.71	0.33
	100	97.62	**0.27**	0.00	0.00	0.27
	105	97.77	**0.15**	0.00	0.00	0.15
	110	98.21	**0.45**	0.00	0.00	0.45
	115	98.60	**0.39**	0.00	0.00	0.39
	120	98.70	**0.10**	0.00	0.00	0.10
	125	99.03	**0.33**	0.00	0.00	0.33
	130	99.15	**0.12**	0.00	0.00	0.12
	135	99.34	**0.19**	0.00	0.00	0.19
	160	99.52	**0.18**	0.00	0.00	0.18
	170	100.00	**0.48**	0.00	0.00	0.48
	Total		***100.00***	*66.59*	*25.52*	*7.89*
Estimated Grain Size Distribution NSG	5	14.39	**14.39**	14.38	0.02	0.00
	10	33.39	**19.00**	18.71	0.26	0.02
	15	45.90	**12.51**	11.73	0.74	0.05
	20	53.23	**7.33**	5.84	1.39	0.10
	25	59.15	**5.92**	3.59	2.17	0.16
	30	63.03	**3.88**	0.88	2.72	0.28
	35	66.46	**3.42**	0.00	3.04	0.39
	40	70.15	**3.69**	0.00	3.17	0.52
	45	73.69	**3.54**	0.00	2.89	0.66
	50	77.20	**3.51**	0.00	2.70	0.81
	55	80.38	**3.18**	0.00	2.26	0.92
	60	83.31	**2.93**	0.00	1.93	1.00
	65	85.83	**2.51**	0.00	1.51	1.01
	70	88.08	**2.26**	0.00	1.14	1.11
	75	89.90	**1.81**	0.00	0.76	1.05
	80	91.45	**1.55**	0.00	0.54	1.01
	85	92.70	**1.25**	0.00	0.23	1.02
	90	93.73	**1.03**	0.00	0.14	0.89
	95	94.63	**0.90**	0.00	0.05	0.85
	100	95.46	**0.83**	0.00	0.04	0.80
	105	96.13	**0.67**	0.00	0.05	0.62
	110	96.70	**0.57**	0.00	0.02	0.55
	115	97.24	**0.55**	0.00	0.03	0.52
	120	97.71	**0.47**	0.00	0.01	0.46
	125	98.08	**0.36**	0.00	0.00	0.36
	130	98.44	**0.36**	0.00	0.00	0.36
	135	98.69	**0.25**	0.00	0.00	0.25
	140	98.93	**0.24**	0.00	0.00	0.24
	145	99.11	**0.19**	0.00	0.00	0.19
	150	99.29	**0.17**	0.00	0.00	0.17
	155	99.39	**0.10**	0.00	0.00	0.10
	160	99.49	**0.11**	0.00	0.00	0.11
	165	99.58	**0.09**	0.00	0.00	0.09
	170	99.65	**0.07**	0.00	0.00	0.07
	175	99.72	**0.07**	0.00	0.00	0.07
	180	99.78	**0.06**	0.00	0.00	0.06
	185	99.82	**0.04**	0.00	0.00	0.04
	190	99.84	**0.02**	0.00	0.00	0.02
	200	99.88	**0.04**	0.00	0.00	0.04
	205	99.90	**0.02**	0.00	0.00	0.02
	210	99.94	**0.04**	0.00	0.00	0.04
	215	99.98	**0.04**	0.00	0.00	0.04
	220	99.99	**0.01**	0.00	0.00	0.01
	225	100.00	**0.01**	0.00	0.00	0.01
	Total		***100.00***	*55.12*	*27.79*	*17.09*

	Passing Size (µm)	Cumulative % passing	Combined	-25	+25/-75	+75
Estimated Grain Size Distribution Pyrite +Arsenopyrite	5	23.47	**23.47**	20.23	1.96	1.28
	10	46.41	**22.94**	10.09	5.92	6.93
	15	66.07	**19.65**	12.15	3.97	3.53
	20	78.37	**12.31**	8.61	2.10	1.60
	25	81.72	**3.35**	0.00	2.03	1.32
	30	85.24	**3.52**	0.00	2.03	1.49
	35	88.37	**3.13**	0.00	2.81	0.31
	40	90.76	**2.40**	0.00	2.13	0.26
	45	92.59	**1.82**	0.00	1.39	0.44
	50	94.56	**1.98**	0.00	1.72	0.25
	55	95.31	**0.75**	0.00	0.51	0.23
	60	96.62	**1.31**	0.00	1.31	0.00
	65	96.76	**0.14**	0.00	0.00	0.14
	70	97.72	**0.96**	0.00	0.40	0.56
	75	98.56	**0.84**	0.00	0.71	0.13
	80	98.83	**0.28**	0.00	0.00	0.28
	85	99.33	**0.50**	0.00	0.00	0.50
	90	99.55	**0.22**	0.00	0.00	0.22
	95	100.00	**0.45**	0.00	0.00	0.45
	Total		***100.00***	*51.08*	*28.98*	*19.94*
Estimated Grain Size Distribution As-Sulphide	5	21.13	**21.13**	20.88	0.18	0.08
	10	43.68	**22.55**	20.31	1.43	0.81
	15	58.74	**15.07**	12.58	1.40	1.09
	20	67.68	**8.94**	6.21	1.75	0.98
	25	73.77	**6.09**	4.23	1.37	0.48
	30	76.05	**2.28**	0.00	1.72	0.57
	35	77.70	**1.65**	0.00	1.32	0.33
	40	79.19	**1.49**	0.00	1.20	0.29
	45	80.82	**1.63**	0.00	0.93	0.70
	50	82.43	**1.61**	0.00	0.67	0.94
	55	83.76	**1.33**	0.00	0.80	0.53
	60	84.92	**1.16**	0.00	0.61	0.55
	65	85.93	**1.00**	0.00	0.67	0.33
	70	87.41	**1.48**	0.00	0.28	1.20
	75	88.15	**0.75**	0.00	0.00	0.75
	80	88.83	**0.67**	0.00	0.34	0.34
	85	90.93	**2.10**	0.00	0.00	2.10
	90	91.45	**0.53**	0.00	0.14	0.39
	95	91.78	**0.33**	0.00	0.00	0.33
	100	92.36	**0.58**	0.00	0.18	0.40
	105	92.81	**0.45**	0.00	0.00	0.45
	110	92.90	**0.09**	0.00	0.00	0.09
	115	93.47	**0.57**	0.00	0.00	0.57
	120	93.55	**0.08**	0.00	0.00	0.08
	125	94.97	**1.42**	0.00	0.00	1.42
	140	95.56	**0.59**	0.00	0.00	0.59
	155	95.76	**0.19**	0.00	0.00	0.19
	160	95.98	**0.22**	0.00	0.00	0.22
	165	96.28	**0.30**	0.00	0.00	0.30
	170	96.60	**0.33**	0.00	0.00	0.33
	195	96.72	**0.12**	0.00	0.00	0.12
	205	98.60	**1.87**	0.00	0.00	1.87
	275	100.00	**1.40**	0.00	0.00	1.40
	Total		***100.00***	*64.20*	*14.98*	*20.82*
Estimated Grain Size Distribution NSG	5	15.36	**15.36**	15.35	0.01	0.00
	10	32.74	**17.38**	17.16	0.20	0.02
	15	40.68	**7.94**	7.37	0.53	0.04
	20	46.91	**6.23**	5.05	1.10	0.08
	25	50.84	**3.93**	2.02	1.78	0.13
	30	53.92	**3.09**	0.59	2.26	0.23
	35	57.05	**3.13**	0.17	2.60	0.36
	40	60.19	**3.14**	0.00	2.67	0.47
	45	63.20	**3.00**	0.00	2.40	0.61
	50	66.42	**3.22**	0.00	2.37	0.85
	55	69.23	**2.81**	0.00	1.82	0.99
	60	72.07	**2.85**	0.00	1.63	1.21
	65	74.38	**2.31**	0.00	1.05	1.25
	70	76.69	**2.31**	0.00	0.82	1.50
	75	78.79	**2.10**	0.00	0.50	1.60
	80	80.74	**1.95**	0.00	0.34	1.62
	85	82.32	**1.58**	0.00	0.21	1.36
	90	83.96	**1.64**	0.00	0.12	1.52
	95	85.42	**1.46**	0.00	0.03	1.43
	100	86.85	**1.43**	0.00	0.03	1.40
	105	88.32	**1.47**	0.00	0.00	1.47
	110	89.56	**1.24**	0.00	0.02	1.23
	115	90.68	**1.12**	0.00	0.00	1.12
	120	91.80	**1.11**	0.00	0.00	1.11
	125	92.82	**1.02**	0.00	0.00	1.02
	130	93.73	**0.92**	0.00	0.00	0.92
	135	94.51	**0.77**	0.00	0.00	0.77
	140	95.28	**0.77**	0.00	0.00	0.77
	145	95.88	**0.60**	0.00	0.00	0.60
	150	96.50	**0.63**	0.00	0.00	0.63
	155	96.88	**0.38**	0.00	0.00	0.38
	160	97.35	**0.47**	0.00	0.00	0.47
	165	97.67	**0.32**	0.00	0.00	0.32
	170	98.00	**0.33**	0.00	0.00	0.33
	175	98.19	**0.20**	0.00	0.00	0.20
	180	98.48	**0.28**	0.00	0.00	0.28
	185	98.70	**0.22**	0.00	0.00	0.22
	190	98.85	**0.15**	0.00	0.00	0.15
	195	99.03	**0.18**	0.00	0.00	0.18
	200	99.12	**0.09**	0.00	0.00	0.09
	205	99.28	**0.16**	0.00	0.00	0.16
	210	99.38	**0.10**	0.00	0.00	0.10
	215	99.49	**0.11**	0.00	0.00	0.11
	220	99.60	**0.10**	0.00	0.00	0.10
	225	99.66	**0.06**	0.00	0.00	0.06
	230	99.73	**0.07**	0.00	0.00	0.07
	235	99.76	**0.03**	0.00	0.00	0.03
	240	99.80	**0.04**	0.00	0.00	0.04
	250	99.82	**0.02**	0.00	0.00	0.02
	255	99.84	**0.02**	0.00	0.00	0.02
	265	99.90	**0.05**	0.00	0.00	0.05
	270	99.94	**0.05**	0.00	0.00	0.05
	275	100.00	**0.06**	0.00	0.00	0.06
	Total		***100.00***	*47.71*	*22.50*	*29.79*

Conrad Estimated Grain Size Distributions



Osiris Estimated Grain Size Distributions

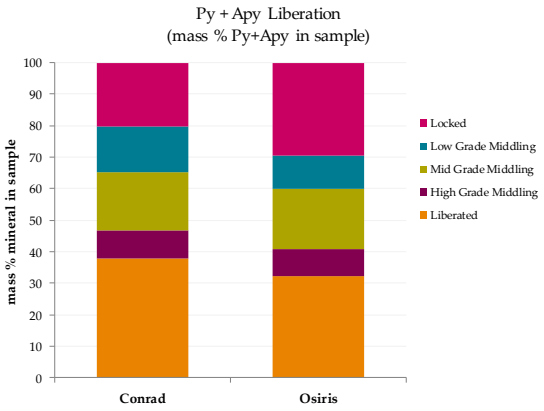


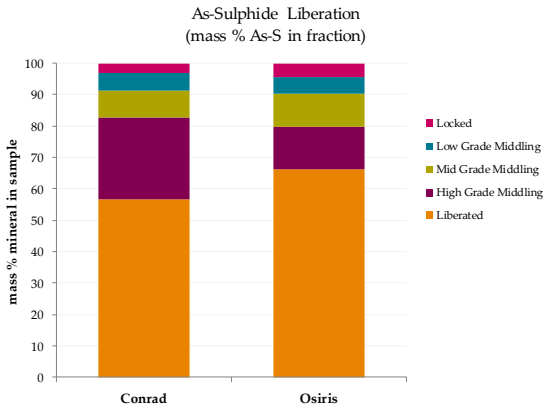
XPS EXPERT PROCESS SOLUTIONS

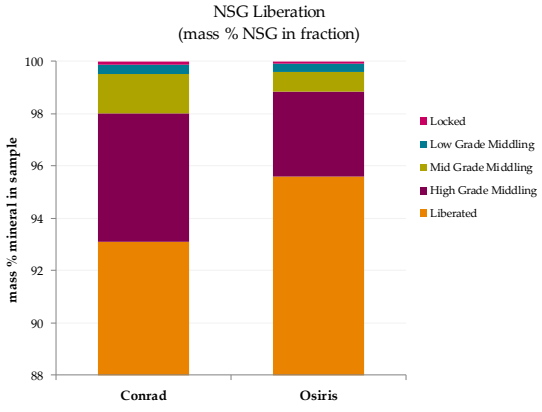
Liberation

Liberation data is shown for pyrite + As-pyrite, As-sulphide and NSG. Liberation is defined on the Definitions sheet. All liberation is based on area %. The grain size of the mineral in each fraction and liberation class indicates potential regrind targets, particularly for coarse locked material.

		Conrad	Osiris
Py + Apy Liberation (mass % Py+Apy in fraction)	Locked	20.11	29.43
	Low Grade Middling	14.72	10.59
	Mid Grade Middling	18.47	18.98
	High Grade Middling	8.80	8.72
	Liberated	37.90	32.28
	Total	*100.00*	*100.00*
As-Sulphide Liberation (mass % As-S in fraction)	Locked	3.04	4.51
	Low Grade Middling	5.77	5.18
	Mid Grade Middling	8.61	10.52
	High Grade Middling	25.83	13.51
	Liberated	56.75	66.28
	Total	*100.00*	*100.00*
NSG Liberation (mass % NSG in fraction)	Locked	0.13	0.09
	Low Grade Middling	0.39	0.34
	Mid Grade Middling	1.50	0.76
	High Grade Middling	4.90	3.21
	Liberated	93.09	95.60
	Total	*100.00*	*100.00*



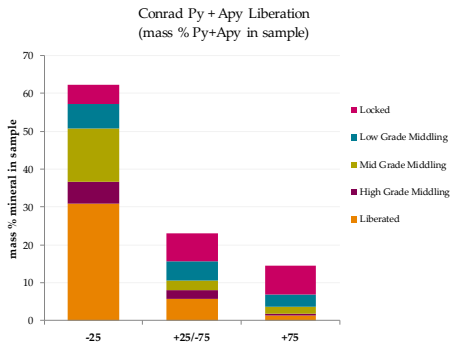

As-Sulphide Liberation
(mass % As-S in fraction)
mass % mineral in sample
100
90
80
70
60
50
40
30
20
10
0
Conrad
Osiris
Locked
Low Grade Middling
Mid Grade Middling
High Grade Middling
Liberated


NSG Liberation
(mass % NSG in fraction)
mass % mineral in sample
100
98
96
94
92
90
88
Conrad
Osiris
Locked
Low Grade Middling
Mid Grade Middling
High Grade Middling
Liberated

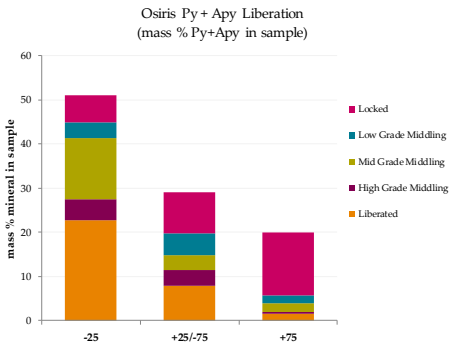
Conrad					
	Mass Flow	100			
		Combined	-25	+25/-75	+75
	Min Size		3	25	75
	Max Size		25	75	1000
	Average Particle Size (µm)		7	37	81
	Size Distribution (%)	**100.00**	55.68	27.57	16.75
	Mass Flow	**100.00**	55.68	27.57	16.75
	No. Particles Measured		9094	20943	13386
		Combined	-25	+25/-75	+75
Py+Apy Liberation (mass % Py+Apy in fraction)	Locked	**20.11**	8.13	32.06	52.20
	Low Grade Middling	**14.72**	10.27	21.70	22.65
	Mid Grade Middling	**18.47**	22.51	11.50	12.27
	High Grade Middling	**8.80**	9.39	10.24	4.02
	Liberated	**37.90**	49.70	24.50	8.86
	Total	***100.00***	*100.00*	*100.00*	*100.00*
Py+Apy Liberation (mass % Py+Apy in sample)	Locked	**20.11**	5.06	7.42	7.63
	Low Grade Middling	**14.72**	6.39	5.02	3.31
	Mid Grade Middling	**18.47**	14.01	2.66	1.79
	High Grade Middling	**8.80**	5.84	2.37	0.59
	Liberated	**37.90**	30.93	5.67	1.30
	Total	***100.00***	*62.23*	*23.15*	*14.62*
Py+Apy Liberation Grain size (µm)	Locked		2	7	8
	Low Grade Middling		*4*	11	14
	Mid Grade Middling		*8*	17	25
	High Grade Middling		*5*	23	42
	Liberated		*7*	33	72
As-Sulphide Liberation (mass % As-S in fraction)	Locked	**3.04**	1.66	3.70	12.53
	Low Grade Middling	**5.77**	6.05	4.49	7.58
	Mid Grade Middling	**8.61**	9.96	5.41	7.56
	High Grade Middling	**25.83**	33.52	11.12	8.19
	Liberated	**56.75**	48.81	75.28	64.14
	Total	***100.00***	*100.00*	*100.00*	*100.00*
As-Sulphide Liberation (mass % As-S in sample)	Locked	**3.04**	1.11	0.94	0.99
	Low Grade Middling	**5.77**	4.03	1.14	0.60
	Mid Grade Middling	**8.61**	6.64	1.38	0.60
	High Grade Middling	**25.83**	22.35	2.83	0.64
	Liberated	**56.75**	32.54	19.16	5.05
	Total	***100.00***	*66.68*	*25.45*	*7.87*
As-Sulphide Liberation Grain size (µm)	Locked		*1*	6	8
	Low Grade Middling		*4*	13	20
	Mid Grade Middling		*4*	20	32
	High Grade Middling		*5*	33	40
	Liberated		*6*	36	83
NSG Liberation (mass % NSG in fraction)	Locked	**0.13**	0.18	0.08	0.03
	Low Grade Middling	**0.39**	0.51	0.22	0.26
	Mid Grade Middling	**1.50**	1.33	1.64	1.81
	High Grade Middling	**4.90**	2.61	6.23	10.12
	Liberated	**93.09**	95.38	91.83	87.77
	Total	***100.00***	*100.00*	*100.00*	*100.00*
NSG Liberation (mass % NSG in sample)	Locked	**0.13**	0.10	0.02	0.01
	Low Grade Middling	**0.39**	0.28	0.06	0.04
	Mid Grade Middling	**1.50**	0.73	0.45	0.31
	High Grade Middling	**4.90**	1.44	1.73	1.73
	Liberated	**93.09**	52.57	25.52	15.00
	Total	***100.00***	*55.11*	*27.79*	*17.09*
NSG Liberation Grain size (µm)	Locked		*1*	7	9
	Low Grade Middling		3	10	15
	Mid Grade Middling		*4*	17	25
	High Grade Middling		*7*	27	45
	Liberated		*7*	36	73

Osiris					
	Mass Flow	100			
		Combined	-25	+25/-75	+75
	Min Size		3	25	75
	Max Size		25	75	1000
	Average Particle Size (µm)		6	36	92
	Size Distribution (%)	**100.00**	48.50	22.24	29.25
	Mass Flow	**100.00**	48.50	22.24	29.25
	No. Particles Measured		9744	20380	12818
		Combined	-25	+25/-75	+75
Py+Apy Liberation (mass % Py+Apy in fraction)	Locked	**29.43**	12.02	31.66	70.82
	Low Grade Middling	**10.59**	7.00	17.48	9.76
	Mid Grade Middling	**18.98**	27.19	11.27	9.14
	High Grade Middling	**8.72**	9.14	12.05	2.82
	Liberated	**32.28**	44.65	27.54	7.45
	Total	***100.00***	*100.00*	*100.00*	*100.00*
Py+Apy Liberation (mass % Py+Apy in sample)	Locked	**29.43**	6.14	9.17	14.12
	Low Grade Middling	**10.59**	3.58	5.06	1.95
	Mid Grade Middling	**18.98**	13.89	3.27	1.82
	High Grade Middling	**8.72**	4.67	3.49	0.56
	Liberated	**32.28**	22.81	7.98	1.49
	Total	***100.00***	*51.09*	*28.97*	*19.94*
Py+Apy Liberation Grain size (µm)	Locked		2	6	8
	Low Grade Middling		*3*	13	16
	Mid Grade Middling		*7*	23	30
	High Grade Middling		*4*	30	49
	Liberated		*7*	35	67
As-Sulphide Liberation (mass % As-S in fraction)	Locked	**4.51**	1.54	9.47	10.19
	Low Grade Middling	**5.18**	4.07	9.28	5.71
	Mid Grade Middling	**10.52**	13.96	7.71	1.84
	High Grade Middling	**13.51**	19.62	5.21	0.49
	Liberated	**66.28**	60.81	68.32	81.77
	Total	***100.00***	*100.00*	*100.00*	*100.00*
As-Sulphide Liberation (mass % As-S in sample)	Locked	**4.51**	0.99	1.41	2.11
	Low Grade Middling	**5.18**	2.62	1.38	1.19
	Mid Grade Middling	**10.52**	8.99	1.15	0.38
	High Grade Middling	**13.51**	12.63	0.78	0.10
	Liberated	**66.28**	39.13	10.18	16.97
	Total	***100.00***	*64.36*	*14.89*	*20.75*
As-Sulphide Liberation Grain size (µm)	Locked		*1*	7	9
	Low Grade Middling		*3*	12	16
	Mid Grade Middling		*4*	18	23
	High Grade Middling		*5*	22	28
	Liberated		*7*	32	80
NSG Liberation (mass % NSG in fraction)	Locked	**0.09**	0.15	0.05	0.01
	Low Grade Middling	**0.34**	0.57	0.22	0.07
	Mid Grade Middling	**0.76**	0.70	0.98	0.68
	High Grade Middling	**3.21**	2.41	4.27	3.71
	Liberated	**95.60**	96.18	94.48	95.53
	Total	***100.00***	*100.00*	*100.00*	*100.00*
NSG Liberation (mass % NSG in sample)	Locked	**0.09**	0.07	0.01	0.00
	Low Grade Middling	**0.34**	0.27	0.05	0.02
	Mid Grade Middling	**0.76**	0.33	0.22	0.20
	High Grade Middling	**3.21**	1.15	0.96	1.10
	Liberated	**95.60**	45.88	21.26	28.46
	Total	***100.00***	*47.70*	*22.50*	*29.79*
NSG Liberation Grain size (µm)	Locked		*1*	6	7
	Low Grade Middling		2	13	18
	Mid Grade Middling		*3*	20	30
	High Grade Middling		*6*	29	52
	Liberated		*6*	35	84

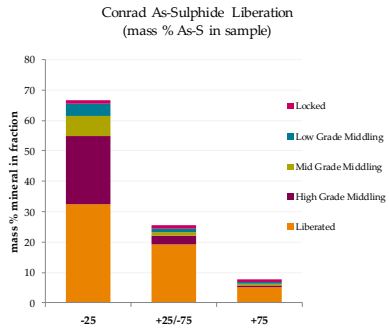
Conrad Py + Apy Liberation (mass % Py+Apy in sample)



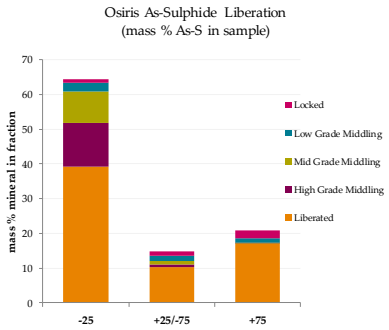
Osiris Py + Apy Liberation (mass % Py+Apy in sample)



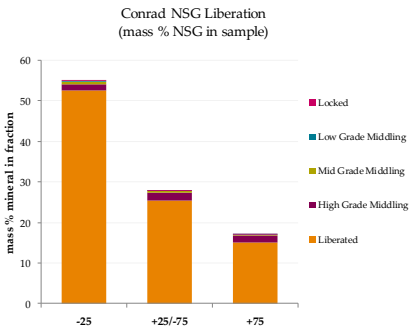
Conrad As-Sulphide Liberation (mass % As-S in sample)



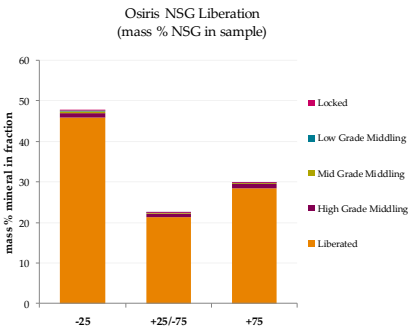
Osiris As-Sulphide Liberation (mass % As-S in sample)



Conrad NSG Liberation (mass % NSG in sample)



Osiris NSG Liberation (mass % NSG in sample)

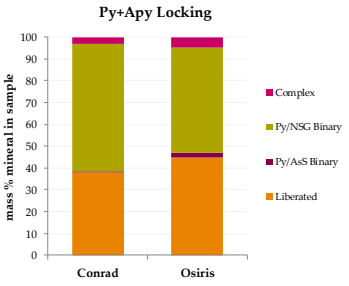


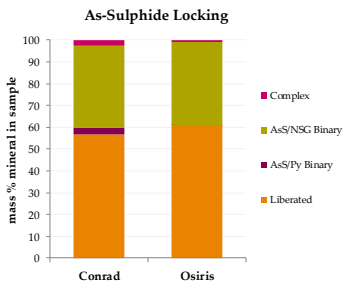
XPS EXPERT PROCESS SOLUTIONS

Locking

Locking data is shown for pyrite + arsenopyrite, As-sulphide and NSG. Locking is defined on the Definitions sheet. All locking is based on area %. The grain size of the mineral in each fraction and locking class indicates potential regrind targets, particularly for coarse locked material.

		Conrad	Osiris
Py+Apy Locking (mass % Py+Apy in fraction)	Liberated	37.90	44.65
	Py/AsS Binary	0.65	2.03
	Py/NSG Binary	58.38	48.61
	Complex	3.08	4.72
	Total	*100.00*	*100.00*
As-Sulphide Lockin (mass % As-S in fraction)	Liberated	56.75	60.81
	AsS/Py Binary	2.79	0.24
	AsS/NSG Binary	37.96	37.85
	Complex	2.49	1.10
	Total	*100.00*	*100.00*
NSG Locking (mass % NSG in fraction)	Liberated	93.09	96.18
	NSG/Py Binary	6.09	1.91
	NSG/AsS Binary	0.67	1.83
	Complex	0.15	0.08
	Total	*100.00*	*100.00*



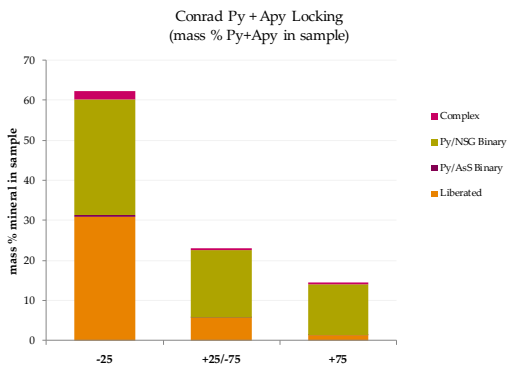


BLUE COAST RESEARCH PASSION · CREATIVITY · EXPERIENCE

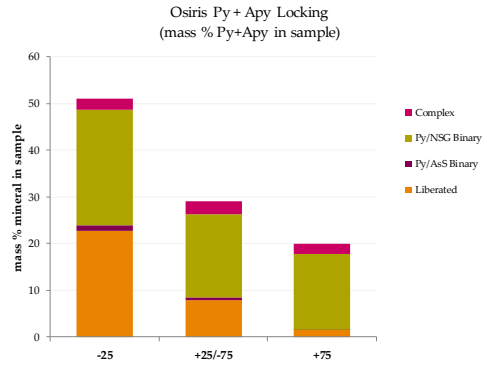
		Conrad			
	Mass Flow	100			
		Combined	-25	+25/-75	+75
	Min Size		3	25	75
	Max Size		25	75	1000
	Average Particle Size		7	37	81
	Size Distribution (%)	**100.00**	55.68	27.57	16.75
	Mass Flow	**100.00**	55.68	27.57	16.75
	No. Particles Measured		9094	20943	13386
		Combined	-25	+25/-75	+75
Py+Apy Locking (mass % Py+Apy in fraction)	Liberated	**37.90**	49.70	24.50	8.86
	Py/AsS Binary	**0.65**	0.74	0.77	0.04
	Py/NSG Binary	**58.38**	46.39	72.29	87.41
	Complex	**3.08**	3.17	2.45	3.70
	Total	***100.00***	*100.00*	*100.00*	*100.00*
Py+Apy Locking (mass % Py+Apy in sample)	Liberated	**37.90**	30.93	5.67	1.30
	Py/AsS Binary	**0.65**	0.46	0.18	0.01
	Py/NSG Binary	**58.38**	28.87	16.73	12.78
	Complex	**3.08**	1.97	0.57	0.54
	Total	***100.00***	*62.23*	*23.15*	*14.62*
Py+Apy Locking Grain size (µm)	Liberated		*7*	33	72
	Py/AsS Binary		*3*	10	8
	Py/NSG Binary		*4*	9	11
	Complex		*3*	9	11
As-Sulphide Lockin (mass % As-S in fraction)	Liberated	**56.75**	48.81	75.28	64.14
	AsS/Py Binary	**2.79**	3.78	0.90	0.53
	AsS/NSG Binary	**37.96**	45.65	20.82	28.34
	Complex	**2.49**	1.76	3.01	6.99
	Total	***100.00***	*100.00*	*100.00*	*100.00*
As-Sulphide Lockin (mass % As-S in sample)	Liberated	**56.75**	32.54	19.16	5.05
	AsS/Py Binary	**2.79**	2.52	0.23	0.04
	AsS/NSG Binary	**37.96**	30.44	5.30	2.23
	Complex	**2.49**	1.17	0.77	0.55
	Total	***100.00***	*66.68*	*25.45*	*7.87*
As-Sulphide Lockin Grain size (µm)	Liberated		*6*	36	83
	AsS/Py Binary		*8*	13	26
	AsS/NSG Binary		*4*	18	16
	Complex		2	8	9
NSG Locking (mass % NSG in fraction)	Liberated	**93.09**	95.38	91.83	87.77
	NSG/Py Binary	**6.09**	3.81	7.38	11.31
	NSG/AsS Binary	**0.67**	0.69	0.65	0.64
	Complex	**0.15**	0.12	0.14	0.27
	Total	***100.00***	*100.00*	*100.00*	*100.00*
NSG Locking (mass % NSG in sample)	Liberated	**93.09**	52.57	25.52	15.00
	NSG/Py Binary	**6.09**	2.10	2.05	1.93
	NSG/AsS Binary	**0.67**	0.38	0.18	0.11
	Complex	**0.15**	0.07	0.04	0.05
	Total	***100.00***	*55.11*	*27.79*	*17.09*
NSG Locking Grain size (µm)	Liberated		*7*	36	73
	NSG/Py Binary		*6*	23	39
	NSG/AsS Binary		2	24	40
	Complex		2	18	27

		Osiris			
	Mass Flow	100			
		Combined	-25	+25/-75	+75
	Min Size		3	25	75
	Max Size		25	75	1000
	Average Particle		6	36	92
	Size Distribution	**100.00**	48.50	22.24	29.25
	Mass Flow	**100.00**	48.50	22.24	29.25
	No. Particles Measured		9744	20380	12818
		Combined	-25	+25/-75	+75
Py+Apy Locking (mass % Py+Apy in fraction)	Liberated	**32.28**	44.65	27.54	7.45
	Py/AsS Binary	**1.59**	2.03	1.83	0.10
	Py/NSG Binary	**58.98**	48.61	61.53	81.87
	Complex	**7.15**	4.72	9.10	10.58
	Total	***100.00***	*100.00*	*100.00*	*100.00*
Py+Apy Locking (mass % Py+Apy in sample)	Liberated	**32.28**	22.81	7.98	1.49
	Py/AsS Binary	**1.59**	1.03	0.53	0.02
	Py/NSG Binary	**58.98**	24.83	17.82	16.32
	Complex	**7.15**	2.41	2.64	2.11
	Total	***100.00***	*51.09*	*28.97*	*19.94*
Py+Apy Locking Grain size (µm)	Liberated		*7*	35	67
	Py/AsS Binary		*3*	11	41
	Py/NSG Binary		*4*	9	9
	Complex		2	9	9
As-Sulphide Lockin (mass % As-S in fraction)	Liberated	**66.28**	60.81	68.32	81.77
	AsS/Py Binary	**0.34**	0.24	1.06	0.15
	AsS/NSG Binary	**31.12**	37.85	23.94	15.38
	Complex	**2.26**	1.10	6.69	2.70
	Total	***100.00***	*100.00*	*100.00*	*100.00*
As-Sulphide Lockin (mass % As-S in sample)	Liberated	**66.28**	39.13	10.18	16.97
	AsS/Py Binary	**0.34**	0.16	0.16	0.03
	AsS/NSG Binary	**31.12**	24.36	3.57	3.19
	Complex	**2.26**	0.71	1.00	0.56
	Total	***100.00***	*64.36*	*14.89*	*20.75*
As-Sulphide Lockin Grain size (µm)	Liberated		*7*	32	80
	AsS/Py Binary		*3*	13	18
	AsS/NSG Binary		*4*	11	12
	Complex		2	9	10
NSG Locking (mass % NSG in fraction)	Liberated	**95.60**	96.18	94.48	95.53
	NSG/Py Binary	**2.43**	1.91	3.55	2.40
	NSG/AsS Binary	**1.76**	1.83	1.57	1.78
	Complex	**0.21**	0.08	0.39	0.28
	Total	***100.00***	*100.00*	*100.00*	*100.00*
NSG Locking (mass % NSG in sample)	Liberated	**95.60**	45.88	21.26	28.46
	NSG/Py Binary	**2.43**	0.91	0.80	0.72
	NSG/AsS Binary	**1.76**	0.87	0.35	0.53
	Complex	**0.21**	0.04	0.09	0.08
	Total	***100.00***	*47.70*	*22.50*	*29.79*
NSG Locking Grain size (µm)	Liberated		*6*	35	84
	NSG/Py Binary		*6*	26	48
	NSG/AsS Binary		2	25	45
	Complex		2	19	28

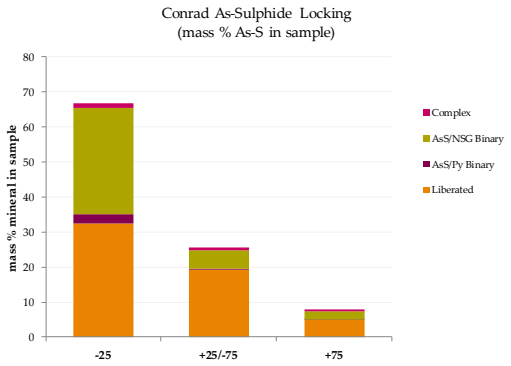
Conrad Py + Apy Locking(mass % Py+Apy in sample)



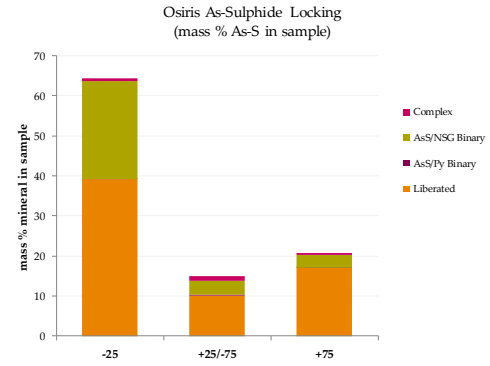
Osiris Py + Apy Locking(mass % Py+Apy in sample)



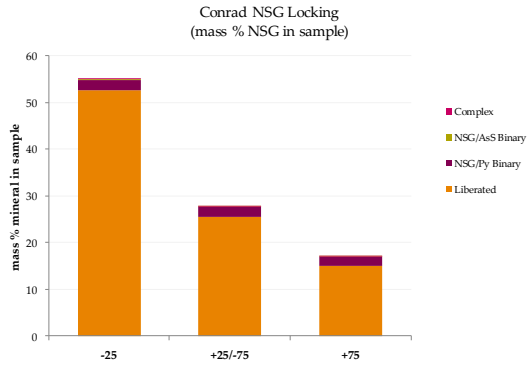
Conrad As-Sulphide Locking(mass % As-S in sample)



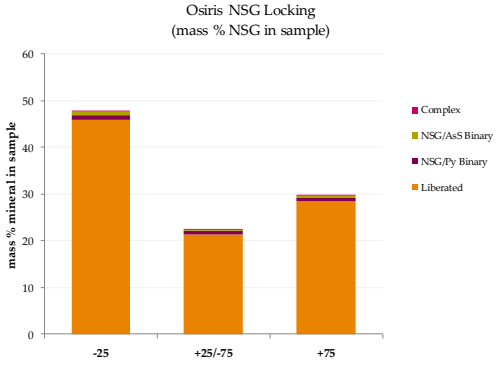
Osiris As-Sulphide Locking(mass % As-S in sample)



Conrad NSG Locking(mass % NSG in sample)



Osiris NSG Locking(mass % NSG in sample)



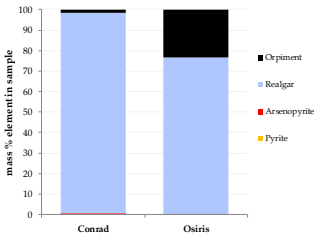
XPS EXPERT PROCESS SOLUTIONS

Elemental Deportments

These data show the distribution of arsenic between minerals identified in the sample. Data is shown both as mass of the element in the sample and as a mass percent of the element in the sample on a size by size and combined basis.
Deportment data is calculated based on the mass of a mineral in the sample and the amount of the element in the composition of that mineral measured by EPMA

		Conrad	Osiris
As Deportment (mass % As in sample)	Pyrite	0.19	0.05
	Arsenopyrite	0.31	0.36
	Realgar	97.95	76.36
	Orpiment	1.55	23.24
	Total	*100.00*	*100.00*

As Deportment (mass % As in sample)

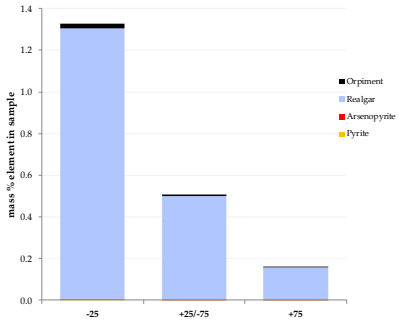


			Conrad		
	Min Size		3	25	75
	Max Size		25	75	1000
	Average Particle Size (µm)		7	37	81
	Size Distribution (%)	**100.00**	55.68	27.57	16.75
	Mass Flow	**100.00**	55.68	27.57	16.75
	No. Particles Measured		*9,094*	*20,943*	*13,386*
		Combined	-25	+25/-75	+75
As Deportment (mass As)	Pyrite	**0.00**	0.00	0.00	0.00
	Arsenopyrite	**0.01**	0.00	0.00	0.00
	Realgar	**1.95**	1.30	0.50	0.15
	Orpiment	**0.03**	0.02	0.01	0.00
	Total	***1.99***	***1.33***	***0.51***	***0.16***
As Deportment (mass % As in sample)	Pyrite	**0.19**	0.17	0.17	0.38
	Arsenopyrite	**0.31**	0.31	0.24	0.51
	Realgar	**97.95**	97.82	98.24	98.15
	Orpiment	**1.55**	1.70	1.35	0.96
	Total	***100.00***	*100.00*	*100.00*	*100.00*

			Osiris		
	Min Size		3	25	75
	Max Size		25	75	1000
	Average Particle Size (µm)		6	36	92
	Size Distribution (%)	**100.00**	48.50	22.24	29.25
	Mass Flow	**100.00**	48.50	22.24	29.25
	No. Particles Measured		*9,744*	*20,380*	*12,818*
		Combined	-25	+25/-75	+75
As Deportment (mass As)	Pyrite	**0.00**	0.00	0.00	0.00
	Arsenopyrite	**0.01**	0.01	0.00	0.00
	Realgar	**2.35**	1.83	0.34	0.18
	Orpiment	**0.72**	0.19	0.11	0.41
	Total	***3.08***	***2.02***	***0.46***	***0.60***
As Deportment (mass % As in sample)	Pyrite	**0.05**	0.03	0.09	0.05
	Arsenopyrite	**0.36**	0.37	0.51	0.18
	Realgar	**76.36**	90.22	74.69	30.76
	Orpiment	**23.24**	9.38	24.71	69.01
	Total	***100.00***	*100.00*	*100.00*	*100.00*

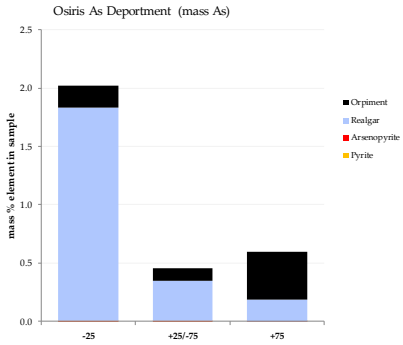
Conrad As Deportment (mass As)

Conrad As Deportment (mass As)



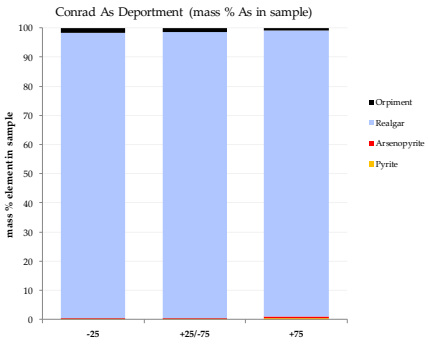
Osiris As Deportment (mass As)

Osiris As Deportment (mass As)



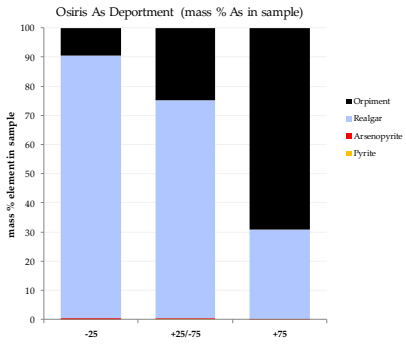
Conrad As Deportment (mass % As in sample)

Conrad As Deportment (mass % As in sample)



Osiris As Deportment (mass % As in sample)

Osiris As Deportment (mass % As in sample)



XPS EXPERT PROCESS SOLUTIONS

Electron Probe Micro Analysis (EPMA)

EPMA compositional data is collected and recombined with the QEMSCAN mineralogy to calculate accurate deportments of elements of interest. Values highlighted in grey are below the detection limit. Oxygen in the silicate analyses is a calculated value. Due to the fine intergrowths of the alteration assemblage analyses of carbonate and clay alteration returned mixed spectra. This is due to microprobe beam interactions with neighbouring grains, the purest analyses have been tabulated here.

Major Element Concentrations Determined by EPMA (wt%)

Mineral	Fe	As	S	Co	Ni	Cu	Zn	Se	Ag	Cd	Sb	Pb	Total	n
DL %	0.06	0.08	0.03	0.07	0.07	0.09	0.08	0.3	0.08	0.09	0.08	0.2		
Pyrite (low total)	44.88	0.33	51.56	0.05	0.02	bd	bd	bd	0.01	bd	bd	0.2	96.82	27
Pyrite	46.20	0.11	53.41	0.03	bd	bd	bd	0.0	0.01	bd	bd	0.2	99.91	10
Orpiment	0.02	61.41	38.37	bd	0.01	bd	bd	bd	bd	bd	0.87	0.2	100.44	6

Mineral	Na	Mg	Al	Si	P	K	Ca	Ti	Cr	Fe	As	Mn	Zn	O	Total	n
DL %	0.06	0.04	0.03	0.03	0.03	0.02	0.04	0.03	0.03	0.04	0.07	0.04	0.06			
Mixed Clay (alteration)	0.04	1.39	11.91	27.29	0.03	5.99	0.26	0.39	0.01	1.00	bd	0.01	bd	44.60	92.40	12
Mg-Fe-Carbonate	bd	8.69	0.15	0.39	0.01	0.06	24.37	0.01	bd	2.35	bd	0.73	bd	17.02	53.18	5
Calcite (dirty)	bd	0.22	0.65	1.08	0.02	0.27	36.83	0.01	bd	0.11	bd	0.08	bd	16.86	56.01	5

* values below detection are highlighted in grey

APPENDIX C – FLOTATION

Test Description:

Test #:	F-1
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	February 27, 2019
Purpose:	Sighter Test - Realgar Pre-Float
Feed:	2kg of 100% -10M Osiris
Grind:	p80 = 47 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Realgar/Orpiment Circuit	Reagents (g/tonne)				Reagents				Time (min)			pH		Ep	
Stage		Diesel		MIBC		Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)
Primary Grind									20.30				8.4		-220
Re/Or Rougher 1				31		0		60		1	4	8.4	8.4	-218	-136
Re/Or Rougher 2				10		0		20		1	4	8.4	8.3	-112	-86
Re/Or Rougher 3		5		10		10		20		1	4	8.3	8.3	-81	-59
Total	0	5	0	51	0.00	10.0	0.0	100		3	12				

Pyrite Circuit	Reagents (g/tonne)				Reagents				Time (min)			pH		Ep	
Stage	Lime		PAX	MIBC	Lime (g)		PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)
Pyrite Rougher 1			25	10			2.5	20		1	10	8.2	8.2	-111	-35
Pyrite Rougher 2			25	10			2.5	20		1	10	8.2	8.2	-37	-25
Pyrite Rougher 3			50	15			5.0	30		1	20	8.2	8.2	-14	-22
Total	0	0	50	20	0.00	0	5.0	40		2	20				

Stage	Rougher
Flotation Cell	4 litre cell
RPM	1400
Air (LPM)	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S					Other Instructions Pulv.?	PSD?	Comments
Re/Or Ro Con 1	100.89	Y	Y	Y					No	No	
Re/Or Ro Con 2	56.13	Y	Y	Y					No	No	
Re/Or Ro Con 3	56.98	Y	Y	Y					No	No	
Pyrite Ro Con 1	131.89	Y	Y	Y					No	No	
Pyrite Ro Con 2	122.45	Y	Y	Y					No	No	
Pyrite Ro Con 3	154.37	Y	Y	Y					No	No	
Rougher Tail (cut)	270.98	Y	Y	Y					No	No	
Rougher Tail (cake)	**1103.4**	N	N	N					No	**Yes**	

Mass Balance:

Product	Weight g	%	Assays, %,g/t Au	As	S	% Distribution Au	As	S	Grade, % As minerals	Pyrite	% Distribution As minerals	Pyrite
Re/Or Ro Con 1	**100.9**	5.05	14.8	29.9	15.0	17.3	60.9	38.4	43.27	2.99	60.87	9.34
Re/Or Ro Con 2	**56.1**	2.81	21.7	10.1	9.02	14.1	11.4	12.8	14.56	8.46	11.40	14.73
Re/Or Ro Con 3	**57.0**	2.85	19.6	4.44	8.19	12.9	5.11	11.8	6.43	11.63	5.11	20.56
Pyrite Ro Con 1	**131.9**	6.60	11.6	1.25	3.09	17.7	3.32	10.4	1.80	4.75	3.32	19.45
Pyrite Ro Con 2	**122.5**	6.13	7.70	0.65	1.50	10.9	1.61	4.66	0.94	2.27	1.61	8.61
Pyrite Ro Con 3	**154.4**	7.73	5.12	0.71	1.16	9.14	2.21	4.55	1.03	1.58	2.21	7.58
Rougher Tails	**1374.4**	68.82	1.13	0.56	0.50	17.9	15.5	17.3	0.81	0.46	15.49	19.74
Calculated Head	1997.1	100.00	4.33	2.48	1.97	100.00	100.00	100.00	3.59	1.61	100.00	100.00
Direct Head	2000.0	100.00	4.35	2.41	1.91	-	-	-				
Reconciliation	99.9	-	99.5	102.7	103.5	-	-	-				

Test Description:

Test #:	F-2
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	February 27, 2019
Purpose:	Sighter Test - Realgar Pre-Float
Feed:	2kg of 100% -10M Conrad
Grind:	p80 = 76 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Realgar/Orpiment Circuit	Reagents (g/tonne)				Reagents				Time (min)			pH		Ep		
Stage		Diesel		MIBC		Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind									9.75				8.0		-163	
Re/Or Rougher 1		-		31		-		60		1	4	7.9	8.0	-146	-89	
Re/Or Rougher 2		-		15		-		30		1	4	8.0	8.0	-69	-35	
Re/Or Rougher 3		5		15		10		30		1	4	8.0	8.0	-24	-6	
Total	0	5	0	61	0.00	10.0	0.0	120		3	12					
Pyrite Circuit	**Reagents (g/tonne)**				**Reagents**				**Time (min)**			**pH**		**Ep**		
Stage	Lime		PAX	MIBC	Lime (g)		PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	
Pyrite Rougher 1			25	15			2.5	30		1	10	8.0	8.0	13	9	
Pyrite Rougher 2			25	15			2.5	30		1	10	8.0	8.0	37	16	
Pyrite Rougher 3			50	0			5.0			1	20	8.0	8.2	15	22	
Total	0	0	50	31	0.00	0	5.0	60		2	20					

Stage	Rougher
Flotation Cell	4 litre cell
RPM	1400
Air (LPM)	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S					Other Instructions Pulv.?	PSD?	Comments
Re/Or Ro Con 1	91.86	Y	Y	Y					No	No	
Re/Or Ro Con 2	44.99	Y	Y	Y					No	No	
Re/Or Ro Con 3	57.63	Y	Y	Y					No	No	
Pyrite Ro Con 1	113.06	Y	Y	Y					No	No	
Pyrite Ro Con 2	125.03	Y	Y	Y					No	No	
Pyrite Ro Con 3	258.33	Y	Y	Y					No	No	
Rougher Tail (cut)	290.26	Y	Y	Y					No	No	
Rougher Tail (cake)	**1014.0**	N	N	N					No	**Yes**	

Mass Balance:

Product	Weight		Assays, %,g/t			% Distribution			Grade, %		% Distribution	
	g	%	Au	As	S	Au	As	S	As minerals	Pyrite	As minerals	Pyrite
Re/Or Ro Con 1	**91.9**	4.60	15.4	25.0	16.3	14.6	68.2	31.8	36.27	9.47	68.18	14.54
Re/Or Ro Con 2	**45.0**	2.26	14.8	8.30	8.17	6.87	11.1	7.81	12.03	8.32	11.07	6.26
Re/Or Ro Con 3	**57.6**	2.89	14.3	7.78	7.67	8.47	13.3	9.40	11.27	7.84	13.30	7.55
Pyrite Ro Con 1	**113.1**	5.67	16.8	0.82	8.00	19.5	2.74	19.2	1.19	14.30	2.74	27.04
Pyrite Ro Con 2	**125.0**	6.27	13.7	0.44	4.93	17.6	1.63	13.1	0.64	8.87	1.63	18.55
Pyrite Ro Con 3	**258.3**	12.95	6.55	0.18	2.03	17.4	1.41	11.2	0.27	3.66	1.41	15.81
Rougher Tails	**1304.2**	65.37	1.16	0.04	0.27	15.5	1.66	7.49	0.06	0.47	1.66	10.25
Calculated Head	1995.1	100.00	4.87	1.69	2.36	100.00	100.00	100.00	2.45	3.00	100.00	100.00
Direct Head	2000.0	100.00	4.83	1.62	2.22	-	-	-				
Reconciliation	99.8	-	100.8	104.0	106.4	-	-	-				

Test Description:

Test #:	F-3
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	March 6, 2019
Purpose:	Sighter Test - Realgar Cleaner
Feed:	2kg of 100% -10M Conrad
Grind:	p80 = ~76 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Realgar/Orpiment Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Diesel		MIBC	Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind							9.75				8.0		-175	
Re/Or Rougher 1	-		31	-		60		1	4	8.0	8.0	-181	-108	
Re/Or Rougher 2	-		20	-		40		1	4	8.0	8.0	-104	-72	
Re/Or Rougher 3	5		15	10		30		1	4	8.0	8.0	-63	-32	~200g
Re/Or Cleaner 1			10	0		20		1	10	7.9	8.0	126	97	
Re/Or Cleaner 2			10	0		20		1	7	7.9	8.0	147	117.0	~100-140g
Total	0	5	0 66	0.00	10.0	0.0 130		3	29					

Pyrite Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Lime	PAX	MIBC	Lime (g)	PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	
Pyrite Rougher 1		37.5	15		3.8	30		1	10	7.9	8.0	12	3	
Pyrite Rougher 2		37.5	15		3.8	30		1	10	8.0	8.0	8	12	
Pyrite Rougher 3		75	20		7.5	40		1	20	8.0	8.1	36	30	600g
Total	0	0 75	31	0.00	0 7.5	60		2	20					

Stage	Rougher	Re/Or Cln 1, 2
Flotation Cell	4 litre cell	1 litre cell
RPM	1400	1000
Air (LPM)	Natural	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S	C spec				Other Instructions Pulv.?	PSD?	Comments
Re/Or Cln 2 Con	83.75	Y	Y	Y	Y				No	No	
Re/Or Cln 2 Tail	44.93	Y	Y	Y	Y				No	No	
Re/Or Cln 1 Tail	81.16	Y	Y	Y	Y				No	No	
Pyrite Ro Con 1	150.34	Y	Y	Y	Y				No	No	
Pyrite Ro Con 2	154.4	Y	Y	Y	Y				No	No	
Pyrite Ro Con 3	301.61	Y	Y	Y	Y				No	No	
Rougher Tail (cut)	141.26	Y	Y	Y	Y				No	No	
Rougher Tail (cake)	**1037.7**	N	N	N	N				No	No	

Mass Balance:

Product	Weight		Assays, %,g/t					% Distribution					Grade, %		% Distribution	
	g	%	Au	As	S	Ctotal	Corg	Au	As	S	Ctotal	Corg	As minerals	Pyrite	As minerals	Pyrite
Re/Or Cln 2 Con	**83.8**	4.20	22.8	37.2	23.3	3.87	2.56	19.3	92.1	41.5	2.04	37.6	53.86	12.46	92.14	17.44
Re/Or Cln 2 Tail	**44.9**	2.25	14.0	0.80	4.52	6.52	0.75	6.36	1.06	4.31	1.85	5.88	1.16	7.79	1.06	5.85
Re/Or Cln 1 Tail	**81.2**	4.07	8.09	0.33	2.36	7.43	0.40	6.66	0.79	4.06	3.80	5.65	0.48	4.14	0.79	5.62
Pyrite Ro Con 1	**150.3**	7.54	17.5	0.68	7.75	5.60	0.52	26.7	3.01	24.7	5.31	13.6	0.98	13.96	3.01	35.08
Pyrite Ro Con 2	**154.4**	7.74	10.8	0.27	3.44	5.79	0.36	16.9	1.24	11.3	5.64	9.72	0.39	6.22	1.24	16.06
Pyrite Ro Con 3	**301.6**	15.12	4.95	0.11	1.44	6.69	0.21	15.2	0.99	9.20	12.7	11.3	0.16	2.60	0.99	13.10
Rougher Tails	**1178.9**	59.09	0.74	0.02	0.20	9.23	0.08	8.83	0.77	4.89	68.6	16.2	0.03	0.35	0.77	6.86
Calculated Head	1995.1	100.00	4.94	1.69	2.36	7.95	0.29	100.00	100.00	100.00	100.00	100.00	2.45	-0.89	100.00	100.00
Direct Head	2000.0	100.00	4.83	1.62	2.22	7.86	0.26	-	-	-	-	-				
Reconciliation	99.8	-	102.3	104.2	106.5	101.2	112.1	-	-	-	-	-				

Test Description:

Test #:	F-4
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	March 6, 2019
Purpose:	Realgar Pre-Float, Finer Grind
Feed:	2kg of 100% -10M Osiris
Grind:	p80 = 34 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Realgar/Orpiment Circuit	Reagents (g/tonne)				Reagents				Time (min)			pH		Ep		
Stage		Diesel		MIBC		Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind									30.00				8.4		-238	
Re/Or Rougher 1				46		0		90		1	4	8.4	8.5	-261	-154	
Re/Or Rougher 2				15		0		30		1	4	8.5	8.4	-152	-104	
Re/Or Rougher 3		5		15		10		30		1	4	8.4	8.4	-103	-70	
Total	0	5	0	77	0.00	10.0	0.0	150		3	12					
Pyrite Circuit	**Reagents (g/tonne)**				**Reagents**				**Time (min)**			**pH**		**Ep**		
Stage	Lime		PAX	MIBC	Lime (g)		PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	
Pyrite Rougher 1			37.5				3.8	30		1	10	8.2	8.2	-118	-41	
Pyrite Rougher 2			37.5				3.8	30		1	10	8.2	8.2	-26	-13	
Pyrite Rougher 3			75				7.5	30		1	20	8.2	8.2	-12	-10	
Total	0	0	75	0	0.00	0	7.5	60		2	20					

Stage	Rougher
Flotation Cell	4 litre cell
RPM	1400
Air (LPM)	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S					Other Instructions Pulv.?	PSD?	Comments
Re/Or Ro Con 1	112.32	Y	Y	Y					No	No	
Re/Or Ro Con 2	77.97	Y	Y	Y					No	No	
Re/Or Ro Con 3	76.33	Y	Y	Y					No	No	
Pyrite Ro Con 1	246.78	Y	Y	Y					No	No	
Pyrite Ro Con 2	144.16	Y	Y	Y					No	No	
Pyrite Ro Con 3	229.56	Y	Y	Y					No	No	
Rougher Tail (cut)	312.82	Y	Y	Y					No	No	
Rougher Tail (cake)	**802.3**	N	N	N					No	**Yes**	**20µm Wet Screen**

Mass Balance:

Product	Weight		Assays, %,g/t			% Distribution			Grade, %		% Distribution	
	g	%	Au	As	S	Au	As	S	As minerals	Pyrite	As minerals	Pyrite
Re/Or Ro Con 1	**112.3**	5.61	18.1	30.2	15.1	23.8	69.4	43.1	43.82	2.86	69.37	9.88
Re/Or Ro Con 2	**78.0**	3.89	13.1	3.96	4.78	12.0	6.31	9.47	5.74	5.63	6.31	13.48
Re/Or Ro Con 3	**76.3**	3.81	12.4	3.06	5.80	11.0	4.76	11.2	4.43	8.29	4.76	19.46
Pyrite Ro Con 1	**246.8**	12.33	7.63	1.01	2.34	22.0	5.10	14.7	1.47	3.53	5.10	26.76
Pyrite Ro Con 2	**144.2**	7.20	5.28	0.94	1.43	8.89	2.78	5.24	1.37	1.89	2.78	8.37
Pyrite Ro Con 3	**229.6**	11.47	3.31	1.06	1.18	8.87	4.98	6.87	1.54	1.31	4.98	9.26
Rougher Tails	**1115.1**	55.69	1.03	0.29	0.33	13.4	6.70	9.38	0.43	0.37	6.70	12.79
Calculated Head	2002.2	100.00	4.27	2.45	1.96	100.00	100.00	100.00	3.54	1.62	100.00	100.00
Direct Head	2000.0	100.00	4.35	2.41	1.91	-	-	-				
Reconciliation	100.1	-	98.3	101.3	103.1	-	-	-				

Test Description:

Test #:	F-5
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	March 14, 2019
Purpose:	Realgar Cleaner - Target 50% As
Feed:	2kg of 100% -10M Conrad
Grind:	p80 = ~76 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Realgar/Orpiment Circuit	Reagents (g/tonne)		Reagents		Time (min)			pH		Ep		
Stage	Diesel	MIBC	Diesel (µl)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind					9.75				7.8		-38	
Re/Or Rougher 1	-	46	-	90		1	4	7.9	7.9	-97	-73	
Re/Or Rougher 2	-	20	-	40		1	4	7.9	7.9	-69	-33	
Re/Or Rougher 3	5	15	10	30		1	4	7.9	7.9	-14	36	~200g
Re/Or Cleaner 1		10	0	20		1	10	7.9	7.9	161	130	~125g
Re/Or Cleaner 2		10	0	20		1	7	7.9	8.0	160	150	~85g
Re/Or Cleaner 3		10	0	20		1	4	7.9	8.0	170	160	~55g
Total	0 5 0	82	0.00 10.0 0.0	160		3	29					

Stage	Rougher	Re/Or Cln 1, 2,3
Flotation Cell	4 litre cell	1 litre cell
RPM	1400	1000
Air (LPM)	Natural	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S	Other Instructions Pulv.?	PSD?	Comments
Re/Or Cln 3 Con	53.3	Y	Y	Y	No	No	
Re/Or Cln 3 Tail	33.26	Y	Y	Y	No	No	
Re/Or Cln 2 Tail	49.15	Y	Y	Y	No	No	
Re/Or Cln 1 Tail	89.5	Y	Y	Y	No	No	
Rougher Tail (cut)	157.43	Y	Y	Y	No	No	
Rougher Tail (cake)	**1616.0**	N	N	N	No	No	

Mass Balance:

Product	Weight		Assays, %,g/t			% Distribution			Grade, %		% Distribution	
	g	%	Au	As	S	Au	As	S	As minerals	Pyrite	As minerals	Pyrite
Re/Or Cln 3 Con	**53.3**	2.67	17.7	46.3	28.4	10.1	76.9	32.2	67.09	14.33	76.87	12.47
Re/Or Cln 3 Tail	**33.3**	1.66	25.3	13.0	14.6	8.98	13.5	10.3	18.82	16.46	13.46	8.94
Re/Or Cln 2 Tail	**49.2**	2.46	15.0	1.34	5.30	7.85	2.05	5.53	1.94	8.81	2.05	7.07
Re/Or Cln 1 Tail	**89.5**	4.48	8.38	0.75	2.70	8.01	2.10	5.13	1.09	4.43	2.10	6.46
Rougher Tails	**1773.4**	88.73	3.43	0.10	1.24	65.1	5.52	46.8	0.14	2.25	5.52	65.07
Calculated Head	1998.6	100.00	4.68	1.61	2.36	100.00	100.00	100.00	2.33	-1.35	100.00	100.00
Direct Head	2000.0	100.00	4.83	1.62	2.22	-	-	-				
Reconciliation	99.9	-	96.9	98.9	106.3	-	-	-				

Test Description:

Test #:	F-6
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	March 21, 2019
Purpose:	As Pre-Float, Pyrite Depression
Feed:	2kg of 100% -10M Osiris
Grind:	p80 = 34 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Arsenic Circuit	Reagents (g/tonne)				Reagents				Time (min)			pH		Ep		
Stage	Lime	Diesel		MIBC	Lime (g)	Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind	500				1.00				30.00				8.7		-149	
Aeration					1.42						10	**10.0**	10.0	-262	-111	
As Rougher 1	40			46	0.08	0		90		1	4	**10.0**	9.6	-109	-73	
As Rougher 2	95			15	0.19	0		30		1	4	**10.0**	9.5	-85	-66	
As Rougher 3	125	5		15	0.25	10		30		1	4	**10.0**	9.4	-87	-67	
Total	760	5	0	77	2.94	10.0	0.0	150		3	22					
Pyrite Circuit	**Reagents (g/tonne)**				**Reagents**				**Time (min)**			**pH**		**Ep**		
Stage	H2SO4		PAX	MIBC	H2SO4 (mL)		PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	
Reduce pH to 8	175				3.50					2		**8.0**	8.0		-64.0	
Pyrite Rougher 1	0		37.5		0.00		3.8	30		1	10	**8.0**	8.1	-64	-74	
Pyrite Rougher 2	50		37.5		1.00		3.8	30		1	10	**8.0**	8.2	-72	-92	
Pyrite Rougher 3	50		75		1.00		7.5	30		1	20	**8.0**	8.1	-82	-73	
Total	225	0	75	0	5.50	0	7.5	60		4	40					

Stage	Rougher
Flotation Cell	4 litre cell
RPM	1400
Air (LPM)	Natural

Reagents:

Lime	100 %
Diesel	100 %
H2SO4	10 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S					Other Instructions Pulv.?	PSD?	Comments
As Ro Con 1	112.48	Y	Y	Y					No	No	
As Ro Con 2	32.56	Y	Y	Y					No	No	
As Ro Con 3	58.48	Y	Y	Y					No	No	
Pyrite Ro Con 1	166.96	Y	Y	Y					No	No	
Pyrite Ro Con 2	108.32	Y	Y	Y					No	No	
Pyrite Ro Con 3	186.34	Y	Y	Y					No	No	
Rougher Tail (cut)	161.47	Y	Y	Y					No	No	
Rougher Tail (cake)	**1180.1**	N	N	N					No	No	

Mass Balance:

Product	Weight g	%	Assays, %,g/t Au	As	S	% Distribution Au	As	S	Grade, % As minerals	Pyrite	% Distribution As minerals	Pyrite
As Ro Con 1	**112.5**	5.61	21.7	29.0	16.1	27.8	68.9	44.6	41.95	5.87	68.93	18.08
As Ro Con 2	**32.6**	1.62	29.9	8.40	9.87	11.1	5.79	7.90	12.17	11.43	5.79	10.19
As Ro Con 3	**58.5**	2.91	21.5	3.28	8.31	14.3	4.06	11.9	4.75	12.82	4.06	20.53
Pyrite Ro Con 1	**167.0**	8.32	11.4	1.28	3.70	21.7	4.52	15.2	1.85	5.85	4.52	26.78
Pyrite Ro Con 2	**108.3**	5.40	3.17	0.64	0.78	3.91	1.47	2.07	0.93	0.92	1.47	2.74
Pyrite Ro Con 3	**186.3**	9.29	2.36	0.52	0.73	5.00	2.05	3.34	0.75	0.93	2.05	4.75
Rougher Tails	**1341.6**	66.85	1.06	0.46	0.45	16.2	13.2	15.0	0.67	0.46	13.18	16.93
Calculated Head	2006.7	100.00	4.38	2.35	2.03	100.00	100.00	100.00	3.41	1.82	100.00	100.00
Direct Head	2000.0	100.00	4.35	2.41	1.91	-	-	-				
Reconciliation	100.3	-	100.7	97.5	106.3	-	-	-				

Test Description:

Test #:	F-7
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	March 21, 2019
Purpose:	As Pre-Float, Pyrite Depression
Feed:	2kg of 100% -10M Osiris
Grind:	p80 = 34 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Arsenic Circuit	Reagents (g/tonne)				Reagents				Time (min)			pH		Ep		
Stage	Lime	Diesel	NaCN	MIBC	Lime (g)	Diesel (µl)	NaCN (mL)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind	750		50		1.50		5.0		30.00				9.0		-263	
As Rougher 1	185			46	0.37	0		90		1	4	**10.0**	9.5	-317	-211	
As Rougher 2	90			15	0.18	0		30		1	4	**10.0**	9.6	-212	-159	
As Rougher 3	95	5		15	0.19	10		30		1	4	**10.0**	9.5	-172	-127	
Total	1120	5	50	77	2.24	10.0	5.0	150		3	12					
Pyrite Circuit	**Reagents (g/tonne)**				**Reagents**				**Time (min)**			**pH**		**Ep**		
Stage	H2SO4		PAX	MIBC	H2SO4 (mL)		PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	
	320				3.20								8.0	-202	-136	
Pyrite Rougher 1	0		37.5		0.00		3.8	30		1	10	**8.0**	8.3	-135	-120	
Pyrite Rougher 2	100		37.5		1.00		3.8	30		1	10	**8.0**	8.2	-107	-104	
Pyrite Rougher 3	80		75		0.80		7.5	30		1	20	**8.0**	8.1	-80	-56	
Total	420	0	75	0	5.00	0	7.5	60		2	20					

Stage	Rougher
Flotation Cell	4 litre cell
RPM	1400
Air (LPM)	Natural

Reagents:

Lime	100 %
NaCN	2 %
Diesel	100 %
H2SO4	20 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S					Other Instructions Pulv.?	PSD?	Comments
As Ro Con 1	99.32	Y	Y	Y					No	No	
As Ro Con 2	67.69	Y	Y	Y					No	No	
As Ro Con 3	55.6	Y	Y	Y					No	No	
Pyrite Ro Con 1	138.65	Y	Y	Y					No	No	
Pyrite Ro Con 2	171.15	Y	Y	Y					No	No	
Pyrite Ro Con 3	185.86	Y	Y	Y					No	No	
Rougher Tail (cut)	140.34	Y	Y	Y					No	No	
Rougher Tail (cake)	**1147.9**	N	N	N					No	No	

Mass Balance:

Product	Weight g	%	Assays, %,g/t Au	As	Fe	S	% Distribution Au	As	Fe	S	Grade, % As minerals	Pyrite	% Distribution As minerals	Pyrite
As Ro Con 1	**99.3**	4.95	19.6	34.2	2.11	17.7	22.9	69.2	6.76	43.7	49.49	4.36	69.15	12.75
As Ro Con 2	**67.7**	3.37	15.0	4.92	2.67	4.51	12.0	6.79	5.83	7.60	7.13	4.31	6.79	8.59
As Ro Con 3	**55.6**	2.77	13.5	3.50	3.15	4.78	8.83	3.96	5.65	6.62	5.06	6.02	3.96	9.85
Pyrite Ro Con 1	**138.7**	6.91	8.45	1.36	3.16	3.54	13.8	3.84	14.1	12.2	1.97	5.49	3.84	22.39
Pyrite Ro Con 2	**171.2**	8.53	4.58	0.62	2.03	1.71	9.23	2.16	11.2	7.27	0.90	2.68	2.16	13.48
Pyrite Ro Con 3	**185.9**	9.26	5.34	0.70	1.92	1.52	11.7	2.63	11.5	7.02	1.01	2.26	2.63	12.34
Rougher Tails	**1288.2**	64.20	1.42	0.44	1.08	0.49	21.5	11.5	44.9	15.6	0.63	0.54	11.45	20.61
Calculated Head	2006.5	100.00	4.23	2.44	1.54	2.00	100.00	100.00	100.00	100.00	3.54	1.69	100.00	100.00
Direct Head	2000.0	100.00	4.35	2.41	1.25	1.91	-	-	-	-				
Reconciliation	100.3	-	97.4	101.3	123.2	105.0	-	-	-	-				

Test Description:

Test #:	F-8
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	March 29, 2019
Purpose:	As Pre-Float, Pyrite Depression
Feed:	2kg of 100% -10M Osiris
Grind:	p80 = 47 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Arsenic Circuit	Reagents (g/tonne)				Reagents				Time (min)			pH		Ep		
Stage	Lime	Diesel	NaCN	MIBC	Lime (g)	Diesel (µl)	NaCN (mL)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind	750		50		1.50		5.0		20.30				9.0		-186	
As Rougher 1	185			46	0.37	0		90		1	4	**10.0**	9.5	-279	-192	
As Rougher 2	130			15	0.26	0		30		1	4	**10.0**	9.6	-208	-150	
As Rougher 3	85	5		15	0.17	10		30		1	4	**10.0**	9.7	-161	-110	
As Cleaner 1	60			15	0.12	0		30		1	8	**10.0**	9.0	-38	-52	
Total	1150	5	50	77	2.30	10.0	5.0	150		3	20					

Stage	Rougher
Flotation Cell	4 litre cell
RPM	1400
Air (LPM)	Natural

Reagents:	
Lime	100 %
NaCN	2 %
Diesel	100 %
H2SO4	20 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	Take cut of As Cleaner 1 Con for Assay, remainder to desliming & Superpanning

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S	Other Instructions Pulv.?	PSD?	Comments
Sp Tip	0.2	Y	Y	Y	No	No	
Sp Mid	6.9	Y	Y	Y	No	No	
SP Tail	44.92	Y	Y	Y	No	No	
As Cln 1 Con Slimes	16.15	Y	Y	Y	No	No	
As Cln 1 Con (cut)	36.64	Y	Y	Y	No	No	
As Cln 1 Tail	97.14	Y	Y	Y	No	No	
Rougher Tail (cut)	147.3	Y	Y	Y	No	No	
Rougher Tail (cake)	**1647.2**	N	N	N	No	No	

Mass Balance:

Product	Weight g	%	Assays, %,g/t Au	As	S	% Distribution Au	As	S	Grade, % As minerals	Pyrite	% Distribution As minerals	Pyrite
As Cln 1 Con (cut)	**104.8**	5.25	26.9	35.5	18.7	33.7	74.4	51.8	51.37	5.23	#DIV/0!	#DIV/0!
As Cln 1 Tail	**97.1**	4.87	7.85	1.51	2.16	9.13	2.93	5.53	2.19	2.77	#DIV/0!	#DIV/0!
Rougher Tails	**1794.5**	89.88	2.66	0.63	0.90	57.2	22.7	42.7	0.92	1.16	#DIV/0!	#DIV/0!
Calculated Head	1996.5	100.00	4.18	2.50	1.90	100.00	100.00	100.00	3.63	1.45	#DIV/0!	#DIV/0!
Direct Head	2000.0	100.00	4.83	2.41	2.22	-	-	-				
Reconciliation	99.8	-	86.6	103.7	85.6	-	-	-				

Test Description:

Test #:	F-9
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	April 10, 2019
Purpose:	Arsenic Cleaner/Pyrite Cleaner
Feed:	2kg of 100% -10M Conrad
Grind:	p80 = ~76 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Arsenic Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Diesel		MIBC	Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind							9.75				7.7		54	
As Rougher 1	-		46	-		90		1	4	7.8	7.9	-80	-85	
As Rougher 2	-		20	-		40		1	4	7.9	7.9	-76	-43	
As Rougher 3	5		15	10		30		1	4	7.9	7.9	-31	3	~200g
As Cleaner 1			10	0		20		1	10	7.9	7.9	127	120	
As Cleaner 2			10	0		20		1	7	7.9	8.0	141	140	~100-140g
As Cleaner 3			10	0		20		1	4	7.9	8.0	159	150	~65g
Total	0	5	0 112	0.00	10.0	0.0 220		6	33					

Pyrite Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Lime	PAX	MIBC	Lime (g)	PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	
As Cleaner Tails To Py Ro														
Pyrite Rougher 1		37.5	15		3.8	30		1	10	7.8	7.9	151	99	
Pyrite Rougher 2		37.5	15		3.8	30		1	10	7.9	8.0	109	74	
Pyrite Rougher 3		75	20		7.5	40		1	20	8.0	8.0	100	70	600g
Pyrite Cleaner 1		37.5	0		3.8			1	25	8.0	8.0	140	118	
Pyrite Cleaner 2		15	0		1.5			1	20	8.0	8.0	138	120	
Pyrite Cleaner 3 Con 1		2.5	0		0.3			1	5	8.0	8.0	148	125	
Pyrite Cleaner 3 Con 2		2.5	0		0.3			1	5	8.0	8.0	145	126	
Pyrite Cleaner 3 Con 3		2.5	0		0.3			1	10	8.0	8.1	140	118	
Pyrite Cleaner 3 Con 4		2.5	0		0.3			1	10	8.1	8.2	137	142	~75g
Total	0	0 210	51	0.00	0	21.0 100		8	105					

Stage	Rougher	As Cln 1, 2	Py Cln 1, 2	Py Cln 3
Flotation Cell	4 litre cell	1 litre cell	4 litre cell	2 litre cell
RPM	1400	1000		
Air (LPM)	Natural	Natural	Natural	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S	Fe				Other Instructions Pulv.?	PSD?	Comments
As Cln 3 Con	67.19	Y	Y	Y	Y				No	No	
Py Cln 3 Con 1	28.01	Y	Y	Y	Y				No	No	
Py Cln 3 Con 2	20.53	Y	Y	Y	Y				No	No	
Py Cln 3 Con 3	32.47	Y	Y	Y	Y				No	No	
Py Cln 3 Con 4	48.95	Y	Y	Y	Y				No	No	
Pyrite Cln 3 Tail	39.53	Y	Y	Y	Y				No	No	
Pyrite Cln 2 Tail	62.08	Y	Y	Y	Y				No	No	
Pyrite Cln 1 Tail	437.54	Y	Y	Y	Y				No	No	
Rougher Tail (cut)	111.36	Y	Y	Y	Y				No	No	
Rougher Tail (cake)	**1149.8**	N	N	N	N				No	No	

Mass Balance:

Product	Weight		Assays, %,g/t				% Distribution				Grade, %		% Distribution	
	g	%	Au	As	S	Fe	Au	As	S	Fe	As minerals	Pyrite	As minerals	Pyrite
As Cln 3 Con	**67.2**	3.36	20.3	44.2	25.8	5.69	13.9	87.0	37.1	11.5	63.98	11.19	86.99	12.78
Py Cln 3 Con 1	**28.0**	1.40	33.5	3.62	15.8	12.5	9.52	2.98	9.47	10.6	5.25	26.54	2.98	12.64
Py Cln 3 Con 2	**20.5**	1.03	30.9	3.26	15.0	12.4	6.44	1.96	6.61	7.66	4.72	25.44	1.96	8.88
Py Cln 3 Con 3	**32.5**	1.63	32.9	2.82	14.9	12.4	10.8	2.68	10.4	12.1	4.08	25.65	2.68	14.16
Py Cln 3 Con 4	**49.0**	2.45	32.0	1.52	12.6	10.7	15.9	2.19	13.2	15.7	2.21	22.34	2.19	18.59
Pyrite Cln 3 Tail	**39.5**	1.98	21.4	0.42	6.29	5.80	8.60	0.49	5.33	6.90	0.61	11.44	0.49	7.69
Pyrite Cln 2 Tail	**62.1**	3.11	8.61	0.22	2.37	2.28	5.42	0.41	3.16	4.26	0.32	4.26	0.41	4.50
Pyrite Cln 1 Tail	**437.5**	21.90	3.34	0.09	0.87	1.02	14.8	1.15	8.13	13.4	0.13	1.55	1.15	11.53
Rougher Tails	**1261.2**	63.14	1.14	0.03	0.24	0.47	14.6	1.15	6.58	17.9	0.04	0.43	1.15	9.23
Calculated Head	1997.5	100.00	4.93	1.71	2.34	1.66	100.00	100.00	100.00	100.00	2.47	2.94	100.00	100.00
Direct Head	2000.0	100.00	4.83	1.62	2.22	1.56	-	-	-	-	2.35	2.79	0.00	0.00
Reconciliation	99.9	-	102.2	105.1	105.5	106.6	-	-	-	-				

Test Description:

Test #:	F-10
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	May 16, 2019
Purpose:	Arsenic Cleaner/Pyrite Rougher
Feed:	2kg of 100% -10M Conrad 2
Grind:	p80 = 89 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Arsenic Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Diesel		MIBC	Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind							10'45"				7.9		-157	
As Rougher 1	-		46	-		90		1	4	7.9	8.0	-155	-117	
As Rougher 2	-		20	-		40		1	4	8.0	8.0	-119	-84	
As Rougher 3	15		61	30		120		1	16	8.0	8.1	-82	-3	730g
As Cleaner 1			10	0		20		1	10	8.1	8.1	114	76	495g
As Cleaner 2			10	0		20		1	7	8.1	8.1	159	120	315g
As Cleaner 3			10	0		20		1	4	8.1	8.1	146	91	200g
Total	0	15	0 158	0.00	30.0	0.0 310		6	45					

Pyrite Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Lime	PAX	MIBC	Lime (g)	PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	
As Cleaner Tails To Py Ro														
Pyrite Rougher 1		48	15		4.8	30		1	10	8.0	8.2	170	18	
Pyrite Rougher 2		48	15		4.8	30		1	10	8.2	8.2	30	-14	
Pyrite Rougher 3		96	20		9.6	40		1	20	8.2	8.3	10	-22	775g
Total	0	0 193	51	0.00	0 19.3	100		3	40					

Stage	Rougher	As Cln 1	As Cln 2,3	
Flotation Cell	4 litre cell	4 litre cell	2 litre cell	
RPM	1400	1400	1200	
Air (LPM)	Natural	Natural	Natural	

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S					Other Instructions Pulv.?	PSD?	Comments
As Cln 3 Con	238.24	Y	Y	Y					No	No	
Pyrite Ro Con 1	198.61	Y	Y	Y					No	No	
Pyrite Ro Con 2	228.8	Y	Y	Y					No	No	
Pyrite Ro Con 3	362.73	Y	Y	Y					No	No	
Rougher Tail (cut)	357.04	Y	Y	Y					No	Yes	
Rougher Tail (cake)	**739.7**	N	N	N					No	No	

Mass Balance:

Product	Weight		Assays, %,g/t					% Distribution					Grade, %		% Distribution	
	g	%	Au	As	S	Fe		Au	As	S	Fe		As minerals	Pyrite	As minerals	Pyrite
As Cln 3 Con	**238.2**	11.21	19.8	51.7	26.4	3.12		25.3	96.5	68.4	20.5		74.92	6.02	96.50	22.03
Pyrite Ro Con 1	**198.6**	9.35	27.5	0.84	7.40	6.32		29.3	1.31	16.0	34.5		1.22	13.16	1.31	40.14
Pyrite Ro Con 2	**228.8**	10.77	17.8	0.54	3.27	2.88		21.9	0.96	8.13	18.1		0.78	5.68	0.96	19.96
Pyrite Ro Con 3	**362.7**	17.07	7.84	0.24	1.27	1.30		15.3	0.68	5.01	13.0		0.34	2.18	0.68	12.16
Rougher Tails	**1096.8**	51.61	1.41	0.06	0.21	0.46		8.27	0.55	2.50	13.9		0.09	0.34	0.55	5.72
Calculated Head	2125.2	100.00	8.77	6.01	4.33	1.71		100.00	100.00	100.00	100.00		8.70	3.06	100.00	100.00
Direct Head	2000.0	100.00	9.11	5.97	4.59	1.82		-	-	-	-		8.65	3.58	0.00	0.00
Reconciliation	106.3	-	96.3	100.7	94.4	93.8		-	-	-	-					

Test Description:

Test #:	F-11
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	May 16, 2019
Purpose:	Arsenic Cleaner/Pyrite Cleaner
Feed:	2kg of 100% -10M Conrad 2
Grind:	p80 = 65 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Arsenic Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Diesel		MIBC	Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind							11'45"				7.9		-200	
As Rougher 1	-		69	-		135		1	8	7.9	8.0	-200	-68	
As Rougher 2	-		46	-		90		1	8	7.9	8.0	-84	-6	
As Rougher 3	15		46	30		90		1	8	8.0	8.1	-3	29	730g
As Cleaner 1			10	0		20		1	12	8.0	8.1	21	31	495g
As Cleaner 2			10	0		20		1	8	8.1	8.1	43	56	315g
As Cleaner 3			10	0		20		1	6	8.0	8.1	38	41	250g
As Cleaner 4			10	0		20		1	3	8.0	8.1	36	40	200g MAX
Total	0	15	0 202	0.00	30.0	0.0 395	0.00	7	53					

Pyrite Circuit	Reagents (g/tonne)				Reagents				Time (min)			pH		Ep	
Stage	Lime	PAX	MIBC		Lime (g)	PAX (ml)	MIBC (µl)		Grind	Cond.	Froth	(start)	(end)	(start)	(end)
As Cleaner Tails To Py Ro															
Pyrite Rougher 1		48	15			4.8	30			1	10	8.0	8.1	73	14
Pyrite Rougher 2		48	15			4.8	30			1	10	8.1	8.2	32	-22
Pyrite Rougher 3		96	20			9.6	40			1	20	8.2	8.2	1	-37	775g
Pyrite Cleaner 1		48	20			4.8	40			1	25	8.2	8.2	12	20
Pyrite Cleaner 2		24	20			2.4	40			1	20	8.2	8.1	38	21
Pyrite Cleaner 3		15	20			1.5	40			1	2	8.2	8.2	55	-10	100g
Total	0	0 280	112		0.00	0	28.0	220		6	87				

Stage	Rougher	As Cln 1, 2	As Cln 3, 4	Py Cln 1, 2	Py Cln 3
Flotation Cell	4 litre cell	4 litre cell	2 litre cell	4 litre cell	2 litre cell
RPM	1400	1400	1200		
Air (LPM)	Natural	Natural	Natural	Natural	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S					Other Instructions Pulv.?	PSD?	Comments
As Cln 4 Con	220.48	Y	Y	Y					No	No	
Pyrite Cln 3 Con	94.79	Y	Y	Y					No	No	
Pyrite Cln 3 Tail	217.67	Y	Y	Y					No	No	
Pyrite Cln 2 Tail	173.52	Y	Y	Y					No	No	
Pyrite Cln 1 Tail	346.88	Y	Y	Y					No	No	
Rougher Tail (cut)	270.17	Y	Y	Y					No	Yes	
Rougher Tail (cake)	**662.8**	N	N	N					No	No	

Mass Balance:

Product	Weight		Assays, %,g/t					% Distribution					Grade, %		% Distribution	
	g	%	Au	As	S			Au	As	S			As minerals	Pyrite	As minerals	Pyrite
As Cln 4 Con	**220.5**	11.10	17.6	52.5	27.7			20.5	93.4	65.1			76.12	7.66	93.37	23.70
Pyrite Cln 3 Con	**94.8**	4.77	43.1	4.58	13.1			21.6	3.50	13.3			6.64	20.72	3.50	27.55
Pyrite Cln 3 Tail	**217.7**	10.96	33.3	1.15	6.87			38.3	2.02	16.0			1.67	11.91	2.02	36.36
Pyrite Cln 2 Tail	**173.5**	8.74	7.02	0.20	0.99			6.44	0.28	1.84			0.29	1.70	0.28	4.13
Pyrite Cln 1 Tail	**346.9**	17.46	3.84	0.14	0.53			7.05	0.39	1.97			0.20	0.88	0.39	4.29
Rougher Tails	**933.0**	46.97	1.24	0.06	0.19			6.12	0.44	1.87			0.09	0.30	0.44	3.96
Calculated Head	1986.3	100.00	9.52	6.24	4.72			100.00	100.00	100.00			9.05	3.59	100.00	100.00
Direct Head	2000.0	100.00	9.11	5.97	4.59			-	-	-			8.65	3.58	0.00	0.00
Reconciliation	99.3	-	104.6	104.6	102.8			-	-	-						

Test Description:

Test #:	F-12
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	June 10, 2019
Purpose:	Arsenic Cleaner/Pyrite Rougher
Feed:	2kg of 100% -10M Conrad 2
Grind:	p80 = 65 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Arsenic Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Diesel		MIBC	Diesel (µl)		MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	Target
Primary Grind							11'45"				7.9		-173	
As Rougher 1	-		69	-		135		1	8	7.9	8.1	-176	-70	
As Rougher 2	-		46	-		90		1	8	8.0	8.1	-69	-14	
As Rougher 3	15		46	30		90		1	8	8.1	8.2	-35	24	730g
As Cleaner 1			10	0		20		1	12	8.1	8.2	65	69	495g
As Cleaner 2			10	0		20		1	8	8.1	8.2	106	100	315g
As Cleaner 3			10	0		20		1	5	8.0	8.1	108	79	250g
As Cleaner 4			10	0		20		1	1	8.0	8.1	89	52	180g MAX
Total	0	15	0 202	0.00	30.0	0.0 395	0.00	7	50					

Pyre Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
Stage	Lime	PAX	MIBC	Lime (g)	PAX (ml)	MIBC (µl)	Grind	Cond.	Froth	(start)	(end)	(start)	(end)	
As Cleaner Tails To Py Ro											8.1		115	
Pyrite Rougher 1		48	31		4.8	60		1	10	8.1	8.2	111	53	
Pyrite Rougher 2		48	31		4.8	60		1	10	8.2	8.3	60	6	
Pyrite Rougher 3		96	20		9.6	40		1	20	8.2	8.4	21	-14	775g
Total	0	0 280	143	0.00	0	28.0 280		6	87					

Stage	Rougher	As Cln 1, 2	As Cln 3, 4	Py Cln 1, 2	Py Cln 3
Flotation Cell	4 litre cell	4 litre cell	2 litre cell	4 litre cell	2 litre cell
RPM	1400	1400	1200		
Air (LPM)	Natural	Natural	Natural	Natural	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S	Other Instructions Pulv.?	PSD?	Comments
As Cln 4 Con	173.73	Y	Y	Y	No	No	
Pyrite Ro Con 1	401.92	Y	Y	Y	No	No	
Pyrite Ro Con 2	236.77	Y	Y	Y	No	No	
Pyrite Ro Con 3	264.29	Y	Y	Y	No	No	
Rougher Tail (cut)	119.53	Y	Y	Y	No	No	
Rougher Tail (cake)	**787.7**	N	N	N	No	No	

Mass Balance:

Product	Weight		Assays, %,g/t			% Distribution			Grade, %		% Distribution	
	g	%	Au	As	S	Au	As	S	As minerals	Pyrite	As minerals	Pyrite
As Cln 4 Con	**173.7**	8.76	18.3	55.4	27.6	17.0	79.6	54.5	80.28	5.18	79.62	14.20
Pyrite Ro Con 1	**401.9**	20.26	23.5	5.57	7.43	50.5	18.5	33.9	8.06	9.24	18.50	58.54
Pyrite Ro Con 2	**236.8**	11.93	12.9	0.47	2.38	16.3	0.91	6.39	0.67	4.07	0.91	15.20
Pyrite Ro Con 3	**264.3**	13.32	6.41	0.22	1.03	9.06	0.48	3.09	0.32	1.74	0.48	7.27
Rougher Tails	**907.2**	45.73	1.48	0.06	0.21	7.18	0.48	2.14	0.09	0.34	0.48	4.80
Calculated Head	1983.9	100.00	9.43	6.09	4.44	100.00	100.00	100.00	8.83	3.20	100.00	100.00
Direct Head	2000.0	100.00	9.11	5.97	4.59	-	-	-	8.65	3.58	0.00	0.00
Reconciliation	99.2	-	103.6	102.1	96.8	-	-	-				

Test Description:

Test #:	F-13
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	June 18, 2019
Purpose:	Arsenic Cleaner/Pyrite Rougher
Feed:	2kg of 100% -10M Conrad 2
Grind:	p80 = 65 µm Mill #1/ Charge #3
Comments:	

Flotation Schedule:

Arsenic Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
	Diesel		MIBC	Diesel		MIBC	Grind	Cond.	Froth					
Stage				(µl)		(µl)				(start)	(end)	(start)	(end)	Target
Primary Grind							11'45"				7.9		-219	
As Rougher 1	-		69	-		135		1	8	7.9	8.0	-209	-80	
As Rougher 2	-		46	-		90		1	8	8.0	8.1	-61	19	
As Rougher 3	15		69	30		135		1	10	8.0	8.2	12	59	730g
Regrind (Ceramic Jar Mill)							30.00							
As Cleaner 1			10	0		20		1	12	8.2	8.1	41	139	495g
As Cleaner 2			10	0		20		1	8	8.1	8.1	140	138	315g
As Cleaner 3			10	0		20		1	6	8.0	8.1	135	120	250g
As Cleaner 4			10	0		20		1	2	8.0	8.0	121	119	180g MAX
Total	0	15	0 224	0.00	30.0	0.0 440	30.00	7	54					

Pyrite Circuit	Reagents (g/tonne)			Reagents			Time (min)			pH		Ep		
	Lime	PAX	MIBC	Lime	PAX	MIBC	Grind	Cond.	Froth					
Stage				(g)	(ml)	(µl)				(start)	(end)	(start)	(end)	
Do NOT Recycle As Tails														
Pyrite Rougher 1		48	15		4.8	30		1	10	8.2	8.3	70	24	
Pyrite Rougher 2		48	15		4.8	30		1	10	8.3	8.3	32	-7	
Pyrite Rougher 3		96	41		9.6	80		1	20	8.3	8.4	-5	-19	775g
Total	0	0 280	133	0.00	0	28.0 260		6	87					

Stage	Rougher	As Cln 1, 2	As Cln 3, 4
Flotation Cell	4 litre cell	4 litre cell	2 litre cell
RPM	1400	1400	1200
Air (LPM)	Natural	Natural	Natural

Reagents:

Diesel	100 %
PAX	2 %
MIBC	100 %
Charge	2000 g

Observations:	

Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au	As	S	C spec				Other Instructions Pulv.?	PSD?	Comments
As Cln 4 Con	171.27	Y	Y	Y	Y				No	No	
As Cln 4 Tail	62.86	Y	Y	Y	Y				No	No	
As Cln 3 Tail	14.5	Y	Y	Y	Y				No	No	
As Cln 2 Tail	51.76	Y	Y	Y	Y				No	No	
As Cln 1 Tail	417.3	Y	Y	Y	Y				No	No	
Pyrite Ro Con 1	211.57	Y	Y	Y	Y				No	No	
Pyrite Ro Con 2	117.57	Y	Y	Y	Y				No	No	
Pyrite Ro Con 3	225.97	Y	Y	Y	Y				No	No	
Rougher Tail (cut)	118.26	Y	Y	Y	Y				No	No	
Rougher Tail (cake)	**598.3**	N	N	N	N				No	No	

Mass Balance:

Product	Weight		Assays, %,g/t					% Distribution					Grade, %		% Distribution	
	g	%	Au	As	S	Ctotal	Corg	Au	As	S	Ctotal	Corg	As minerals	Pyrite	As minerals	Pyrite
As Cln 4 Con	**171.3**	8.61	16.5	56.7	25.3	1.08	0.92	15.5	76.4	47.7	1.44	25.7	82.22	-0.42	76.42	-1.13
As Cln 4 Tail	**62.9**	3.16	28.0	41.3	28.9	2.14	1.53	9.69	20.4	20.0	1.04	15.6	59.85	19.36	20.42	19.29
As Cln 3 Tail	**14.5**	0.73	48.1	2.43	11.2	3.98	1.34	3.84	0.28	1.79	0.45	3.17	3.52	19.00	0.28	4.37
As Cln 2 Tail	**51.8**	2.60	26.0	0.82	5.04	5.30	0.65	7.40	0.33	2.87	2.13	5.49	1.18	8.77	0.33	7.19
As Cln 1 Tail	**417.3**	20.98	7.82	0.31	1.80	6.81	0.24	17.9	1.03	8.26	22.0	16.0	0.45	3.10	1.03	20.52
Pyrite Ro Con 1	**211.6**	10.64	23.2	0.48	5.84	4.76	0.44	27.0	0.80	13.6	7.82	15.3	0.70	10.54	0.80	35.33
Pyrite Ro Con 2	**117.6**	5.91	12.5	0.25	2.02	5.58	0.26	8.06	0.23	2.62	5.08	4.88	0.36	3.58	0.23	6.67
Pyrite Ro Con 3	**226.0**	11.36	5.08	0.14	0.83	6.82	0.15	6.31	0.24	2.07	12.0	5.37	0.20	1.44	0.24	5.17
Rougher Tails	**716.5**	36.02	1.06	0.05	0.14	8.65	0.07	4.17	0.25	1.12	48.1	8.51	0.07	0.23	0.25	2.60
Calculated Head	1989.3	100.00	9.14	6.39	4.56	6.48	0.31	100.00	100.00	100.00	100.00	100.00	9.26	3.17	100.00	100.00
Direct Head	2000.0	100.00	9.11	5.97	4.59	6.85	0.26	-	-	-	-	-	8.65	3.58	0.00	0.00
Reconciliation	99.5	-	100.4	107.1	99.4	94.6	116.9	-	-	-	-	-				

Test ID	Product	Weight	Assays, %,g/t		
		g	Au	As	S
F-10	Pyrite Ro Con 1	**191.6**	27.5	0.84	7.40
	Pyrite Ro Con 2	**221.1**	17.8	0.54	3.27
	Pyrite Ro Con 3	**354.0**	7.84	0.24	1.27
F-11	Pyrite Cln 3 Con	**87.0**	43.1	4.58	13.1
	Pyrite Cln 3 Tail	**209.6**	33.3	1.15	6.87
	Pyrite Cln 2 Tail	**163.9**	7.02	0.20	0.99
	Pyrite Cln 1 Tail	**328.0**	3.84	0.14	0.53
F-13	Pyrite Ro Con 1	**187.5**	23.2	0.48	5.84
	Pyrite Ro Con 2	**95.0**	12.5	0.25	2.02
	Pyrite Ro Con 3	**200.7**	5.08	0.14	0.83
	Combined Con	**2038**	**15.5**	**0.60**	**3.42**

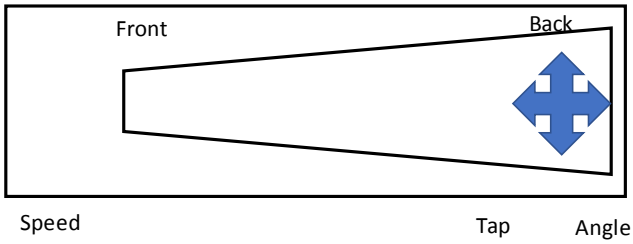
APPENDIX D – GRAVITY

Test Description:

Test #:	SP-1		
Project #:	PJ5270 - ATAC		
Operator:	JF		
Date:			
Purpose:	Pyrite Separation		
Feed:	F-4 As Rougher Concentrate	**Initial Weight:**	29.13 g
Grind:			
Comments:			

Conditions	Start	End
Speed	**15**	**30**
Angle	**1.5**	**4**
Tap	**2**	**7**
Throw (Front*)	**1**	**12**
Throw (Back*)	**16**	**16**

*Position on teeth



Sample Prep Instructions:

Product	Weight (g)	Requested Assays Au			Other Instructions Pulv.?	PSD?	Comments
Sp Tip	0.32	Y			No	No	
Sp Mid	7.12	Y			No	No	
Sp Tails	19	Y			No	No	
Sp Slimes	2.67	Y			No	No	Not Recovered

Mass Balance:

Product	Weight g	%	Assays, %,g/t Au			% Distribution Au		
Sp Tip	**0.3**	1.10	137.0			9.87		
Sp Mid	**7.1**	24.46	24.1			38.6		
Sp Tails	**19.0**	65.27	12.1			51.5		
Sp Slimes	**2.7**	9.17				0.00		
Calculated Head	**29.1**	**100.00**	**15.26**			**100.00**		
Direct Head	29.1	100.00	15.02			-		
Reconciliation	99.9	-	101.6			-		

Test Description:

Test #:	F-8
Project #:	PJ5270 - ATAC
Operator:	JF
Date:	March 29, 2019
Purpose:	As Pre-Float, Pyrite Depression
Feed:	2kg of 100% -10M Osiris
Grind:	p80 = 47 µm Mill #1/ Charge #3
Comments:	

Super Panner Balance:

Product	Weight		Assays, %,g/t			% Distribution		
	g	%	Au	As	S	Au	As	S
Sp Tip	**0.2**	0.29	176.8			2.04		
Sp Mid	**6.9**	10.12	42.6	36.0	19.4	17.0	11.0	11.1
SP Tail	**44.9**	65.89	23.1	35.6	18.6	59.9	70.6	69.5
As Cln 1 Con Slimes	**16.2**	23.69	22.6	25.8	14.5	21.1	18.4	19.4
Calculated Head	**68.2**	**100.0**	**25.37**	**33.20**	**17.67**	**100.00**	**100.00**	**100.00**
Direct Head	68.2	100.00	26.86	35.45	18.71	-	-	-
Reconciliation	100.0	-	94.5	93.6	94.4	-	-	-

APPENDIX E – ROASTING

- CONFIDENTIAL -

KPM
Kingston Process Metallurgy Inc.

ATAC PYRITE CONCENTRATE ROASTING AND CYANIDATION

PREPARED BY:
TREVOR LEBEL & JESSICA PICKETT

FOR
BLUE COAST RESEARCH

ATTENTION:
ANDREW KELLY AND ALEX HALL

OCTOBER 21, 2019

Kingston Process Metallurgy Inc.
759 Progress Avenue, Kingston, ON CANADA K7M 6N6
Tel: 613-634-2022 Fax: 613-547-2018

- Confidential -

ATAC PYRITE CONCENTRATE ROASTING AND CYANIDATION

TABLE OF CONTENTS

1 INTRODUCTION....2

2 EXPERIMENTAL PROCEDURE....2

2.1 MINI-KILN ROASTING....2

3 CYANIDATION....3

3.1 EXPERIMENTAL SETUP....4

3.2 EXPERIMENTAL PROCEDURE....4

3.3 RESULTS....4

4 CONCLUSION....5

A APPENDIX....6

Kingston Process Metallurgy Inc.
759 Progress Avenue, Kingston, ON CANADA K7M 6N6
Tel: 613-634-2022 Fax: 613-547-2018

- Confidential -

ATAC PYRITE CONCENTRATE ROASTING AND CYANIDATION

1 Introduction

Kingston Process Metallurgy Inc. (KPM) was requested to complete some roasting and cyanidation work on composite samples of pyrite concentrate containing gold and some arsenic.

Arsenic present in the ore is in the form of realgar, arsenian pyrite, and arsenopyrite. The bulk of the gold was considered refractory due to being locked in pyrite/arsenopyrite. Historical work suggested that the majority of the gold (~90%) was sub microscopic in the pyrite matrix, that no Au was detected in realgar, and that some of the pyrite contained As (arsenian pyrite, but very little if any arsenopyrite). Arsenic in the concentrate could negatively impact gold recovery, so for this reason, KPM's two-stage rotary was chosen to complete the roasting tests. It also allows tests to be completed with a small amount of material.

Three two-stage mini-kiln roasts, each followed by cyanidation and fire assay were planned, to give a sense of the impact of roasting. The goal of these roasts is not necessarily to obtain the best overall recovery, but to learn about the impact of basic parameters. The information obtained will provide: (1) an idea of the potential improvement in gold recovery from roasting, and (2) a set of samples allowing to do a mineralogical study with, to understand the cause of refractoriness (before roasting, after roasting, and after cyanidation).

Overall, the work completed at KPM, detailed in the report includes:

- Three two-stage mini-kiln roasts
- Four CIL cyanidation, 48 hours bottle roll tests (as received and each roast product)
- Fire assay on concentrate received, the 3 roast products, and the 5 cyanidation products

2 Experimental Procedure

2.1 Mini-Kiln Roasting

The 2-stage mini-kiln roasts were completed in KPM's setup, as shown below in Figure 1. A quartz reactor tube was used with a quartz capsule positioned inside an external resistance furnace to provide heating. Stainless steel end-caps provided connections for the thermocouple and gas inlet. The end caps were sealed to the quartz tube with Teflon rings. A motor, chain, and sprocket were used to provide rotation for the mini-kiln.

Kingston Process Metallurgy Inc.
759 Progress Avenue, Kingston, ON CANADA K7M 6N6
Tel: 613-634-2022 Fax: 613-547-2018

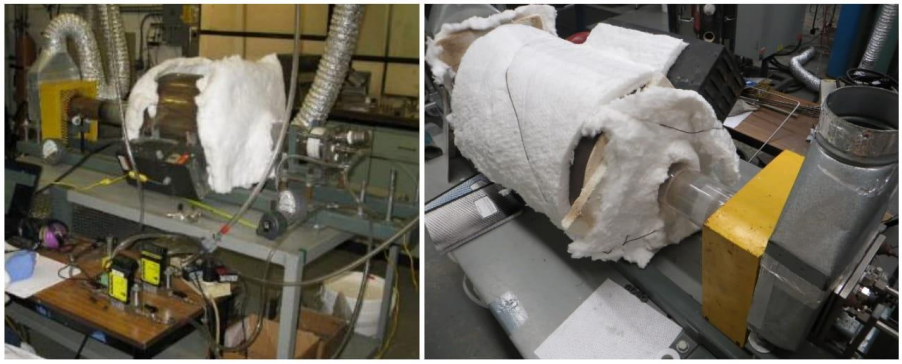


Figure 1 – Rotary mini-kiln setup

The three tests were planned to see the impact between different atmospheric conditions. The test matrix conditions are shown below in Table 1.

Table 1 – Roasting Test Conditions

Test #	Stage 1					Stage 2				
	Description	Temp (°C)	Inlet O_2%	Duration (min)	Flow Rate (L/min)	Description	Temp (°C)	Inlet O_2%	Duration (min)	Flow Rate (L/min)
1	Partial roast to FeS Heat and hold under N_2	525	5%	60	1.1	Dead roast FeS to Fe_2O_3	650	21%	60	1.1
2	Partial roast to FeS Heat under 5% O_2	525	5%	60	1.1	Dead roast FeS to Fe_2O_3	650	21%	60	1.1
3	Partial roast to Fe_3O_4 Heat under 13% O_2	525	13%	60	1.1	Dead roast Fe_3O_4 to Fe_2O_3	650	21%	45	1.1

Conditions for Test 1 and Test 2 were defined to try to keep the oxygen partial pressure in the kiln low. This was done to try to prevent the arsenic in the concentrate from oxidizing to As^{5+}, which is much more likely to form iron arsenate and fix the arsenic in the calcine. Test 1 and Test 2 were the same conditions, except that in Test 1, heating to the Stage 1 target temperature was done under inert conditions, allowing time for As compounds to be released, while in Test 2 was heated with the same inlet O_2 as was used in Stage 1 (5%). Test 3 used higher oxygen in the inlet gas, to see if it was detrimental to the gold recovery.

3 Cyanidation

Cyanidation test setup and procedure are described in this section. Au extraction results from bottle roll tests are also presented.

Kingston Process Metallurgy Inc.
759 Progress Avenue, Kingston, ON CANADA K7M 6N6
Tel: 613-634-2022 Fax: 613-547-2018

- Confidential -

ATAC PYRITE CONCENTRATE ROASTING AND CYANIDATION

3.1 Experimental Setup

Carbon in Leach (CIL) bottle roll cyanidation tests were conducted in 2 L Nalgene bottles. The content in the bottle is mixed by rolling the bottle on a mechanical variable-speed set of rollers. The tests were conducted in a well-ventilated room. pH control is maintained manually, and HCN detectors are used as part of standard personal protective equipment.

3.2 Experimental Procedure

The sample is initially conditioned by mixing with DI water 0.5 hours at 40 RPM on the mechanical rollers, measuring and adjusting to pH > 11.00 using a 200 g/L lime solution, and leaving the bottle to roll overnight, before re-adjusting the pH the next morning. The bottle is rolled for an additional hour. DI water is then added to reach a target pulp density of 30%. Activated carbon is then added at 25 g/L and NaCN is added to the bottle to keep the free cyanide concentration above 1000 ppm. All masses (lime addition, DI water, total mass) are recorded for the duration of the leaching period.

Samples are taken twice daily to measure pH (and make necessary adjustments) and to determine the free cyanide concentration. Free cyanide is determined by titration with 0.01 M silver nitrate solution using rhodamine as an indicator. Any liquid that was taken out of the bottle during sampling is replenished with DI water.

After the 48 hours, the sample is first passed through a 425 µm sieve to collect the active carbon. The remaining sample is filtered using a pressure filter. The active carbon and pressure filter wet cake are washed using DI water. The wet cake and active carbon are dried in an oven. Once dry, the final solids and active carbon are analyzed by fire assay. The filtrate and wash water are also analyzed.

3.3 Results

Table 2 summarizes the CIL cyanidation results.

Table 2 – Fire Assay and Cyanidation Results

Sample	Au			NaCN Consumption (kg/t)
	Assay (g/t)	CIL Extraction	CIL Mass Balance	
Feed	15.20	6%	97%	1.79
Roast 1	15.68	89%	92%	1.38
Roast 2	15.96	89%	98%	1.23
Roast 3	16.06	91%	97%	1.57

Kingston Process Metallurgy Inc.
759 Progress Avenue, Kingston, ON CANADA K7M 6N6
Tel: 613-634-2022 Fax: 613-547-2018

The CIL extraction is very comparable for the three roasting conditions. A slightly higher (91% vs 89%) Au extraction is achieved after roasting with a higher (13%) O_2% inlet in the rotary kiln at 525°C, yielding 91% Au extraction in a bottle roll CIL cyanidation test.

The as-received concentrate bottle roll CIL cyanidation testing resulted in only 6% Au extraction with a 1.79 kg/t NaCN consumption.

4 Conclusion

Overall, all three roast conditions resulted in good Au extraction, with all results in 89% to 91% of Au extraction. At this stage, it appear that roasting of the concentrate allow to access the Au value, but the concentrate does not seems to be very sensitive to the roasting conditions. A single stage, direct roasting could very well provide good recovery while reducing capital and operation costs.

Kingston Process Metallurgy Inc.
759 Progress Avenue, Kingston, ON CANADA K7M 6N6
Tel: 613-634-2022 Fax: 613-547-2018

- Confidential -

ATAC PYRITE CONCENTRATE ROASTING AND CYANIDATION

A. Appendix

KPM
Kingston Process Metallurgy Inc.

MEMORANDUM

TO: Alain Roy
FROM: Elaine Small

DATE: June 27, 2019
CC: Boyd Davis, Jonathan Leung, Trevor LeBel, Ashley Lamey
SUBJECT: **Samples Received – Blue Coast Research – ATAC Pyrite Concentrate P1928 – received 190627**

This memo is to document the reception of samples from Blue Cost Research, Parksville, BC, on June 27, 2019, of ATAC Pyrite Concentrate for our project P1928.

One box containing a double wrapped plastic bag of ATAC Pyrite Concentrate blend sample material, weighing 2,739.68 g, including the packaging was received as shown in Figure 1 and Figure 2. The safety Data Sheet for ATAC Pyrite Concentrate was included in this shipment.

Specific contents are listed below in Table 1.

Table 3 - Sample List

Sample No.	Sample Description	Mass of Sample, envelope (g)	Instructions as seen on bag
Project # 5270	ATAC Pyrite Con Blend Source/Material: Conrad 2	2,073 g	Blend well before using

See pictures below

Kingston Process Metallurgy Inc.
759 Progress Avenue, Kingston, ON CANADA K7M 6N6
Tel: 613-634-2022 Fax: 613-547-2018



Figure 2 – One box of sample material from Blue Coast Research weighing 2,739 g

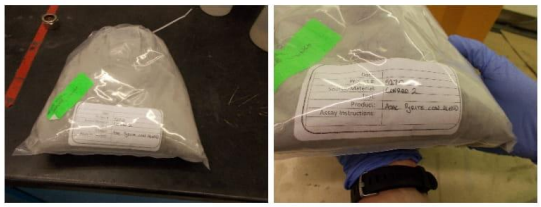


Figure 3 – Project# 5270, Source/Material Conrad 2,
ATAC Pyrite Con Blend weighing 2,073 g

Kingston Process Metallurgy Inc.
759 Progress Avenue, Kingston, ON CANADA K7M 6N6
Tel: 613-634-2022 Fax: 613-547-2018

APPENDIX V

GEOTECHNICAL ANALYSIS REPORT

REPORT

Osiris Project, Rackla Gold Property, Yukon, Canada

Scoping-level Pit Slope Evaluation

Submitted to:

ATAC Resources Limited
1016 - 510 West Hastings Street
Vancouver, BC
V6B 1L8

Attention: Mr. Graham Downs

Submitted by:

Golder Associates Ltd.
Suite 200 - 2920 Virtual Way, Vancouver,
British Columbia, V5M 0C4, Canada

+1 604 296 4200

Reference No. 18100420-002-R-Rev0-4000

30 September 2019



Distribution List

Electronic Copy - Graham Downs, ATAC Resources Limited

Electronic Copy - Andrew Carne, Archer, Cathro & Associates (1981) Limited

Electronic Copy - Golder Associates Inc., Reno Office

Electronic Copy - Golder Associates Ltd., Vancouver Office

Study Limitations

Golder Associates Ltd. (Golder) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

This document, including all text, data, tables, plans, figures, drawings and other documents contained herein, has been prepared by Golder for the sole benefit of ATAC Resources Limited (ATAC). It represents Golder's professional judgement based on the knowledge and information available at the time of completion. Golder is not responsible for any unauthorized use or modification of this document. All third parties relying on this document do so at their own risk.

The factual data, interpretations, suggestions, recommendations and opinions expressed in this document pertain to the specific project, site conditions, design objective, development and purpose described to Golder by ATAC, and are not applicable to any other project or site location. In order to properly understand the factual data, interpretations, suggestions, recommendations and opinions expressed in this document, reference must be made to the entire document.

This document, including all text, data, tables, plans, figures, drawings and other documents contained herein, as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder. ATAC may make copies of the document in such quantities as are reasonably necessary for those parties conducting business specifically related to the subject of this document or in support of or in response to regulatory inquiries and proceedings. Electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore no party can rely solely on the electronic media versions of this document.

Table of Contents

STUDY LIMITATIONS ..... **ii**

1.0 INTRODUCTION **1**

1.1 Scope of Work 1

1.2 Method of Work 1

1.3 Available Data 2

1.4 Proposed Pit Development 3

2.0 SITE CONDITIONS **4**

2.1 Topography, Vegetation, and Glaciation 4

2.2 Climate 5

2.3 Regional Geology 5

2.4 Site Geology 5

2.4.1 Lithology 6

2.4.2 Geologic Structure 7

2.4.2.1 Major Geologic Structures 7

2.4.2.2 Minor Geologic Structures 8

2.4.3 Rock Alteration 9

2.4.4 Mineralization 9

2.4.5 Weathering 10

2.5 Hydrogeology 10

3.0 GEOTECHNICAL DATA REVIEW **11**

3.1 Surface Geologic Mapping 11

3.2 Corehole Data 12

3.3 Point Load Testing 15

3.4 Core Orientation 16

3.5 Golder Site Visit 16

3.5.1 Core Logging Procedure Review 17

3.5.2 Exploration Corehole Review 17

3.5.3 Outcrop Mapping and Observations 18
4.0 GEOTECHNICAL CHARACTERIZATION 20
4.1 Intact Rock Strength 20
4.1.1 International Society of Rock Mechanics Intact Rock Strength Estimation 20
4.1.2 Point Load Testing Data 23
4.2 Rock Fracturing 24
4.3 Structural Geology 25
4.3.1 Major Structures 26
4.3.2 Minor Structures 26
4.3.3 Structural Domains 27
4.4 Rock Mass Rating 29
4.5 Weathering 33
4.6 Geotechnical Units 34
5.0 PIT SLOPE DESIGN CONSIDERATIONS 36
5.1 Slope Design Definitions 36
5.2 Rock Slope Failure Mechanisms 37
5.2.1 Structurally Controlled Failure Mechanisms 37
5.2.2 Overall Rock Mass Failure Mechanisms 38
6.0 SCOPING-LEVEL PIT SLOPE EVALUATION 39
6.1 Structurally Controlled Stability 39
6.1.1 Large-scale Structurally Controlled Stability 39
6.1.2 Bench-scale Stability 40
6.2 Overall Rock Mass Slope Stability 41
6.2.1 Strength Parameters 41
6.2.2 Design Material Properties 42
6.2.2.1 Rock Mass 42
6.2.2.2 Weathered Zone 43
6.2.2.3 Discontinuity Shear Strength 43
6.2.2.4 Hydrogeological Conditions 44

6.2.3 Overall Pit Slope Rock Mass Slope Stability Analyses 44

7.0 SCOPING-LEVEL PIT SLOPE DESIGN 47

8.0 CONCLUSIONS 51

8.1 General 51

8.2 Risks 51

8.3 Opportunities 52

9.0 RECOMMENDED GEOTECHNNICAL PROGRAM TO SUPPORT PRE-FEASIBILITY PIT SLOPE DESIGN 53

9.1 Geologic Modelling 53

9.2 Exploration Core Drilling 54

9.3 Geotechnical Drilling 54

9.3.1 Geotechnical Core Logging 54

9.3.2 Core Orientation 55

9.3.3 Drillhole Surveys 55

9.3.4 Field Strength Testing 56

9.3.5 Laboratory Testing 56

9.4 Surface Mapping 56

9.5 Pre-Feasibility Level Analyses and Pit Slope Design 56

10.0 CLOSING 57

REFERENCES 59

TABLES

Table 1: Approximate Dimensions of the Proposed Pits 3

Table 2: Site Lithology Descriptions 6

Table 3: Osiris Project Structure Type Codes 8

Table 4: Summary of Geotechnical Data Status for Scoping-level Pit Slope Evaluation 11

Table 5: Summary of Surface Mapping Structural Orientations 12

Table 6: Rock Unit Drilled Length and Average Recovery for the Osiris Exploration Coreholes 13

Table 7: Summary of Point Load Test Strength Index Results by Pit and Rock Unit 15

Table 8: Engineering Geology Descriptions of Rock Units from Outcrop Observations 19

Table 9: Osiris Project and ISRM Intact Rock Strength Classifications 20
Table 10: Average Rock Strength Field Estimates by Pit and Rock Unit....21
Table 11: Average Unconfined Compressive Strength Estimates from Is_{50} by Pit and Rock Unit....23
Table 12: Summary of Rock Quality Designation (RQD) System 24
Table 13: Average Rock Quality Designation by Pit and Rock Unit....24
Table 14: Average Orientation of Minor Structures by Domain....28
Table 15: Summary of Rock Massing Rating (RMR_{76}) System[(a)]....30
Table 16: Average Rock Massing Rating (RMR_{76}) by Pit and Rock Unit....31
Table 17: Average Geological Strength Index (GSI) by Rock Unit 32
Table 18: Osiris Project Weathering Classification 33
Table 19: Summary of Average Geotechnical Parameters for the Weathered Zone Rocks by Pit....34
Table 20: Summary of Geotechnical Engineering Properties of the Osiris Project Geotechnical Units 35
Table 21: Summary of Scoping-level Overall Slope Stability Analyses – Critical Cross-sections 44
Table 22: Summary of Scoping Level Slope Stability Analyses – General Cross-sections 46
Table 23: Inter-ramp Slope Angle Based on Bench Configuration 48

FIGURES

Figure 1: Project Location....62
Figure 2: Proposed Pit Developments....63
Figure 3: Interaction of Proposed Pits and Seasonal Creeks....64
Figure 4: Osiris Valley Observed Lobate Features 65
Figure 5: Proposed Conrad Pit Geology Cross-section 66
Figure 6: Proposed Osiris, Sunrise, and Ibis Pits Geology Cross-section 67
Figure 7: Bedrock Geology Map....68
Figure 8: Stratigraphic Column....69
Figure 9: Osiris Project Pit Shells with Projected Geology Plan View....70
Figure 10: Conrad Pit with Projected Geology Plan View 71
Figure 11: Osiris Pit with Projected Geology Plan View....72
Figure 12: Sunrise Pit with Projected Geology Plan View....73
Figure 13: Ibis Pit with Projected Geology Plan View 74
Figure 14: Weathered Zone for All Pits Plan View 75
Figure 15: Osiris Project Structural Domains Plan View 76

Figure 16: Structurally Controlled Failure Mechanisms in Rock Slopes 77

Figure 17: Overall Rock Mass Failure Mechanism.....78

Figure 18: Osiris Project Scoping Level Pit Slope Design Domains Plan View 79

APPENDICES

APPENDIX A
Site Photographs

APPENDIX B
Surface Mapping Data

APPENDIX C
Geotechnical Cross-sections

APPENDIX D
Oriented Core Data

APPENDIX D1
Stereographic Projections by Exploration Corehole

APPENDIX D2
Stereographic Projections by Proposed Pit

APPENDIX E
Downhole Plots

APPENDIX F
Core Review

APPENDIX G
Outcrop Mapping

APPENDIX G1
Discontinuity Survey Data Sheets

APPENDIX G2
Rock Mass Description Data Sheets

APPENDIX H
Rock Exposure and Core Photographs of Osiris Rock Units

APPENDIX I
Core Photographs of Weathered Zone Rocks

APPENDIX J
Scoping-level Pit Slope Stability Analyses

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) is pleased to provide this geotechnical data review and scoping-level design recommendations for ATAC Resources Limited's (ATAC) Osiris Project. The Osiris Project is a gold exploration property located in the Yukon Territory, Canada (Figure 1). No previous pit slope geotechnical studies have been performed for the Osiris Project to Golder's knowledge. This report presents the following:

- a summary of the scope of work, method of work, and available data (Sections 1.1 to 1.3)
- a description of the proposed pit developments (Section 1.4)
- a description of the site conditions (Section 2.0)
- a review of the available geotechnical data relevant to a pit slope evaluation (Section 3.0)
- a description of the geotechnical characterization (Section 4.0)
- a summary of general pit slope design considerations (Section 5.0)
- a scoping-level pit slope evaluation (Section 6.0)
- scoping-level pit slope design recommendations (Section 7.0)
- conclusions of the geotechnical data review, geotechnical characterization, and the scoping-level pit slope evaluation (Section 8.0)
- recommendations for additional geotechnical investigations to support a pre-feasibility pit slope evaluation (Section 9.0)

1.1 Scope of Work

The scope of work for the project was defined in Golder's Proposal "Geotechnical Review and Site Visit, ATAC Osiris Project, Rackla Gold Property, Yukon, Canada", proposal number P18100420-001-P-Rev0, dated 9 May 2018 (Golder 2018). The scope of work consisted of reviewing available geotechnical data and a site visit. An optional task consisting of preliminary stability analyses and scoping-level pit slope design recommendations was included in the scope of work. On 11 May 2018 ATAC authorized the scope of work. ATAC authorized Golder to proceed with the optional task on 22 August 2018.

1.2 Method of Work

The method of work outlined in Golder's proposal consisted of:

- collection and review of a geologic model, structural orientation data, point load testing data, core logs, and core photographs provided by ATAC
- a site visit by Golder to review site conditions and the exploration drill core
- development of a preliminary geotechnical model
- preliminary pit slope stability analyses if appropriate

- scoping-level pit slope design recommendations based on available data, any preliminary slope stability analyses, and Golder's experience at similar sites
- recommendations for additional geotechnical studies to support a pit slope design suitable for Pre-Feasibility Study (PFS)
- documentation of Golder's observations, engineering analyses, conclusions, and recommendations in a report

Golder's study was initiated at a kickoff meeting in Golder's Vancouver office on 14 May 2018 that was attended by Julia Lane, Vice President of Exploration for ATAC; Al Chance, Principal Mining Geotechnical Engineer with Golder's Vancouver office; Trevor Tamburri, Mine Engineering and Stability Group with Golder's Vancouver office; and George Lightwood, Senior Geotechnical Engineer, who participated remotely from Golder's Reno office.

Trevor Tamburri visited the Osiris Project site between 23 and 28 June 2018. The purpose of the site visit was to familiarize Golder with the project site, review selected exploration drill core, and observe surface geologic features in the area of the proposed open pits. ATAC's 2018 exploration drilling program was in progress at the time of the site visit. Mr. Tamburri spent two days reviewing exploration drill core, two and a half days in the field mapping rock exposures, and time in the core logging facility reviewing ATAC's exploration core logging procedures. Mr. Tamburri spent one day in the field with Andrew Steiner, a structural geologist with ATAC, and Andrew's field assistant Saadan Khalid, reviewing rock exposure in the proposed pit areas. Julia Lane and Adam Coulter, geologists with ATAC, were on site to describe various aspects of the project and answer Mr. Tamburri's questions. A detailed description of the data reviewed and collected during the site visit is presented in Section 3.5.

1.3 Available Data

Information made available by ATAC to support this review and the scoping-level pit slope recommendations consisted of:

- a NI43-101 technical report (Ristorcelli, et al., 2018)
- reports and publications describing the project and regional geology
- an aerial photograph of the project site dated September 2011
- a database containing geology and geotechnical data from the 280 coreholes drilled by ATAC at the Osiris Project (including 2010 to 2018 exploration drilling data)
- core photographs
- structural orientation data from drill core and outcrop mapping
- point load test data
- a geology model updated following ATAC's 2018 exploration drilling program
- pit shells (ATAC 2018b) for ATAC's maiden inferred mineral resource estimate

Exploration drilling initiated at the project in 2010 consisted primarily of HQ and NQ diamond bit drilled coreholes with some rotary air blast (RAB) holes. Geological and geotechnical data was collected from the recovered diamond drill core and is available for coreholes drilled between 2010 and 2018. As RAB drilling returns cuttings to surface, there are no data applicable to a pit slope evaluation from the RAB drilling and Golder did not receive their data. Structural orientation data was collected by ATAC in forty-nine of the coreholes. Point load testing was also performed on core from some coreholes. No laboratory strength testing data or hydrogeological data has been collected for this project to date.

1.4 Proposed Pit Development

Preliminary pit shells for the Osiris Project that were generated by ATAC from the maiden inferred mineral resource estimate (ATAC 2018b) include four open pits in two areas across the project site (Figure 2). The pit shells were generated with slopes inclined at 45 degrees and were provided to Golder for use in the preliminary pit slope stability analyses. Table 1 summarizes the approximate dimensions of the proposed pits and the height of the highest pit slope at each pit.

Table 1: Approximate Dimensions of the Proposed Pits

Pit	Length[(a)] (metre)	Width[(b)] (metre)	Maximum Crest Elevation (metre)	Minimum Floor Elevation (metre)	Maximum Pit Slope Height (metre)	Highest Pit Slope[(c)]
Conrad	880	760	1830	1102	660	North wall
Osiris	400	195	1656	1442	216	Southwest wall
Sunrise	230	470	1800	1642	140	Southeast wall
Ibis	395	445	1761	1412	134	Northeast wall

(a) Measured from north to south.

(b) Measured from east to west.

(c) Highest pit slope corresponds with maximum pit slope height value.

2.0 SITE CONDITIONS

The Osiris Project is a Carlin-type gold deposit located approximately 180 kilometres east-northeast of Mayo, Yukon Territory, Canada (Figure 1). There are no roads leading to the site, and the project area is typically accessed by a combination of small fixed wing aircraft and helicopter. The following description of site conditions is based on Golder's understanding of the project and review of existing reports.

2.1 Topography, Vegetation, and Glaciation

The Osiris Project is located in the Nadaleen Range of the Selwyn Mountains. The four proposed open pits are located in three separate valleys and drainages (Figure 2). The Conrad Pit is to be separated from the other pits by a north to south trending ridge and located in a valley that drains towards the east, where the drainage intersects a larger valley that drains the Nadaleen Range towards the south to the Stewart River. The Sunrise Pit is to be located along an east-west trending ridge (Osiris Ridge) between the Osiris and Ibis Pits. The Osiris and Ibis Pits are to be located at the head of valleys that drain towards the west and then towards the north to the Nadaleen River. The drainages in which the Conrad, Osiris, and Ibis Pits are to be located carry seasonal creek flows. The creek valleys and the proposed pit outlines are shown on Figure 3.

The ground surface elevation ranges from approximately 1,225 to 1,830 metres in the pit areas, and the existing natural slope angles range from approximately 15 to 45 degrees. Photographs of the project site and the natural slopes at each proposed pit are shown in Appendix A, Figures A-1 to A-4.

The natural slopes in the proposed Conrad Pit area are generally covered with vegetation consisting of moss and low shrubs, with some mature black spruce trees along the lower slopes and scree and rock outcrops along the upper slopes. The other pits are located at higher elevations than the lower slopes of the Conrad Pit, and the slopes are typically covered with moss, low shrubs, and rock scree with no to few trees. The amount of vegetation gradually decreases with increasing elevation. Tree line at the project site is located at approximately 1,500 metres elevation (Ristorcelli, et al., 2018). The slopes above tree line are un-vegetated, with the exception of moss and lichen. Outcrops of bedrock occur along the ridge lines and within actively eroding gullies.

The region was glaciated in the Late Pleistocene (Ristorcelli, et al., 2018). During glaciation, the project site was covered by the Selwyn lobe, a sector of the Cordilleran ice sheet, with regional ice flow towards the west to northwest (Jackson 1989). In general, the natural slopes are talus covered at higher elevations and glacial till is present at lower elevations.

Lobate features and associated tension cracks are observed on the ground surface at the head of the Osiris Valley from the September 2011 aerial photograph (Figure 4). The lobate features and tension cracks likely represent the presence of talus derived rock glaciers. Johnson 1978 describes the different types and drainage systems of rock glaciers in southeast Yukon. The steep north facing slopes at the head of the Osiris Valley are likely the source area for the material that has formed the lobate features. It appears that flow has occurred towards the north and north-northwest based on the presence of tension cracks and the general geomorphology of the surface soils in this area, however, it is not known if the features are still displacing. The Osiris Pit is proposed to be excavated in the area of these small rock glaciers.

2.2 Climate

The Osiris Project site is in subarctic climate zone. Winters are long and cold with below freezing temperatures for about 230 days each year. The project area is typically snow free from June to September. Historical weather records from the past 30 years in Mayo indicate that the average daytime temperature in January is -21˚C, dropping to -31˚C at night (Ristorcelli, et al., 2018). In July the daytime average temperature is 23˚C, dropping to 9˚C at night. Annual precipitation is 313 mm on average, with 205 mm of rain and 147 mm of snow.

The site is located within the zone of discontinuous permafrost (Jackson 1989). Permafrost is typically encountered on north-facing slopes which are tree and moss-covered.

2.3 Regional Geology

The regional geology of the project area is described in Ristorcelli, et al. (2018) and Moynihan (2014), based on their review of studies and reports prepared by the Geological Survey of Canada and the Yukon Geological Survey. The following summary of the regional and site geology is based on these reports and additional information provided by ATAC.

The Osiris Project lies within an east-west trending fold and thrust package bounded by the Dawson Thrust to the south and the Kathleen Lakes Fault to the north. The stratigraphic units within this package of sediments generally form open folds that parallel the thrusts.

The project is located along the boundary between deep-water clastic sedimentary sequence of rocks of the Selwyn Basin to the south and shallower-water shelf strata of the Ogilvie platform to the north. The stratigraphic sequence of the Selwyn Basin consists of basin sediments of Neoproterozoic to Cambrian age. The stratigraphic sequence of the Ogilvie Platform consists dominantly of platform shelf and slope facies carbonate and clastic sediments that were deposited in the Proterozoic to Paleozoic.

The Dawson Thrust Fault is a regional scale fault that could date to the late Neoproterozoic rifting and was likely reactivated as a north-direction thrust in the Cretaceous. This fault has thrust the Selwyn Basin rocks over the Ogilvie Platform rocks. Intrusive rocks are not extensive in the region, however, can form local project scale features such as dykes.

2.4 Site Geology

ATAC developed a geologic model for the Osiris Project using Leapfrog®, a 3D geologic modelling software. The geological model has been developed primarily on the basis of corehole intersects of the major rock units at the project. This model was updated to include results from the 2018 exploration drilling program, and the resulting 3D solids of the major rock units were provided to Golder. A cross-section that shows all major rock types and faults at the Conrad Pit is presented in Figure 5, and a cross-section for the Osiris, Sunrise, and Ibis Pits is presented in Figure 6. The cross-section locations are shown on Figure 2.

ATAC geologists have carried out surface mapping of the major rock units and the structural geology at the Osiris Project. The shape files of the digitized mapping data were provided to Golder. The Osiris Project major rock units, major faults, proposed pit outlines, and exploration corehole collars are presented in Figure 7. The stratigraphic column of the major rock units that have been mapped at the Osiris Project in relation to the regional geology units is presented in Figure 8.

The following sections briefly describe the site geology based on data provided by ATAC and on Golder's review of site-specific reports.

2.4.1 Lithology

The mineralization at the Osiris Project is hosted in carbonate rocks of the Windermere Supergroup. The Windermere Supergroup was deposited between the Neoproterozoic and Cambrian period, and is comprised of slope-facies sedimentary rocks. The sedimentary rock units identified by surface mapping and core drilling at the Osiris Project are described in Table 2.

Table 2: Site Lithology Descriptions

Rock Unit	Code	Description[(a)]	Exposed in Pit Slopes?
Osiris Limestone 2	O-LST2	*Quartz grit limestone and calcareous sandstone. Also referred to as "flaggy" limestone.*	YES
Osiris Diamictite	O-DMT	*Distinctive unsorted polymictic conglomerate debrite. Dominated by carbonate clasts in a siltstone and shale matrix.*	YES
Osiris Dolostone	O-DST	*Fine grained, diagenetic dolostone. Retains original depositional fabrics identical to O-LST1.*	YES
Osiris Limestone 1	O-LST1	*Thinly laminated lime mudstone with quartz-rich silty interlayers and distinctive rudstone and packstone horizons. This is the main host of mineralization within Osiris / Sunrise / Ibis zones.*	YES
Osiris Gabbro	O-GAB	*Gabbroic intrusion.*	NO
Osiris Mudstone	O-MST1	*Maroon and green to greenish-grey silty mudstone.*	YES
Conrad Limestone 2 & Conrad Diamictite	C-LST2 & C-DMT	*Black, coarsely crystalline thickly bedded limestone. The Conrad Diamictite (C-DMT) rock unit occurs within C-LST2 as debris flows. This unit is not explicitly modelled as a separate unit as its special variation does not match with bedding folds or orientations.*	YES
Conrad Shale	C-SHL	*Black, laminated siltstone to shale with local intervals of sandstone associated with trace disseminated pyrite.*	YES
Conrad Dolostone	C-DST	*Finely crystalline hydrothermal dolostone with distinctive black crackle breccia veinlets throughout.*	YES
Conrad Siliclastic	C-SLC	*Laminated siltstone to sandstone with disseminated pyrite throughout. Variability containing matrix supported quartz grit to pebble conglomerate intervals throughout.*	YES
Conrad Limestone 1	C-LST1	*Massive to silty laminated limestone, lime mudstone, packstone and wackestone. This is the main host of mineralization within Conrad zone.*	YES
Conrad Intrusive	C-INT	*Pervasively altered gabbroic dike.*	YES
Nadaleen Fault Zone	NFZ	*Cataclastic shear zone up to 50 m wide in section that dips steeply to the north; defined on surface as pronounced bench.*	YES
Conrad Nonad Mudstone	C-NONAD	*Light teal-green to maroon and brown mudstone with minor interbedded quartz pebble conglomerate and distinctive rusty weathering.*	YES

(a) Lithology descriptions are from ATAC's stratigraphy column (Figure 8).

The Osiris Project sedimentary rock sequence is in fault contact with a thick mudstone package, referred to as the Nonad mudstone, at the north side of the project area (Tucker, et. al., 2013). The Nadaleen Fault Zone (NFZ) separates the Nonad mudstone from the main sedimentary rock sequence of the Osiris Project. To the south of the Nonad mudstone, the sedimentary rock sequence can be separated into two sedimentary packages; Conrad and Osiris. The Conrad strata are located in the proposed Conrad Pit area and underlie the Osiris strata. The Osiris strata are located in the proposed Osiris, Sunrise, and Ibis areas (Figure 7). Two separate small mafic intrusions have been identified at the Osiris Project. They are referred to as the Osiris Gabbro and the Conrad dykes (Tucker 2015). The Osiris Gabbro is not expected to be exposed in the proposed pit slopes. The Conrad dykes are steeply dipping towards the north and range in thickness from 25 cm to 25 m. These dykes can be expected to be exposed in localized portions of the proposed Conrad Pit slopes. Geology projected onto the proposed pit slopes is shown in Figures 9 to 13.

2.4.2 Geologic Structure

2.4.2.1 Major Geologic Structures

Major structures that may affect overall pit slope stability consist of continuous faults and contacts between geologic units. Folding can change the orientation of geological contacts over short distances, so can also affect pit slope stability. The major structures at the Osiris Project interpreted by ATAC from surface mapping and exploration coreholes are shown in Figure 7.

The project scale faults typically strike east, west, northwest, or southwest and are steeply dipping (Steiner et al 2018). Two major faults have been intersected in the coreholes and have been modelled in 3D by ATAC. These faults are the NFZ, which will be exposed in the Conrad Pit (Figure 10), and the Sunrise Fault, which will be exposed in the Sunrise Pit (Figure 12). The NFZ is a large brittle shear zone that is up to 60 metres wide which dips at approximately 60 degrees towards the north. The NFZ is a reverse normal fault that places the Ice Brook Formation Conrad Nonad Mudstone on top of the younger sedimentary units of the Conrad and Osiris strata. The Sunrise Fault is a continuous brittle shear zone that dips at approximately 70 degrees towards the south, with a variable strike along its length. The Sunrise Fault has a combination of strike-slip and normal fault displacement, with dextral-reverse sense. This fault is responsible for the repetition of the Osiris strata from the Osiris / Sunrise Pits to the Ibis Pit and for placing older rock units in the Osiris strata in contact with younger rock units. The orientation of these major faults indicate they post-date or were re-activated following the regional folding events.

The sedimentary rock units at the Osiris Project have been folded during two major deformation events (Steiner et al 2018). The first deformation event occurred from northwest to southeast compression and formed F_1 folds with a subvertical limb and a shallow limb. The second deformation event occurred from south-southwest to north-northeast compression and formed F_2 folds with S_2 as an axial planar cleavage. The second deformation event inclined the F_1 fold axes so that they typically plunge towards the south to southwest. The F_2 fold axes generally plunge steeply towards the east and west.

2.4.2.2 Minor Geologic Structures

Minor structures noted in the geologic logs at the Osiris Project that can affect bench scale slope stability included joints, fractures, bedding planes, foliation, and open veins. Joints, bedding planes, and foliation can form discontinuities that are planes of weakness in the rock mass. Veins can also form planes of weakness when there is a significant difference between the strength of the vein material and the wall rock or they are not completely filled. At the Osiris Project, veins are unlikely to form planes of weakness based on Golder's review of the core. However, it is noted that gold mineralization can be associated with calcite flooding and chaotic calcite veining (Coulter et al 2018) and this could locally affect the quality of the rock mass and the bench scale stability.

Additional minor structures that are not likely to form planes of weakness and to affect bench scale stability were also noted in the geological logs at the Osiris Project. The structure type codes and names used for the Osiris Project are presented in Table 3.

Table 3: Osiris Project Structure Type Codes

Structure Code		Structure Name	Structure Code		Structure Name
1	BD	Bedding	12	JT	Joint
2	BX	Breccia	13	LA	Lamination
3	CO	Contact	14	NF	Nadaleen Fault
4	CR	Crenulation	15	RF	Realgar Fracture
5	CV	Cleavage	16	SH	Shear
6	DY	Dyke	17	SS	Slickensided
7	FD	Fold	18	ST	Stringer
8	FO	Foliation	19	SY	Styolite
9	FR	Fracture	20	VB	Vein Breccia
10	FT	Fault	21	VN	Vein
11	GO	Gouge	22	VT	Veinlet

(a) ATAC Manual for Core Handling (AC 2017).

2.4.3 Rock Alteration

Alteration changes the chemical or mineralogical composition of rock and can either reduce or increase the strength of intact rock. The primary types of alteration at the Osiris Project are noted to be decarbonatization and silicification (Tucker 2013 and 2015). Both alteration types occur within rock units containing carbonate minerals and have an effect on intact rock strength. Rock units containing insignificant carbonate minerals do not appear to have been significantly altered. Alteration data is available for portions of the Osiris Project in the form of alteration type and intensity. However, at the time of this scoping level pit slope evaluation, no alteration model was available as a 3D solid.

Decarbonatization alteration occurs when large amounts of carbonate are removed from the host rocks (Tucker 2015). Complete decarbonatization alteration results in a black sooty friable residue. Due to the significant volume loss associated with decarbonatization, the altered and surrounding rock commonly exhibits collapse brecciation (Ristorcelli, et al., 2018). Decarbonatization alteration at the Osiris Project can be very pervasive and reduces the strength of intact rock.

Decarbonatization alteration is typically followed by silicification alteration. Silicification occurs when carbonate minerals are replaced with silica minerals. Silicification can replace and preserve the broken textures of collapse breccias formed during decarbonatization. This alteration type at the Osiris Project is not particularly well developed. Silicification is typically associated with decarbonatization, however, the net affect of the combined alteration types on the intact rock strength has not been defined.

The occurrence of these alteration types is limited to mineralized zones or immediately adjacent to mineralized zones. Therefore, it is not likely that alteration will effect the pit slopes, except possibly at the bottom of the pit where mineralized rocks may be exposed in the slopes.

2.4.4 Mineralization

There are four zones of mineralization at the Osiris Project, consisting of the Conrad, Osiris, Sunrise, and Ibis Zones. Mineralization occurring within these zones is described on the ATAC website (ATAC 2018a) and is summarized below.

In the Conrad Zone, mineralization occurs in three areas located predominantly in the footwall of the west-northwest striking Nadaleen Fault Zone. The fault dips steeply to the northeast, and places mudstone over the Conrad Limestone and Siliciclastic. Mineralization in the Upper Zone occurs along the contact between the Conrad limestone and siliciclastic, with the thickest mineralization occurring along the crest of an anticline. In the Middle Zone, mineralization occurs near the limestone-siliciclastic contact. The newly discovered and high-grade Lower Zone is located below the Middle Zone.

Mineralization in the Osiris Zone is located in the crest of a southwest-plunging anticline. Stratabound mineralization has also been identified along the limbs and within the hinge of the fold.

Mineralization at the Sunrise Zone is hosted in the Osiris Limestone, in the footwall of the Sunrise Fault. The Sunrise Fault strikes east-northeast and dips steeply to the southeast. Mineralization occurs as subparallel tabular bodies parallel to the Sunrise Fault.

In the Ibis Zone, mineralization is concentrated in the crest of the southwest-plunging Osiris Anticline. The mineralization is stratabound and associated with the contact between dolomite-altered limestone and underlying silty limestone.

2.4.5 Weathering

Mechanical and chemical weathering of bedrock at the Osiris Project has affected the rock mass properties. The frequent freeze-thaw cycles typical of sub-arctic climates has resulted in fracturing of the rock mass due to frost wedging. The degree of weathering and Rock Quality Designation (RQD) of the core was reviewed to determine the depth of weathering. In general, the finer grained rocks at the Osiris Project are more extensively weathered than the coarse grained rocks, and weathering reduced the strength of the rock mass.

2.5 Hydrogeology

There are no observation wells or piezometers at the Osiris Project. The exploration coreholes are left open and to date no water flowing from the holes has been observed. Additionally, there have been no reports of artesian groundwater conditions from the exploration corehole drillers.

The Sunrise Pit is to be excavated along a ridge top, and therefore, Golder does not expect groundwater to be encountered in the pit slopes unless a perched water table exists above the Sunrise Fault. The Conrad, Osiris, and Ibis Pits are to be excavated through drainages of varying size that seasonally carry surface water flow (Figure 3). Therefore, Golder expects that groundwater will be encountered in the pits, particularly where pit slopes are excavated through drainages or located below groundwater recharge zones.

3.0 GEOTECHNICAL DATA REVIEW

The following sub-sections present the data relevant to a pit slope evaluation which Golder has reviewed as part of this geotechnical assessment. Table 4 presents a summary of the available geotechnical data.

Table 4: Summary of Geotechnical Data Status for Scoping-level Pit Slope Evaluation

Data Type	Pit				Comments
	Conrad	Osiris	Sunrise	Ibis	
Lithologic Model	Yes				Geology model solids available by rock type.
Alteration Model	Partial				Alteration data collected starting in 2017. No alteration solids available.
Major Structure Model (Faults)	Partial	No	Yes	No	Surface mapping indicates not all major structures were modelled at the time of this assessment.
Minor Structure Model	Yes				Assumptions of joint orientations were made based on the orientation of bedding.
Intact Rock Properties	Yes				ISRM rock strength estimates and point load test results.
Rock Discontinuity Properties	Yes				Descriptions of discontinuities.
Hydrogeology	No				No subsurface data available.
Geotechnical Characterization Data (RQD, RMR_{76}, etc.)	Yes				Joint characteristic data to support RMR_{76} calculations available starting in 2017.

3.1 Surface Geologic Mapping

ATAC performed geologic mapping at the Osiris Project and provided an electronic surface mapping database to Golder. Golder used this data to obtain the structural orientation of geologic features in the rock mass at the proposed open pit areas. The likely continuity of structural orientations between the surface outcrops and rock mass at depth was assessed by comparing surface data to oriented corehole data (Section 3.4) at depth. All structural orientation data collected by ATAC is rotated to be relative to UTM grid north, which is -2.24 degrees (west) from true north at the Osiris Project site location. In this report Golder present orientation data relative to UTM grid north to be consistent with ATAC's convention.

The surface mapping data is presented in Appendix B. Figure B-1 presents dip and dip direction of a sub-set of the bedding measurements at the Osiris Project. Figure B-2 shows the dip and dip direction of bedding measurements at the proposed Ibis Pit. Golder selected areas of surface mapping data containing structure orientations in the areas of the pits and plotted the data on stereonets. Figure B-3 shows the areas selected and Figures B-4 to B-10 present the stereonets for seven selected areas.

The strike of the bedding measurements generally align with the orientations of the mapped geologic contacts (Figure B-1). While there is a wide range of bedding orientations in the selected areas, the highest concentrations of bedding orientations within each selected area match well with the general trends of the mapped geological contacts. Bedding measurements that do not align with the geologic contacts may represent the occurrence of small scale folds or mislabeled measurements. The concentrations of structural orientations at each area were used to summarize the dip and dip direction of bedding and joints presented in Table 5.

Table 5: Summary of Surface Mapping Structural Orientations

Area No.[(a)]	Pit	Structure Type	Dip (description, degrees)	Dip Direction (description, UTM Grid North)
1	Conrad (northeast portion)	Bedding	Moderate, 40 to 60	North, 350 to 035
1	Conrad (northeast portion)	Joint	Moderate to steep, 50 to 75	South, 170 to 040
2	Conrad (southwest portion)	Bedding	Steep, 70 to 80	South, 170 to 200
3	Osiris	Bedding	Steep, 75 to 90	East, 090 to 100, AND Southwest to West, 230 to 280
4	Sunrise West	Bedding	Steep, 65 to 90	East-southeast, 110 to 120, AND West, 250 to 280
5	Sunrise East	Bedding	Shallow to moderate, 20 to 60	South, 180 to 200, AND West, 260 to 280
6	Ibis (west portion)	Bedding	Steep, 70 to 85	Southwest, 220 to 240
7	Ibis (east portion)	Bedding	Shallow to moderate, 30 to 50	South, 180 to 200

(a) Areas are shown in plan view on Figure B-3.

3.2 Corehole Data

ATAC provided geologic logs that included rock type descriptions, alteration minerals, and descriptions of structures intersecting the core.

The coreholes were typically drilled along orientations approximately perpendicular to geological contacts to target the mineralized zones. Based on the location and number of the coreholes in the pit slopes (Figure 2), the subsurface geology expected to be exposed in the pit slopes is adequately defined for a scoping-level project.

Golder combined the geologic logs with the core recovery data into a database containing all coreholes. The percentage of each rock unit in the database by drilled length and average core recovery is presented in Table 6.

Table 6: Rock Unit Drilled Length and Average Recovery for the Osiris Exploration Coreholes

Rock Unit	Rock Code	Total Drilled Length[(a)] (metres)	Average Core Recovery (percent)	Percent of Project Total Drilled Length
Conrad Dolostone	C-DST	548	81	0.6
Conrad Limestone 1	C-LST1	22,224	96	25.6
Conrad Limestone 2	C-LST2	2,275	85	2.6
Nadaleen Fault Zone	C-NFZ	3,015	85	3.5
Conrad Nonad Mudstone	C-NONAD	2,383	74	2.7
Conrad Shale	C-SHL	1,193	79	1.4
Conrad Siliciclastic	C-SLC	23,888	92	27.5
Osiris Diamictite	O-DMT	2,233	91	2.6
Osiris Dolostone	O-DST	8,068	90	9.3
Osiris Gabbro	O-GAB	91	97	0.1
Osiris Limestone 1	O-LST1	13,094	93	15.1
Osiris Limestone 2	O-LST2	2,935	87	3.4
Osiris Mudstone 1	O-MST1	4,921	88	5.7

(a) Includes data from 280 exploration coreholes drilled between 2010 and 2018.

All of the rock units listed in Table 6 will be exposed in the proposed pit slopes (Table 2), except for the Osiris Gabbro. While no core drilling has been performed specifically for geotechnical studies ATAC geologists collect the following geotechnical data from exploration coreholes for each drill interval:

- Core Recovery
- Rock Quality Designation (RQD)
- Rock Strength
- Weathering
- Joint Condition Descriptions (detailed descriptions for 2017 and 2018 coreholes)
- Joint Count (2017 and 2018 coreholes)

ATAC provided an electronic database containing the geotechnical interval data to Golder. Golder combined the geotechnical and geologic databases and imported the data into SURPAC version 6.6 (DS 2019), a geologic modelling and mine design software package. Golder prepared cross-sections showing the downhole geotechnical and geology data to illustrate the likely geotechnical conditions in the proposed pit slopes. The cross-sections are presented in Appendix C. The cross-sections show the RQD, rock strength, and weathering observed in the core. An explanation of the geotechnical data classifications is provided on Figure C-1. The cross-section locations for the proposed Osiris and Sunrise Pits, Ibis Pit, and Conrad Pit are shown on Figures C-2, C-15, and C-25, respectively.

The cross-sections suggest a pervasive weathered zone up to approximately 50 metres deep below natural ground surface, as indicated by a change in RQD and degree of weathering with depth, and to a lesser extent a change in estimated rock strength. The rock mass was considered to be significantly weathered if core was logged as both moderately to extremely weathered (3W to 5W/6W) and very poor to poor rock quality (0-50% RQD). Based on this definition of significantly weathered rock, the following weathered zone depths were defined:

- Conrad Pit north of and including the Nadaleen Fault Zone – 50 metres
- Conrad Pit south of the Nadaleen fault Zone – 25 metres
- Osiris, Sunrise, and Ibis Pits – 20 metres

Figure 14 shows the weathered zones projected onto the Osiris Project pit shells. The weathered rock is restricted to the upper portions of the pit slopes. The geotechnical data from within this zone is not applicable to rocks below the weathered zone which will from the majority of the pit slopes at the Osiris Project. The geotechnical characterization of the weathered zone rock is provided in Section 4.5.

Review of the cross-sections shown in Appendix C indicates inconsistent assignment of geotechnical parameters to the core intervals between field exploration programs performed in different years. Figure C-11 shows that some of the 2010 core was logged as moderately weathered (3W) for the majority of the corehole length while other core logged between 2011 and 2013 indicates that the degree of weathering varies from moderately to slightly weathered (3W to 2W) near the ground surface to fresh rock (1W) at depth. Figure C-20 shows that the majority of the 2013 core was logged consistently as very weak to weak (S1 to S2) rock along a significant portion of the corehole lengths while adjacent coreholes logged in 2011 and 2012 indicate medium strong to strong (S3 to S4) rock at similar depths and within the same rock units.

The focus of ATAC’s exploration corehole drilling programs has been for mineral resource studies and to identify future exploration targets. While the geotechnical data collected as part of ATAC’s exploration programs will contain some errors and inconsistencies Golder considers the amount of geotechnical data and level of detail is adequate for a scoping level pit slope evaluation of an exploration project at this stage. Golder advises ATAC resolve inconsistencies in the database prior to performing a PFS-level study.

3.3 Point Load Testing

Point load testing provides quantitative estimates of the rock unconfined compressive strength through a simple field test. These tests are typically completed with a higher frequency than laboratory unconfined compressive strength (UCS) tests, and so allow closer tracking of compressive strength variations over the length of coreholes.

Point load tests (PLTs) were performed by ATAC geologists on core from exploration coreholes at their on-site core logging facility. Tests were carried out on select intervals for three coreholes in 2017 and at a much closer spacing in additional coreholes in 2018. Data collected for each test include depth, rock type, test orientation, sample dimensions, failure load, and comments regarding failure type (AC 2017). An electronic database containing the PLT results was provided to Golder.

A PLT consists of compressing rock samples between two conical platens until the sample fails. Tests are generally considered valid when failure surfaces are generated through intact rock between the loading platens, or when the pressure gauge range is exceeded. Refer to Section 3.5.1 for recommendations pertaining to maximum point load testing pressures. Tests were considered invalid if the sample did not break cleanly and entirely through the intact rock at failure. A test was deemed invalid under any of the following conditions:

- fragments of rock chipped off the sample (chipping)
- the platens of the Point Load Tester dug into the weak core sample (punching)
- the sample slipped out of the centre of the platens during testing (slipping)

Invalid tests are typically excluded from data sets used in statistical analyses. A total of 236 valid tests representing failure through intact rock core are included in the summary point load testing statistics. Sample dimensions and failure load were used to calculate point load strength index (Is50) for each rock unit based on the American Society for Testing and Materials (ASTM) standard test methods for PLTs (ASTM 2008). The results of the point load strength index statistics for all tested rock units are presented in Table 7.

Table 7: Summary of Point Load Test Strength Index Results by Pit and Rock Unit

Pit	Rock Unit	Rock Code	Number of Valid Tests[(a)]	Range (Is_{50} MPa)	Average (Is_{50} MPa)	Median (Is_{50} MPa)	Standard Deviation (Is_{50} MPa)
Conrad	Conrad Limestone 1	C-LST1	30	1.2 - 8.6	3.9	3.5	1.7
	Nadaleen Fault Zone	C-NFZ	4	1.7 - 4.9	2.6	2.3	1.5
	Conrad Siliciclastic	C-SLC	81	0.1 - 9.5	3.3	2.9	2.0
Osiris	Osiris Diamictite	O-DMT	8	1.2 - 6.5	3.7	2.3	1.8
	Osiris Dolostone	O-DST	26	0.5 - 7.7	3.1	2.8	2.1
	Osiris Limestone 1	O-LST1	26	0.4 - 7.2	3.8	3.1	1.8
	Osiris Limestone 2	O-LST2	12	0.7 - 4.2	2.2	2.9	1.1
	Osiris Mudstone 1	O-MST1	8	1.2 - 4.1	2.7	3.1	0.9
Sunrise	Conrad Limestone 2	C-LST2	2	5.6 - 6.0	5.8	2.8	0.3
	Osiris Dolostone	O-DST	2	3.6 - 4.6	4.1	3.0	0.8
	Osiris Limestone 1	O-LST1	28	0.6 - 6.3	3.3	3.1	1.5
	Osiris Mudstone 1	O-MST1	9	0.8 - 2.9	1.8	2.9	0.8

(a) All tests are diametral.
Is_{50} = size corrected point load strength index; MPa = mega pascal.

3.4 Core Orientation

Oriented core logging was performed by ATAC on exploration drill core in 2012, 2013, 2017, and 2018. Core orientation was collected by ATAC geologists following procedures provided in an oriented core manual (AC 2015). Oriented core measurements collected in 2012, 2013, and 2017 were made mostly on good quality rock. The quantity of oriented core measurements was increased in 2018 and measurements were made along the majority of the corehole length for select coreholes. The core orientation line was marked on the top of the core for all oriented core logging (Carne 2018, pers. comm.). The following provides a summary of core orientation techniques used by ATAC:

- the Reflex Act III system (Reflex 2018a) was used in 2012, 2013, and 2017
- the Reflex IQ-logger™ (Reflex 2018b) was used starting in 2018

ATAC provided an electronic database of the core orientation data to Golder for review and processing. Golder used DIPS version 7.0 (RocScience 2019a), a stereographic projection software, to process the raw alpha and beta angle measurements along with the corehole survey data to produce stereographic projections of the structural orientations. The corehole survey data (azimuth and dip) is relative to UTM grid north and the oriented core data processed in DIPS is also relative to UTM grid north.

Stereographic projections of poles representing structural orientations by structure type are presented in Appendix D1 and are separated by pit and corehole. The locations of the oriented coreholes relative to the Conrad Pit, Osiris Pit, Sunrise Pit, and Ibis Pit are shown on Figures D1-1, D1-28, D1-40, and D1-61, respectively. The stereographic projections by corehole are presented in the figures following each plan view. Golder reviewed the structural orientation data by corehole to assess variations in structural trends and to define structural domains, if possible.

To assess if there are structural orientations that vary with depth, the dip and dip direction of bedding, joints, and faults for selected coreholes were plotted versus depth. Structural orientation data versus depth from two coreholes at the Conrad Pit and one corehole from the other pits are presented in Appendix E. The downhole plots illustrate the benefit of collecting oriented core data along the entire length of a corehole when feasible. It allows structural trends that are a function of depth to be identified.

3.5 Golder Site Visit

The following sub-sections present a summary of the discussions held and the observations made during the June 2018 site visit carried out by Mr. Trevor Tamburri of Golder. The main activities carried out during the site visit were a review of core logging procedures, review and spot check of selected exploration core, and outcrop mapping.

3.5.1 Core Logging Procedure Review

During the site visit Golder visited the on-site core logging facility while ATAC's geologists were logging core from the 2018 exploration drilling program. This allowed Golder to review ATAC's core logging procedures and obtain a better understanding of the condition and characteristics of the core from various Osiris Project rock units. After the site visit Golder provided recommendations via email (Tamburri 2018, pers. comm.) so that they could be incorporated into the remainder of the 2018 exploration drilling program. These recommendations are summarized as follows:

- Add the surface description of polished to the Joint Surface Condition description.
- Assign a Core Orientation Reliability rating to each core orientation measurement. Reliability ratings are generally based on how precisely the orientation line from the current run matches with the previous run.
- Indicate to geologists that geotechnical intervals do not have to be limited to the run length. Golder observed that in general the geotechnical intervals were approximately 3 metres, the distance between drill runs. Golder recommends that if the fracture frequency, rock strength, or RQD are variable within a 3 metre drill run, a geotechnical interval of less than 3 metres can be used to capture the variability of geotechnical parameters.
- Do not exceed a load of 35 MPa during point load testing. A load of 35 MPa should not be exceeded during testing for safety reasons and to reduce the likelihood that the point load testing machine will be damaged. If this pressure is reached, it can be considered a valid test even though the core did not break. The point load tester can record load readings in excess of 35 MPa, therefore, the maximum pressure reading should be recorded for a test that is classified as pressure gauge range exceeded.

3.5.2 Exploration Corehole Review

Golder reviewed core from coreholes OS-12-119 and OS-12-136 during the site visit. The purpose of this review was to observe the geotechnical properties of the core and the condition of the natural discontinuities formed by the minor structures. OS-12-119 was drilled at the proposed Conrad Pit, and intersected the Conrad Nonad mudstone, Nadaleen Fault Zone, Conrad Intrusive, and Conrad Limestone 1. OS-12-136 was drilled at the proposed Ibis Pit, and intersected the Osiris Limestone 2, Osiris Diamictite, and Osiris Dolostone.

Golder spot checked the geotechnical parameters for portions of coreholes during the core review. Appendix F presents the Golder spot checks for coreholes OS-12-119 and OS-12-136. The check was carried out by grouping intervals of similar geotechnical parameters to provide an overview of the general condition of the intersected rock units. The spot check carried out by Golder was compared to ATAC's detailed geotechnical logs from the same coreholes. In general, the geotechnical logging of the exploration coreholes appears to have been performed appropriately. Based on this review, Golder determined it was appropriate to use ATAC's corehole database without further checking for the purposes of geotechnical characterization for this scoping level pit slope evaluation.

3.5.3 Outcrop Mapping and Observations

Golder performed rock outcrop mapping in the areas of the proposed open pits, along ridge lines and in drainages with bedrock exposures. The outcrop mapping focused on characterizing natural discontinuities and characterizing the rock mass of the rock units that are to be exposed in the pit slopes. Golder performed outcrop mapping at eight locations in the Conrad zone and fifteen locations in the Osiris, Sunrise, and Ibis zones. The discontinuity mapping raw data sheets are presented in Appendix G1 and the rock mass description sheets are provided in Appendix G2. The discontinuity and rock mass mapping locations are presented in Figures G1-1 and G2-1, respectively.

The orientations of the structural measurements collected by Golder during the site visit were generally in agreement with the structural orientation measurements that have been collected by ATAC. The structural orientations collected by Golder were included in the surface mapping data discussed in Section 3.1 to expand the database.

The rock mass descriptions include the state of weathering, texture, lithology, strength, and Geological Strength Index (GSI) of the outcrop exposures. The GSI values were collected using industry standard guidelines as presented and discussed in Marinos, et al 2007. GSI is a value that provides information on the quality of a rock mass based on the degree of fracturing and condition of discontinuity surfaces. This value can be used to compare the quality of rock from surface observations to drill core observations and is also used along with the rock type and intact rock strength to estimate rock mass strength. Photographs of the rock exposures are presented by rock unit in Appendix H. The engineering geology descriptions of the rock units observed during the site visit are presented in Table 8. These descriptions are based on the rock mass description sheets presented in Appendix G2.

Table 8: Engineering Geology Descriptions of Rock Units from Outcrop Observations

Rock Unit	Symbol	Engineering Geology Description[(a)]
Osiris Limestone 2	O-LST2	Slightly to moderately weathered, very thinly bedded, brownish grey, very fine to medium grained, medium strong, LIMESTONE [BLUEFLOWER FORMATION], interbedded with siltstone and sandstone.
Osiris Diamictite	O-DMT	Moderately weathered, unsorted debris flow, reddish brown, very course grained sand to cobble size clasts in very fine to medium grained mudstone matrix, medium strong to strong, DIAMICTITE [GAMETRAIL FORMATION].
Osiris Dolostone	O-DST	Moderately weathered, medium to thickly bedded, brownish grey, finely to medium crystalline, medium strong to strong, DOLOSTONE [GAMETRAIL FORMATION].
Osiris Limestone 1	O-LST1	Slightly to moderately weathered, thickly laminated to thinly bedded, greyish brown, fine to medium grained, medium strong to strong, LIMESTONE [GAMETRAIL FORMATION], interbedded with siltstone and packstone.
Osiris Gabbro	O-GAB	Moderately weathered, massive, greyish brown, medium crystalline, medium strong to strong, GABBRO.
Osiris Mudstone	O-MST1	Moderately weathered, thickly laminated to very thinly bedded, maroon and greenish-grey, very fine to fine grained, weak to medium strong, MUDSTONE [NADALEEN FORMATION], locally with well-developed cleavage.
Conrad Diamictite	C-DMT	Slightly weathered, unsorted debris flow, yellowish grey, very course grained sand to cobble size clasts in fine grained mudstone matrix, strong to very strong, DIAMICTITE [NADALEEN FORMATION].
Conrad Shale	C-SHL	Moderately weathered, thickly laminated, black, very fine grained, weak to medium strong, SHALE [NADALEEN FORMATION], well-developed cleavage, locally interbedded with siltstone and sandstone.
Conrad Dolostone	C-DST	Moderately weathered, medium to thickly bedded, greyish brown, finely crystalline, medium strong to strong, DOLOSTONE [NADALEEN FORMATION].
Conrad Siliclastic	C-SLC	Moderately weathered, thickly laminated to medium bedded, greyish brown, very fine to course grained, weak to medium strong, SILICICLASTIC [NADALEEN FORMATION], interbeds of mudstone to conglomerate.
Conrad Limestone 1	C-LST1	Slightly weathered, massive to medium bedded, grey, fine to course grained, strong to very strong, LIMESTONE [NADALEEN FORMATION].
Nadaleen Fault Zone	NFZ	Moderately weathered, cataclastic, brown, very fine grained, weak, MUDSTONE.
Conrad Nonad Mudstone	C-NONAD	Moderately weathered, thickly laminated to thinly bedded, reddish brown, very fine to medium grained, weak to medium strong, MUDSTONE [ICE BROOK FORMATION], locally with well-developed cleavage.

(a) Geological formations from (Coulter et al 2018).

4.0 GEOTECHNICAL CHARACTERIZATION

The geotechnical properties of the rock units were characterized using the available data as listed in Section 1.3. These characteristics were then used to estimate the rock mass shear strength properties used in the overall slope stability analyses. Characterizing the geotechnical properties provides an understanding of the controls on pit slope stability based on rock mass strength, degree of fracturing, and structure orientations. This allows for the selection of appropriate mining methods, specifically blasting techniques, to maximize pit slope angles and produce stable bench faces.

To more accurately characterize the rock units that are to be exposed in the pit slopes, the geotechnical core interval data was filtered to exclude data not representative of the rock that is to be exposed in the pit slopes. Data from within the surface weathered zone (as discussed in Section 3.2) and data collected at depths greater than 150 metres below the pit shells were excluded. The corehole data from within the surface weathered zone was excluded so average values of geotechnical parameters would not be influenced by poor rock quality zones near the surface. Data collected at depths greater than 150 metres below the pit shells was excluded as it is much deeper than the proposed pit slopes.

4.1 Intact Rock Strength

The strength of intact rock at the Osiris Project has been estimated based on field estimates of intact rock strength by the International Society for Rock Mechanics Classification (ISRM) guidelines. The intact rock strength was also estimated from point load tests on core.

4.1.1 International Society of Rock Mechanics Intact Rock Strength Estimation

ATAC estimated the intact rock strength for each core interval. The field classification and identification method used by ATAC to estimate intact rock strength is similar to the International Society for Rock Mechanics (ISRM) classification. There are slight variations in the field identification methods used by ATAC. The ISRM intact rock strength classification is correlated with approximate ranges of the Unconfined Compressive Strength (UCS) values as shown in Table 9.

Table 9: Osiris Project and ISRM Intact Rock Strength Classifications

Osiris Project Strength Classification		ISRM Strength Classification		
Classification and Code[(a)]	Field Identification[(a)]	ISRM Strength (R)	Field Identification	UCS (MPa)
Extremely Weak (0S)	Can be readily indented, grooved or gouged with fingernail.	R0	Indented with thumbnail.	0.25-1
Very Weak (1S)	Can be peeled easily by a pocket knife. Crumbles under firm blow with point of geological hammer.	R1	Crumbles under firm blow with point of geological hammer, can be peeled with a pocket knife.	1-5

Table 9: Osiris Project and ISRM Intact Rock Strength Classifications

Osiris Project Strength Classification		ISRM Strength Classification		
Classification and Code[(a)]	Field Identification[(a)]	ISRM Strength (R)	Field Identification	UCS (MPa)
Weak (2S)	Can be peeled by a pocket knife. Shallow indentation made with a firm blow of point of a geological hammer.	R2	Can be peeled with pocket knife with difficulty, shallow indentations made by a firm blow of geologic hammer.	5-25
Moderately Strong (3S)	Cannot be scratched or peeled with a knife. Core breaks with single hammer blow.	R3	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of geologic hammer.	25-50
Strong (4S)	Requires more than one blow with a geological hammer to fracture core.	R4	Specimen requires more than one blow of geologic hammer to fracture it.	50-100
Very Strong (5S)	Requires many blows with a geological hammer to fracture core.	R5	Specimen requires many blows of geologic hammer to fracture it.	100-250
Extremely Strong (6S)	Can only be chipped with repeated heavy hammer blows.	R6	Specimen can only be chipped with geologic hammer.	> 250

(a) ATAC Manual for Core Handling (AC 2017).

The rock strength data collected by ATAC indicates that all rock units vary in strength from Extremely Weak and Very Weak to Very Strong and Extremely Strong. The range and average ISRM rock strength classification for each of the rock units by pit presented in Table 10.

Table 10: Average Intact Rock Strength Field Estimates by Pit and Rock Unit

Pit	Rock Unit	Rock Code	Range of Rock Strength	Average Rock Strength Rating	Weighted Average Rock Strength[(a)]	Estimated UCS[(b)] (MPa)
Conrad	Conrad Dolostone	C-DST	R0 - R5	R3	3.0	25
	Conrad Limestone 1	C-LST1	R0 - R6	R3	3.4	35
	Conrad Limestone 2	C-LST2	R1 - R5	R3	2.9	23
	Nadaleen Fault Zone	C-NFZ2	R1 - R6	R3	3.4	35
	Conrad Nonad Mudstone	C-NONAD	R1 - R6	R4	3.8	45
	Conrad Shale	C-SHL	R1 - R5	R3	3.0	25
	Conrad Siliciclastic	C-SLC	R0 - R6	R3	3.2	30
Ibis	Osiris Diamictite	O-DMT	R1 - R6	R3	2.5	15
	Osiris Dolostone	O-DST	R0 - R5	R3	3.1	28

Table 10: Average Intact Rock Strength Field Estimates by Pit and Rock Unit

Pit	Rock Unit	Rock Code	Range of Rock Strength	Average Rock Strength Rating	Weighted Average Rock Strength[a]	Estimated UCS[b] (MPa)
	Osiris Limestone 1	O-LST1	R1 - R5	R3	3.2	30
	Osiris Limestone 2	O-LST2	R1 - R6	R3	2.8	21
	Osiris Mudstone 1	O-MST1	R2 - R5	R4	3.7	43
Osiris	Osiris Diamictite	O-DMT	R1 - R5	R4	3.8	45
	Osiris Dolostone	O-DST	R0 - R6	R3	3.5	38
	Osiris Limestone 1	O-LST1	R0 - R6	R3	3.5	38
	Osiris Limestone 2	O-LST2	R1 - R5	R4	3.6	40
	Osiris Mudstone 1	O-MST1	R0 - R5	R3	3.1	28
Sunrise	Conrad Limestone 2	C-LST2	R1 - R5	R3	2.6	17
	Osiris Dolostone	O-DST	R1 - R5	R3	2.7	19
	Osiris Limestone 1	O-LST1	R1 - R5	R3	2.6	17
	Osiris Mudstone 1	O-MST1	R1 - R6	R3	2.6	17

(a) Rock strength values are weighted averages based on variable length of logged intervals. Value presented to one decimal place for correlation with estimated UCS (Table 9).

(b) UCS estimates calculated from typical range of UCS values based on intact rock strength field estimate (Table 9) and decimal value of weighted average.

UCS = Unconfined compressive strength.

The average rock strengths presented in Table 10 indicate that all rock units were typically classified as Medium Strong (R3, 25 < UCS < 50 MPa) to Strong (R4, 50 < UCS < 100 MPa) rock. In general, the carbonate rock units (limestone and dolostone) were classified as medium strong rock and the rock units typically classified as strong rock were the Nonad mudstone, Osiris Mudstone 1 (Ibis Pit), Osiris Diamictite and Osiris Limestone 2 (Osiris Pit). Carbonate rocks can be difficult to classify by the field identification methods listed in Table 9 because rocks composed primarily of calcite and dolomite can be scratched with a steel knife point or scribe and bedded rocks will often break with one blow of hammer along the bedding although this is not an indication of the intact strength of the rock between bedding planes. For these reasons, based on the ISRM field identification strength classification, the bedded carbonate rocks may have been estimated to be weaker than they actually are. Read and Stacey (2009) indicate that the intact rock strength of limestone and dolomite typically ranges from Strong (R4, 50 < UCS < 100 MPa) to Very Strong (R5, 100 < UCS < 250 MPa) rock and that the strength of shale and siltstone typically ranges from Medium Strong (R3, 25 < UCS < 50 MPa) to Very Strong (R5, 100 < UCS < 250 MPa) rock.

Based on our core review while on site, it appears that the ISRM intact rock strength field estimate classification of the carbonate rocks is appropriate. However, some of the limestone may consist of strong rock (higher than classified by ATAC). The average intact strength classification assigned to the Nonad mudstone appears to be too high, since Golder's review indicated intervals of rock classified as strong rock consisted of beds of sandstone within the mudstone unit. Golder's observations indicate the Nonad mudstone should be classified Weak (R2, 5 < UCS < 25 MPa) to Medium Strong (R3, 25 < UCS < 50 MPa) rock.

In general, the weak rock (R2 or less) at the Osiris Project is located in the weathered zone, the Nadaleen Fault Zone, adjacent to smaller faults, and the finer grained portions of the rock units consisting of mudstones and shale.

4.1.2 Point Load Testing Data

Point load tests (PLTs) were performed by ATAC on exploration core in their on-site core logging facility (Section 3.3). A quantitative estimate of the UCS of the intact rock can be obtained from the PLT strength index (Is_{50}) results. The estimate of UCS is obtained by multiplying the corrected point load strength index ($Is_{(50)}$) by a factor, K, so that:

$$UCS = K * Is_{(50)}$$

where *K* is the correlation factor (ASTM 2008).

Ideally, the correlation factor is determined by correlating UCS to the $Is_{(50)}$ for each rock type from tests on adjacent core samples. However, in the absence of UCS laboratory testing results, average correction factors can be used. Typically, the UCS value is equal to approximately 18 to 25 times the $Is_{(50)}$ value, depending on the core diameter (ASTM 2008). The generalized correction factors presented in ASTM 2008 suggest a correction factor of 23 for 50 mm diameter core and a correction factor of 24.5 for 60 mm diameter core. ATAC performed PLTs on HQ (approximately 60 mm diameter) and NQ (approximately 48 mm diameter) exploration core. Golder have assumed a conservative correction factor of 20 to estimate UCS of intact rock based on PLT strength index ($Is_{(50)}$). The UCS estimates by pit and rock unit are presented in Table 11.

Table 11: Average Unconfined Compressive Strength Estimates from $Is_{(50)}$ by Pit and Rock Unit

Pit	Rock Unit	Rock Code	Range of UCS Estimates[(a)] (MPa)	Average UCS Estimate[(a)] (MPa)
Conrad	Conrad Limestone 1	C-LST1	25 - 172	78
	Nadaleen Fault Zone	C-NFZ	34 - 99	53
	Conrad Siliciclastic	C-SLC	1 - 189	66
Osiris	Osiris Diamictite	O-DMT	24 - 131	75
	Osiris Dolostone	O-DST	10 - 154	62
	Osiris Limestone 1	O-LST1	8 - 145	76
	Osiris Limestone 2	O-LST2	15 - 85	44
	Osiris Mudstone 1	O-MST1	24 - 82	54
Sunrise	Conrad Limestone 2	C-LST2	112 - 120	116
	Osiris Dolostone	O-DST	71 - 93	82
	Osiris Limestone 1	O-LST1	13 - 126	66
	Osiris Mudstone 1	O-MST1	16 - 58	35

(a) UCS estimates were calculated using UCS = 20 * $Is_{(50)}$.

UCS = Unconfined compressive strength.

The estimated UCS based on the results of the point load testing (Table 11) suggest intact rock strengths higher than estimated from ISRM field estimates (Table 10). In general, the rock units were classified as Strong (R4, 50 < UCS < 100 MPa) rock from the UCS estimates based on $Is_{(50)}$. The only rock units classified as Medium Strong (R3, 25 < UCS < 50 MPa) rock based on the results of point load testing were Osiris Limestone 2 (Osiris Pit) and Osiris Mudstone 1 (Sunrise Pit). The UCS strength estimates based on the point load strength index ($Is_{(50)}$) results are likely more representative of the intact rock strengths in Golder's opinion. Point load testing is a quantitative measure of intact rock strength compared to the ISRM field identification strength classification, and the UCS estimated from point load tests are generally within the typical range of strengths by rock type as indicated by Read and Stacey (2009).

4.2 Rock Fracturing

RQD is measured by ATAC for each core interval and this data can be used to assess the degree of rock fracturing. RQD is the percentage of sound core recovered in lengths of 10 cm or greater (Deere 1964) and can be correlated to the discontinuity spacing as shown in Table 12.

Table 12: Summary of Rock Quality Designation (RQD) System

RQD (percent)	Rock Quality Classification	Approximate Discontinuity Spacing[(a)] (mm)
0-25	Very Poor	< 70
25-50	Poor	70-100
50-75	Fair	100-150
75-90	Good	150-300
90-100	Excellent	> 300

(a) Based on correlation between RQD and mean discontinuity spacing by Bieniawski (1989).

Typical and average values for RQD for each rock unit by pit are presented in Table 13.

Table 13: Average Rock Quality Designation by Pit and Rock Unit

Pit	Rock Unit	Rock Code	Typical Range of RQD[(a)] (percent)	Average RQD[(b)] (percent)	Rock Quality Classification[(c)]
Conrad	Conrad Dolostone	C-DST	32-89	37	Poor
	Conrad Limestone 1	C-LST1	44-86	70	Fair
	Conrad Limestone 2	C-LST2	23-76	49	Poor
	Nadaleen Fault Zone	C-NFZ2	30-93	57	Fair
	Conrad Nonad Mudstone	C-NONAD	34-94	64	Fair
	Conrad Shale	C-SHL	29-89	54	Fair
	Conrad Siliciclastic	C-SLC	36-90	61	Fair
Ibis	Osiris Diamictite	O-DMT	26-81	60	Fair
	Osiris Dolostone	O-DST	18-74	44	Poor
	Osiris Limestone 1	O-LST1	18-70	46	Poor
	Osiris Limestone 2	O-LST2	32-80	45	Poor
	Osiris Mudstone 1	O-MST1	10-55	51	Fair

Table 13: Average Rock Quality Designation by Pit and Rock Unit

Pit	Rock Unit	Rock Code	Typical Range of RQD[(a)] (percent)	Average RQD[(b)] (percent)	Rock Quality Classification[(c)]
Osiris	Osiris Diamictite	O-DMT	16-75	53	Fair
	Osiris Dolostone	O-DST	14-71	41	Poor
	Osiris Limestone 1	O-LST1	20-76	52	Fair
	Osiris Limestone 2	O-LST2	21-72	46	Poor
	Osiris Mudstone 1	O-MST1	23-78	54	Fair
Sunrise	Conrad Limestone 2	C-LST2	35-79	50	Fair
	Osiris Dolostone	O-DST	26-78	60	Fair
	Osiris Limestone 1	O-LST1	28-82	56	Fair
	Osiris Mudstone 1	O-MST1	31-84	53	Fair

(a) Typical range of RQD is within one standard deviation of the mean.

(b) Average RQD values are weighted averages based on variable length of logged intervals.

(c) Rock Quality Classification is from Table 12 and based on Average RQD.

RQD = Rock Quality Designation.

The average RQD values presented in Table 13 indicate that all rock units were typically classified as Poor (25 < RQD < 50) to Fair (50 < RQD < 75) rock quality. In general, the carbonate rock units were typically classified as poor rock quality and non-carbonate clastic sedimentary rock units were classified as fair rock quality. The main exception to this is the Conrad Limestone 1 that has an average RQD of 70% which is the highest average RQD of all rock units at the Osiris Project. The average RQD values presented in Table 13 indicate that in general the carbonate rock units are more fractured than the non-carbonate clastic sedimentary rock units and the Conrad Limestone 1 is the least fractured rock unit.

4.3 Structural Geology

Structures that form planes of weakness in the rock mass upon which sliding may occur are of interest in pit slope stability studies. Wide fault zones containing highly fractured rock may also limit the ability to form steep stable benches and can also affect inter-ramp and overall slope scale stability depending on their orientation.

A detailed discussion of the structural geology for the Osiris Project is presented in Steiner et al (2018). A summary of the major and minor structures that have the potential to impact bench, inter-ramp, and overall slope stability is presented in the following sub-sections.

4.3.1 Major Structures

Major structures that can affect inter-ramp and overall slope scale stability consist of the Nadaleen Fault Zone (NFZ) and the Sunrise fault, as described in Section 2.4.2.1. These are project scale faults that are steeply dipping and have been modelled in 3D by ATAC. There are also continuous faults observed and mapped on the surface which have not been modelled, these faults are expected to be steeply dipping (Steiner et al 2018).

The NFZ and Sunrise Fault are described as brittle shear zones with associated damaged rock adjacent to the fault zone core. The NFZ has been intersected in many Conrad zone coreholes and is up to 60 metres wide. During Golder's core review this fault zone it was observed to be a healed breccia and classified as Very Weak (R1, 1 < UCS < 5 MPa) to Medium Strong (R3, 25 < UCS < 50 MPa) rock with intervals of rubble and clay gouge. Point load testing performed by ATAC on competent sections of core from the NFZ confirmed that some portions of this fault zone can be classified as medium strong to strong (Table 11). However, as point load testing was performed on NFZ core, this indicates that the PLT dataset for the NFZ is biased towards strengths exhibited by the competent core within this zone. Point load testing is difficult to perform on weak rocks and rubble and is typically not attempted. The NFZ is a very wide fault zone that has been intersected in about 3,000 metres of exploration core, and therefore, has been defined as an individual rock unit. The Sunrise Fault zone is a discrete brittle shear zone with a limited width as indicated by corehole intersections and is not defined as an individual rock unit. Therefore, no geotechnical characterization has been performed for the Sunrise Fault and it is treated as a discrete interface between rock units. Two major deformation events have folded the sedimentary rocks at the Osiris Project which has resulted in spatially variable orientations of the minor structures.

4.3.2 Minor Structures

Minor structures that form discontinuities in the rock mass consist predominantly of joints, foliation, and bedding. All of the sedimentary rock units contain bedding surfaces of variable thickness and are systematically jointed. Based on our review of the core and outcrop exposures, the bedding and joint surfaces form natural discontinuities at surface and at depth. The fine grained sedimentary rocks (mudstones and siltstones) contain a well-defined S_2 axial planar cleavage (also described as foliation). The carbonate rocks have been observed to locally contain the S_2 cleavage. This cleavage forms natural discontinuities observed in outcrop exposures (Steiner et al 2018). The S_2 cleavage has similar orientations to bedding in some areas at the Osiris Project and can be confused with bedding in these areas. The cleavage was not observed during our core review.

In the core Golder reviewed on site, bedding discontinuities are typically planar, smooth to rough, with either clean surfaces or coating of iron oxide on the surface. The bedding surfaces are locally slickensided or polished. The joints are typically undulating, rough to very rough and contain no significant infilling. Highly fractured rock and clay gouge were observed in fault zones during the core review.

The sedimentary rocks at the Osiris Project contain two sets of discontinuous joints that are oriented perpendicular to bedding and are mutually orthogonal to one another. These two sets were observed in outcrop during our site visit (Appendix G). The J1 set strikes sub-parallel to the strike of the bedding. The second set, termed the J2 set, was observed to strike perpendicular to the bedding. The cross-joints are also observed in the oriented core data (Figures D1-35 and D1-37). However, it is important to note that the corehole structural orientation data contain an inherent orientation bias, where structures that are oriented parallel to the core axis are intersected less frequently than structures that are oriented perpendicular to the core axis. The exploration coreholes at the Osiris Project are typically drilled along orientations approximately perpendicular to bedding planes to target the mineralized zones. This is a favourable corehole orientation to investigate the orientation of bedding, however, structures that are perpendicular to bedding planes (the J2 joint set) are under-sampled in the coreholes and are generally not observed in the oriented core data.

Based on observations that the rock units generally contain a systematic joint network relative to the orientation to bedding, assumptions on the orientation of joints can be made if the orientation of bedding is well defined. This is particularly beneficial for this scoping level pit slope evaluation, as surface mapping and oriented core data has focused on the characterization of bedding orientations for mineral exploration purposes. Furthermore, lacking controls on overall pit slope stability from major structures, it will be the minor structures that control the bench design.

The oriented core data discussed in Section 3.4 and presented in Appendix D1 has been combined by pit and is presented in Appendix D2. Structure types presented in the stereonets combined by pit were filtered to plot only bedding, joints, foliation, and faults, as the other minor structures that were oriented by ATAC are not likely to affect the bench scale stability. Based on our review on the oriented core data by corehole (Appendix D1), it was determined that the only pit with significant variation in bedding orientations to justify division of the pit into sub-domains was the Sunrise Pit. The surface mapping data and oriented core data indicates that bedding strikes north and south at the Sunrise West Pit and strikes east at the Sunrise East Pit. The Sunrise Fault cuts through the south wall of the proposed Sunrise East Pit, and the oriented core data was separated to the north and south of the fault to determine if structural orientations vary on either side of the fault. Figures D2-5 to D2-7 show that bedding dips steeply towards the south on both sides of the Sunrise Fault in the Sunrise East Pit. Although observations from surface mapping suggest variations in bedding in the Conrad Pit and the Ibis Pit, insufficient oriented core data exist to define sub-domains with this dataset. Structural domains were defined based on our review of the oriented core data by pit and the surface mapping data by area, and is discussed in Section 4.3.3.

Syn-sedimentary soft sediment deformation features have been observed at the Osiris Project (Steiner et al 2018). These features consist of slumps and debris flows. The occurrence of these features is infrequent and therefore the affect on bench stability due to variations in the minor structure orientations is expected to be localized. The Nonad mudstone has been thrust over the Osiris strata and relatively little structural orientation data exist within this rock unit, particularly at depth. It is possible that the orientation of minor structures within this mudstone unit could be variable, particularly adjacent to the fault contact with the Osiris strata. If the orientation of minor structures within this rock unit is variable, effects on slope stability are likely to be limited to localized bench scale instability or increased ravelling.

4.3.3 Structural Domains

The structural domains at the Osiris Project have been defined based on our review of surface mapping data and corehole data. These domains represent the orientation of the minor structures that Golder expect to be exposed in the pit slopes. In general, the orientations of the joints have been assumed based on the orientation of bedding and on the observed systematic joint network discussed in Section 4.3.2. Table 14 presents a summary of the expected orientation of the minor structures for each structural domain and the data source on which the orientation of the structures is based. The domain boundaries are shown on Figure 15. These domains are preliminary and will likely need to be revised as additional data becomes available.

Table 14: Average Minor Structure Orientation by Domain

Pit	Structural Domain	Structure Type	Dip (description)	Dip Direction (description)	Data Source of Structure Orientations
Conrad	1	Bedding	Moderately	North	Surface
		Joint[a]	Moderately to Steep	South	Surface
	2	Bedding	Steep	South and North	Surface[b]
		Joint[a]	Shallow	North and South	Surface[b]
Osiris	3	Bedding	Steep	Northeast and Southwest	Surface and Corehole
		Joint[a]	Shallow	Southwest and Northeast	Surface and Corehole
Sunrise West	4	Bedding	Steep	East and West	Surface and Corehole
		Joint[a]	Shallow	West and East	Surface and Corehole
Sunrise East	5	Bedding	Steep	South	Corehole[c]
		Joint[a]	Shallow	North	Corehole[c]
Ibis	6	Bedding	Shallow to Moderate	Southwest	Surface
		Joint[a]	Steep to Moderate	Northeast	Surface
	7	Bedding	Moderate	Southwest	Surface
		Joint[a]	Moderate	Northeast	Surface
	8	Bedding	Steep	Southwest	Surface and Corehole
		Joint[a]	Shallow	Northeast	Surface and Corehole

(a) Orientation of joint structures includes description of J1 set only. J2 set is likely to be near vertical in most locations.

(b) Oriented corehole data indicates bedding dips steeply towards the northwest and southeast.

(c) Surface mapping data indicates shallow southerly dipping bedding in the proposed Sunrise East Pit area.

Bedding in the Conrad Nonad mudstone (proposed Conrad Pit north wall) and in the northeast portion of the proposed Ibis Pit is expected to dip at shallow to moderate angles. The remainder of the bedding that will be exposed in the proposed pit slopes is expected to be steeply dipping, as described below.

The orientation of bedding in the Conrad Nonad mudstone has been determined from surface mapping data (Figure B-4). There are no oriented core data within the Conrad Nonad mudstone to confirm bedding orientations at depth. The Nonad Mudstone has been placed in fault contact with the Osiris strata to the south, therefore, the orientation of the contact between the Conrad Nonad mudstone with the Osiris strata cannot be relied upon to determine the orientation of bedding in the mudstone at depth (Figure 5). To the south of the Conrad Nonad mudstone, surface mapping indicates that bedding is steeply dipping towards the north and south (Figure B-5). Although some of the oriented corehole collars are shown in the Nonad mudstone, all of the oriented core data at the Conrad zone has been collected in the strata to the south of the Conrad Nonad mudstone (Figure D2-1). The oriented corehole data indicates that bedding is typically steeply dipping towards the northwest and southeast (Figure D2-2). The difference between the surface mapping data and the oriented core data is likely due to data collection location bias. The majority of the oriented core data at the Conrad zone has been collected at depth near the contact of the Conrad Limestone 1 and the Conrad Siliciclastic on the east and west sides of the proposed Conrad Pit (Figure D2-1). Figure 10 shows that at depth the strike of the contact between the Conrad Limestone 1 and the Conrad Siliciclastic strikes northeast and southwest, particularly along the east side, where the majority of the oriented core data has been collected. However, in order to generalize the orientation of the bedding to the south of the Conrad Nonad mudstone for this scoping-level pit slope evaluation, Golder has chosen to use surface mapping to represent the bedding orientations expected to be exposed in the proposed Conrad Pit slopes to the south of the Nonad mudstone.

The orientation of bedding at the proposed Osiris Pit is expected to be relatively consistent. Both the surface mapping data (Figure B-6) and the oriented core data (Figure D2-3) indicate bedding is steeply dipping towards the northeast and the southwest.

The proposed Sunrise Pit has been separated into the Sunrise East and West Pits, based on the clear change in bedding strike from the surface exposures of the rock units in the area of the Sunrise Pit (Figure 7 and 12). Both the surface mapping data (Figure B-7) and the oriented core data (Figure D2-4) indicate bedding is steeply dipping towards the east and west at the Sunrise West Pit. At the Sunrise East Pit, the surface mapping data indicates bedding is dipping shallowly towards the south and west (Figure B-8) and the oriented core data indicates bedding is steeply dipping towards the south (Figure D2-5). The oriented core data at the Sunrise East Pit has been collected on both the north and south sides of the Sunrise Fault. Golder compared the oriented core data on both sides of the fault (Figures D2-6 to D2-7) which indicates that bedding is expected to dip steeply towards the south on both sides (north and south) of the Sunrise Fault. Golder has assumed that the oriented core data collected at depth in the Sunrise East Pit will be representative of the bedding orientations exposed in the pit slopes. It is likely that a fold structure or a fault are responsible for the observed variation in bedding orientations between the surface and oriented core datasets.

Surface mapping data at the proposed Ibis Pit (Figure B-2) indicates that bedding orientations change from shallow dipping towards the south and southwest near the proposed crest of the pit (Figure B-10) to steeply dipping towards the southwest in the centre of the pit (Figure B-9). Oriented core data at the Ibis zone was collected in the southwest portion of the proposed pit (Figure D2-1) and confirms the steep southwest dipping bedding in the central and southwest portion of the Ibis Pit (Figure D2-8). However, no oriented core data has been collected in the northeast portion of the proposed pit at depth to confirm if shallow dipping bedding can be expected to be exposed in the pit slopes. Based on a combination of surface mapping data and oriented core data, Golder has defined three structural domains in the proposed Ibis Pit that represent shallow to steep dipping bedding (Figure 15).

4.4 Rock Mass Rating

Bieniawski's (1976) Rock Mass Rating (RMR_{76}) classification system was used to provide a quantitative measure of rock mass quality. This system incorporates UCS, RQD, joint spacing, joint condition (as defined by Joint Condition Rating), and groundwater condition to characterize rock masses. Each of these parameters is assigned a numerical rating, and the sum of the rating values yields an RMR_{76} from 0 (very poor quality rock mass) to 100 (very good quality rock mass). For this study, we used RMR_{76} to estimate the rock mass strength of rock units where sufficient corehole data exists. The 2017 and 2018 exploration included discontinuity counts per interval and descriptions of discontinuity characteristics. Based on the discontinuity characteristic descriptions logged by ATAC, Golder calculated Joint Condition Rating (JCR) values for each interval which were used for the RMR_{76} calculations. The exploration corehole interval data collected during 2010 to 2016 did not have sufficient discontinuity count or characteristics data to calculate RMR_{76}. A groundwater rating of 10 (dry) is assigned to the rock mass, as groundwater is not a property of the rock mass and is accounted for in the overall slope stability evaluation by performing effective stress analyses. The RMR_{76} classification system is summarized in Table 15.

Table 15: Summary of Rock Massing Rating (RMR_{76}) System[(a)]

Parameter	Range of RMR_{76} Parameter Values (RMR_{76} Value)						
UCS (MPa)	>200 **(15)**	100-200 **(12)**	50-100 **(7)**	25-50 **(4)**	10-25 **(2)**	<3-10 **(1)**	1-3 **(0)**
RQD (percent)	90-100% **(20)**	75-90% **(17)**	50-75% **(13)**	25-50% **(8)**	<25% **(3)**		
Joint Spacing	>3 m **(30)**	1-3 m **(35)**	0.3-1 m **(20)**	50-300 mm **(10)**	<50 mm **(5)**		
Joint Condition	Very Rough No Separation Hard Wall Rock **(25)**	Slightly Rough Separation <1 mm Hard Wall Rock **(20)**	Slightly Rough Separation <1 mm Soft Wall Rock **(12)**	Slickensides, Separation or Gouge <5 mm **(6)**	Soft Gouge or Separation >5 mm **(0)**		
Groundwater	Completely Dry **(10)**		Moist **(7)**	Moderate Pressure **(4)**	Severe **(0)**		
Total RMR_{76} Value (Sum of Ratings for 5 Parameters)							
Rating	**100-81**	**80-61**	**60-41**	**40-21**	**20-0**		
Description	I – Very Good	II – Good	III – Fair	IV – Poor	V – Very poor		

(a) Rating system from Bieniawski (1976).

In order to calculate RMR_{76} for each rock unit, we used the following geotechnical interval data from the 2017 and 2018 coreholes:

- intact rock strength estimates (Section 4.1.1) logged by ATAC
- RQD (Section 4.2) logged by ATAC
- joint spacing logged by ATAC
- JCR calculated by Golder
- assumed groundwater rating of 10

The joint characteristic descriptions provided by ATAC from the 2017 and 2018 coreholes were used to assign a Joint Condition Rating (JCR) for each core interval. The joint descriptions provided by ATAC include information on the joint shape, joint roughness, infill type, and infill thickness, which is sufficient to assign a JCR for each interval. The average RMR_{76} values by pit and rock unit are presented in Table 16. RMR_{76} averages are not available for all Osiris Project rock units.

Table 16: Average Rock Massing Rating (RMR_{76}) by Pit and Rock Unit

Pit	Rock Unit	Rock Code	Typical Range of RMR_{76}	Average RMR_{76}	Rock Quality Classification
Conrad	Conrad Dolostone	C-DST	37-57	44	Fair
	Conrad Limestone 1	C-LST1	31-84	58	Fair
	Conrad Limestone 2	C-LST2	36-71	52	Fair
	Nadaleen Fault Zone	C-NFZ2	24-61	45	Fair
	Conrad Shale	C-SHL	53-63	59	Fair
	Conrad Siliciclastic	C-SLC	18-87	53	Fair
Osiris	Osiris Diamictite	O-DMT	39-66	49	Fair
	Osiris Dolostone	O-DST	27-77	51	Fair
	Osiris Limestone 1	O-LST1	22-79	55	Fair
	Osiris Limestone 2	O-LST2	28-71	46	Fair
	Osiris Mudstone	O-MST1	27-77	49	Fair
Sunrise	Conrad Limestone 2	C-LST2	28-76	48	Fair
	Osiris Dolostone	O-DST	33-84	56	Fair
	Osiris Limestone 1	O-LST1	28-84	52	Fair
	Osiris Mudstone	O-MST1	31-74	48	Fair

The rock mass ratings presented in Table 16 indicate that rock units typically exhibit fair rock mass quality ($40 < RMR_{76} < 60$). In general, the RMR_{76} of carbonate rock units typically range from 50 to 60 and the RMR_{76} of non-carbonate clastic sedimentary rock units typically range from 40 to 50. The exceptions to this are the Conrad and Osiris Limestone 2 rock units in the Osiris and Sunrise Pits that classified within the lower half of fair rock mass quality ($40 < RMR_{76} < 50$) and the Conrad Shale and Siliciclastic in the Conrad Pit that were classified within the upper half of fair rock mass quality ($50 < RMR_{76} < 60$).

Geological Strength Index (GSI) ratings were assigned to most of the rock units at the Osiris Project during the Golder 2018 site visit (Appendix G2). A summary of the qualitatively measured values by rock unit is presented in Table 17. The GSI is approximately equal to RMR_{76}, however, GSI is estimated from observations of surface outcrop exposures of the rock mass rather than calculated from geotechnical interval data collected from drill core.

Table 17: Average Geological Strength Index (GSI) by Rock Unit

Rock Unit	Rock Code	Range of Assessed GSI[(a)]	Average Assessed GSI[(b)]
Conrad Dolostone	C-DST	65-75	NA
Conrad Limestone 1	C-LST1	70-80	NA
Conrad Diamictite[(c)]	C-DMT	75-80	NA
Nadaleen Fault Zone	NFZ	25-35	NA
Conrad Nonad Mudstone	C-NONAD	40-70	53
Conrad Shale	C-SHL	25-35	NA
Conrad Siliclastic	C-SLC	35-45	NA
Osiris Diamictite	O-DMT	40-70	58
Osiris Dolostone	O-DST	45-55	NA
Osiris Gabbro	O-GAB	70-80	NA
Osiris Limestone 1	O-LST1	40-70	53
Osiris Limestone 2	O-LST2	35-60	40
Osiris Mudstone 1	O-MST1	25-45	35

(a) GSI is related to RMR_{76}. GSI values are from outcrop and RMR_{76} is calculated from corehole interval data.

(b) average assessed GSI based on multiple outcrop assessments, if applicable (Appendix G2).

(c) rock unit occurs within the Conrad Limestone 2 rock unit.

NA = not applicable, only one outcrop assessment.

The range and average GSI values collected during Golder's 2018 site visit (Table 17) are generally lower than the average RMR_{76} values calculated from corehole data for each rock unit (Table 16). This is expected, as rock mass quality typically increases with depth through the zone of weathering. However, there are a few rock units where the GSI values are higher than the average RMR_{76} values. There are a few possible reasons why the GSI values are higher than the RMR_{76} values:

- The GSI values were assessed from observations of rock outcrops at surface for each rock unit. The surface outcrops could represent better rock masses that are more resistive to surface weathering than the portion of the rock mass with poor rock mass quality that is less likely to form rock outcrops. The RMR_{76} values calculated from core are not biased by surficial weathering.
- Estimates of JCR calculated by Golder may be biased towards the low end based on ATAC's joint characteristic observations and interpretations of core logging guidelines. These estimates were used to calculate RMR_{76} and could have lowered the ratings.

- The intact rock strength field estimates may be biased toward the low end due to reasons discussed in Section 4.1.1. These estimates were used to calculate RMR_{76} and could have lowered the ratings.

Appendix H presents a comparison of outcrop photos with representative core photos for each rock unit with the assessed GSI values (from outcrop) and the calculated RMR_{76} values. This comparison shows that in general the rock mass quality for each rock unit improves with depth.

4.5 Weathering

The degree of weathering is recorded by ATAC for each core interval based on the classification presented in Table 18.

Table 18: Osiris Project Weathering Classification

Classification	Code[(a)]	Field Identification[(b)]
Fresh	1W	No weathering effect visible to naked eye.
Slightly Weathered	2W	Visible change in appearance but not significant loss in strength.
Moderately Weathered	3W	Visible change in appearance and with significant loss in strength.
Highly Weathered	4W	Shows considerable change in appearance and loss in strength. Material is still a rock but normally very weak.
Extremely Weathered	5W/6W	Has soil properties and often shows complete change in appearance.

(a) ATAC Manual for Core Handling (AC 2017).

(b) There are no field identification guidelines to classify weathering presented in ATAC's manual for core handling (AC 2017). The field identification guidelines presented here are consistent with the guidelines presented in Golder 2014 from the Tiger Zone Project. It has been assumed that these same guidelines were used at the Osiris Project.

For this project weathering classification is related to rock strength and can be used to identify portions of the rock core that have undergone significant loss in strength from weathering. Golder defined a weathered zone for each pit based on the average depth that rocks were observed to be significantly weathered. Figure 14 shows these weathered zones projected onto the proposed Osiris Project pit shells. The average geotechnical parameters of the rocks and depth of weathering within the defined zones are summarized in Table 19.

Table 19: Summary of Average Geotechnical Parameters for the Weathered Zone Rocks by Pit

Pit	Rock Unit	Average Depth of Weathered Rock[(a)] (m)	Average RQD (percent)	Average Rock Strength	Average RMR_{76}
Conrad	Nonad Mudstone and Nadaleen Fault Zone	50	19	R3	NA
	South of Nadaleen Fault Zone	25	18	R3	42
Osiris	All rock units	20	23	R2	45
Sunrise	All rock units	20	26	R3	40
Ibis	All rock units	20	27	R3	NA

(a) Depth is normal to average natural slope topography.

NA = not applicable. Insufficient geotechnical interval data available to calculate RMR_{76}.

RQD = Rock Quality Designation. RMR = Rock Mass Rating.

The weathered zone for each pit was defined by core intervals that were logged as both moderately to extremely weathered (3W to 5W/6W) and very poor to poor rock quality (0-50% RQD). The summary of geotechnical parameters presented in Table 19 indicates that the weathered rocks were typically classified as Weak (R2, 5 < UCS < 25 MPa) to Medium Strong (R3, 25 < UCS < 50 MPa) rock. The RMR_{76} values indicate that the weathered rocks typically exhibit poor rock mass quality ($21 < RMR_{76} < 40$) to fair rock mass quality ($41 < RMR_{76} < 60$). Core photographs of rocks from the weathered zones at each pit were reviewed, and a summary of this core photograph review and the average logged geotechnical parameters are presented in Appendix I. Based on visual observations from the core photographs it appears that in general the rock strength and RQD within the weathered zone were logged appropriately. However, there are some intervals where it appears that the rock strength was logged higher than the actual rock strength.

4.6 Geotechnical Units

Geological units are based on age and composition of the rock (Section 2.4.1) while geotechnical units are based on engineering properties (Section 4.0). In some cases, geological units with similar geotechnical engineering properties are combined to form a geotechnical unit. Alternatively, geological units may be subdivided if there are significant variation in their geotechnical engineering properties. The geotechnical data from the exploration coreholes at the Osiris Project indicate that the geological units are also the geotechnical units except where the units are significantly weathered near the ground surface. The geotechnical units have been further sub-divided by proposed pit to account for any potential spatial variability in geotechnical properties within the geological units. The geotechnical characterization summarized in Sections 4.1 through Section 4.5 have been used to determine material properties for the geotechnical units by pit and are presented in Table 20.

Table 20: Summary of Geotechnical Engineering Properties of the Osiris Project Geotechnical Units

Geotechnical Unit		Geotechnical Engineering Properties			Thickness Exposed in Pit Slope[c] (m)	Source of Assigned UCS Value
Pit	Rock Unit	Average RQD (percent)	Assigned UCS[a] (MPa)	Assigned Rock Mass Rating[b] (GSI/RMR_{76})		
Conrad	Conrad Dolostone	37	60	44	35	Osiris Dolostone PLT Results
	Conrad Limestone 1	70	78	58	240	PLT Results
	Conrad Limestone 2	49	80	52	90	Maximum of 80 MPa[d]
	Nadaleen Fault Zone	57	35	46	75	ISRM Strength Estimate
	Conrad Nonad Mudstone	64	45	53	485	ISRM Strength Estimate
	Conrad Shale	54	25	59	95	ISRM Strength Estimate
	Conrad Siliciclastic	61	66	53	270	PLT results
Osiris	Osiris Diamictite	53	75	49	30	PLT Results
	Osiris Dolostone	41	62	51	90	PLT Results
	Osiris Limestone 1	52	76	55	160	PLT Results
	Osiris Limestone 2	46	44	46	55	PLT Results
	Osiris Mudstone 1	54	54	49	110	PLT Results
Sunrise	Conrad Limestone 2	50	80	48	45	Maximum of 80 MPa[d]
	Osiris Dolostone	60	82	56	75	PLT Results
	Osiris Limestone 1	56	66	52	95	PLT Results
	Osiris Mudstone 1	53	35	48	65	PLT Results
Ibis	Osiris Diamictite	60	75	49	135	Osiris Pit PLT Results
	Osiris Dolostone	44	62	51	205	Osiris Pit PLT Results
	Osiris Limestone 1	46	76	55	340	Osiris Pit PLT Results
	Osiris Limestone 2	45	44	46	70	Osiris Pit PLT Results
	Osiris Mudstone 1	51	43	49	165	ISRM Strength Estimate

(a) Assigned UCS value is based on a comparison of the two estimations of UCS [intact rock strength field estimates (Section 4.1.1) and point load test result (Section 4.1.2)].

(b) Assigned GSI/RMR_{76} value based on comparison of two rock mass ratings [RMR_{76} calculations from core logging data and GSI assessments from outcrop mapping (Section 4.4)]. All assigned GSI/RMR_{76} values are from the average calculated RMR_{76} (Table 16) except for the Conrad Nonad Mudstone which is based on assessed GSI (Table 17).

(c) Maximum vertical thickness exposed in pit slope is based on geology projections onto pit shells (Figures 10 to 13).

(d) PLT $Is_{(50)}$ strength index conversations to UCS suggests that the UCS of Conrad Limestone 2 is 116 MPa (Table 11). However, there have only been two PLTs completed on this geotechnical unit. The next highest UCS values from PLT conversation indicate strengths of about 80 MPa, therefore, the highest assigned UCS value is 80 MPa.

RQD = Rock Quality Designation. UCS = Unconfined Compressive Strength. GSI = Geological Strength Index. RMR_{76} = Rock Mass Rating (1976). PLT = Point Load Test. ISRM = International Society of Rock Mechanics.

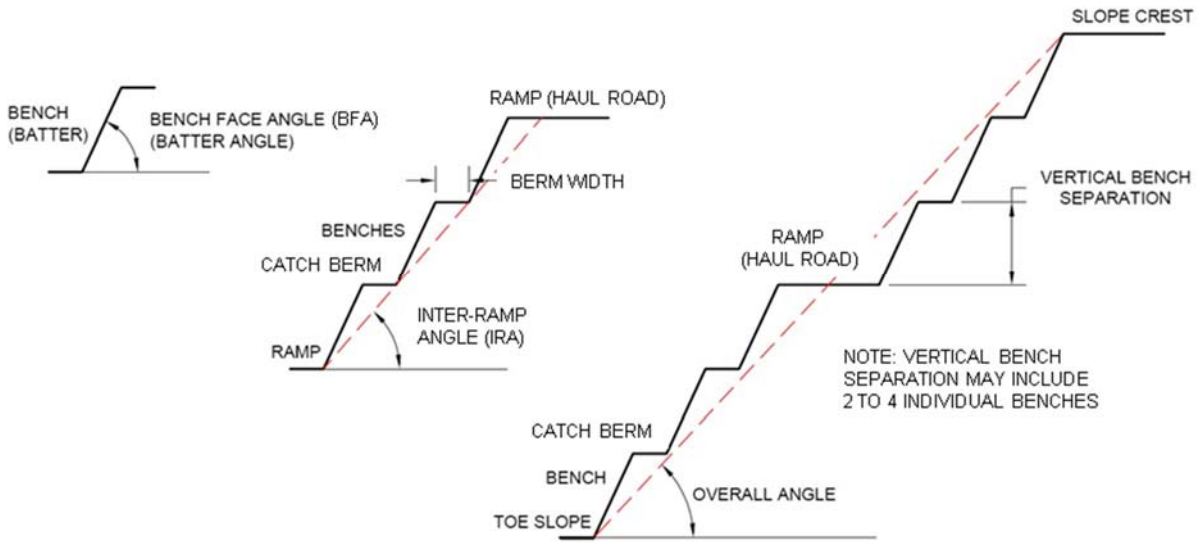
5.0 PIT SLOPE DESIGN CONSIDERATIONS

5.1 Slope Design Definitions

A pit slope has three major components: bench configuration, inter-ramp slope, and overall slope. These are shown in Illustration 1. The bench configuration is defined by the vertical bench separation (bench height), catch-bench width (bench width), and bench face angle (batter angle). The inter-ramp slope is formed by a series of uninterrupted benches, and the overall slope is formed by a series of inter-ramp slopes separated by haul roads or wide geotechnical benches.

It is common practice to establish catch-benches on a pit slope to retain loose material that may fall from either the immediate bench face above or from the upper part of the slope. Where conditions are suitable, it is also common practice to place benches at vertical intervals of two (or occasionally more) bench heights, creating a multi-bench slope configuration. This is typically referred to as a double or triple bench configuration.

The inter-ramp angle (IRA) corresponds to the angle subtended by a line joining the toes of the benches on the wall and the horizontal. The overall slope angle corresponds to the angle formed by the line joining the toe of the lowest bench with the pit crest and the horizontal. The incorporation of ramps onto a wall will result in a slope that has a shallower overall slope angle than the IRA.



Source: Read and Stacey 2009

Illustration 1: Schematic of Bench Face Angle, Inter-ramp Angle, and Overall Slope Angle

5.2 Rock Slope Failure Mechanisms

Rock slope design procedures are intended to establish pit wall design criteria based on the expected failure mechanisms, as determined by analyzing the engineering geological model. In this context, instability in rock slopes can generally be classified according to the following principal failure mechanisms:

- failures due to rock mass fabric and structural discontinuities (kinematic failures)
- failures due to rock mass strength
- failures due to a combination of kinematic failures and rock mass strength failures

The stability of slopes excavated in competent rock is normally a function of structurally controlled failure mechanisms and operating practices. In very high rock slopes or slopes excavated in incompetent rock masses, overall slope failure mechanisms that involve the development of failure surfaces through intact rock and along pre-existing geological surfaces are also a concern. These two principal failure mechanisms are discussed in further detail in the following sub-sections.

5.2.1 Structurally Controlled Failure Mechanisms

The stability of slopes excavated in competent rock is normally a function of structurally controlled failure mechanisms and operating practices. Structurally controlled failure in rock occurs as the result of sliding along pre-existing geological discontinuities. The primary geological structures that will control slope stability in the proposed pits at the Osiris Project are the bedding, joints, foliation, and continuous faults.

The three basic mechanisms of structurally controlled failure in rock slopes are plane failures, wedge failures, and toppling failures, as described below. These mechanisms are shown schematically in Figure 16.

A **plane failure** may occur when a geological discontinuity dips out of a rock slope at an angle that is shallower than the inclination of the slope but steeper than the effective angle of friction along the discontinuity. Plane failures will only develop to a significant extent if the strike of the geological discontinuity is within ±20 to 30 degrees of the strike of the rock slope.

A **wedge failure** may occur when two or more geological discontinuities intersect to form an unstable block. For wedge failure to occur, the line of intersection of the wedge must dip out of the slope at an inclination that is shallower than the inclination of the slope but steeper than the effective angle of friction along the discontinuities. Wedge failures will only develop to a significant extent if the azimuth of the line of intersection is within ±45 degrees of the azimuth of the slope face.

A **toppling failure** may develop when a rock mass contains multiple, steeply in-dipping, continuous geological structures, such as bedding surfaces, that strike nearly parallel to the strike of the slope face. Toppling failure will generally only develop when the strike of the structures is within ±20 degrees of the strike of the slope face. When the structures are closely spaced and continuous, toppling failures have the potential to develop into a multi-bench, shallow-seated failure mechanism, which could result in multiple-bench, or even overall, wall failure. This is illustrated in Figure 16.

All structurally controlled failure mechanisms are aggravated by groundwater pressures within the slope, and toppling failures are particularly sensitive to groundwater pressure. Furthermore, the magnitude and frequency of structurally controlled failures are directly related to the continuity and spacing of the structures along which sliding can occur. Rock mass structures that exhibit limited continuity, such as joints, may result in small bench-scale failures that are rarely of consequence to overall slope stability but may adversely affect access ramps or fixed equipment. Conversely, larger-scale failures can occur along continuous, through-going structures such as major faults. Therefore, it is these more continuous structures that are of primary concern for pit slope design.

5.2.2 Overall Rock Mass Failure Mechanisms

Slopes excavated in weak or heavily fractured rock masses, or extremely high slopes, can be susceptible to overall rock mass failure, which involves the development of pseudo circular type failure zones through intact rock. This overall rock mass instability mechanism is shown schematically in Figure 17. The failure surface can generally be of a circular nature and, in rocks with preferentially oriented structures (i.e., bedding or foliation), the failure surface may form linear segments along these potential planes of weakness. Where major structures are present with an appropriate orientation, these structures may be partially involved in a more complex failure mechanism by creating release planes for the rock mass failure.

6.0 SCOPING-LEVEL PIT SLOPE EVALUATION

Our preliminary stability evaluation consists of evaluating the potential control of pervasive and large-scale structures on bench and inter-ramp slope stability. We also assessed the risk of rock mass instability for overall slopes based on rock mass characteristics at the Osiris Project, slope stability analyses, and slope performance in similar materials at other open pit mines.

Where there are no structural controls on pit slope stability, and the rock mass strength precludes rock mass failure, stability and safely achievable slope designs are controlled by operating practices. We evaluated appropriate operating practices, particularly blasting methods, based on the characteristics of the geotechnical units defined by their RQD, RMR_{76}, and ISRM intact rock strength classification. The stability of the proposed slopes with respect to structurally controlled failures and potential deep-seated rock mass strength circular type instability is discussed in the following sections. The recommended slope designs are provided in Section 7.0.

6.1 Structurally Controlled Stability

The stability of slopes in competent rock can be controlled by structures, or combinations of the structures that define kinematic failure modes. These involve movement of intact blocks along one or more discontinuities, typically in planar, wedge, toppling, or combination modes (Section 5.2.1 and Figure 16). Stability with respect to these failure modes is a function of slope orientation, discontinuity orientation, discontinuity shear strength, groundwater conditions, and external forces. Structures that could potentially control pit slope stability at the proposed Osiris Project pits include bedding, joints, foliation, faults, and geological contacts.

Kinematic failure modes can affect bench-scale, inter-ramp, or overall slopes, depending on the continuity of the structures. As such, persistence is an important consideration in evaluating the significance of any potential failure modes that are indicated. Bedding, fault, and geological contact structures may be continuous on an overall slope scale. Foliation and joints generally have more limited continuity, but until exposure during mining allows persistence to be evaluated directly, prominent structures such as bedding that may form a control on bench stability should be considered continuous on an inter-ramp scale.

Quantitative data on the distribution of structures and their orientations at Osiris includes surficial mapping data, oriented core data, and modelled large scale fault structures (Section 4.3). This data set has allowed Golder to perform a preliminary assessment of potential structural controls on slope stability of the proposed Osiris Pits. However, given the structural complexity at the Osiris project, continued oriented core measurements and additional studies will need to be performed to confirm our preliminary assessment and the assumptions upon which this assessment is based.

6.1.1 Large-scale Structurally Controlled Stability

Faults at the Osiris project generally strike east, west, northwest, or southwest (Figure 7) and are typically steeply dipping. Faults in these orientations are not likely to control the large-scale slope stability because they dip more steeply than the design slope angles. Any instability related to these faults would be expected to be bench-scale or multi-bench scale and limited to the immediate vicinity of the fault zones due to locally low rock mass strength within or adjacent to the fault zones. Where such conditions exist, it is sometimes possible to excavate the pit slope within the footwall of the fault zone to mine out the fault or to decrease the slope angle through the fault zone. Both of these design options can be used to improve stability.

6.1.2 Bench-scale Stability

Bench-scale stability will be controlled by structures with limited continuity, such as joints, by closely-spaced continuous structures, such as foliation and bedding, and by faults where they are present. The orientations of the foliation (also referred to as S_2 axial planar cleavage) at the Osiris Project is not well defined, and therefore, was not considered explicitly in this scoping-level pit slope evaluation. Bedding and joints are expected to be the primary structural control of bench stability. The expected orientations of bedding and joints at each of the proposed pits are discussed in Section 4.3.3. Based on the generalized expected orientations of the bedding and joints, structural domains were defined.

As discussed in Section 4.5, a pervasive weathered zone has been defined and is expected to have decreased the rock mass quality. The rock mass quality within the weathered zone rocks is likely to control the bench-scale stability, and therefore, the bench design configuration (Section 7.0).

Cross-joints are expected to dip out of the proposed Conrad Pit north wall at approximately 50 to 75 degrees. In order to limit the quantity of cross-joints that are undercut in the bench face, the bench face angle for this slope should be limited to 60 degrees. It is likely that 15 metre high triple benches and 7.5 metre wide benches can be achieved along this slope, resulting in an inter-ramp angle of 42.9 degrees.

Bedding orientations in the northeast portion of the Ibis Pit are expected to dip at shallow to moderate angles towards the southwest, out of the slope. Depending on the location at which bedding dips become steeper than the proposed pit slope angle, a portion of the proposed Ibis Pit northeast wall may be required to be excavated along bedding. The orientation of bedding expected to be exposed in the proposed Ibis Pit northeast wall is uncertain due to a lack of structural orientation data at depth in this area. Therefore, the pit slope design recommendations for the Ibis Pit are provided on the basis of bedding dip ranges rather than specific wall orientations or geotechnical units. Where bedding dips are steeper than the effective friction angle of the bedding discontinuities, bedding structures should not be undercut. Planar failure will occur if bedding surfaces are exposed in bench faces and dip at angles steeper than the effective friction angle if the strike of bedding is within $\pm$ 20 to 30 degrees of the strike of the rock slope. The pit slope should be excavated along the bedding orientation to avoid undercutting bedding. This slope configuration is referred to as a footwall design. Footwall slopes should not be excavated in excess of 50 degrees. Steep footwall slopes could be subjected to planar failure along bedding discontinuities behind the slope with failure through the rock mass at the toe of the slope. Therefore, where bedding dips between 50 and 70 degrees, a benched slope configuration should be excavated with a bench face angle of 60 degrees. For these slopes it is likely that 15 metre high triple benches and 7.5 metre wide benches can be achieved, resulting in an inter-ramp angle of 42.9 degrees. Where bedding dips steeper than 70 degrees, structure does not control the bench stability and the bench face angle is controlled by operating practice.

The bedding and joints are expected to be favorably oriented for stability with respect to the remainder of the pit slopes at the Osiris Project. The scoping-level pit slope design recommendations are provided in Section 7.0.

6.2 Overall Rock Mass Slope Stability

Where there is no structural control on inter-ramp or overall slope stability, estimates of rock mass strength are used to evaluate the overall slope stability of the rock mass. The weight of the rock in pit slopes creates shear stresses within the rock mass. Pore pressure in the slope reduces the available effective shear strength of the rock mass. If the shear stresses are greater than the available effective shear strength over large zones within the rock mass, the pit slope will become unstable. The likelihood of pit slope instability due to shear through the rock mass expected to be exposed in the pit slopes was evaluated using the two-dimensional general limit equilibrium (GLE) method of slices with Slide 2018 (RocScience 2019b). Cross-sections to evaluate the pit slope stability were selected for each of the proposed pits at the Osiris Project (Appendix J, Figure J-1). The cross-sections were generally selected based on the highest proposed slope for each pit and were cut approximately perpendicular to the strike to the pit slope.

In evaluating slope stability by limit equilibrium methods, a factor of safety (FOS) that represents the ratio of the shear resistance along the slip surface (mobilized through rock mass strength) over the driving forces destabilizing the slide mass is computed for trial surfaces through the rock mass. The FOS for each trial surface is calculated and the minimum FOS provides an indication of the level of stability of the slope. Algorithms programmed within Slide generate trial slip surfaces and identify the surface with the lowest FOS (critical surface). Typical minimum acceptable FOS for open pit mine slopes are on the order of 1.2 to 1.3 for overall slopes where the consequences of failure are low, and are up to 1.5 for overall slopes containing critical facilities and access ramps (Read and Stacey 2009). For this scoping-level assessment, Golder have considered an overall slope stability FOS of 1.3 to be acceptable (medium consequence of failure), and an inter-ramp slope stability FOS of 1.2 to be acceptable (medium consequence of failure).

In addition to the selected cross-sections, Golder assessed the stability of a slope excavated within the Osiris Mudstone 1 because this rock unit appears to have the lowest rock mass strength at the Osiris Project. The stability of a typical slope excavated through this rock unit was evaluated by performing two-dimensional limit equilibrium slope stability analysis.

6.2.1 Strength Parameters

The shear strength of a rock mass is controlled by the following:

- the strength of the intact rock
- the degree of fracturing of the rock mass
- the nature of the fracture surfaces

The overall shear strength of a rock mass is typically characterized using the results of laboratory testing by empirical estimates of rock mass strength based on rock mass classification methods and the intact rock strength, and orientation and strength properties of natural fractures.

The rock mass strengths used for the slope stability analyses presented in this report were determined using the generalized Hoek-Brown failure criterion (Hoek et al. 2002). Hoek-Brown parameters are derived from the following:

- Geological Strength Index (GSI/RMR_{76}), which describes the overall character and quality of the rock mass. Estimates of GSI/RMR_{76} were obtained from Golder's outcrop mapping and data from ATAC's geotechnical core logs (Section 4.4).
- UCS (σ_{ci}) of the intact rock. The estimates of UCS were derived from ISRM intact rock strength field estimates performed during core logging (4.1.1) and from the PLT strength index ($Is_{(50)}$), Section 4.2.1.
- intact m (m_i), an empirical material constant for the intact rock. For this project these were based on typical values for rock type from published literature (Hoek and Brown 1997).
- disturbance factor (D), an empirical factor based on the degree of disturbance in the rock mass by blast damage and stress relaxation (Hoek 2012).

Given the uncertainty in the rock mass shear strength estimates, the appropriate use of the results of the slope stability analyses is not necessarily as a design tool to select an appropriate slope height and slope angle based on safety factors (Read and Stacey 2009). Rather, the appropriate use of the slope stability analyses results are for semi-quantitative estimates of the likelihood that rock mass shear strength is a controlling factor in slope design. If stability analyses using conservative assumptions indicated reasonable safety factors, our experience suggests that rock mass failure is unlikely to be a controlling factor. If unacceptable safety factors are calculated, additional evaluation of the potential for, and the impacts from, a rock mass failure would be required. These evaluations might include assessment of the impact of unstable slopes on mine plans and incorporation of design elements and operating practices to reduce the impact of potential rock mass failure. They may also include additional engineering studies and laboratory testing depending on the failure mechanism.

6.2.2 Design Material Properties

6.2.2.1 Rock Mass

The Hoek-Brown shear strength criteria requires estimates of UCS and material constant, m_i, of the intact rock; the rock mass quality (RMR_{76}); and an estimate of the degree of disturbance of the rock mass as defined by a disturbance parameter, *D*. We developed Hoek-Brown shear strength parameters for the geotechnical units based on the typical geotechnical parameters presented throughout Section 4.0 and summarized in Section 4.6.

The UCS and RMR_{76} for each of the geotechnical units are summarized in Table 20.

Typical m_i values for sedimentary rocks (shales, siltstones, and sandstones) range from 6 to 17 (Hoek and Brown 1997). The average m_i values available in Slide 2018 by rock type were used in this assessment, which indicate a maximum value of 10 for the geotechnical units defined by limestone rock type.

In 2012, Hoek provided guidelines on how to estimate the blast damage zone thickness and a value for D, the blast damage factor, to assign (Hoek 2012). Based on the recommendations provided in Hoek 2012, a blast damage zone of two times the height of a single bench (conservatively assumed to be 10 metres rather than 5 metres) has been used in the overall slope stability analyses. Therefore, a blast damage zone of 20 metres into the slope was assumed for this study. It has been assumed that the Osiris Pits will be excavated using controlled blasting techniques and a disturbance factor of 0.7 was assumed for the blast damaged zone.

A summary of the UCS, RMR_{76}, m_i, and D values used to estimate the Hoek-Brown shear strength properties for the geotechnical units at each proposed pit are provided in Appendix J, Figures J-2 to J-5.

6.2.2.2 Weathered Zone

The Hoek-Brown failure criterion was developed for tightly interlocked and jointed rock mass with relatively low porosity of the intact material (Hoek et al. 2002). The strength of weathered rock masses comprised of weak intact rock with poor rock mass quality may not be appropriately modelled by the Hoek-Brown criteria (Martin and Stacey 2018). The geotechnical properties of the rock within the weathered zone are summarized in Section 4.5. For this scoping-level pit slope evaluation we have assumed slightly lower geotechnical properties than indicated in Section 4.5, and that the rocks within the weathered zone are weak (R2, 5 < UCS < 25 MPa) with poor rock mass quality.

The rock mass within the weathered zone has been characterized to be heavily fractured and broken based on low RQD. Given the poor rock mass quality, Golder has assumed the weathered rock will have shear strength properties approximately that of typical waste rock fill. Based on our review of weathered zone core photographs (Appendix I) the carbonate rocks are less impacted by weathering than the fine grained non-carbonate sedimentary rocks (i.e., mudstones). Therefore, this is likely a conservative assumption.

Typically, non-degrading waste rock fills have non-linear shear strength relationships largely dependent upon the gradation, angularity, and degree of compaction of the particles (Leps 1970). For this study, Golder assumed the strength of the weathered zone rocks can be approximated by the lower quartile shear strength function suggested by Leps 1970, defined by the following equation:

$$\tau = 1.576\sigma^{0.889}$$

Where τ is the shear strength and σ is the effective normal stress. A unit weight of 21 kN/m^3 has been assumed for weathered rock.

6.2.2.3 Discontinuity Shear Strength

The closely-spaced and continuous bedding surfaces create an anisotropic fabric within the rock mass, with weaker shear strengths along the direction of bedding surfaces than in other directions within the rock mass controlled by joints or intact rock. This condition has not been modelled explicitly for this scoping-level pit slope evaluation as the stability of the majority of the proposed pit slopes are not expected to be controlled by sliding along bedding. However, the design of the northeast portion of the proposed Ibis Pit may be controlled by the orientation and shear strength of bedding discontinuities. To simulate potential stability concerns in this portion of the proposed Ibis Pit, Golder assessed failure along the geological contact between the Osiris Limestone and the Osiris Mudstone 1. The shear strength of this geological contact has been modelled using the Mohr-coulomb failure criterion (Hoek et al. 2002).

There are no strength testing data available for the discontinuities at the Osiris Project. Experience with other mines and direct shear laboratory testing of bedding surfaces in sedimentary rocks with variable grain sizes indicates that a lower bound design shear strength friction angle of 25 degrees with zero cohesion is reasonable for this scoping-level pit slope evaluation.

6.2.2.4 Hydrogeological Conditions

There are no subsurface hydrogeological data at the Osiris Project and the expected hydrogeology conditions are discussed in Section 2.5. Perched water is frequently encountered in rock masses. The persistence and aperture width of bedding and open discontinuities may be great enough to allow the water contained in the rock mass to drain freely as the pits are excavated, however, the degree of drainage will not be known until excavation has started. In order to cover the range of expected hydrogeological conditions at the Osiris Project, Golder performed the overall slope stability analyses assuming dry slopes (most favorable), fully saturated slopes (least favorable), and with 1/3 and 2/3 of the slope height saturated.

Faults can impede drainage of water from rock masses depending on orientation and capability of water to flow across the fault. Water pressures can build behind faults in pit slopes when faults dip into pit slopes and water cannot drain through the fault due to impermeable material in the fault zone. The NFZ dips into the proposed Conrad Pit north wall and the Sunrise Fault dips into the proposed Sunrise East Pit south wall. There is the potential that pore pressures will build up behind these fault zones as the pits are excavated, however, these scenarios have not been evaluated in this scoping-level pit slope evaluation.

6.2.3 Overall Pit Slope Rock Mass Slope Stability Analyses

The overall slope stability analyses have been carried out to assess the potential for a circular failure mechanism to develop involving shear through the rock mass along the stability cross-sections for each pit (Appendix J, Figure J-1) and the formation of a bi-linear shear surface following a geological contact at the Ibis Pit. The overall pit slope stability analyses were carried out on the pit shells provided by ATAC (Section 1.4). The provided pit shells have slopes of 45 degrees for all of the proposed pits. The material properties assumed in the slope stability analyses are discussed in Section 6.2.2, and the result of the analyses are presented in Appendix J and summarized in Table 21.

Table 21: Summary of Scoping-level Overall Slope Stability Analyses – Stability Cross-sections

Pit	Failure Mechanism	Factor of Safety for Assumed Groundwater Table Scenario							
		Fully-Drained		1/3 Slope Saturated		2/3 Slope Saturated		Fully-Saturated	
		FoS	Figure	FoS	Figure	FoS	Figure	FoS	Figure
Conrad	Rock Mass	1.50	J-6	1.35	J-7	1.21	J-8	1.15	J-9
Osiris	Rock Mass	2.41	J-12	2.21	J-13	2.04	J-14	1.78	J-15
Sunrise	Rock Mass	2.42	J-16	2.39	J-17	2.19	J-18	1.85	J-19
Ibis	Rock Mass	1.69	J-20	1.53	J-21	1.38	J-22	1.33	J-23
	Geologic Contact	1.41	J-24	These groundwater table scenarios were not assessed for this failure mechanism				0.99	J-25

FoS = Factor of Safety.

Acceptable factors of safety (FOS ≥ 1.3) for overall slopes in open pit mines (Read and Stacey, 2009) were obtained for the majority of the overall pit slopes and groundwater table scenarios. The exceptions to this are for:

- The Conrad Pit north wall rock mass failure assuming 2/3 slope height saturation and fully saturated slope.
- The Ibis Pit failure along geologic contact with a fully saturated slope.

The results of the overall slope stability analyses indicate that in general the rock mass at the Osiris Project are expected to be stable with respect to shear through the rock mass for the proposed pit slope angles and heights. Read and Stacey (2009) suggest that for moderately strong rock mass the slope design controls are based on structural controls by sector (Section 6.1). Given than the rock mass at the Osiris Project has been typically characterized as moderately strong (Section 4.1) the design of slope angles and heights will generally be controlled by the structural stability evaluation. Therefore, without explicitly assessing the FoS of the proposed pits at angles steeper than 45 degrees, slope angles in excess of 45 degrees can be recommended if indicated by the lack of structural controls. However, additional data are required in the following areas to confirm the results of the scoping-level overall slope stability analyses:

- Hydrogeological data in the proposed Conrad Pit north wall so expected pore pressures in the pit slope can be estimated.
- Intact rock strength testing and detailed geotechnical core logging are required at depth behind the proposed Conrad Pit north wall to confirm the rock mass condition at depth so the geotechnical characterization of the Conrad Nonad Mudstone and other rock units expected to be exposed in the pit can be confirmed.
- Bedding orientation should be confirmed in the northeast portion of the proposed Ibis Pit along with laboratory studies to allow shear strength estimation of bedding discontinuities and geological contacts.

Additional slope stability analyses were performed to assess acceptable slope heights and angles within portions of the rock mass classified as poor quality. These portions of the rock mass include the weathered zone and the Osiris Mudstone 1. The stability of the weathered zone rock mass was evaluated to determine an appropriate design slope angle, and the stability of the Osiris Mudstone 1 was evaluated to determine a maximum acceptable design slope height. For these stability analyses, we considered the current proposed slope angle (45 degrees), a slope angle of 50 degrees in the Osiris Mudstone 1 (to support potential slope steepening), and calculated which slope angle would result in a FoS of approximately 1.2 in the weathered zone rock.

The weathered zone slope was assessed to be fully drained since it is located near the pit crests and generally above the expected groundwater table. The maximum acceptable slope heights in the Osiris Mudstone 1 was modelled with a fully saturated slope to add a degree of conservativism to the analysis. The results of these slope stability analyses are presented in Appendix J and summarized in Table 22.

Table 22: Summary of Scoping-level Slope Stability Analyses – General Cross-sections

Domain	Groundwater Table Scenario	Slope Angle (degrees)	Vertical Slope Height (metres)	Factor of Safety	Figure
Weathered Zone (All Pits)	Fully-Drained	45	80	0.96	J-10
		39	80	1.17	J-11
Osiris Mudstone 1 (All Pits)	Fully-Saturated	45	250	1.29	J-26
		50	200	1.30	J-27

The results of the slope stability analyses described above indicate:

- A maximum inter-ramp slope angle of 39 degrees is appropriate within the weathered zone rocks as it achieves an acceptable FoS at the inter-ramp scale. If a slope angle of 45 degrees is to be excavated the development of an unstable slope is more likely (Table 22).
- Overall slopes up to 250 metres high have an acceptable FoS in the Osiris Mudstone 1 at 45 degrees. If the slope angle is to be increased to 50 degrees, overall slopes should be limited to 200 metres high in the Osiris Mudstone 1.

7.0 SCOPING-LEVEL PIT SLOPE DESIGN

Our preliminary geotechnical characterization and stability analyses indicate that rock mass shear strength has the potential to control slope stability of some of the proposed pit slopes at the Osiris Project. The proposed Conrad Pit north wall may not achieve an acceptable overall slope stability FoS if the slope contains pore pressures resulting from a 2/3 slope height or greater level of saturation. Additionally, the characterization of the rock mass strength of the weathered zone rock has indicated that the slope angle within this zone should be limited in order to achieve acceptable inter-ramp scale safety factors. Additional geotechnical studies are required to confirm the expected pore pressures and rock mass characterization.

Based on our preliminary investigations and understanding of the geology at Osiris Project, the orientation and persistence of the rock fabric indicated potential controls on the bench and inter-ramp scale stability of localized portions of the proposed pit slopes at the Osiris Project. The moderately to steeply south dipping joints expected to be encountered at the proposed Conrad Pit north wall are likely to control the achievable bench face angle for this slope. The shallow to moderately southwest dipping bedding expected to be encountered at the proposed Ibis Pit northeast wall is expected to control the design of this slope.

For the remaining proposed pit slopes at the Osiris Project (Central and South Conrad Pit, Osiris Pit, Sunrise Pit, and Central and Southwest Ibis Pit) neither rock mass shear strength nor major fault structures are expected to form a control on the stability of the slopes. In this case, the inter-ramp slope angles are limited by achievable bench configurations. Based on our understanding of the orientation and persistence of the rock fabric, in this case the bedding and joints, structure does not place a control on the stability of the bench faces for the remaining pit slopes. Where structure does not control the bench stability, the bench face angle is controlled by operating practice, particularly blasting, and excavation methods and bench face scaling.

Given a stable bench configuration, the inter-ramp slope angle can be obtained by:

$$IRA = \arctan\left(\frac{H}{W + Hcot(B)}\right)$$

Where IRA is the inter-ramp slope angle, W is the catch bench width, H is the bench height, and B is the bench face angle. The relationship between bench face angle, catch bench width, bench height and inter-ramp slope angle is shown in Illustration 1.

Effective catch benches should be developed to retain rocks falling from the scaled bench faces. The width of catch benches is selected based on empirical guidelines and experience. A commonly used empirical criterion for catch bench width is the modified Ritchie Criterion (Ryan and Pryor, 2000) as follows:

$$W = 4.5 + 0.2H$$

Where W is the minimum width of the catch bench and H is the bench of height.

The modified Ritchie Criterion was developed based on empirical studies that correlated rockfall travel distance with the height of steep rock slopes (Ritchie, 1963). It is suitable for estimating catch bench width for steep bench faces in hard rock where fall of rock from the bench face is the primary mode of rockfall. Site-specific experience, where this is available, can also be used to select the design catch bench width. A typical minimum catch bench width that is effective for retaining rockfalls from steep bench faces is on the order of 8 metres.

In some provinces in Canada, the design width of catch benches is prescribed in safety regulations. For example, in British Columbia (BC 2017), the minimum width of catch benches is specified to be 8 metres. Based on a review of regulations (Yukon Gov 2019), we did not identify similar regulations specifying minimum catch bench width for the Yukon Territory.

If strong structural control is lacking, the following BFA ranges are typically achievable, depending on rock quality and blasting methods:

- Standard production blasting (including Buffer blasting) – 55 to 65 degrees
- Effective controlled blasting (Trim Blasting) – 65 to 70 degrees
- Best-case controlled blasting (Pre-splitting) – 70 to 80 degrees

Design bench height is dependent on the reach of excavating equipment and the ore control requirements. Production benches can be stacked where feasible to optimize inter-ramp slope angles. Assuming the mining will be accomplished in 5-metre-high production single benches, effective scaling of bench faces, and benches can be stacked to leave catch benches at 10, 15, and 20-metre vertical intervals, the maximum achievable inter-ramp slope angles are presented in Table 23.

Table 23: Inter-ramp Slope Angle Based on Bench Configuration

Bench Height (m)	Catch Bench Width (m)	Blasting Method	Bench Face Angle (degrees)	Inter-ramp Angle (degrees)
10 (double bench)	6.5	Standard Production Blasting	65	41.9
15 (triple bench)	7.5		65	46.0
20 (quad bench)	8.5		65	48.3
10 (double bench)	6.5	Trim Blasting	70	44.6
15 (triple bench)	7.5		70	49.2
20 (quad bench)	8.5		70	51.7
10 (double bench)	6.5	Pre-splitting	75	47.4
15 (triple bench)	7.5		75	52.5
20 (quad bench)	8.5		75	55.3

For this project where rock mass strength is not a limitation and structure does not control the bench stability the bench configuration is controlled by operating practice. In this scenario Golder has assumed the following bench design can be achieved:

- 15-metre-high triple benches
- 7.5-metre-wide catch benches
- bench face angles of 70 degrees by trim blasting
- a resulting 49.2 degree inter-ramp slope angle

If the rock conditions are better than anticipated and a qualified blasting crew is available, it may be possible to form steeper bench face angles by pre-splitting the triple benches. This will likely only be a possibility at greater depths, outside of the influence of surface weathering. Alternatively, if quad benching can be accomplished with trim blasting so that an 8.5 m wide bench is left every 20 vertical metres, then it may be possible to achieve inter-ramp slope angles up to 52 degrees.

The stability assessment carried out for the weathered zone rocks indicates that the rock mass strength of this material may be unlikely to support slopes that are up to 80 metres high excavated at 45 degrees (Section 6.3). The analysis indicates that the slope angle should be reduced to approximately 39 degrees to achieve an acceptable FoS of 1.20. The poor rock mass quality expected to be encountered within this zone indicates that catch benches should be established more frequently than triple benching to catch the high quantity of rock fall expected to be produced by these slopes. Therefore, the bench height should be limited to 10 metres. With a 10 metre high catch bench the modified Ritchie Criterion indicate a bench width of 6.5 metres. Based on these criteria, a 60 degree bench face angle is required to form a slope with an inter ramp angle of approximately 39 degrees.

Based on the expected controls on the stability of the proposed pit slopes (Section 6.0), Golder defined design sectors. The design sectors are presented on Figure 18. The weathered zone is also a design sector, however, is not presented on Figure 18. Figure 14 shows the extents of the weathered zone design sector. The design sectors have primarily been defined on the basis of the structural domains (Figure 15). The Nonad Mudstone is expected to be exposed in the proposed Conrad Pit north wall defined design sector No. 1. The rock mass that will be exposed between the Nonad Mudstone and the NFZ can be expected to be poor quality due to the faulting within this area, therefore, design sector No. 1 has been extended to the south side of the NFZ. Design sectors No. 2, 3, 4, and 7 apply to pit slopes where rock mass strength nor structure control the bench stability and the bench configuration is controlled by operating practice. Design sectors No. 5 and 6 are controlled by the bedding dip expected to be exposed in the proposed Ibis Pit. Table 24 presents Golder's scoping-level pit slope design recommendations.

Table 24: Scoping-level Pit Slope Design Recommendations

Pit	Design Sector	Bench Height (m)	Bench Face Angle (degrees)	Bench Width (m)	Inter-ramp Angle (degrees)	Comments / Assumptions
All	Weathered Rock (Figure 14)	10	60	6.5	39.2	Weak intact rock with poor rock mass quality
Conrad	North Wall Above NFZ (1)	15	60	7.5	42.9	Cross-joints dip out of slope at 50˚ to 75˚
	All Other Rock Units (2)	15	70	7.5	49.2	Steep bedding
Osiris	All Rock Units (3)	15	70	7.5	49.2	Steep bedding
Sunrise	East Pit (4)	15	70	7.5	49.2	Steep bedding
	West Pit (4)	15	70	7.5	49.2	Steep bedding
Ibis	Bedding dip less than 50˚ (5)	Footwall Slope (pit slope should be designed to follow the orientation of bedding)				Shallow bedding
	Bedding dip between 50˚ and 70˚ (6)	15	60	7.5	42.9	Moderate bedding
	Steep bedding dip (7)	15	70	7.5	49.2	Steep bedding

8.0 CONCLUSIONS

8.1 General

Based on available geotechnical data, rock quality and structural conditions generally appear favorable for the development of moderate to steep inter-ramp slope angles within the competent geotechnical units providing future studies do not indicate unfavorable structural orientations or rock mass strengths. The steepness of the inter-ramp slopes will likely be dependent on the ability to form steep, stable bench face configurations during mining.

Specific conclusions supported by our characterization and stability evaluation include:

- Faults are not expected to form large plane shear or wedge failures, so they do not form a control on overall pit slope stability.
- Steep bench face angles should be generally achievable with careful blasting, excavation, and scaling where structural orientations are favorable for bench stability.
- Rock mass shear strength of the un-weathered geotechnical units is sufficiently high that the potential for overall slope failure due to overstressing the rock mass is indicated to be low.
- Based on Golder's opinion of the range of hydrogeological conditions that are likely to exist at the site, the range of groundwater conditions assumed for the limit equilibrium analyses indicate that the potential for overall slope failure due to excess pore pressures in rock mass is low.

Engineering geologic conditions that may be encountered and thus require reduction in inter-ramp and overall pit slope angles are:

- Unfavorable structural orientations that result in bench face instability.
- Zones of intense fracturing along faults that could result in bench face instability or generate rockfall from steep bench faces.
- Local perched groundwater trapped behind in dipping faults.
- Poor rock mass quality and variable depth within the surface weathered zone.

8.2 Risks

Risks of rock mass failure appear to be low in the competent geotechnical units. Risk to rock slope stability therefore pertain primarily to structural complexity and variations in minor structural orientations that are not well understood or the presence of currently unidentified large, unfavorably oriented structures.

There are risks associated with mining at high latitudes that do not occur in more temperate climates. Seasonal freezing of bench faces can result in trapped water behind bench faces that in turn result in localized instability. Control of surface water for an open pit operating in the subarctic can be critical to achieving bench face stability.

Lobate features thought to represent rock glaciers have been identified along the southern side of the Osiris Valley, near the proposed Osiris Pit (Figure 4). Slopes excavated through dormant or active rock glaciers have the potential to re-activate or increase flow rates of the rock glaciers. Additionally, rock glaciers typically contain some ice, and water flows through and or at the base of the talus material. Slopes excavated through this material could be subjected to more surface water flow than anticipated due to the presence of the rock glacier. For this scoping-level pit slope evaluation, these features were not considered in the pit slope design recommendations due to uncertainty in depth and lateral continuity.

8.3 Opportunities

The strength of the weathered zone rocks was modelled using conservatively selected shear strength properties. If detailed geotechnical pit slope studies indicate that the rocks within this zone can be characterized as medium strong with a GSI in excess of 25, the stability of this rock mass shear strength could be estimated by the Hoek-Brown failure criterion and result in acceptable FoS for steeper slopes in the weathered rock. This assessment would require additional study as part of pre-feasibility pit slope studies.

9.0 RECOMMENDED GEOTECHNNICAL PROGRAM TO SUPPORT PRE-FEASIBILITY PIT SLOPE DESIGN

Pre-Feasibility and Feasibility level pit slope designs should be based on factual data that documents geotechnical conditions in the vicinity of the pit slopes with a level of reliability appropriate for this level of study. This should be achieved by a dedicated geotechnical program of core drilling and laboratory testing to support feasibility-level pit slope design analyses.

The occupational Health and Safety Act for Yukon Territory also requires that a design report be prepared and maintained for operating mines (Yukon Gov 2019). The information required in this design report can be most efficiently collected during Pre-Feasibility and Feasibility Level pit slope design studies.

The following sub-sections describe the geotechnical program that should be completed to support Pre-Feasibility level pit slope designs. The geotechnical drilling program outlined will be sufficient for a Feasibility-level study if it documents favorable subsurface geotechnical conditions to a degree that enables reliable interpretation and projection of geotechnical conditions to all important slope sectors. However, if the geotechnical drilling program identifies unfavorable conditions, or does not document conditions sufficiently, additional geotechnical core drilling would be required to fill the geotechnical data gaps to support the Feasibility-level pit slope designs.

9.1 Geologic Modelling

ATAC developed a 3D geological model based on exploration core drilling carried out to date. We recommend that ATAC continue to update the geological model based on additional corehole data that is collected.

Golder recommends the following additional modelling:

- Development of a RQD, weathering, and rock strength block model from the corehole database. Projection of this data into the pit slopes could enable us to identify locations where steep bench faces are likely to be obtained. The block model containing RQD, weathering, and rock strength should be completed prior to finalizing the location of any future geotechnical coreholes.
- Continued modelling of major fault structures. Surficial mapping has identified numerous faults at the Osiris project (Figure 7). Due to limited drill hole data in some locations and uncertainty of drill core fault intersections, ATAC have not explicitly modelled all faults that have been identified by surficial mapping at the Osiris project.
- Development of an alteration model to assess the distribution of decarbonatization and silicification alteration. The strength associated to the alteration types should also be evaluated. Descriptions of decarbonatization have indicated that this alteration type is associated with reduced intact rock strength, and this alteration type may be exposed at the toe of the pit slopes.

9.2 Exploration Core Drilling

Basic geotechnical data of core recovery, RQD, fracture count, joint condition descriptions, degree of weathering, and a field strength estimate should be logged for all exploration cores to support further development of a geotechnical model of rock mass quality and structure. ATAC should continue to orient bedding and joint structures in exploration core. Core orientation reliability ratings should be assigned to each core orientation measurement.

In order to continue to take advantage of the exploration coreholes that are being drilled during summer exploration programs, we recommend that three vibrating wire piezometers are installed within one of the exploration coreholes in the Conrad zone on the north side of the main creek that runs through the area as practical. The proposed north wall of the Conrad Pit is currently proposed to be the highest pit slope at the Osiris Project and the slope stability analyses have indicated that this slope could be sensitive to pore pressures.

9.3 Geotechnical Drilling

9.3.1 Geotechnical Core Logging

Geotechnical coreholes should be drilled in the areas of the proposed pit walls to allow characterization of the rock mass and to help identify any pervasive structures or major faults that may influence bench slope performance. These coreholes should be logged to obtain detailed geotechnical information used to calculate RMR_{76} (Table 15). Additionally, the core should be oriented to add to the structural orientation dataset so structural sets that may control stability can be identified.

Targets for geotechnical drilling should include:

- the Conrad Nonad Mudstone in the north wall of the proposed Conrad Pit
- the geological units expected to be exposed along the proposed Conrad Pit south wall
- the geological units expected to be exposed along the proposed Osiris Pit south wall
- the geological units expected to be exposed along the proposed Sunrise West Pit west wall
- the geological units and the Sunrise Fault expected to be exposed along the proposed Sunrise East Pit south wall
- the orientation of bedding expected to be exposed along the proposed Sunrise East Pit north wall
- the geological units and bedding orientations expected to be exposed along the proposed Ibis Pit northeast wall

In general, the geotechnical coreholes should be inclined at approximately 60 degrees, drilled into the pit walls, pierce the walls around 1/3 of the height from the pit bottom, and should extend to the depth of the proposed pit bottom. The corehole to investigate the Conrad Nonad mudstone should be drilled from the proposed pit crest, behind the proposed pit slope so that it is drilled perpendicular to the orientation of bedding and possibly intersect the NFZ at depth. We estimate seven or eight geotechnical coreholes will be required to provide sufficient geotechnical data for a Pre-Feasibility Study.

The final locations of the geotechnical coreholes should be determined based on the geologic model and discussions with site personnel to ensure that the locations are representative and accessible. To the extent practical, geotechnical coreholes can be located to provide additional information for resource estimates, condemnation purposes, or waste rock characterization.

Geotechnical coreholes should be logged to collect data including RQD, lithology, total core recovery, fracture frequency, ISRM strength index, joint condition rating (JCR), and weathering / alteration index. Fracture characteristics should also be documented by collecting detailed information on the individual fractures within each run, such as depth, type, shape, roughness, infilling type, and infilling thickens. Triple tube (HQ-3) coring is the preferred method of drilling for geotechnical purposes to maximize core recovery and minimize disturbance in sensitive material. The triple tube system enables the core to be viewed and logged in as close to its in-situ condition as possible, and minimizes disturbance during transfer of core from the split tubes to the core box or sample tray. The drilling company should provide extra split tubes to temporarily store the core until it has been logged. Many companies have old split tubes available; if these are not available the drillers should supply suitable materials for temporarily storing core, such as split PVC tubing of an appropriate diameter, or angle iron core trays.

Drilling quality, and driller knowledge and experience, are important considerations in implementing a successful geotechnical core drilling program. We recommend contracting a drilling company that will staff the project with drillers experienced in geotechnical core drilling and that will provide all necessary equipment and supplies.

We understand that some portions of the deposits may be suitable for development by underground mining methods (ATAC 2018b). The geotechnical parameters that ATAC are currently collecting from drill core at the Osiris Project are most relevant for making estimates of RMR_{76} and for use in stability analyses using the Hoek-Brown method. For underground mine design, there are empirical design methods for the size of stopes based on empirical correlations from additional geotechnical characteristics. Additional parameters to characterize degree of jointing (block size) and joint frictions are required so Barton's Q can be calculated for stope design, particularly near the ore zone. The additional geotechnical parameters required for underground design methods are:

- Jn = Number of joint sets, collected at the geotechnical interval level
- Jr = Joint roughness number, collected for each logged joint
- Ja = Joint alteration number, collected for each logged joint

Guidelines for the logging and characterization of rock core for each of the mentioned geotechnical parameters for underground design methods were provided by Trevor Tamburri (2018, pers. comm).

9.3.2 Core Orientation

Oriented core logging should be carried out for the geotechnical drilling investigation to support pre-feasibility level pit slope designs. Core orientation reliability ratings should be assigned to each core orientation measurement.

9.3.3 Drillhole Surveys

We recommend that the geotechnical coreholes continue to be surveyed using a suitable downhole tool to collect accurate measurements. The survey data will be used to correct the 'apparent' measured structural orientations to 'true' orientations.

9.3.4 Field Strength Testing

Point load testing should be implemented to measure strength of selected representative core samples to support the field strength classification system.

9.3.5 Laboratory Testing

Laboratory testing should include:

- Unconfined compressive strength (UCS) testing on representative core samples from different geotechnical units and alteration types for calibration of field point load tests.
- Soil index tests on gouge from fault zones.
- Direct shear tests or triaxial tests on gouge from fault zones.
- Direct shear tests on discontinuities in the rock mass, particularly bedding and joints.

9.4 Surface Mapping

The bedding in the area of the proposed Ibis Pit northeast wall should be evaluated between orientations at the ground surface and at depth to check for changes in orientation with depth. Surface outcrops in this area will provide a good exposure of bedding for this study.

9.5 Pre-Feasibility Level Analyses and Pit Slope Design

The updated geological model and data collected from the recommended geotechnical investigation can be used to develop a geotechnical model which supports a pre-feasibility slope design. Important elements of the engineering evaluation and pre-feasibility level design should include:

- Refine structural characteristics and orientations for the structural domains.
- Characterize intact rock and rock mass strength from field and laboratory testing.
- Consider all surface and subsurface structural data spatially relative to the pit slope locations to assess significance of any systematic structural orientation variability.
- Confirm overall slope stability using rock mass characterization and engineering analyses.
- Evaluate large scale and bench scale structural controls of stability.
- Develop bench configuration based on production bench heights, structural controls, and predicted blast performance and operating practices.
- Develop standards for catch bench developments and bench scaling consistent with slope design recommendations.
- Develop preliminary perimeter blast design to be used as a basis for estimating drilling equipment capital costs, and drilling and blasting operating costs.
- Assess risks and opportunities for recommended slope designs.
- Define ongoing geotechnical program appropriate to support risk management and pit slope optimization.
- Document investigation, testing, model development, analyses, slope design recommendations, operating practices required, and recommended pit slope monitoring program in an engineering report.

10.0 CLOSING

It has been a pleasure to work with ATAC personnel on this project. This report has been prepared for the exclusive use of ATAC and their consultants in preparation of a PEA for the Osiris Project. If a substantial period of time elapses between the date of this report and the time of detailed design of the final pits, we recommend that Golder review the conclusions and recommendations to account for new data that may have been collected in the time elapsed.

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report. We trust this report satisfies your current requirements. If you have any questions or require further assistance, please do not hesitate to contact the undersigned.

Signature Page

Golder Associates Ltd.





Trevor Tamburri
Mine Engineering and Stability Group

Al Chance, P.Eng.
Principal, Mining Geotechnical Engineer

TGT/AVC/GL/rs/no

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/25890g/deliverables/3. issued/18100420-002-r-rev0-4000/18100420-002-r-rev0-4000-atac osiris geotech 30sep_19.docx

REFERENCES

AC (Archer, Cathro and Associates (1981) Limited). 2015. Manual for oriented core, principals and procedures. Vancouver BC: Archer, Cathro and Associates (1981) Limited. 22 September 2015.

AC. 2017. Manual for handling core. Vancouver BC: Archer, Cathro and Associates (1981) Limited. 20 October 2017.

ASTM (American Society for Testing and Materials). 2008. Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications. West Conshohocken, PA: American Society for Testing of Materials. Designation D 5731 – 08. February 2008.

ATAC (ATAC Resources Ltd.). 2018a. Rackla gold property, Osiris project (Carlin-type gold). [updated September 2018; accessed December 2018]. https://www.atacresources.com/rackla-gold-property/osiris-project

ATAC. 2018b. ATAC announces 1,685,000 oz gold in its maiden inferred mineral resource estimate for the Osiris Project, Yukon. [updated 18 June 2018; accessed 25 January 2019]. http://www.atacresources.com/news/news-releases/atac-announces-1-685-000-oz-gold-in-its-maiden-inferred-mineral-resource-estimate-for-the-osiris-project-yukon

Bieniawski Z. T. 1976. Rock mass classification in rock engineering. Proceeding, symposium on exploration for rock engineering, Johannesburg, Vol. 1, 1976, pp. 97-106.

Bieniawski Z. T. 1989. Rock mass classification. John Wiley and Sons, New York.

BC (British Columbia). 2017. Health, safety and reclamation code for mines in British Columbia. Ministry of Energy and Mines. Victoria, British Columbia. Revised June 2017. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/health-and-safety/code-review/health_safety_and_reclamation_code_2017_rev.pdf

Carne A. 2018. Project Engineer, Archer, Cathro and Associates (1981) Limited. Osiris Geotech Data Review – Oct 10 Phone Conversation Summary. Email to Tamburri T., Project Manager, Golder Associates Ltd. 10 October 2018.

Coulter A.B., Lane J., and Steiner A., 2018. Osiris cluster Carlin-type gold, east-central Yukon. *In:* Yukon Exploration and Geology Overview 2017, K.E. MacFarlane (ed.), Yukon Geological Survey, p. 65-74.

Deere D.U. 1964. Technical description of rock cores for engineering purposes. Rock mechanics and Rock Engineering, Vol. 1, pp. 17-22.

DS (Dassault Systemes). 2019. Geovia Surpac ™. [updated 2019; accessed 20 September 2019]. https://www.3ds.com/products-services/geovia/products/surpac/

Golder (Golder Associates Inc.). 2014. Tiger Zone Project, Yukon Territory, Canada. Scoping level pit slope evaluation. Prepared for ATAC Resources Limited. Reno NV: Golder Associates Inc. Project No. 1302357. 27 January 2014.

Golder (Golder Associates Ltd.). 2018. Geotechnical Review and Site Visit. ATAC Orisis Project, Rackla Gold Property, Yukon, Canada. Prepared for ATAC Resources Limited. Vancouver BC: Golder Associates Ltd. Golder Doc. No. P18100420-001-P-Rev0. 9 May 2018.

Hoek E. 2012. Technical note for Rocscience. Blast damage Factor D. Winter 2012 Issue, 2 February 2012.

Hoek E., and Brown E.T. 1997. Practical estimates of rock mass strength. International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts 34(8):1165–1186.

Hoek E., Carranza-Torres C., and Corkum B. 2002. Hoek-Brown failure criterion – 2002 Edition. In: Proceedings of the fifth North American ISRM Rock Mechanics Symposium, p. 267–273.

Jackson L. E., Jr. 1989. Paleoglaciology of the Selwyn Lobe of the Cordilleran Ice Sheet and Quaternary Stratigraphy of the East-Central Yukon. In: Late Cenozoic history of the interior basins of Alaska and Yukon. Edited by L. D. Carter, T. D. Hamilton, and J. P. Galloway, United States Geological Survey, Circular 1026, pp. 60-65.

Johnson, P.G. 1978. Rock Glacier types and their drainage systems, Grizzly Creek, Yukon Territory. In: Canadian Journal of Earth Science, 15, 1496-1507. 1978.

Leps T. M. 1970. Review of shearing strength of rock fill, Proceedings of the ASCE. Journal of the Soil Mechanics and Foundations Division. Vol. 96, No. SM4. July 1970.

Marinos P. G., Marinos V., and Hoek E. 2007. The Geological Strength Index (GSI): A characterization tool for assessing engineering properties of rock masses. In: Underground works under special conditions, Publisher: Taylor and Francis, Editors: Romana, Perucho, Olalla, pp. 13-21. DOI: 10.1201/NOE0415450287.ch2

Martin D., and Stacey P., editors. 2018, Guidelines for open pit slope design in weak rocks. Boca Raton, FL. CRC Press.

Moynihan D. 2014. Bedrock Geology of NTS 106B/04, Eastern Rackla Belt. In: Yukon Exploration and Geology 2013, K.E. MacFarlane, M.G. Nordling, and P.J. Sack (eds), Yukon Geological Survey, p. 147-167.

Read J., and Stacey P., editors. 2009, Guidelines for open pit slope design. Boca Raton, FL. CRC Press.

Reflex (Reflex™ Intelligence on Demand). 2018a. Reflex Act III. [updated 2018; accessed 15 October 2018]. https://reflexnow.com/act-lll/

Reflex. 2018b. Reflex IQ-Logger™. [updated 2018; accessed 15 October 2018]. https://reflexnow.com/reflex-iq-logger/

Ristorcelli S., Ronning P., Martin C., Christensen O. 2018. Technical Report and Estimate of Mineral Resources for the Osiris Project, Yukon, Canada. Report Prepared for ATAC Resources Ltd. Reno, Navada: Mine Development Associates Inc. 2 July 2018.

Ritchie, A.M., 1963. The evaluation of rockfall and its control. Highway Record. 17.

RocScience (RocScience Inc.). 2019a. Dips. [updated 2019; accessed 27 May 2019]. https://www.rocscience.com/software/dips.

RocScience. 2019b. Slide2 2018. [updated 2019; accessed 27 May 2019]. https://www.rocscience.com/software/slide2.

Ryan, T.M., and Pryor P., 2000. Designing Catch benches and Interramp Slopes in Slope Stability in Surface Mining. Society for Mining, Metallurgy, and Exploration, Inc., pp. 27-38.

Steiner A., Hickey K., Coulter A.B. 2018. The Structural Framework for Carlin-type Gold Mineralization in the Nadaleen Trend, Yukon. *In:* Yukon Exploration and Geology 2017, K.E. MacFarlane (ed.). Yukon Geological Survey, p. 139-149.

Tamburri T. 2018. Project Manager, Golder Associates Ltd. Osiris Geotech Review - Post Site Visit Geotechnical Recommendations. Email to Carne A., Project Engineer, Archer, Cathro and Associates (1981) Limited. 25 July 2018.

Tucker, M.J., Hart, C.J.R., and Carne, R.C., 2013. Geology, alteration, and mineralization of the Carlin-type Conrad zone, Yukon. *In:* Yukon Exploration and Geology 2012, K.E. MacFarlane, M.G. Nordling, and P.J. Sack (eds.), Yukon Geological Survey, p. 163-178.

Tucker 2015 – Geology, Mineralization and Geochronology of the Conrad Zone Carlin-type gold prospect, East-Central Yukon Territory, Canada - add full reference.

Yukon Gov (Yukon Government Energy, Mines and Resources). 2019. Legislations and Guides. [updated 21 May 2019; accessed June 2019]. http://www.yukonminingrecorder.ca/mining_acts.html

ATAC RESOURCES LIMITED

FIGURE 1
ARCHER, CATHRO & ASSOCIATES (1981) LIMITED

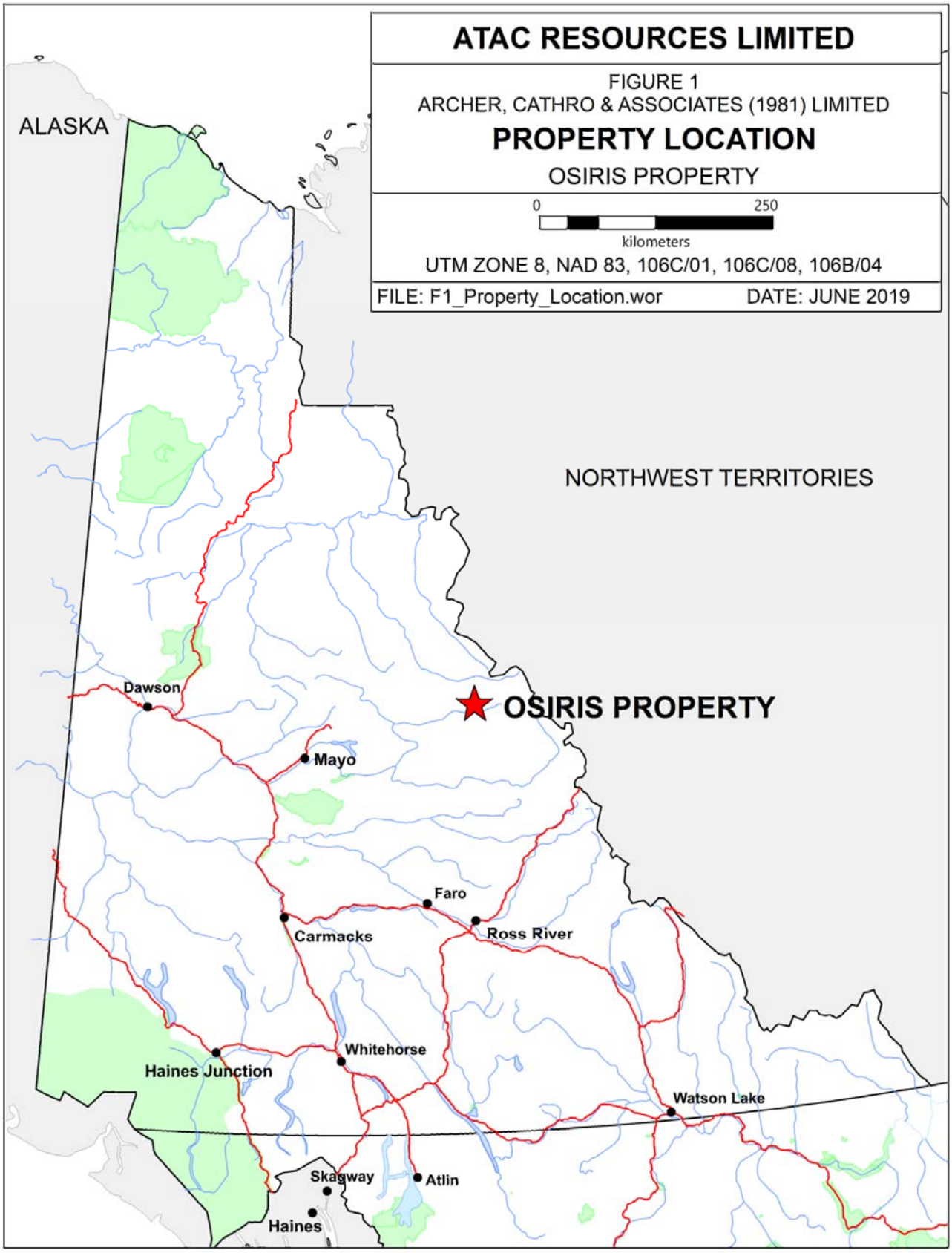
PROPERTY LOCATION

OSIRIS PROPERTY

0 250
kilometers

UTM ZONE 8, NAD 83, 106C/01, 106C/08, 106B/04

FILE: F1_Property_Location.wor DATE: JUNE 2019



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

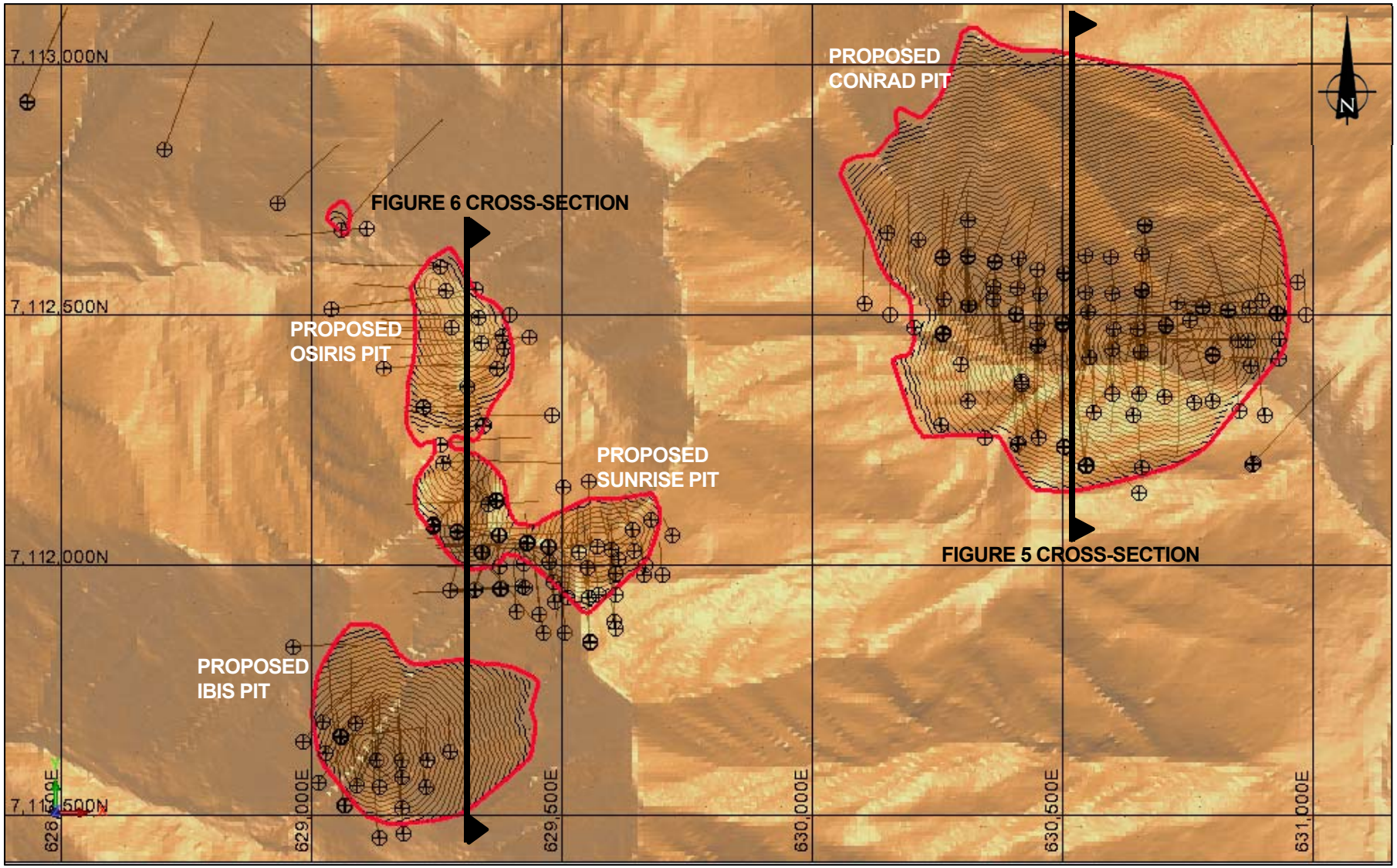
TITLE
PROJECT LOCATION

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**1**

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25880g/Deliverables/2.%20Working/18100420-002-R-RevA-4000?csf=1&e=BkmEZf | File Name: Osiris_8x11_Port_Template.pptx

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



LEGEND

- EXPLORATION COREHOLE COLLAR
- EXPLORATION COREHOLE TRACE
- APPROXIMATE PIT OUTLINE
- GEOLOGY CROSS SECTION
- SITE TOPOGRAPHY

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

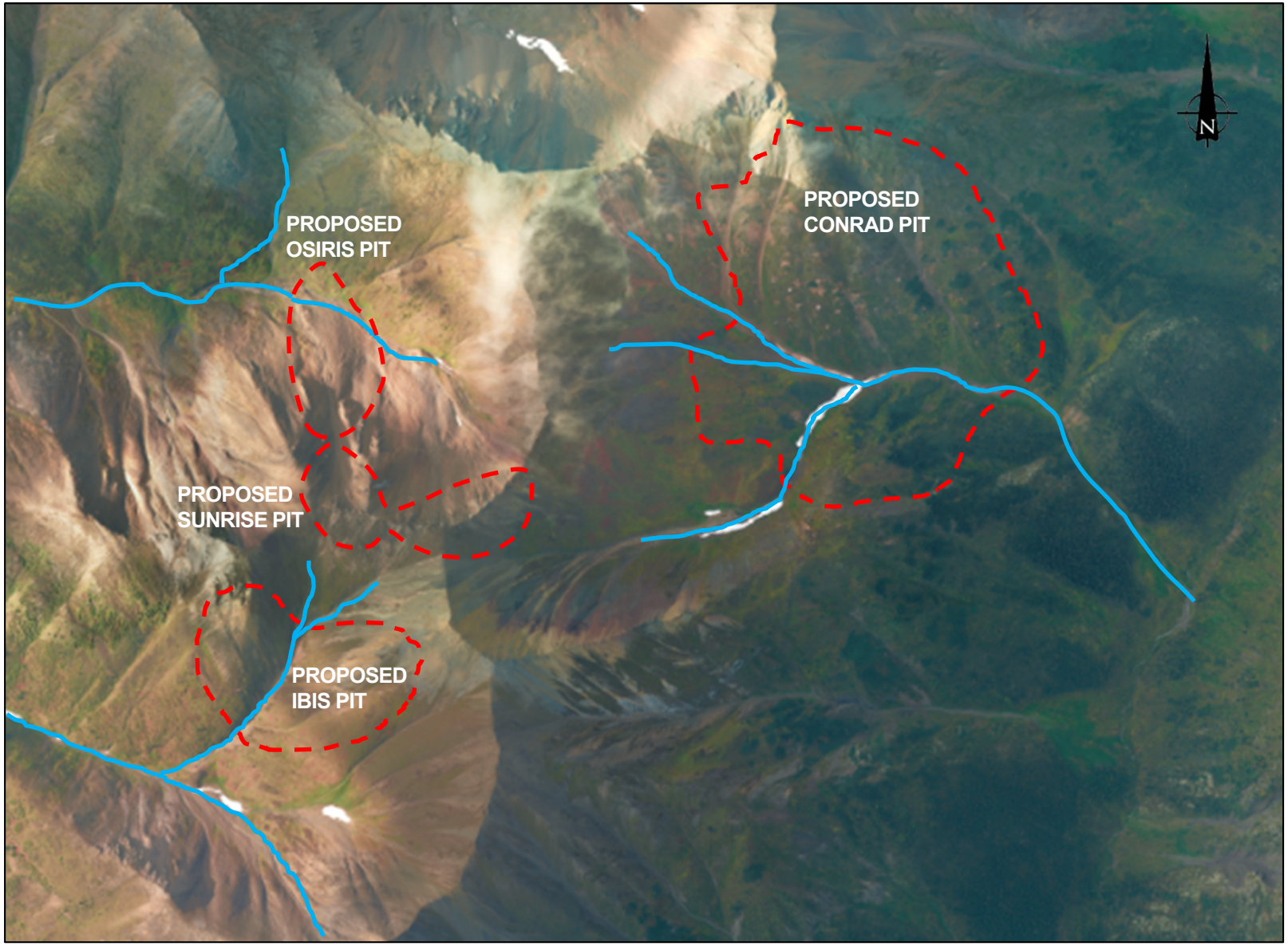
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
PROPOSED PIT DEVELOPMENTS

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**2**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



LEGEND

- SEASONAL CREEKS
- APPROXIMATE PIT OUTLINE

ORTHO PHOTOGRAPH FROM SEPTEMBER 2011

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

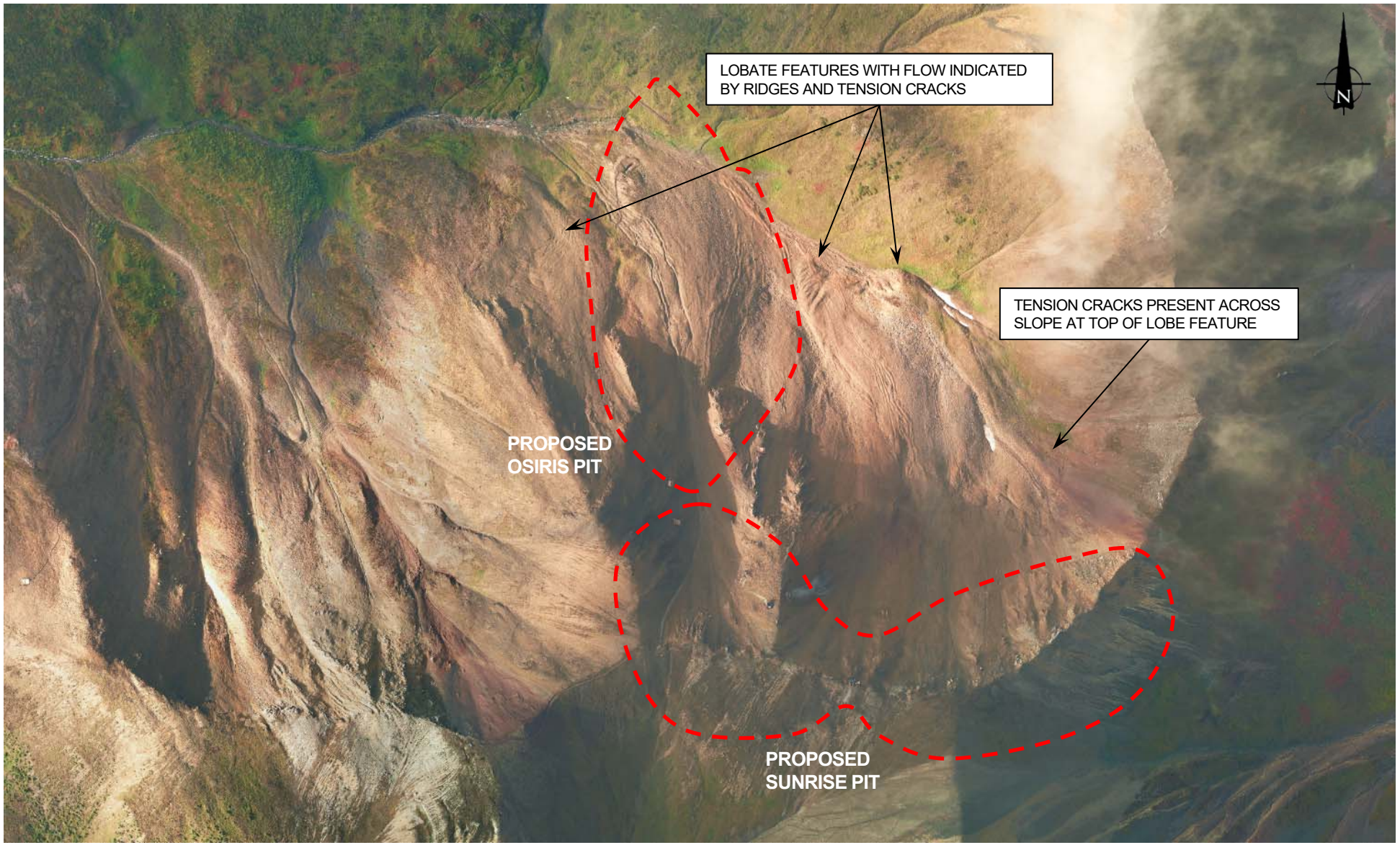
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
INTERACTION OF PROPOSED PITS AND SEASONAL CREEKS

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**3**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



LEGEND

APPROXIMATE PIT OUTLINE

ORTHO PHOTOGRAPH FROM SEPTEMBER 2011

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS VALLEY
OBSERVED LOBATE FEATURES

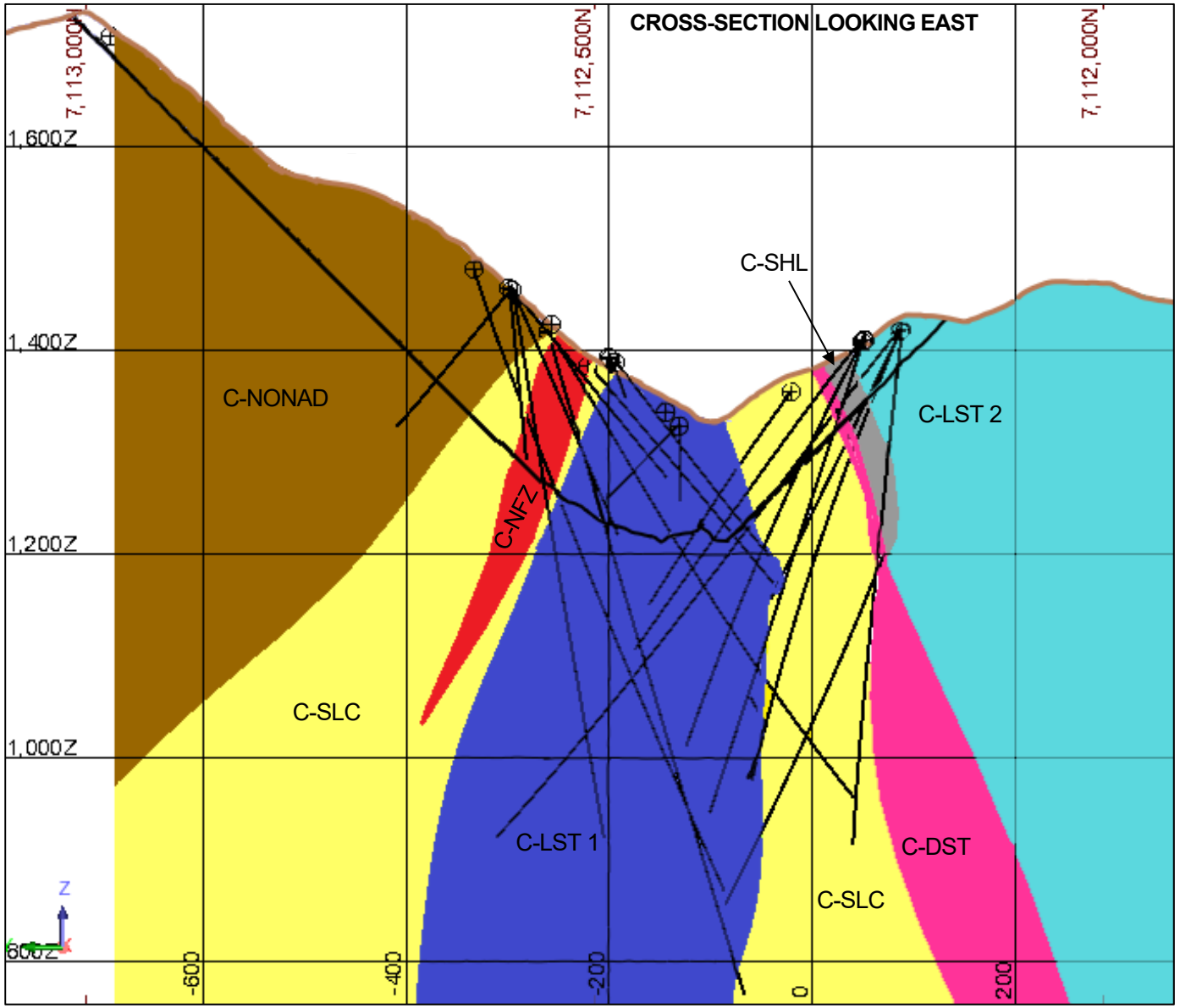
PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**4**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx

LEGEND

- Conrad Dolostone
- Conrad Limestone 1
- Conrad Limestone 2
- Nonad Mudstone
- Conrad Black Shale
- Conrad Siliciclastic
- Nadaleen Fault Zone
- Pit Outline
- Corehole Trace
- Corehole Collar



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED CONRAD PIT
GEOLOGY CROSS-SECTION

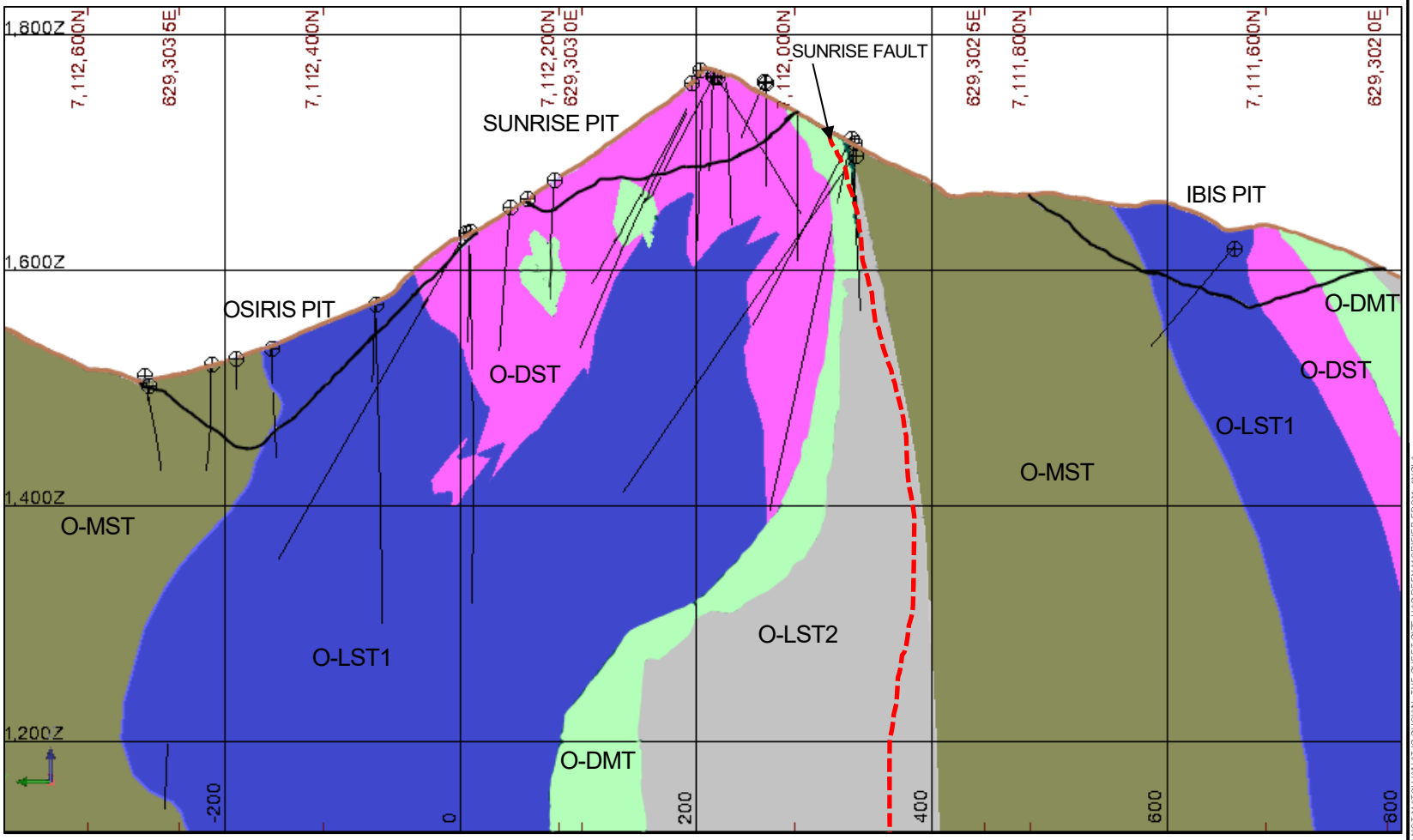
PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**5**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx

CROSS-SECTION LOOKING EAST

LEGEND
Osiris Diamictite
Osiris Dolostone
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Sunrise Fault
Pit Outline
Corehole Trace
Corehole Collar



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

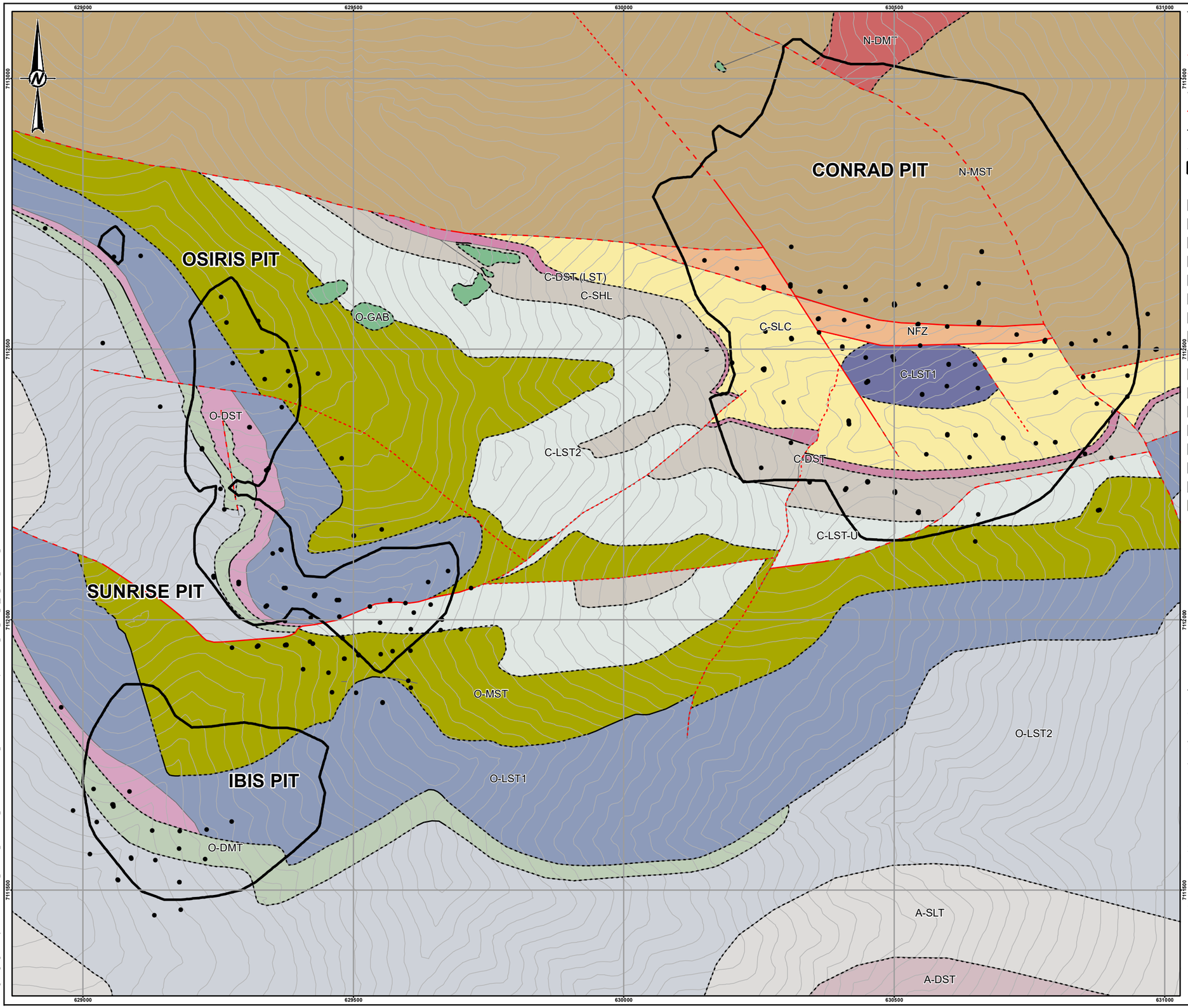
CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED OSIRIS, SUNRISE, AND IBIS PITS GEOLOGY CROSS-SECTION

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm



LEGEND

- COREHOLE COLLARS
- APPROXIMATE FAULTS
- INFERRED FAULTS
- INFERRED CONTACTS
- OBSERVED FAULTS
- OBSERVED CONTACTS
- CONTOUR (20 m)
- PIT OUTLINE

SURFACE GEOLOGY

- A-DST, Atum Dolostone
- A-SLT, Atum Siltstone
- C-DST, Conrad Silica Dolostone
- C-DST (LST), Conrad Silica Dolostone (Limestone)
- C-LST1, Conrad Limestone 1
- C-LST2, Conrad Limestone 2
- C-SHL, Conrad Shale
- C-SLC, Conrad Siliciclastics
- N-DMT, Nonad Diamictite
- N-MST, Unclassified Nonad Mudstone
- NFZ, Nadaleen Fault Zone
- O-DMT, Osiris Diamictite
- O-DST, Osiris Dolostone
- O-GAB, Osiris Gabbro
- O-LST1, Osiris Limestone 1
- O-LST2, Osiris Limestone 2
- O-MST, Osiris Mudstone

0 150 300
1:7,000 METRES

REFERENCE(S)
1. BASE DATA PROVIDED BY CLIENT.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 8N

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
BEDROCK GEOLOGY MAP

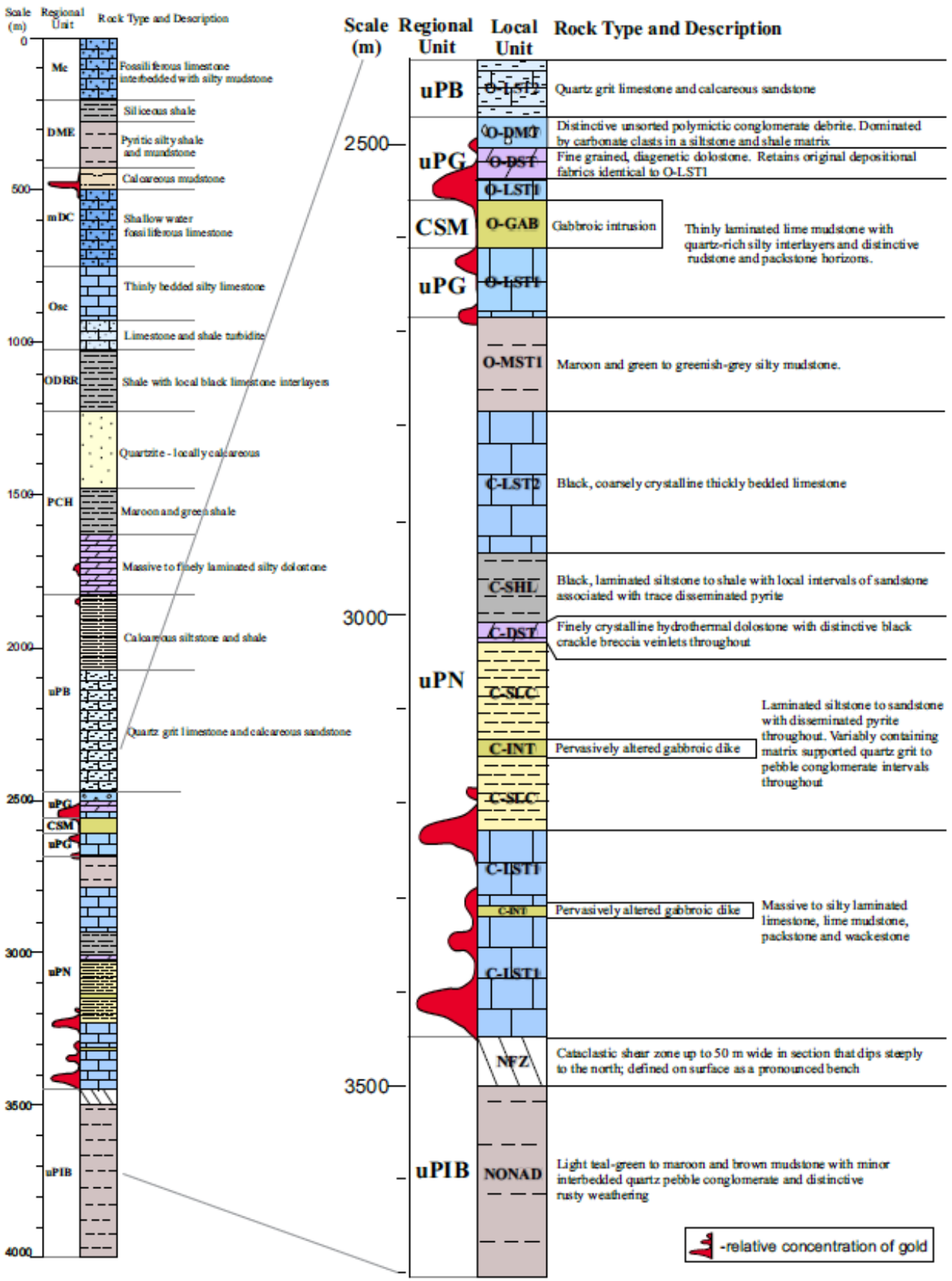
CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-23
DESIGNED	TT/JH
PREPARED	CC
REVIEWED	TGT
APPROVED	AVC

PROJECT NO.	PHASE	REV.	FIGURE
18100420	4000	0	7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25mm
0

PATH: \\golder.gds\ga\burnaby\CAD-GIS\Client\ATAC_Resources_Ltd\Yukon\99_PROJECTS\18100420\02_PRODUCTION\4000\MXD\Report\18100420_4000_4100_Fig_07_Osiris_Geotech_Boreholes.mxd PRINTED ON: 2019-09-23 AT: 9:26:11 AM



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

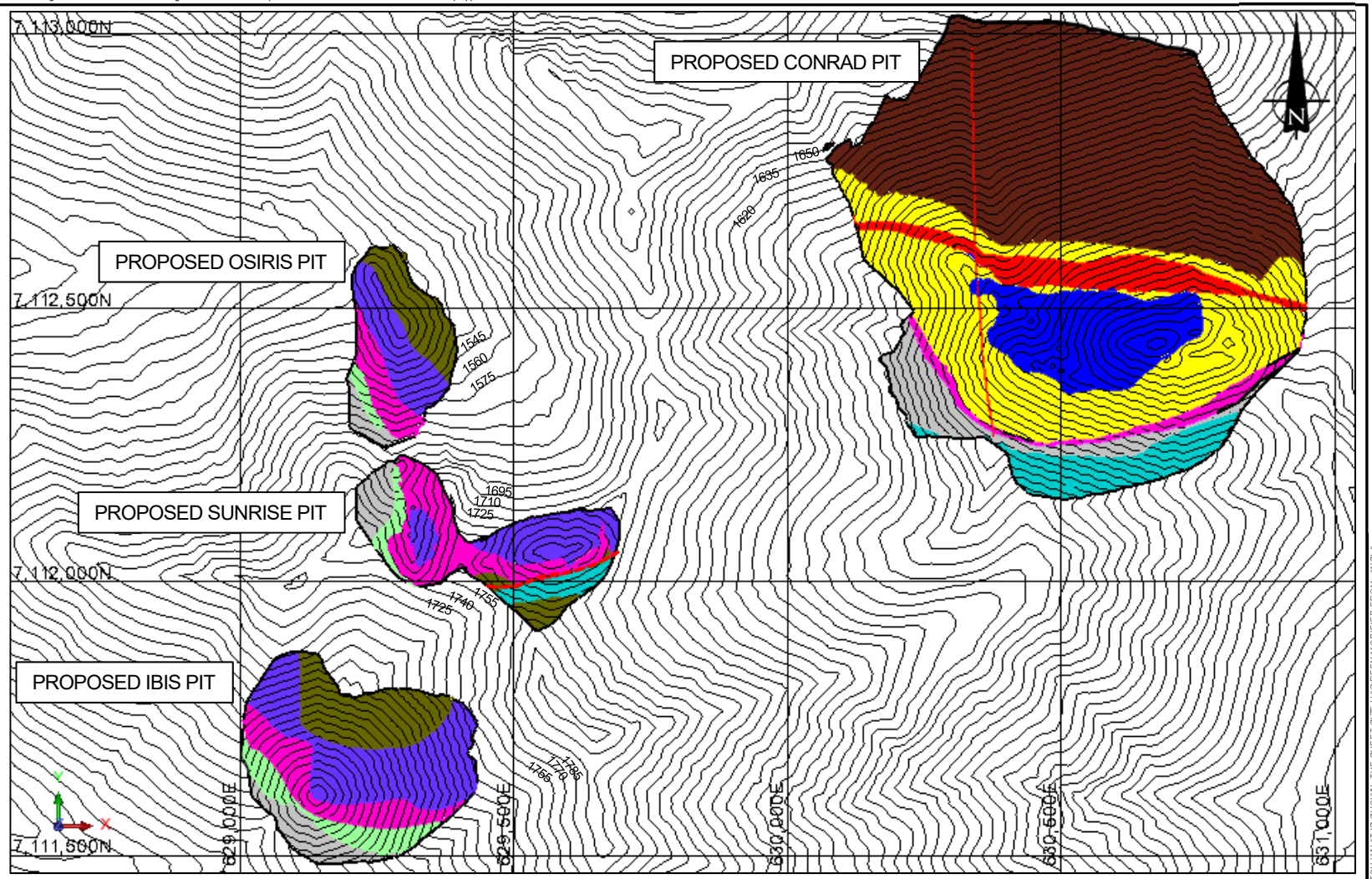
YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
STRATIGRAPHIC COLUMN

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**8**

Path: https://goldenassociates.sharepoint.com/:f:/r/sites/25880g/Deliverables/2.%20Working/18100420-002-R-RevA-4000?csf=1&e=BkmEZf | File Name: Osris_8x11_Port_Template.pptx
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
25 mm
0

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



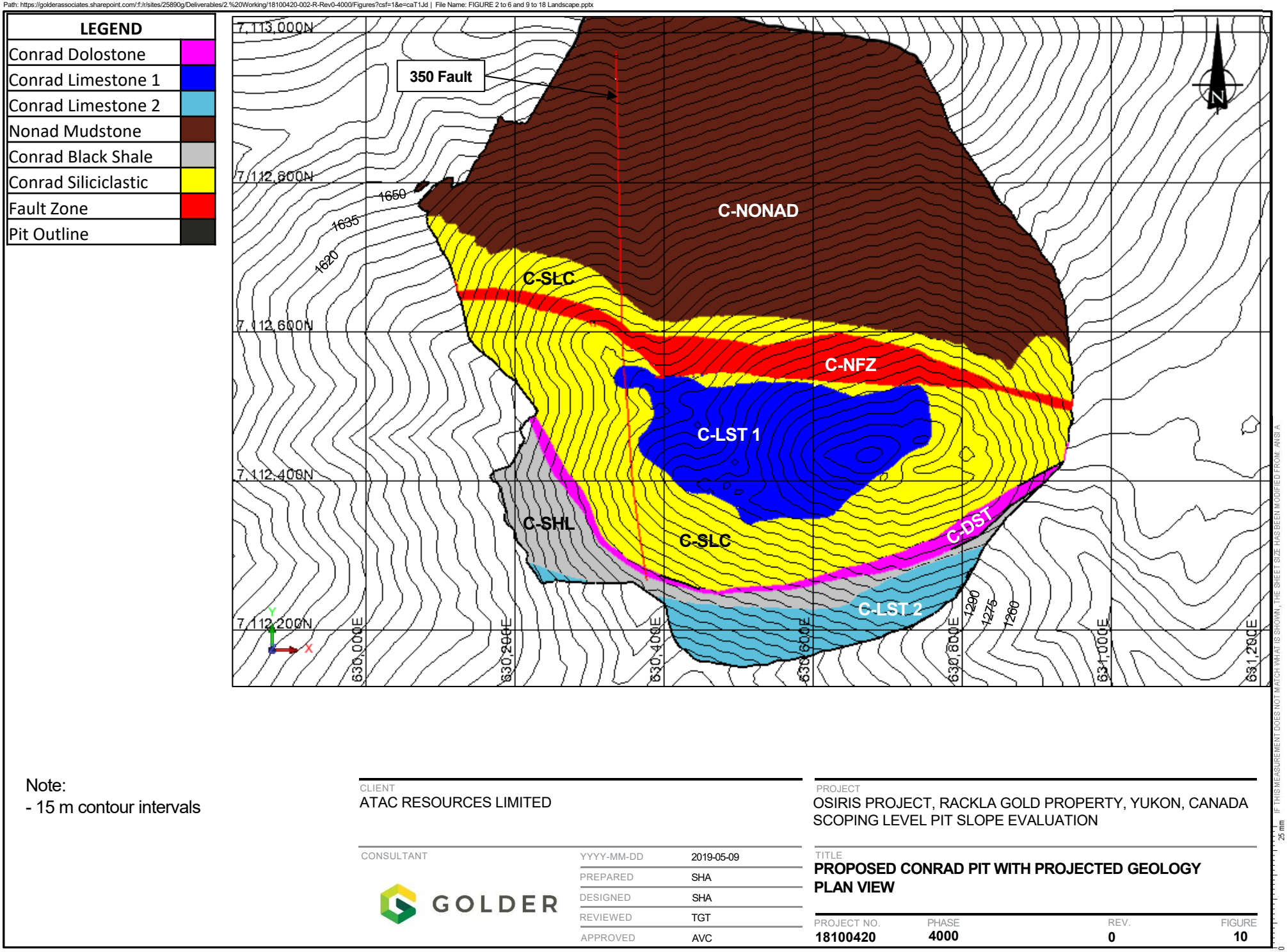
Note:
- 15 m contour intervals

CLIENT	ATAC RESOURCES LIMITED
PROJECT	OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA SCOPING LEVEL PIT SLOPE EVALUATION
CONSULTANT	GOLDER
YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC
TITLE	**OSIRIS PROJECT PIT SHELLS WITH PROJECTED GEOLOGY PLAN VIEW**

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



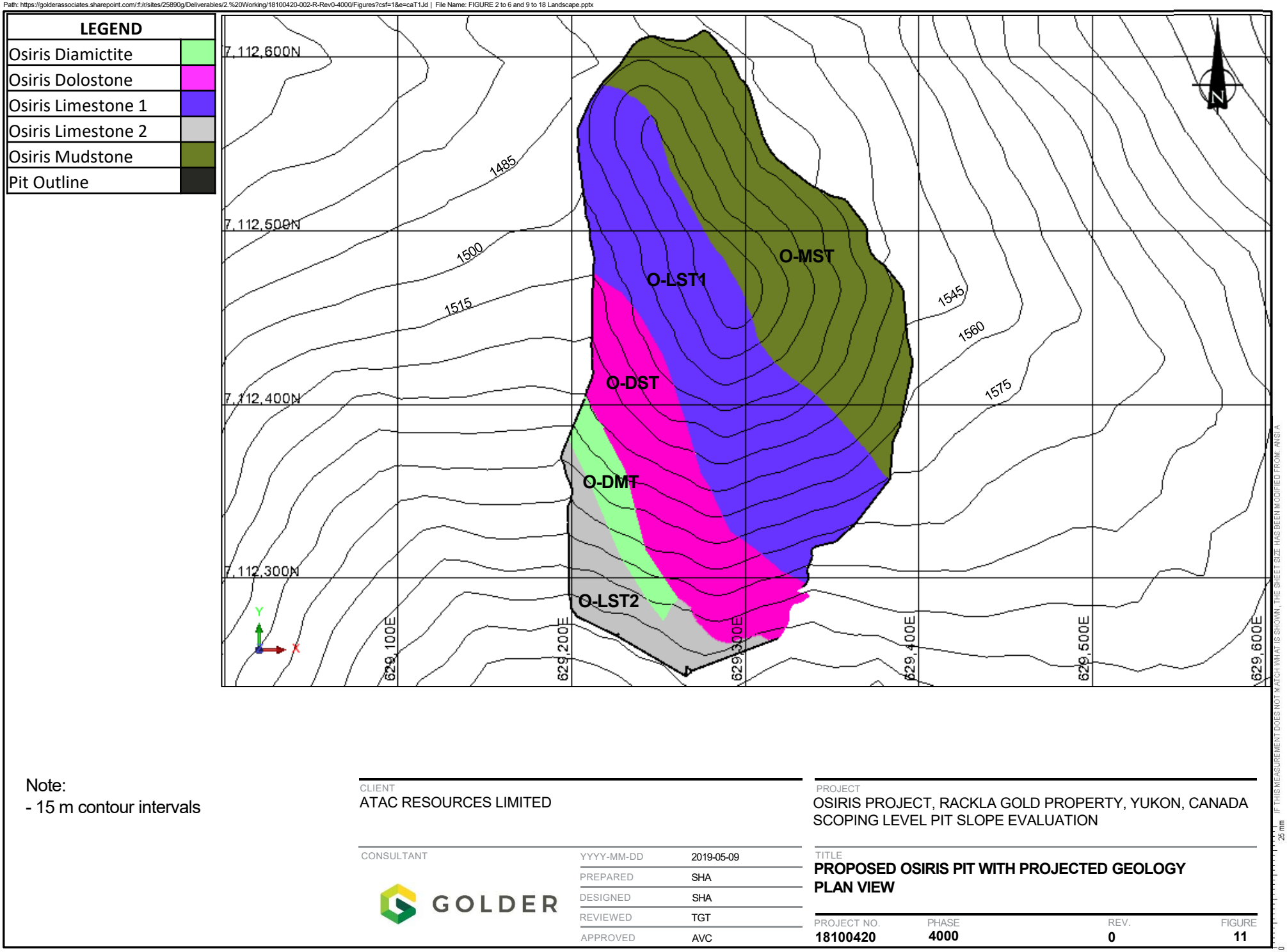
Note:
- 15 m contour intervals

CLIENT	ATAC RESOURCES LIMITED
PROJECT	OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA SCOPING LEVEL PIT SLOPE EVALUATION
CONSULTANT	GOLDER
YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC
TITLE	**PROPOSED CONRAD PIT WITH PROJECTED GEOLOGY PLAN VIEW**

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



Note:
- 15 m contour intervals

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

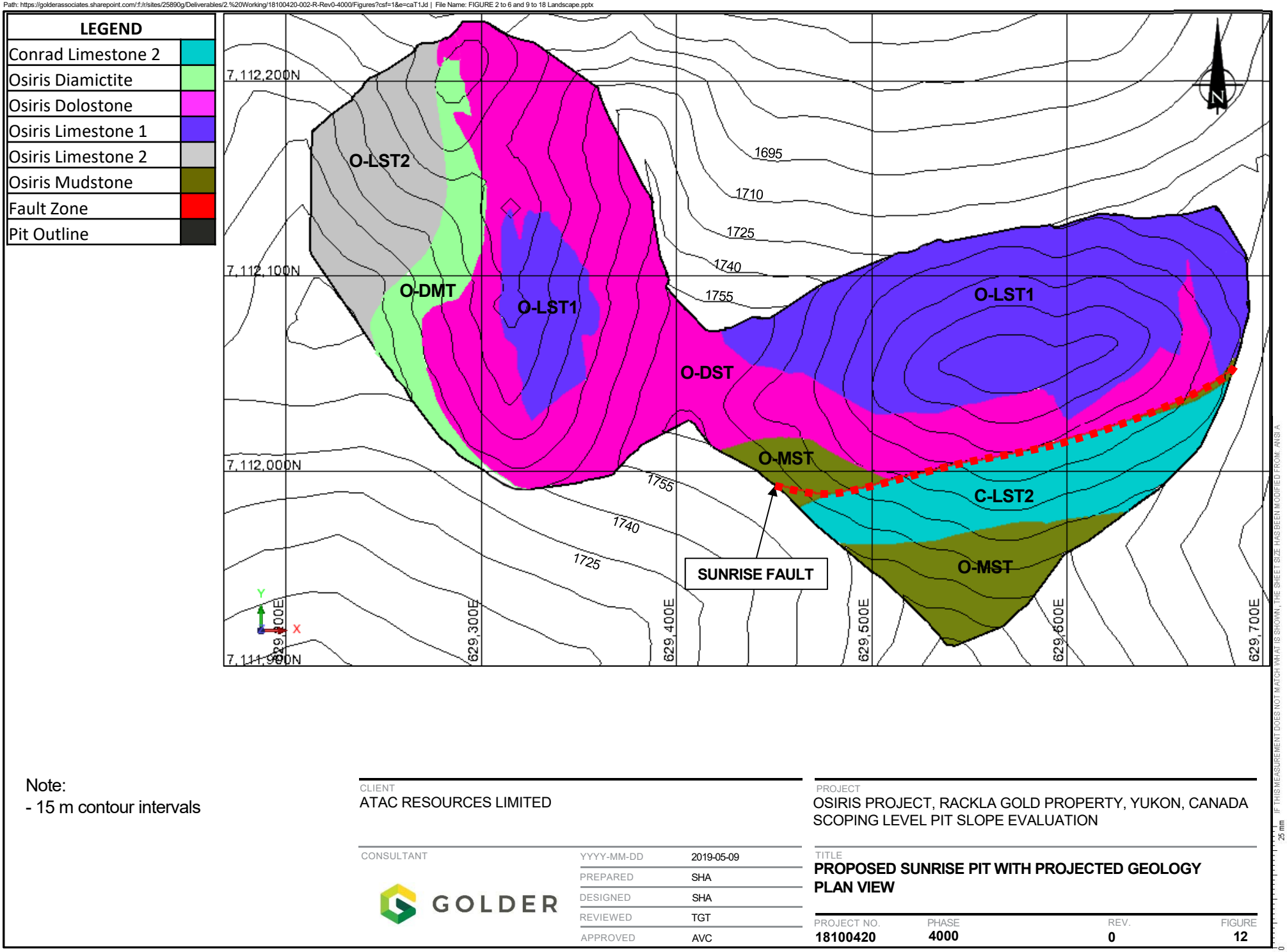
YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED OSIRIS PIT WITH PROJECTED GEOLOGY PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**11**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



Note:
- 15 m contour intervals

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

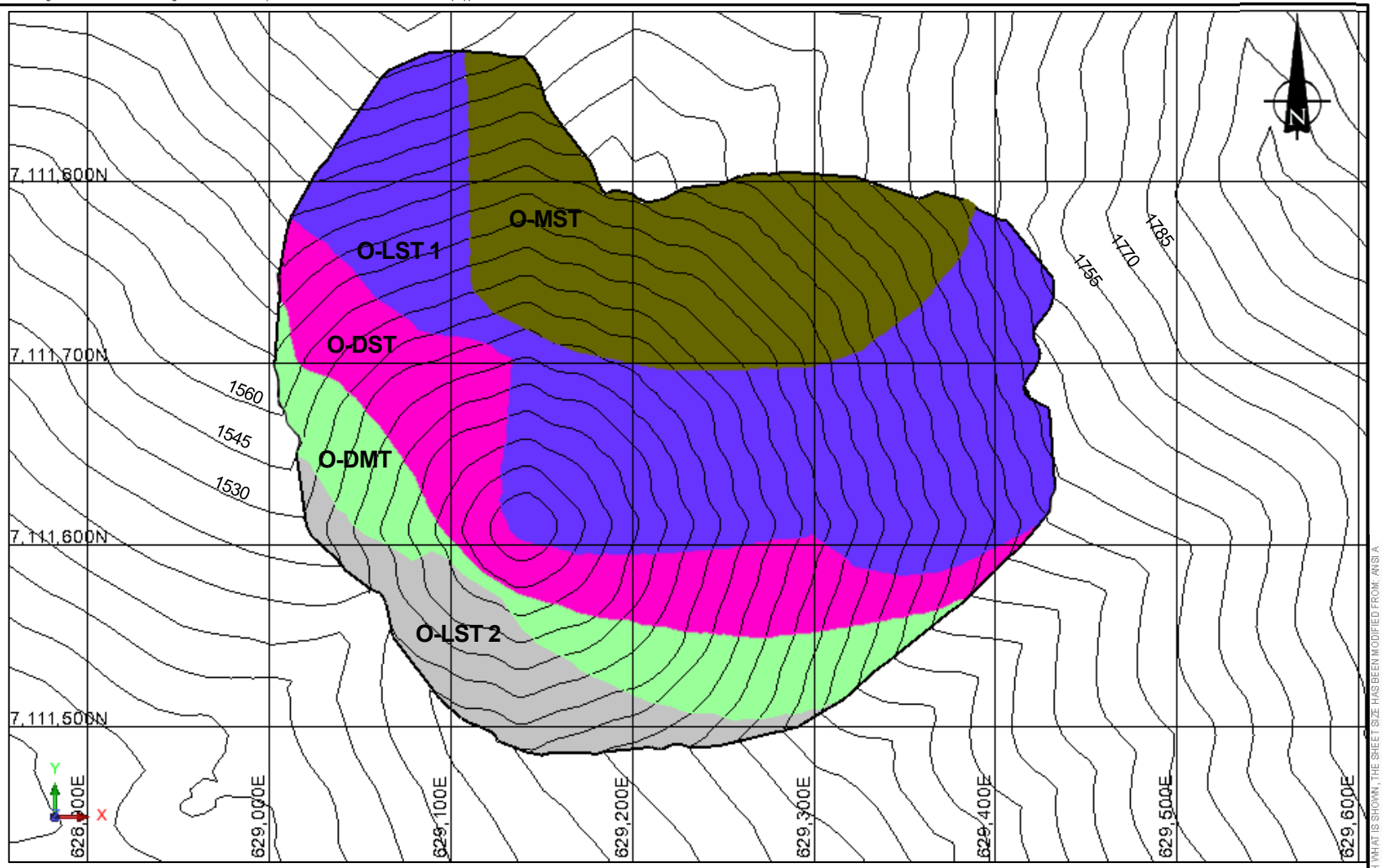
TITLE
PROPOSED SUNRISE PIT WITH PROJECTED GEOLOGY
PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**12**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx

LEGEND
Osiris Diamictite
Osiris Dolostone
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Pit Outline



Note:
- 15 m contour intervals

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

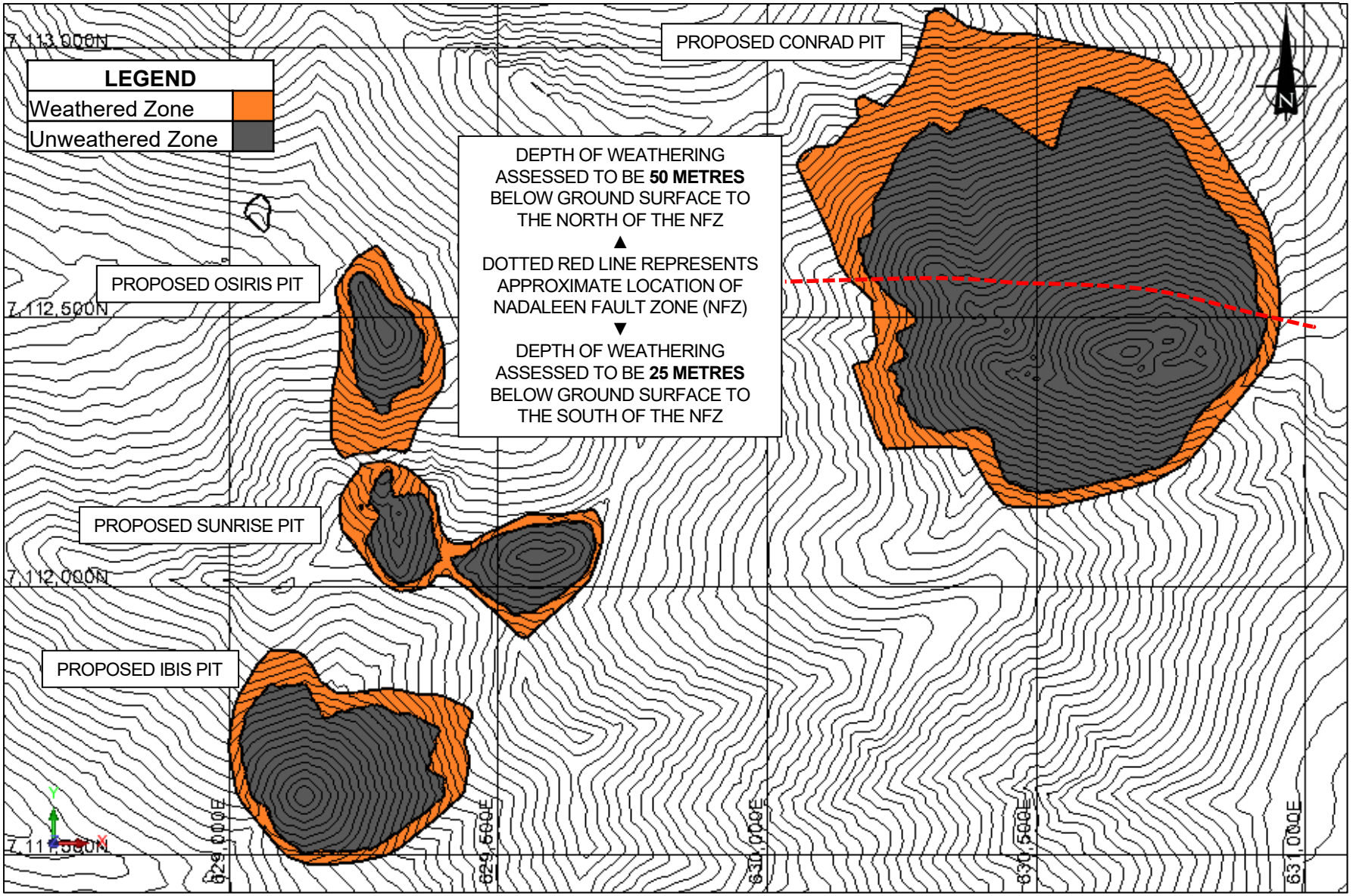
YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED IBIS PIT WITH PROJECTED GEOLOGY
PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**13**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



Note:
- 15 m contour intervals
- Depth of weathering is 50 m on the north side of the Conrad Pit
- Depth of weathering is 25 m on the south side of the Conrad Pit
- Depth of weathering is 20 m for the Osiris, Sunrise, and IBIS Pits

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

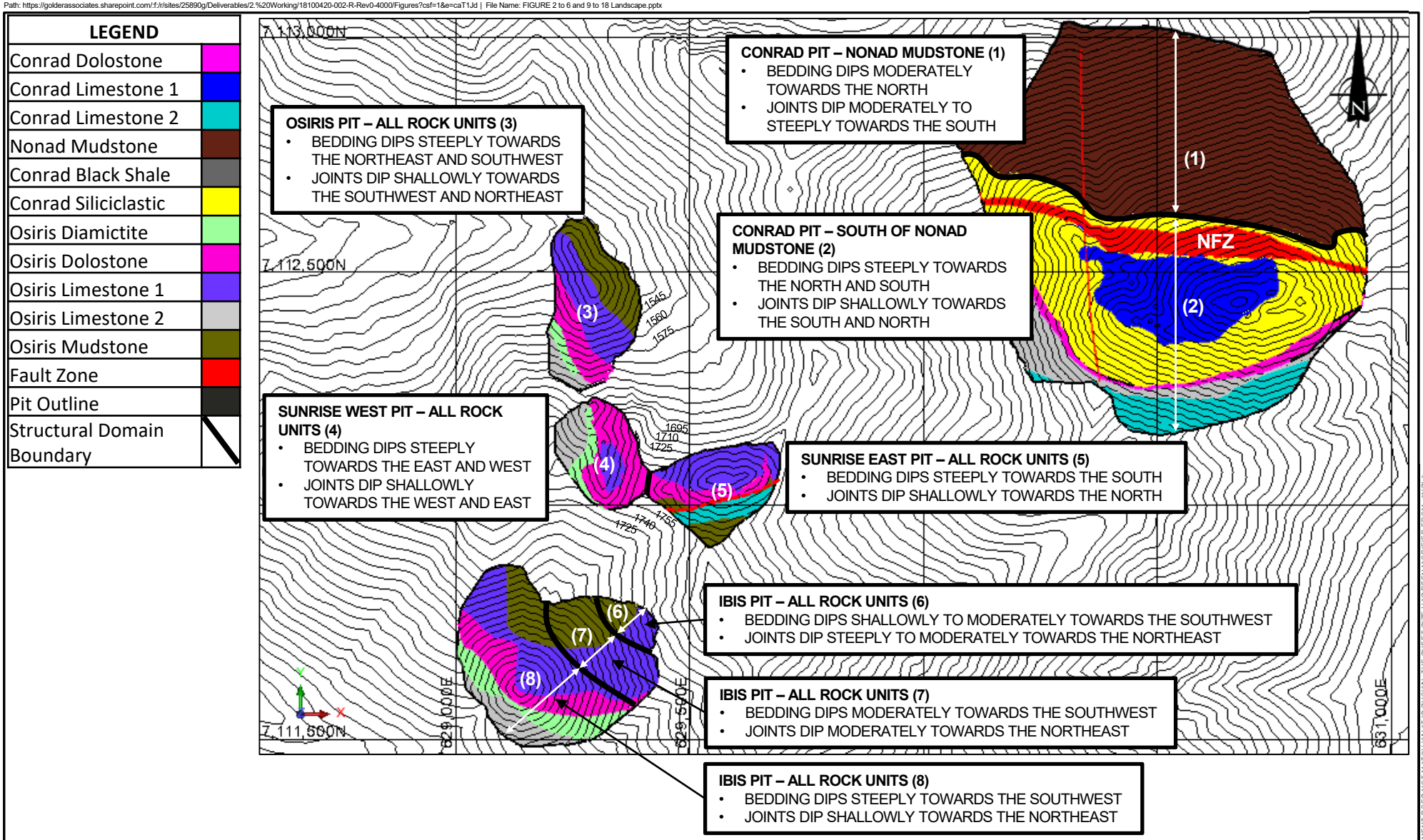
YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
WEATHERED ZONE FOR ALL PITS
PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**14**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



Note:
- 15 m contour intervals
- Conrad Pit design domain (1) includes the Nadaleen Fault Zone
- IBIS Pit design boundaries are approximate, and should be refined based on a detailed study of the bedding dips

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

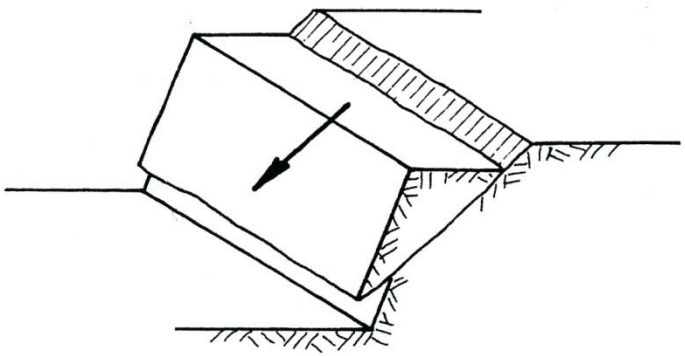
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PROJECT
STRUCTURAL DOMAINS
PLAN VIEW

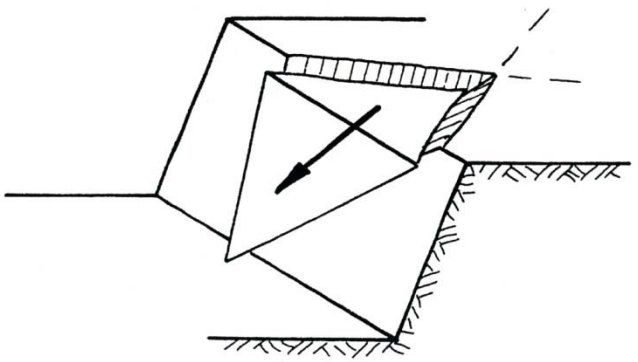
PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**15**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

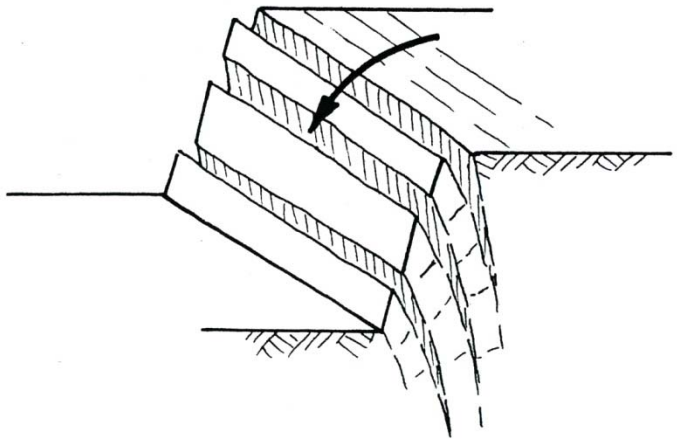
Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



a) Plane Failure on Through Going Discontinuities



b) Wedge Failure Along Line of Intersection of Discontinuities



c) Toppling Failure in Hard Rock with Steeply Dipping Joints

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

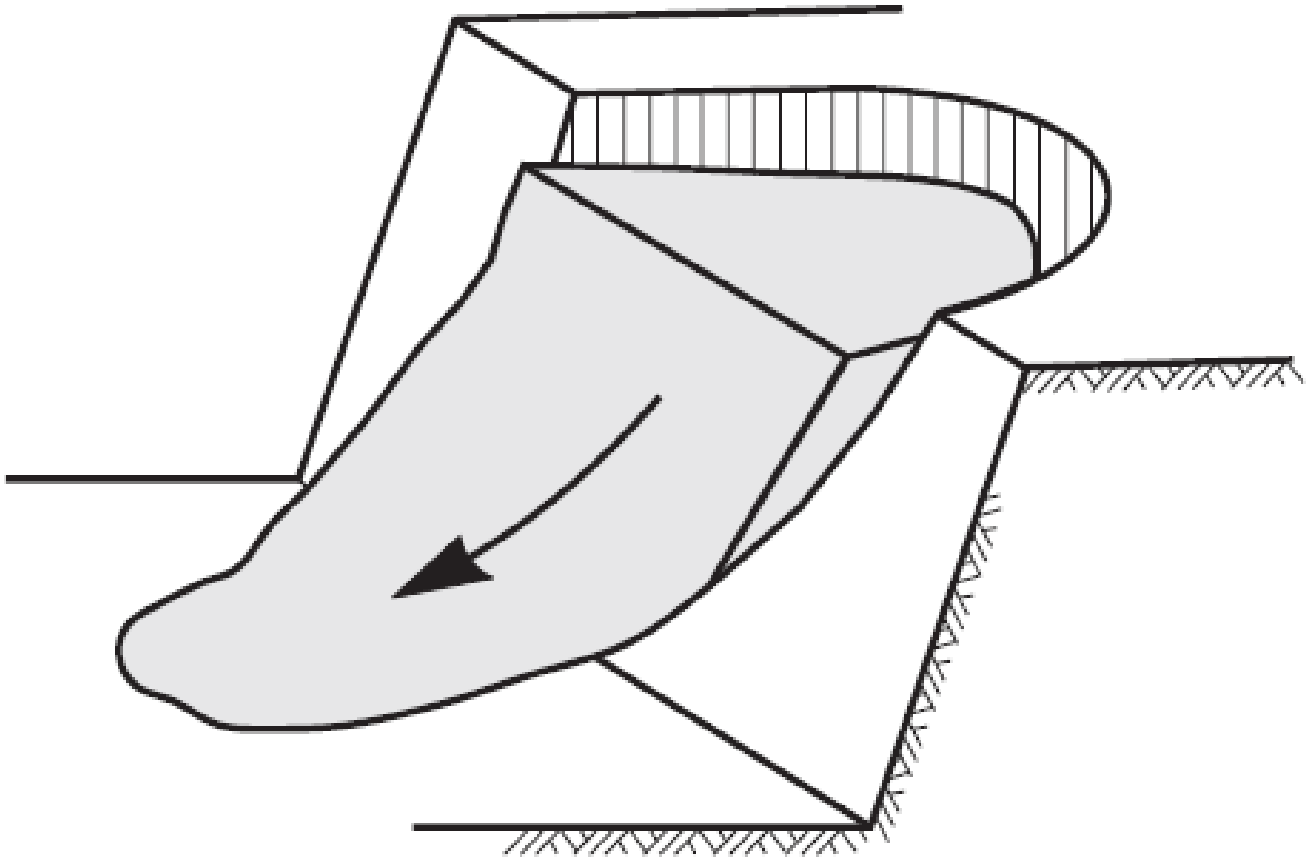
YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
STRUCTURALLY CONTROLLED FAILURE MECHANISMS IN ROCK SLOPES

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**16**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



QUASI-CIRCULAR FAILURE IN WEAK OR HEAVILY FRACTURED ROCK

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

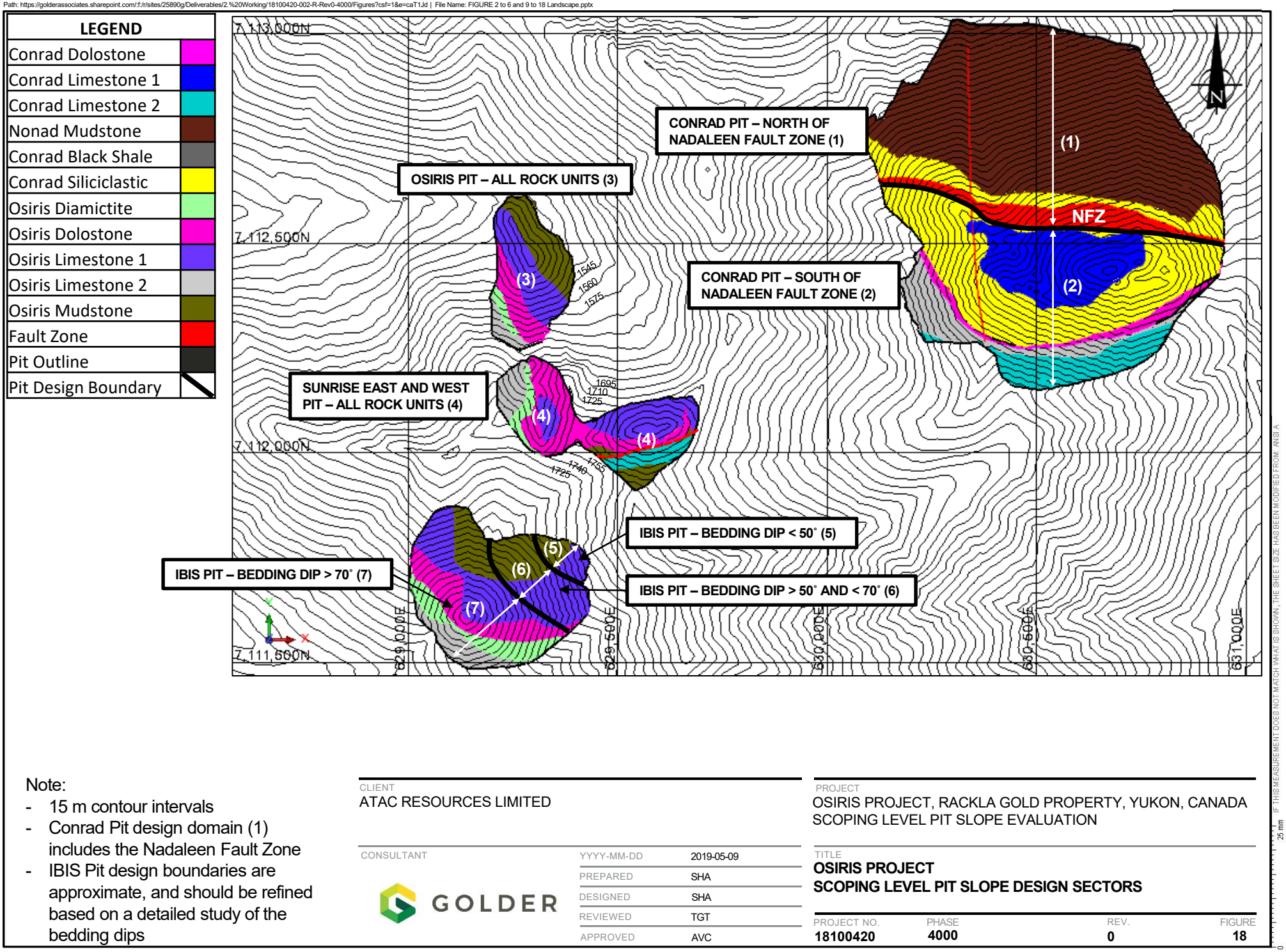
YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
OVERALL ROCK MASS FAILURE MECHANISM

PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**17**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: https://golderassociates.sharepoint.com/:f:/r/sites/25890g/Deliverables/2.%20Working/18100420-002-R-Rev0-4000/Figures?csf=1&e=caT1Jd | File Name: FIGURE 2 to 6 and 9 to 18 Landscape.pptx



Note:
- 15 m contour intervals
- Conrad Pit design domain (1) includes the Nadaleen Fault Zone
- IBIS Pit design boundaries are approximate, and should be refined based on a detailed study of the bedding dips

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-09
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PROJECT
SCOPING LEVEL PIT SLOPE DESIGN SECTORS

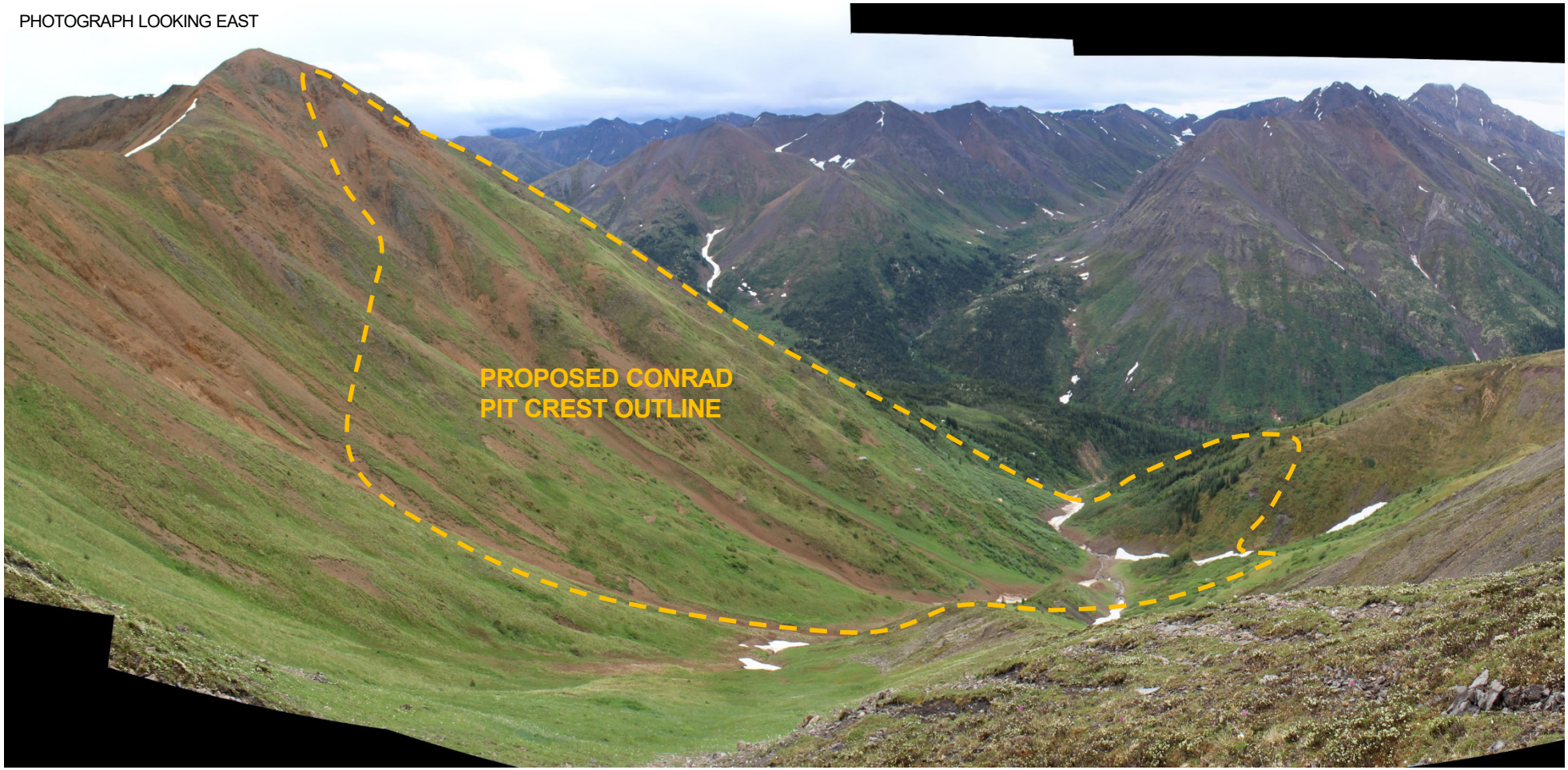
PROJECT NO.	PHASE	REV.	FIGURE
18100420	**4000**	**0**	**18**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

APPENDIX A

Site Photographs

PHOTOGRAPH LOOKING EAST



PHOTOGRAPH TAKEN ON 25 JUNE 2018

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2018-07-04
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

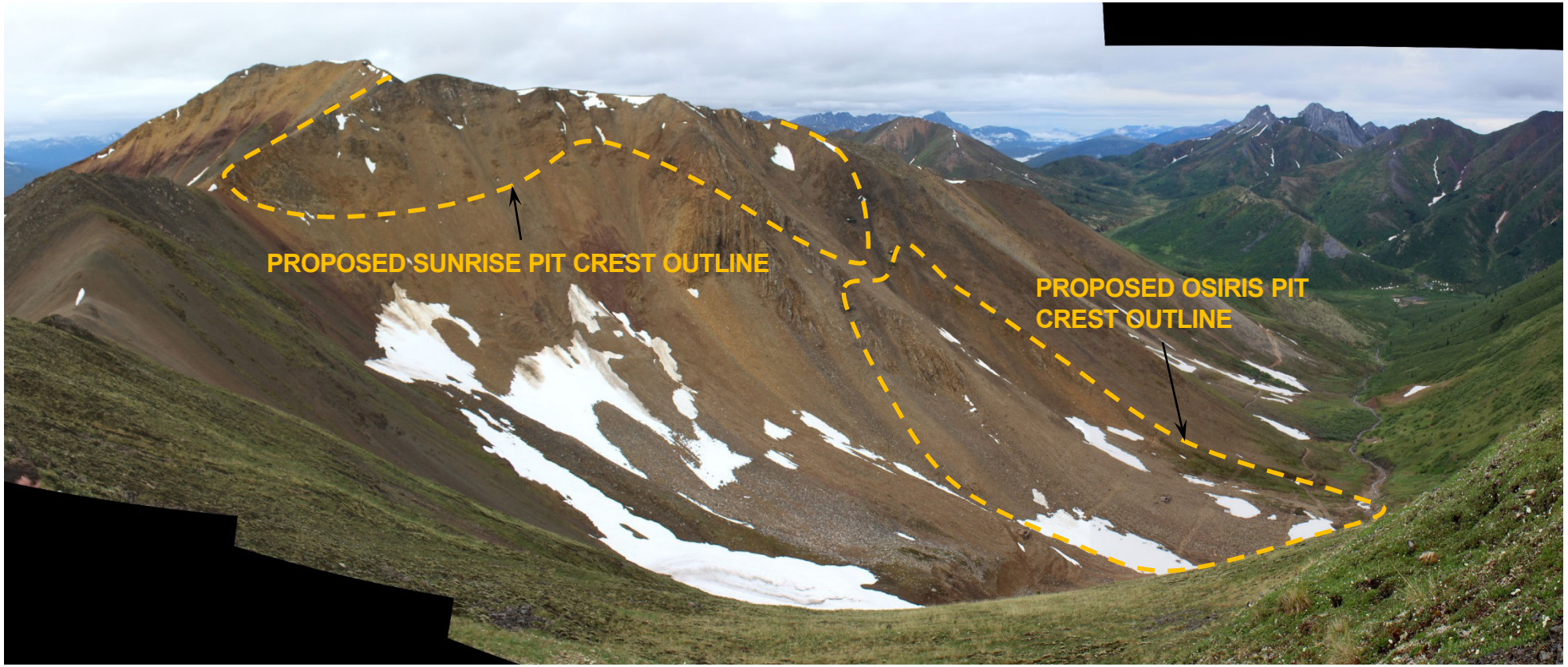
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SITE PHOTOGRAPH NO. 1
PROPOSED CONRAD PIT CREST OUTLINE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**A-1**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PHOTOGRAPH LOOKING SOUTH-SOUTHWEST



PHOTOGRAPH TAKEN ON 25 JUNE 2018

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2018-07-04
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

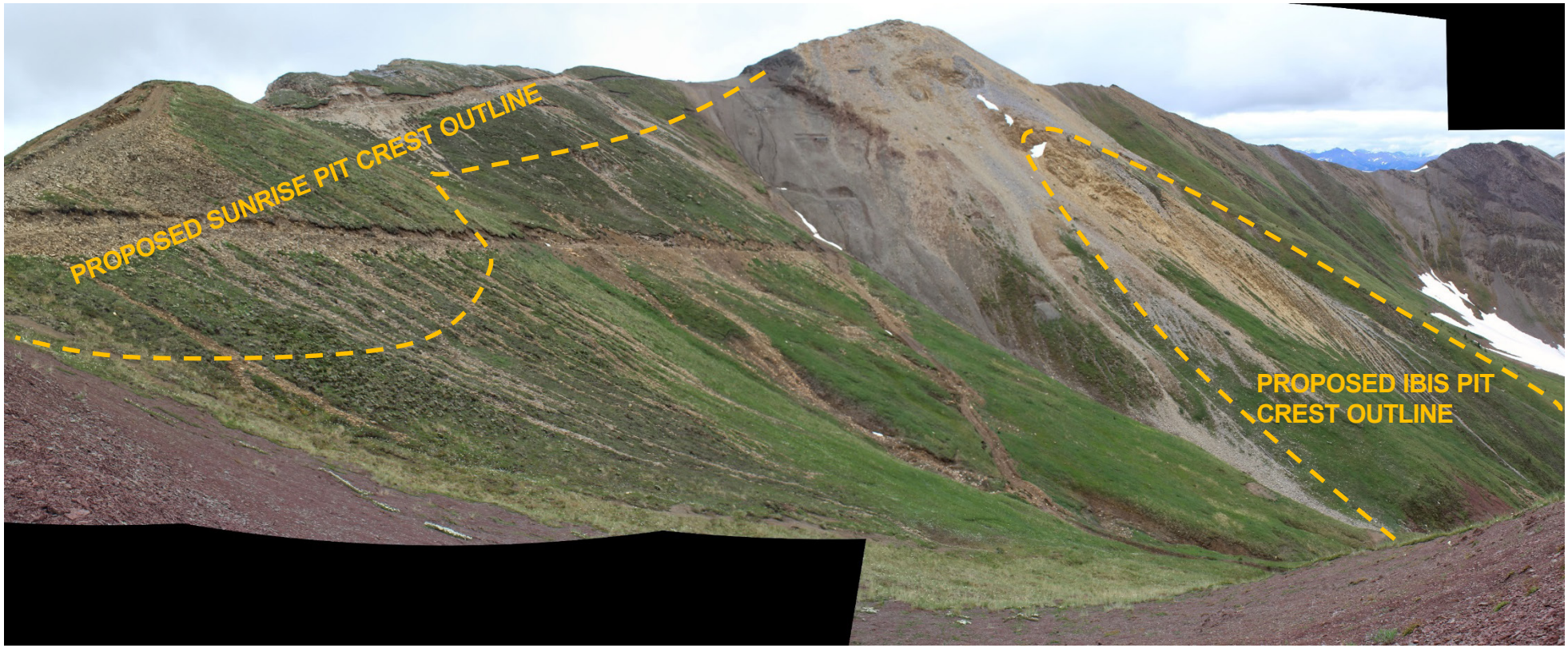
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SITE PHOTOGRAPH NO. 2
PROPOSED SUNRISE PIT AND OSIRIS PIT CREST OUTLINES

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**A-2**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PHOTOGRAPH LOOKING SOUTHEAST



PHOTOGRAPH TAKEN ON 27 JUNE 2018

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2018-07-04
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SITE PHOTOGRAPH NO. 3
PROPOSED SUNRISE PIT AND IBIS PIT CREST OUTLINES

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**A-3**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PHOTOGRAPH LOOKING WEST



PHOTOGRAPH TAKEN ON 27 JUNE 2018

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-07-04
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

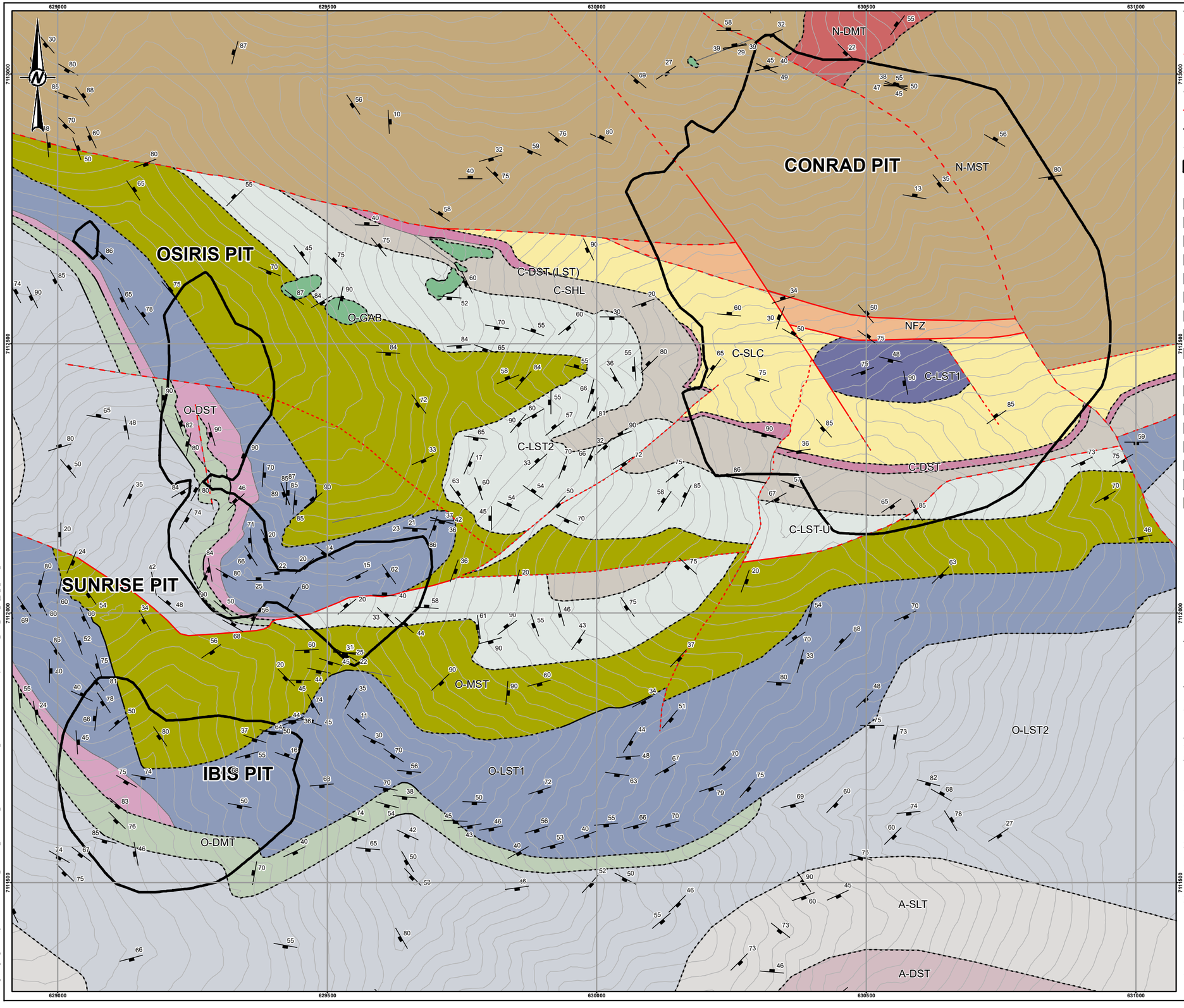
TITLE
SITE PHOTOGRAPH NO. 4
PROPOSED IBIS PIT CREST OUTLINE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**A-4**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

APPENDIX B

Surface Mapping Data



LEGEND

- STRIKE AND DIP
- APPROXIMATE FAULTS
- INFERRED FAULTS
- INFERRED CONTACTS
- OBSERVED FAULTS
- OBSERVED CONTACTS
- CONTOUR (20 m)
- PIT OUTLINE

SURFACE GEOLOGY

- A-DST, Atum Dolostone
- A-SLT, Atum Siltstone
- C-DST, Conrad Silica Dolostone
- C-DST (LST), Conrad Silica Dolostone (Limestone)
- C-LST1, Conrad Limestone 1
- C-LST2, Conrad Limestone 2
- C-SHL, Conrad Shale
- C-SLC, Conrad Siliciclastics
- N-DMT, Nonad Diamictite
- N-MST, Unclassified Nonad Mudstone
- NFZ, Nadaleen Fault Zone
- O-DMT, Osiris Diamictite
- O-DST, Osiris Dolostone
- O-GAB, Osiris Gabbro
- O-LST1, Osiris Limestone 1
- O-LST2, Osiris Limestone 2
- O-MST, Osiris Mudstone

0 150 300
1:7,000 METRES

NOTE(S)
1. STRIKE AND DIP MEASUREMENTS REPRESENT A SUB-SET OF BEDDING MEASUREMENTS. NOT ALL MEASUREMENTS WERE PLOTTED FOR VISUAL PRESENTATION PURPOSES.

REFERENCE(S)
1. BASE DATA PROVIDED BY CLIENT.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 8N

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SURFACE MAPPING BEDDING ORIENTATIONS

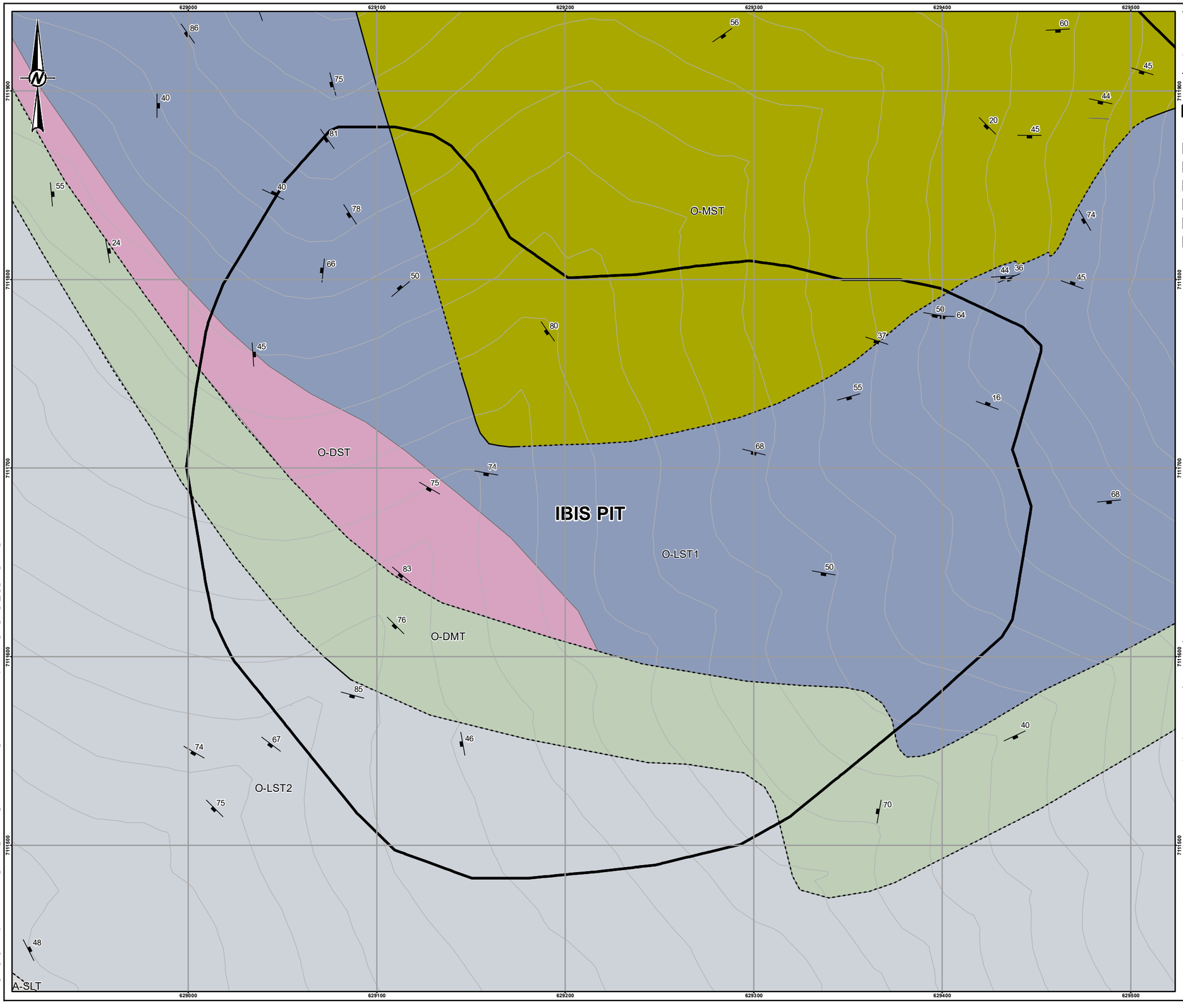
CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-23
DESIGNED	TT/JH
PREPARED	CC
REVIEWED	TGT
APPROVED	AVC

PROJECT NO.	PHASE	REV.	FIGURE
18100420	4000	0	B-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

PATH: \\golder.gds\gal\burnaby\CAD-GIS\Client\ATAC_Resources_Ltd\Yukon\99_PROJECTS\18100420\02_PRODUCTION\4000\MXD\Report\18100420_4000_4100_Fig_B_1_Osiris_Geotech.mxd PRINTED ON: 2019-09-23 AT: 9:28:44 AM



LEGEND

- STRIKE AND DIP
- INFERRED CONTACTS
- OBSERVED CONTACTS
- CONTOUR (20 m)
- PIT OUTLINE

SURFACE GEOLOGY

- A-SLT, Atum Siltstone
- O-DMT, Osiris Diamictite
- O-DST, Osiris Dolostone
- O-LST1, Osiris Limestone 1
- O-LST2, Osiris Limestone 2
- O-MST, Osiris Mudstone

0 50 100
1:2,000 METRES

NOTE(S)

1. STRIKE AND DIP MEASUREMENTS REPRESENT A SUB-SET OF BEDDING MEASUREMENTS. NOT ALL MEASUREMENTS WERE PLOTTED FOR VISUAL PRESENTATION PURPOSES.

REFERENCE(S)

1. BASE DATA PROVIDED BY CLIENT.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 8N

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

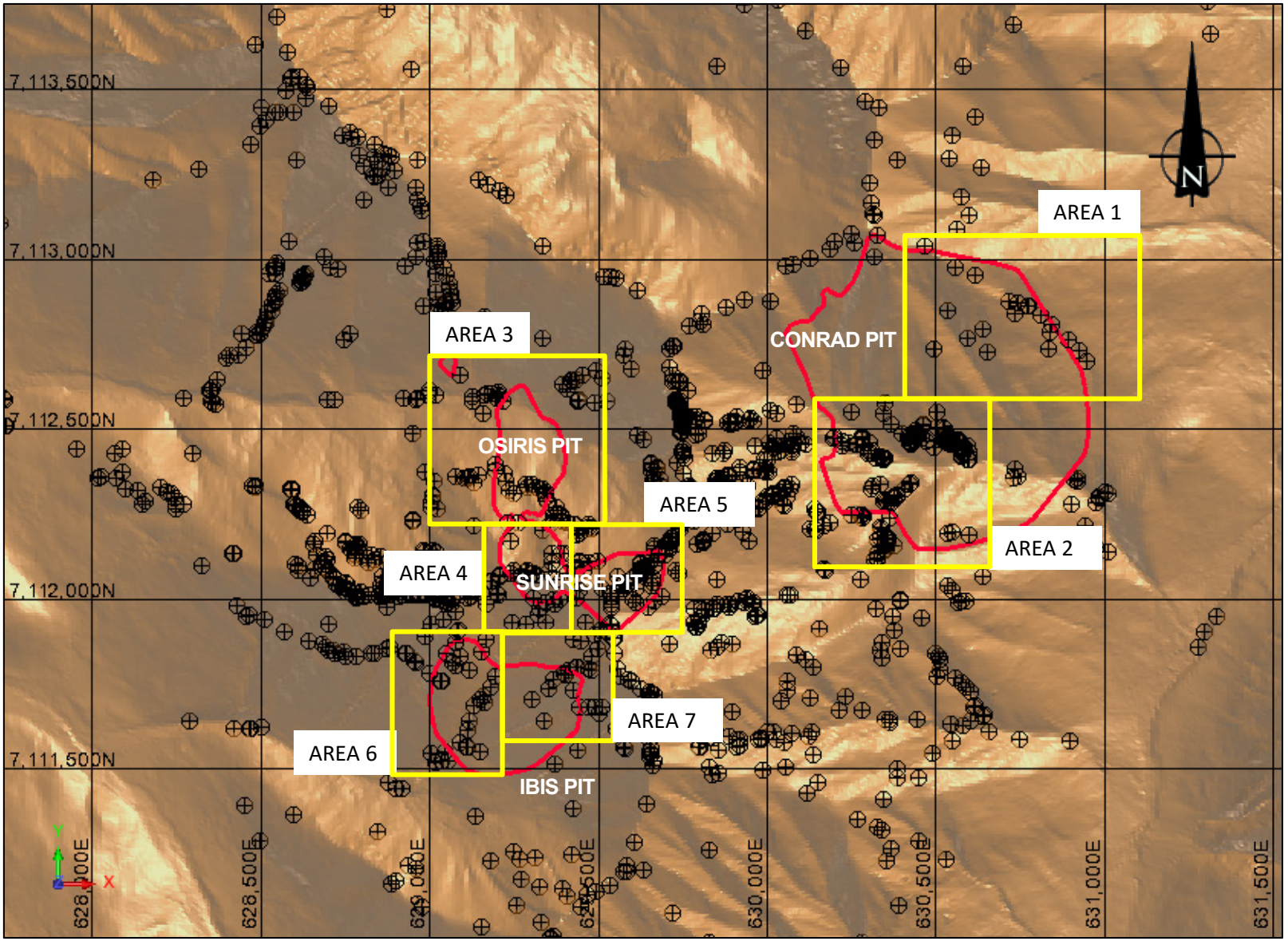
TITLE
IBIS PIT SURFACE MAPPING BEDDING ORIENTATIONS

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-23
DESIGNED	TT/JH
PREPARED	CC
REVIEWED	TGT
APPROVED	AVC

PROJECT NO.	PHASE	REV.	FIGURE
18100420	4000	0	B-2

PATH: \\golder.gds\gal\burnaby\CAD-GIS\Client\ATAC_Resources_Ltd\Vision\99_PROJECTS\181004\20\02_PRODUCTION\4000\MXD\Report\18100420_4000_4100_Fig_B_2_Osiris_Geotech_Zoomin.mxd PRINTED ON: 2019-09-23
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25mm
0



LEGEND

- PROPOSED PIT OUTLIINE
- MEASUREMENT LOCATION
- AREA OF STRUCTURAL ORIENTATIONS PLOTTED ON STEREONETS

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-04-01
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

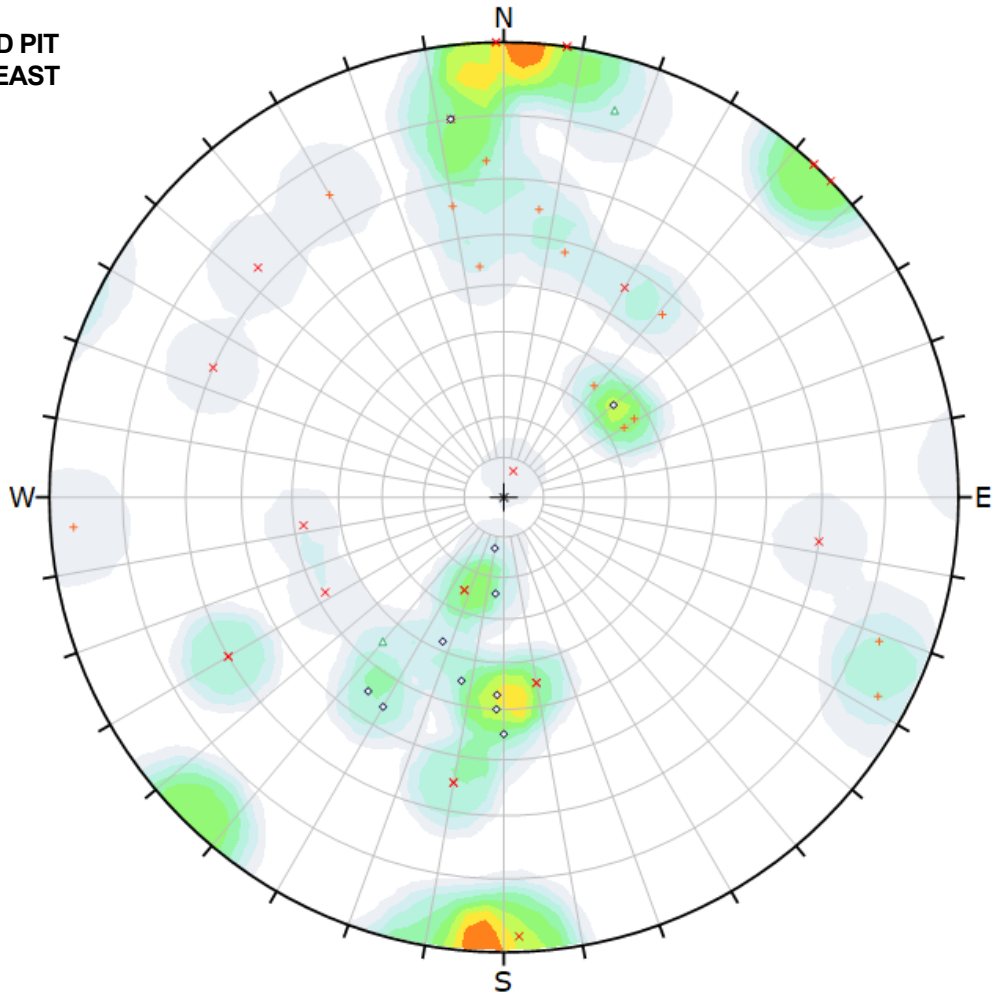
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
ALLSURFACE MAPPING DATA
PLAN VIEW
AREAS SELECTED FOR DATA PLOTTING

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**B-3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

AREA 1
CONRAD PIT
NORTHEAST



Symbol	STRUCTURE TYPE	Quantity
◇	BD	11
×	CV	24
△	FO	2
+	FR	13

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.00%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	50 (50 Entries)
Hemisphere	Lower
Projection	Equal Angle

NOTE:
- Surface mapping data collected by ATAC and Golder. Plotted by Golder.
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-04-01
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

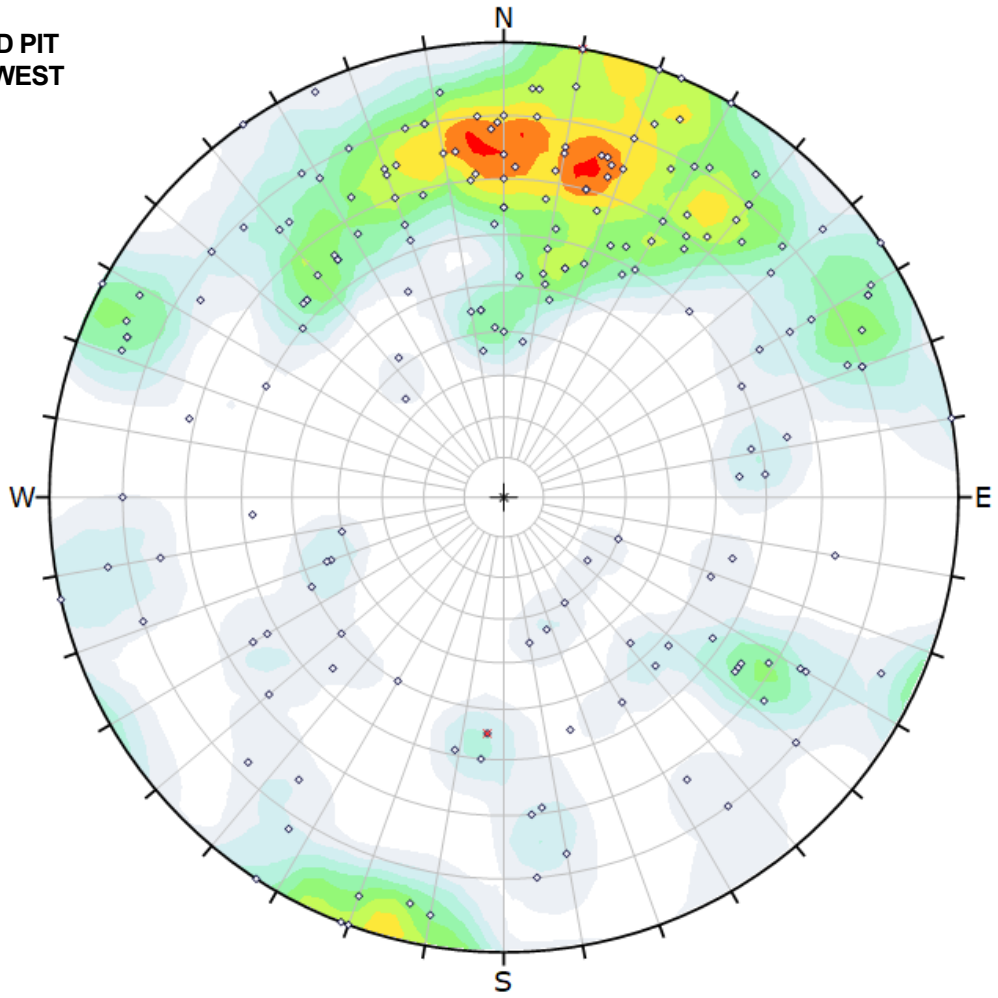
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SURFACE MAPPING DATA
AREA 1
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**B-4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

AREA 2
CONRAD PIT
SOUTHWEST



Symbol	STRUCTURE TYPE	Quantity
◇	BD	192
×	CV	2

Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Contour Data	Pole Vectors
Maximum Density	5.57%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	194 (194 Entries)
Hemisphere	Lower
Projection	Equal Angle

NOTE:
- Surface mapping data collected by ATAC and Golder. Plotted by Golder.
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-04-01
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

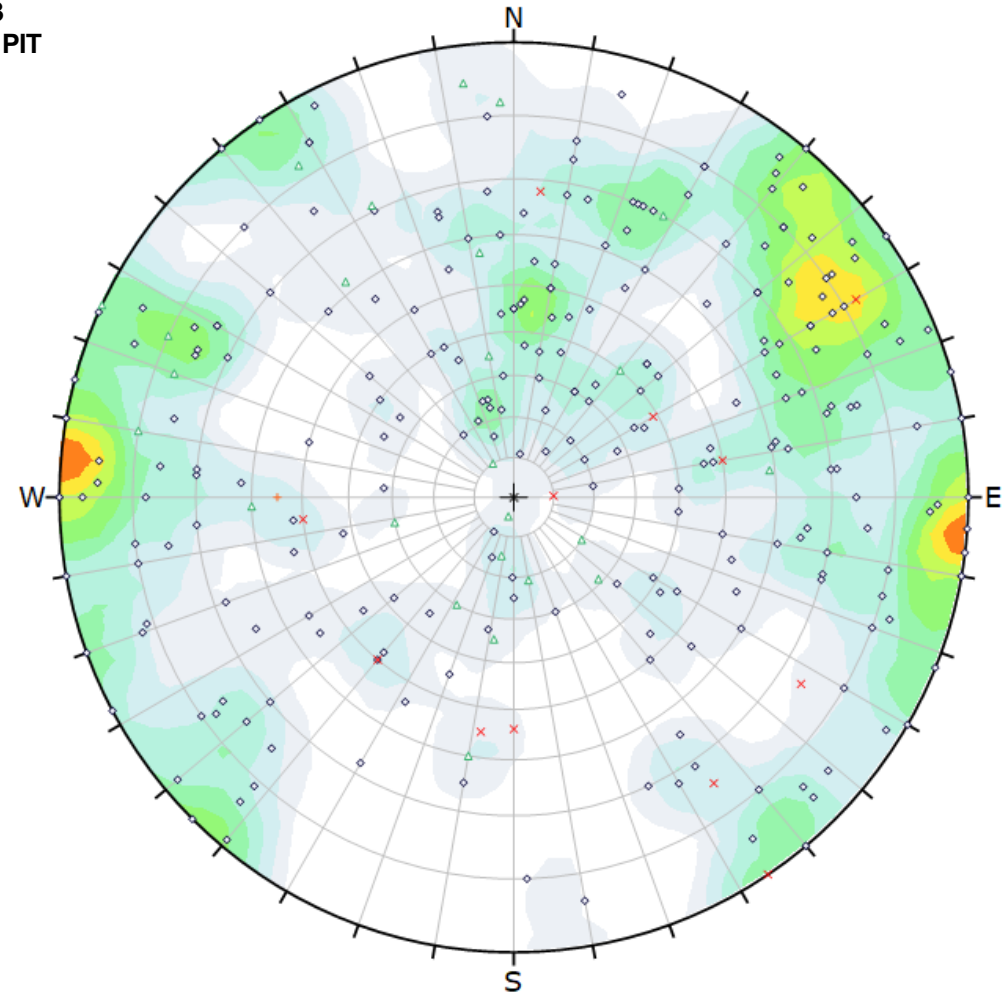
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SURFACE MAPPING DATA
AREA 2
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**B-5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

AREA 3
OSIRIS PIT



Symbol	STRUCTURE TYPE	Quantity
◇	BD	250
×	CV	12
△	FR	25
+	FT	1

Color	Density Concentrations
	0.00 - 0.50
	0.50 - 1.00
	1.00 - 1.50
	1.50 - 2.00
	2.00 - 2.50
	2.50 - 3.00
	3.00 - 3.50
	3.50 - 4.00
	4.00 - 4.50
	4.50 - 5.00

Contour Data	Pole Vectors
Maximum Density	4.40%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	288 (288 Entries)
Hemisphere	Lower
Projection	Equal Angle

NOTE:
- Surface mapping data collected by ATAC and Golder. Plotted by Golder.
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-04-01
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

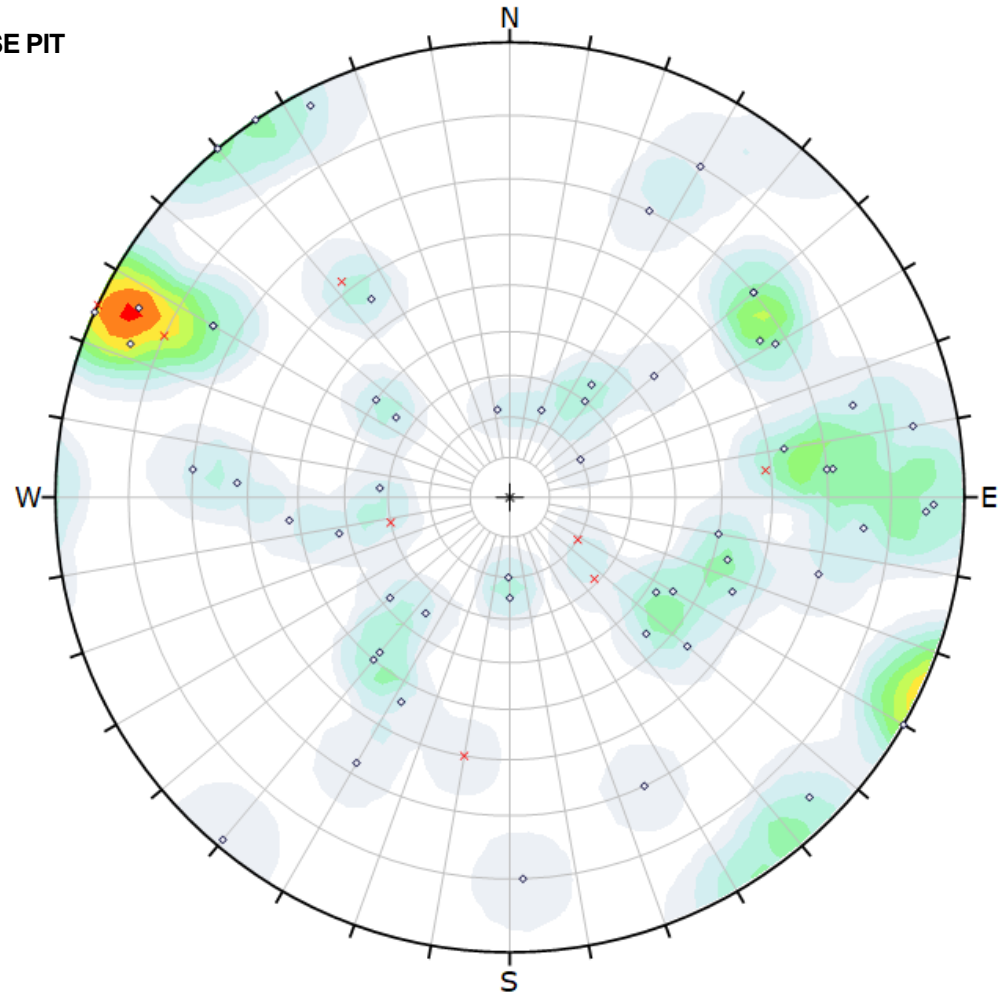
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SURFACE MAPPING DATA
AREA 3
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**B-6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

AREA 4
SUNRISE PIT
WEST



Symbol	STRUCTURE TYPE	Quantity
◇	BD	57
×	FR	8

Color	Density Concentrations
	0.00 - 0.90
	0.90 - 1.80
	1.80 - 2.70
	2.70 - 3.60
	3.60 - 4.50
	4.50 - 5.40
	5.40 - 6.30
	6.30 - 7.20
	7.20 - 8.10
	8.10 - 9.00

Contour Data	Pole Vectors
Maximum Density	8.36%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	65 (65 Entries)
Hemisphere	Lower
Projection	Equal Angle

NOTE:
- Surface mapping data collected by ATAC and Golder. Plotted by Golder.
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-04-01
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

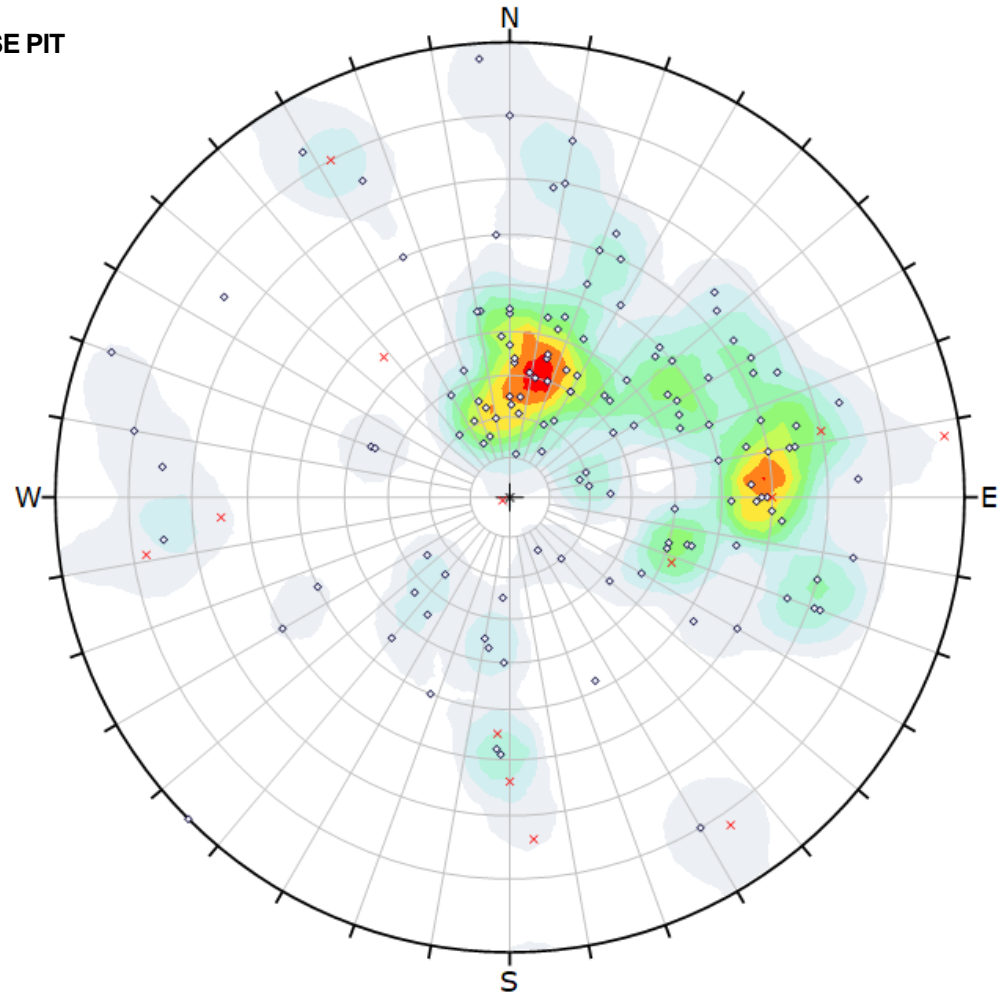
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SURFACE MAPPING DATA
AREA 4
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**B-7**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

AREA 5
SUNRISE PIT
EAST



Symbol	STRUCTURE TYPE	Quantity
◇	BD	133
×	FR	13

Color	Density Concentrations
	0.00 - 0.70
	0.70 - 1.40
	1.40 - 2.10
	2.10 - 2.80
	2.80 - 3.50
	3.50 - 4.20
	4.20 - 4.90
	4.90 - 5.60
	5.60 - 6.30
	6.30 - 7.00

Contour Data	Pole Vectors
Maximum Density	6.58%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	146 (146 Entries)
Hemisphere	Lower
Projection	Equal Angle

NOTE:
- Surface mapping data collected by ATAC and Golder. Plotted by Golder.
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-04-01
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

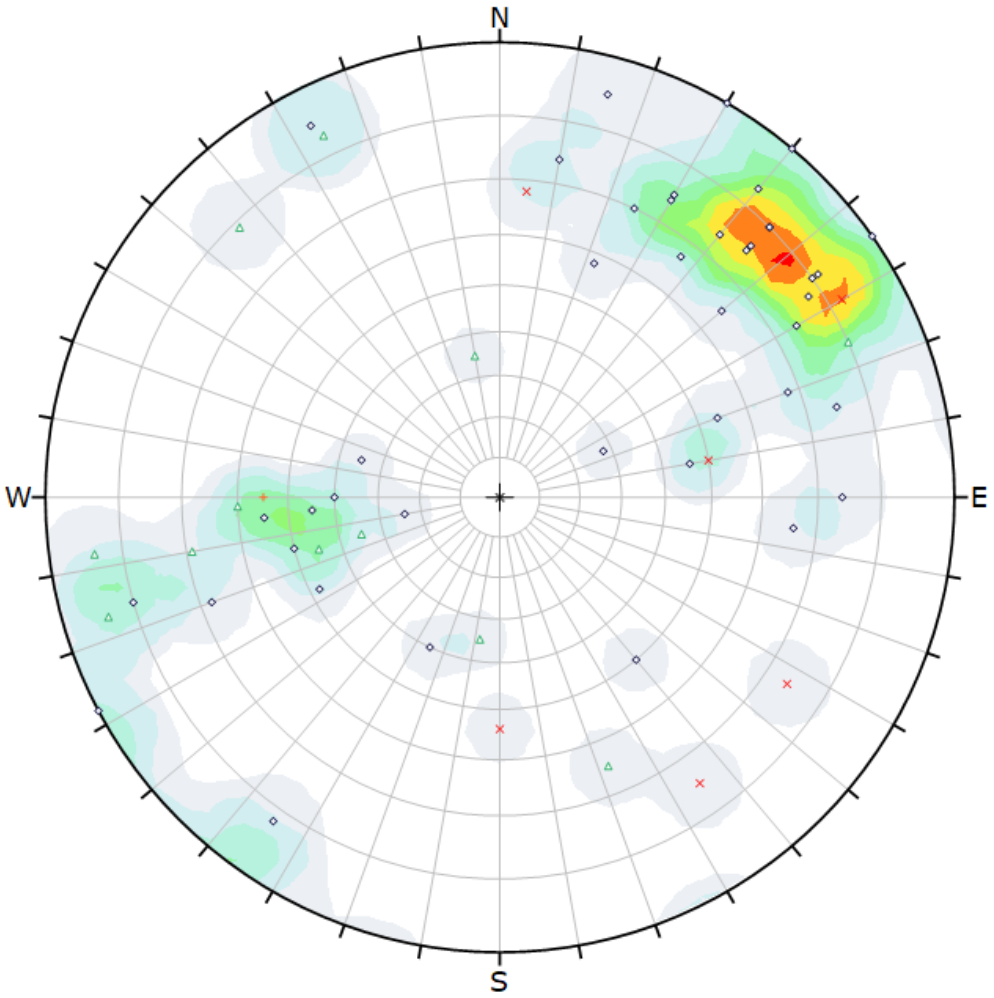
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SURFACE MAPPING DATA
AREA 5
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**B-8**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

AREA 6
IBIS PIT
WEST



Symbol	STRUCTURE TYPE	Quantity
◇	BD	42
×	CV	6
△	FR	12
+	FT	1

Color	Density Concentrations
	0.00 - 1.10
	1.10 - 2.20
	2.20 - 3.30
	3.30 - 4.40
	4.40 - 5.50
	5.50 - 6.60
	6.60 - 7.70
	7.70 - 8.80
	8.80 - 9.90
	9.90 - 11.00

Contour Data	Pole Vectors
Maximum Density	10.18%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	61 (61 Entries)
Hemisphere	Lower
Projection	Equal Angle

NOTE:
- Surface mapping data collected by ATAC and Golder. Plotted by Golder.
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-04-01
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

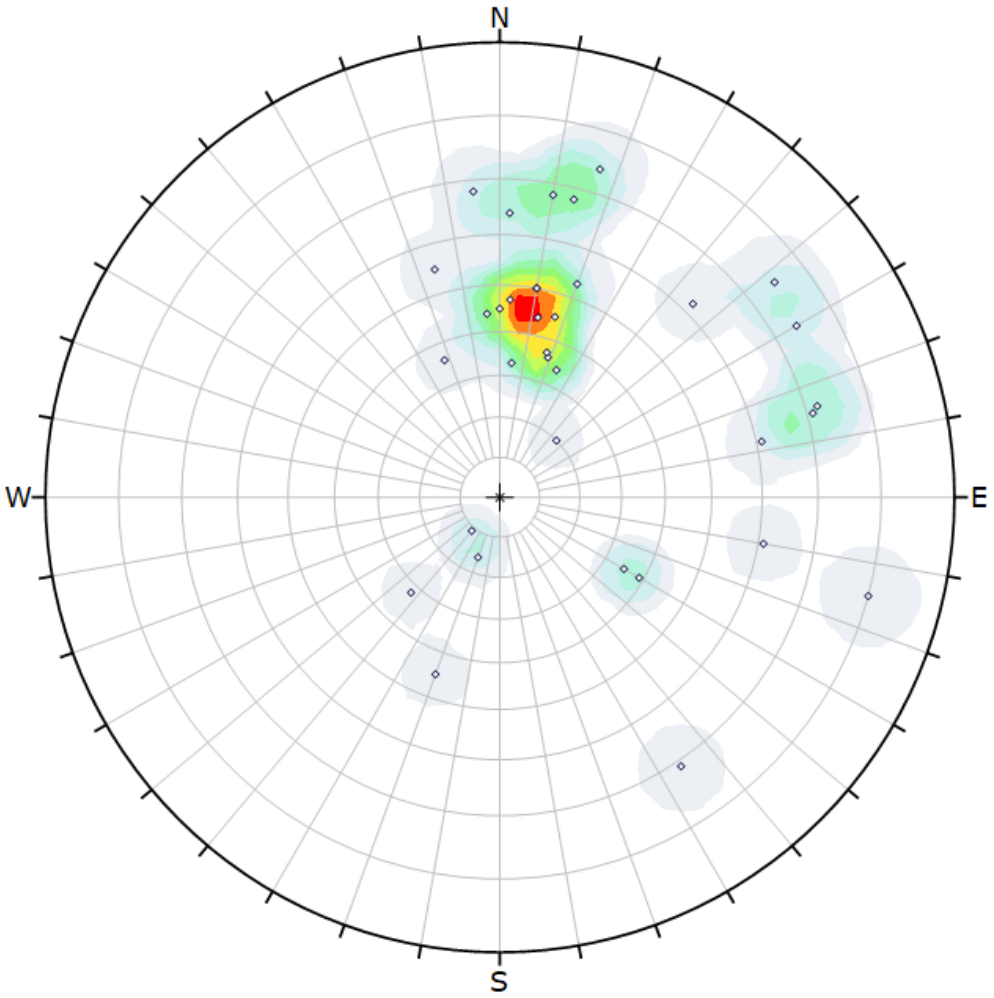
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SURFACE MAPPING DATA
AREA 6
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**B-9**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

AREA 7
IBIS PIT
EAST



Symbol	STRUCTURE TYPE	Quantity
◇	BD	35

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.18%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	35 (35 Entries)
Hemisphere	Lower
Projection	Equal Angle

NOTE:
- Surface mapping data collected by ATAC and Golder. Plotted by Golder.
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-04-01
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SURFACE MAPPING DATA
AREA 7
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**B-10**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

APPENDIX C

Geotechnical Cross-sections

ROCK QUALITY DESIGNATION (RQD) CLASSIFICATION

RQD (percent)	Rock Quality Classification	Approximate Discontinuity Spacing (mm)[(a)]
0-25	Very Poor	< 70
25-50	Poor	70-100
50-75	Fair	100-150
75-90	Good	150-300
90-100	Excellent	> 300

(a) Based on correlation between RQD and mean discontinuity spacing by Bieniawski (1989)

INTACT ROCK STRENGTH CLASSIFICATION

Code	Classification	UCS Estimate (MPa)
0	Extremely Weak	0.25-1
1	Very Weak	1-5
2	Weak	5-25
3	Moderately Strong	25-50
4	Strong	50-100
5	Very Strong	100-250
6	Extremely Strong	> 250

UCS = Unconfined Compressive Strength

WEATHERING CLASSIFICATION

Code	Classification
1	Fresh
2	Slightly Weathered
3	Moderately Weathered
4	Highly Weathered
5	Extremely Weathered
6	Residual Soil

Note: Refer to text in body of report for classification descriptions

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

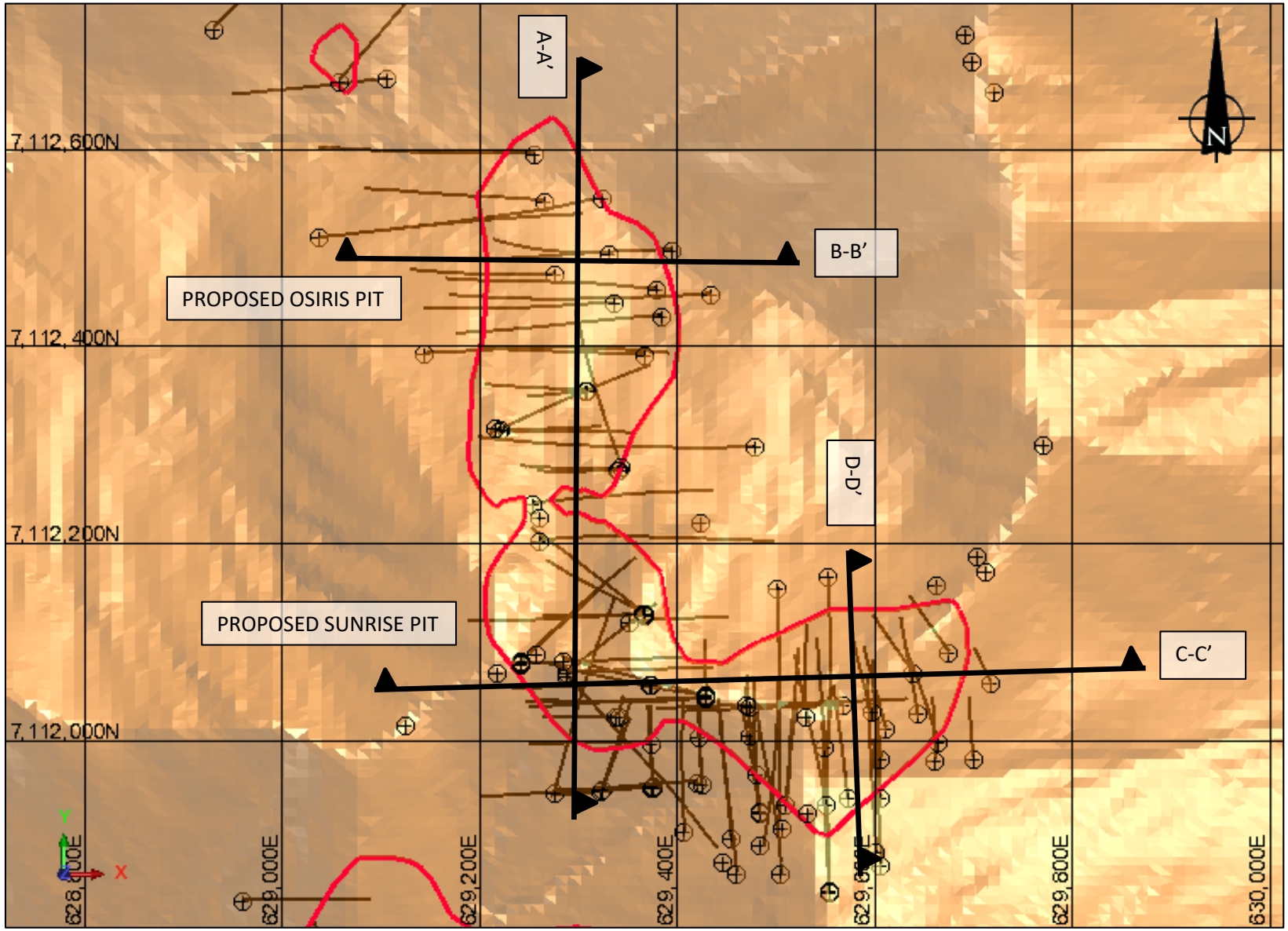
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
GEOTECHNICAL INTERVAL DATA CODES AND CLASSIFICATIONS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm



LEGEND

- EXPLORATION COREHOLE COLLAR
- EXPLORATION COREHOLE TRACE
- PROPOSED PIT OUTLINE
- CROSS SECTION LOCATION
- SITE TOPOGRAPHY

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

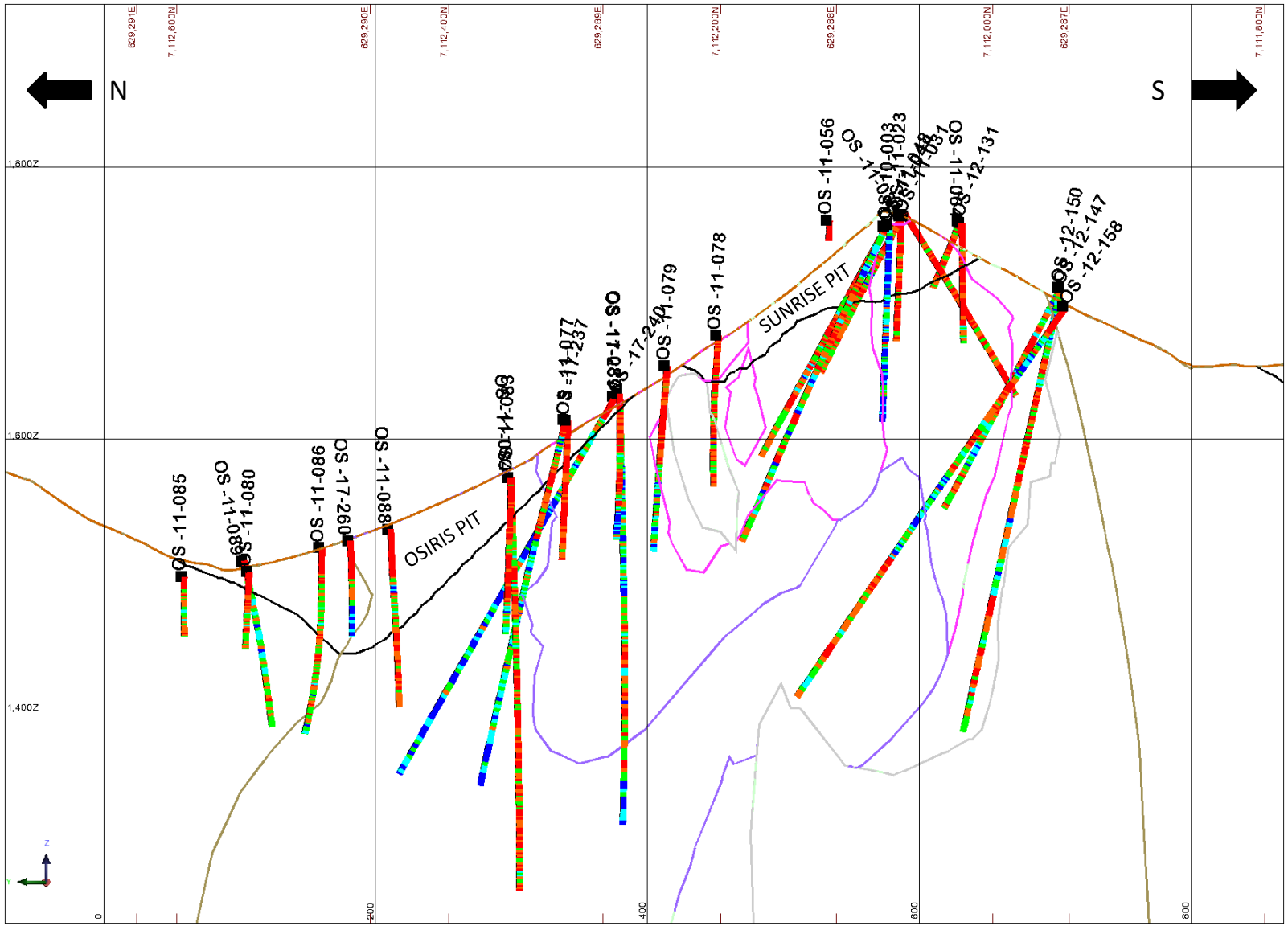
TITLE
CROSS-SECTION LOCATIONS
PROPOSED OSIRIS AND SUNRISE PITS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-2**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

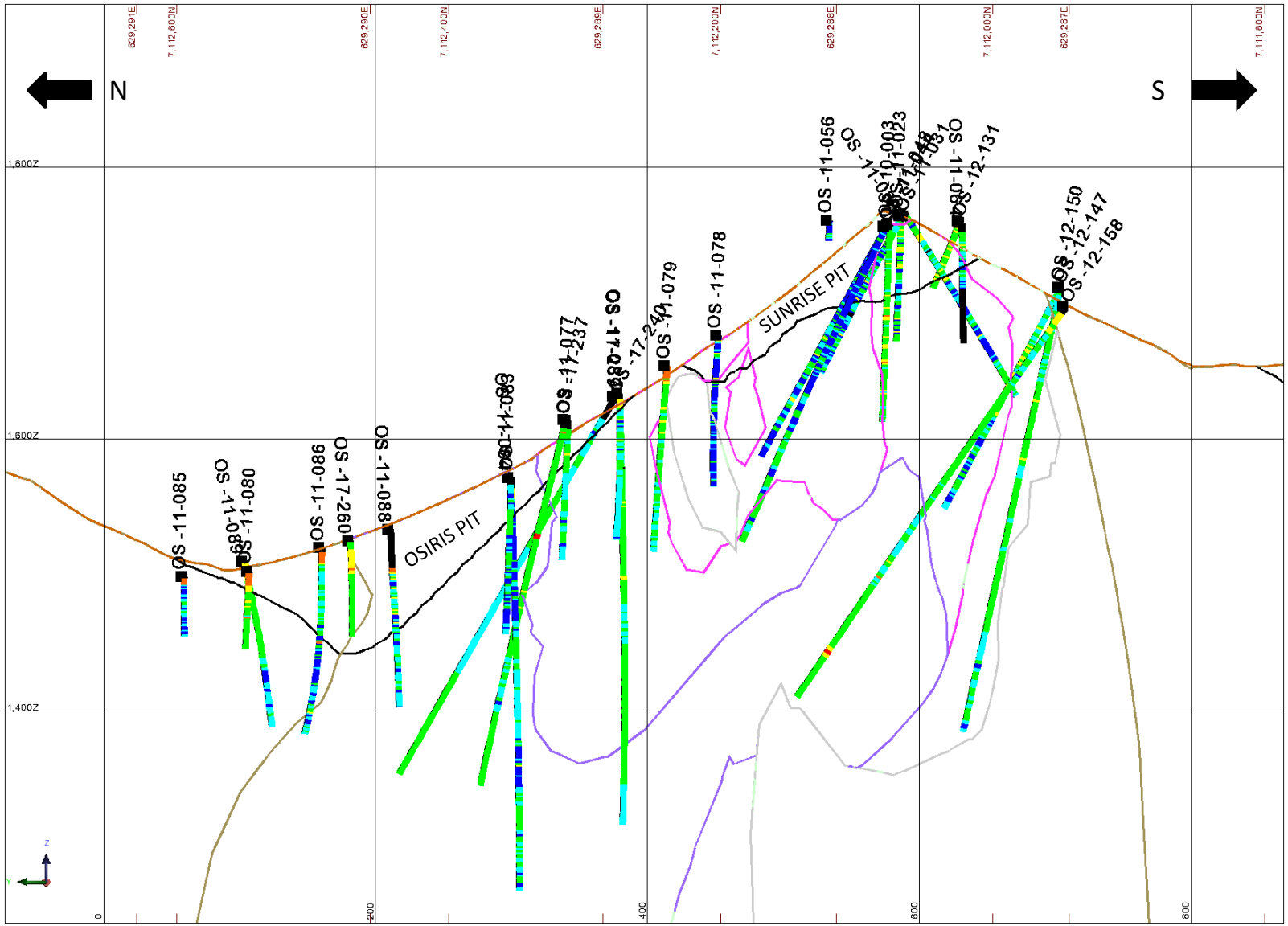
TITLE
SECTION A-A'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

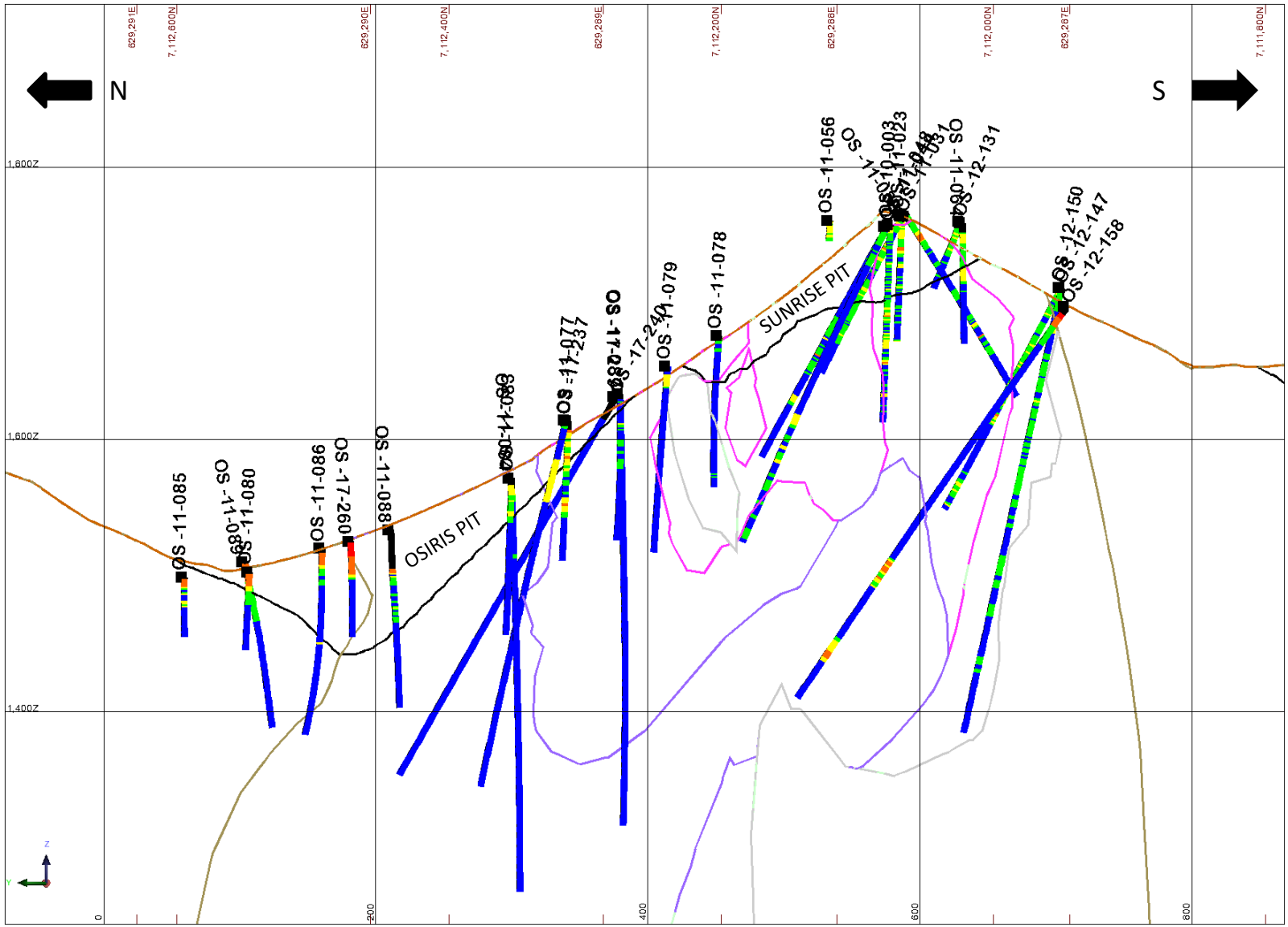
TITLE
SECTION A-A'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

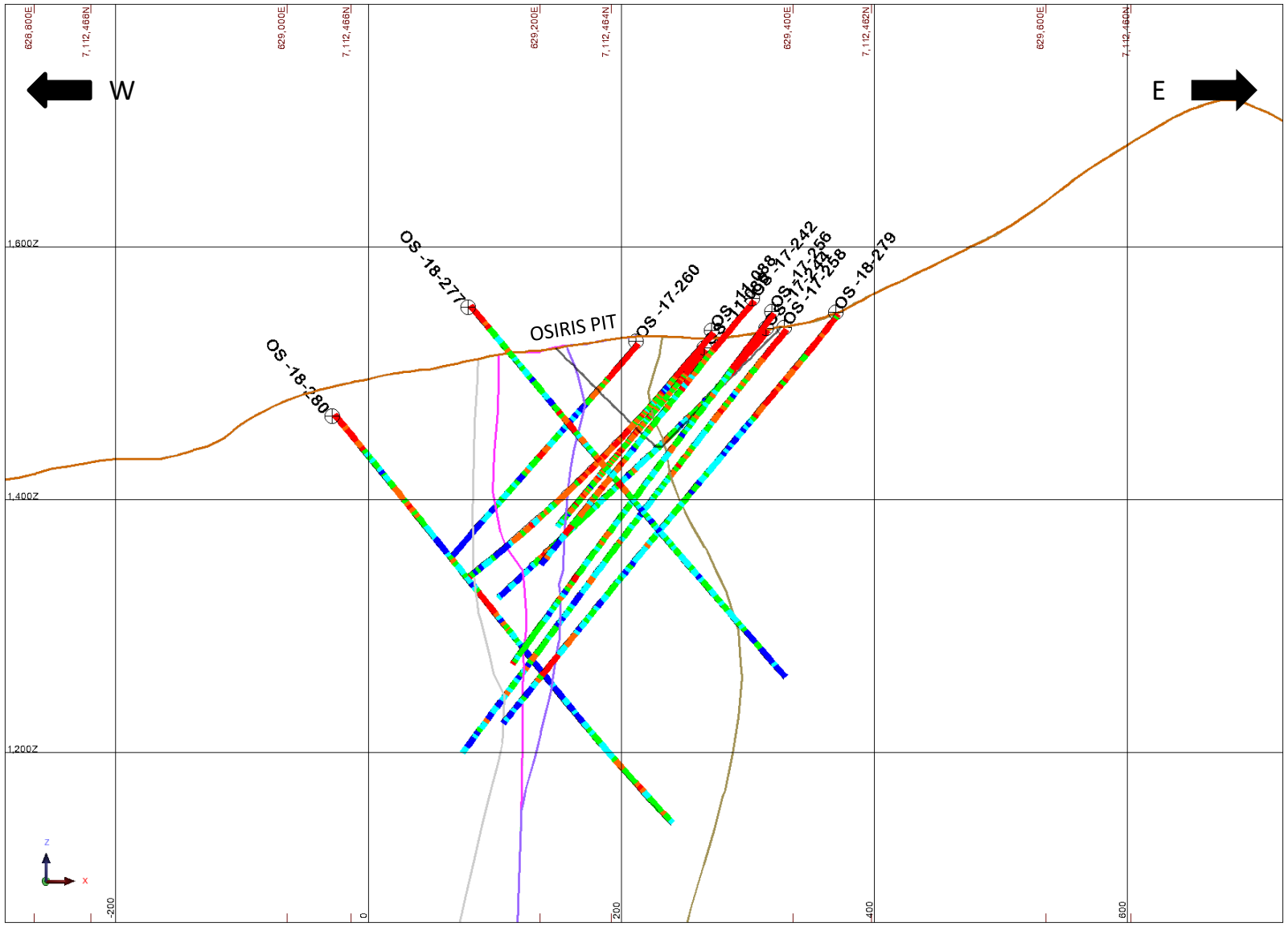
TITLE
SECTION A-A'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

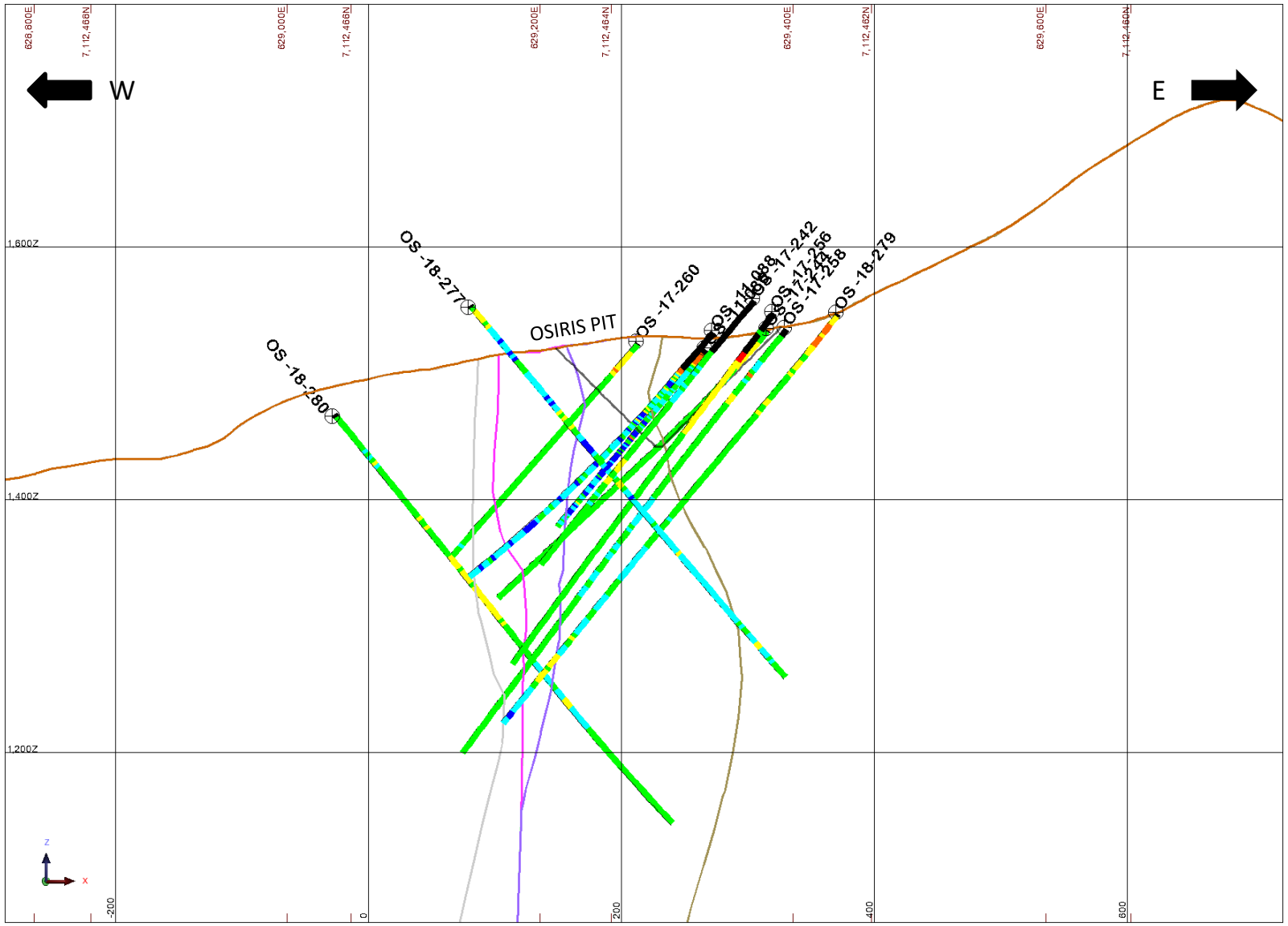
TITLE
SECTION B-B'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

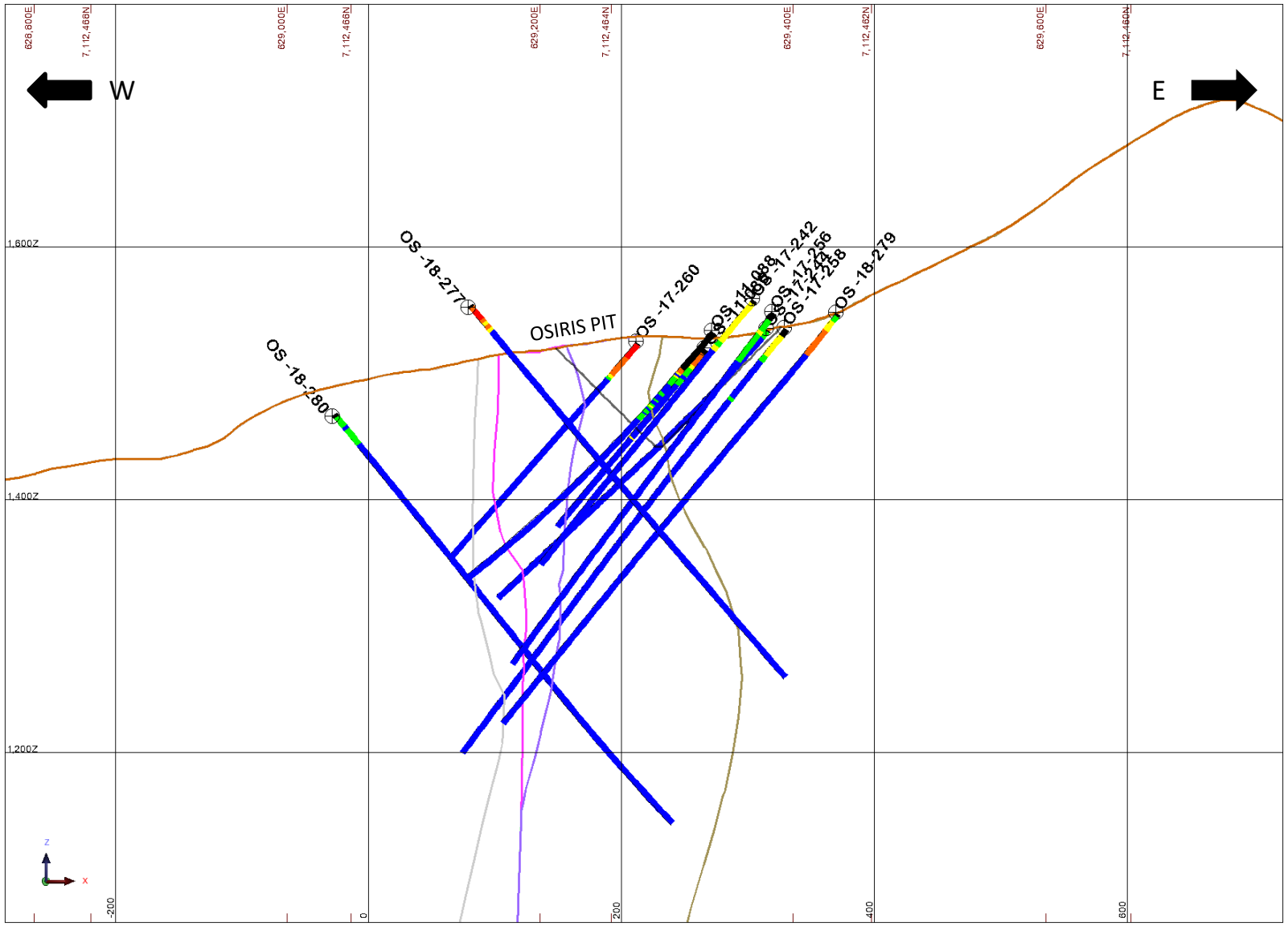
TITLE
SECTION B-B'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

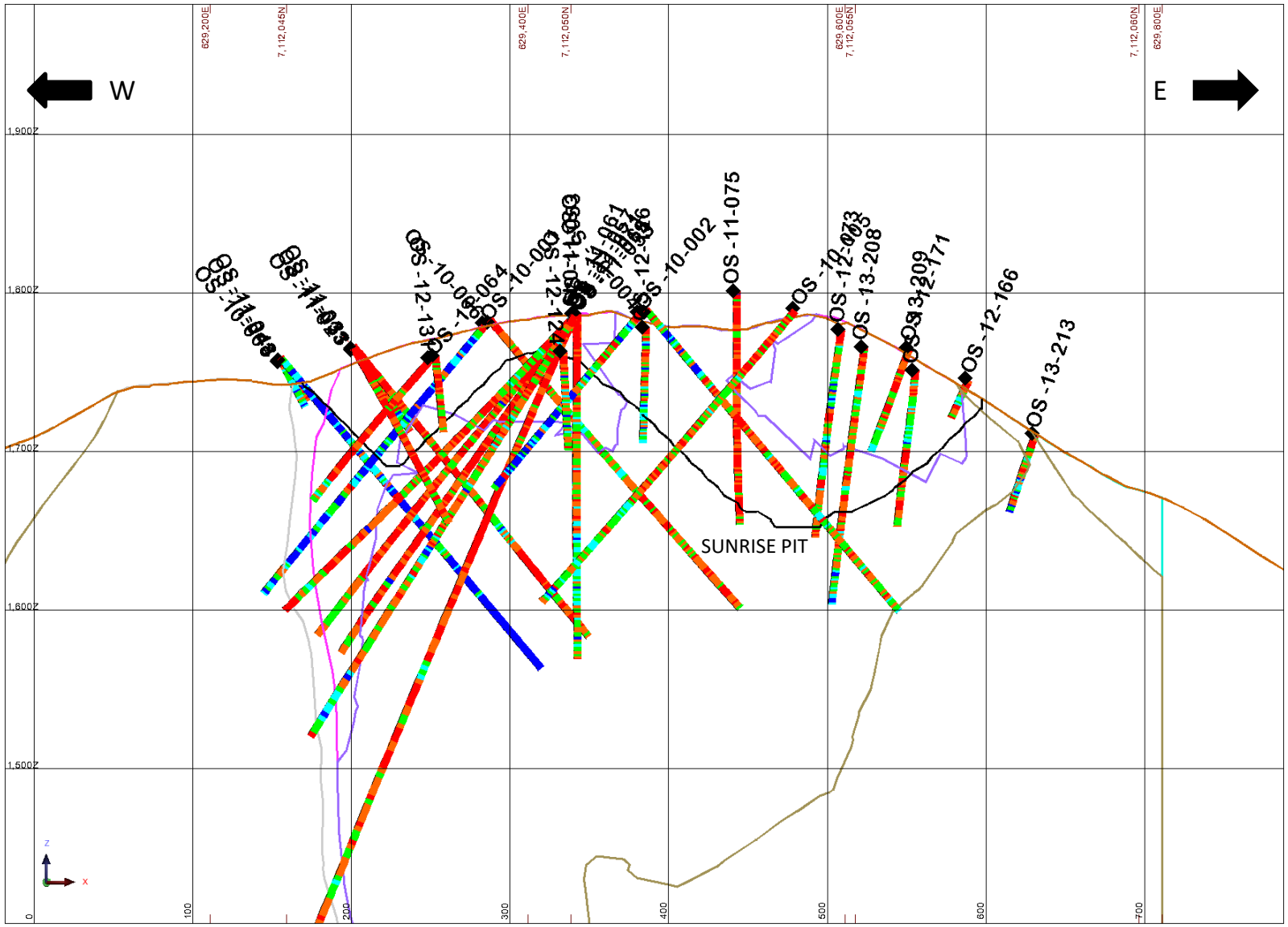
TITLE
SECTION B-B'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

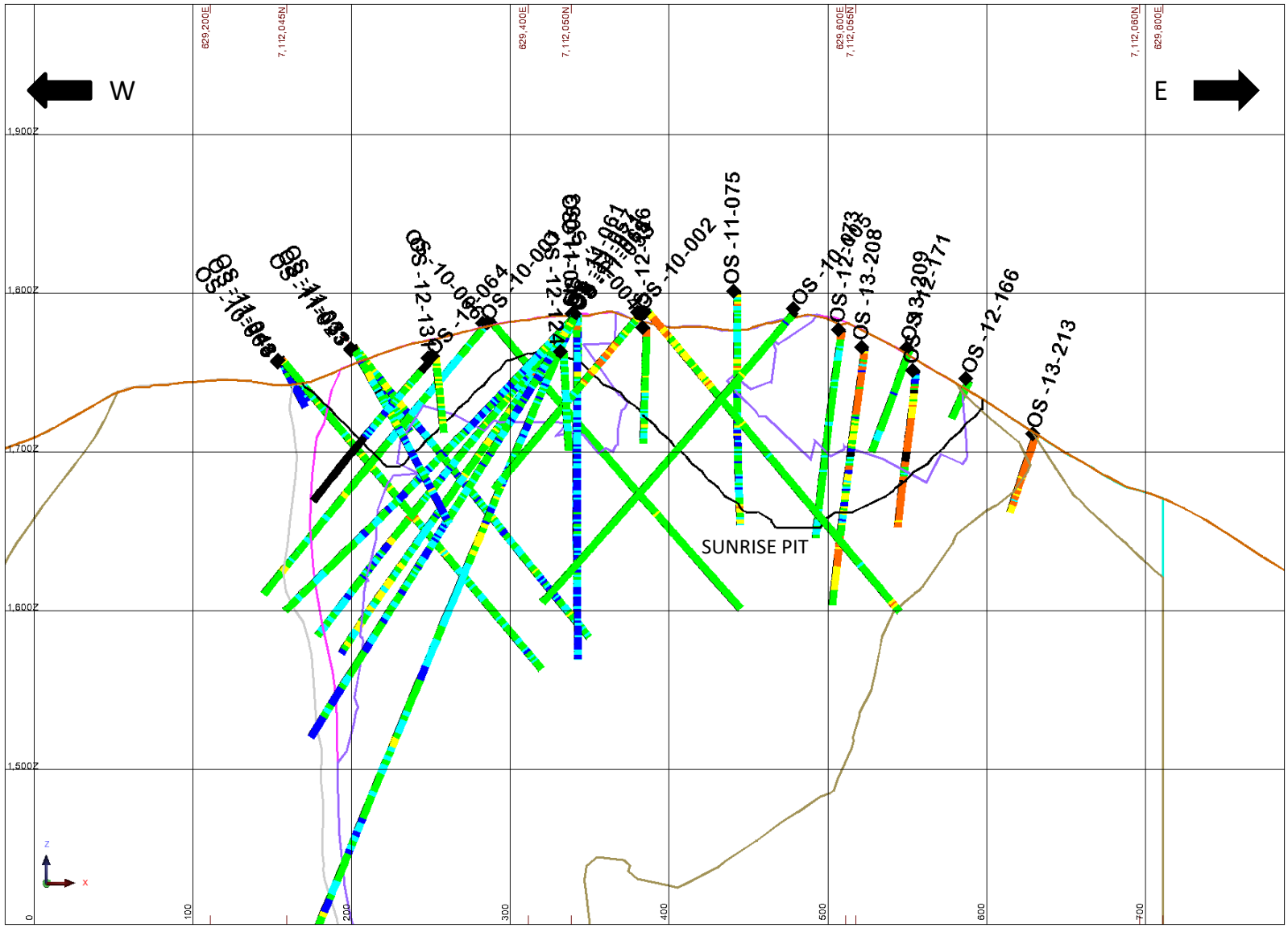
TITLE
SECTION C-C'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

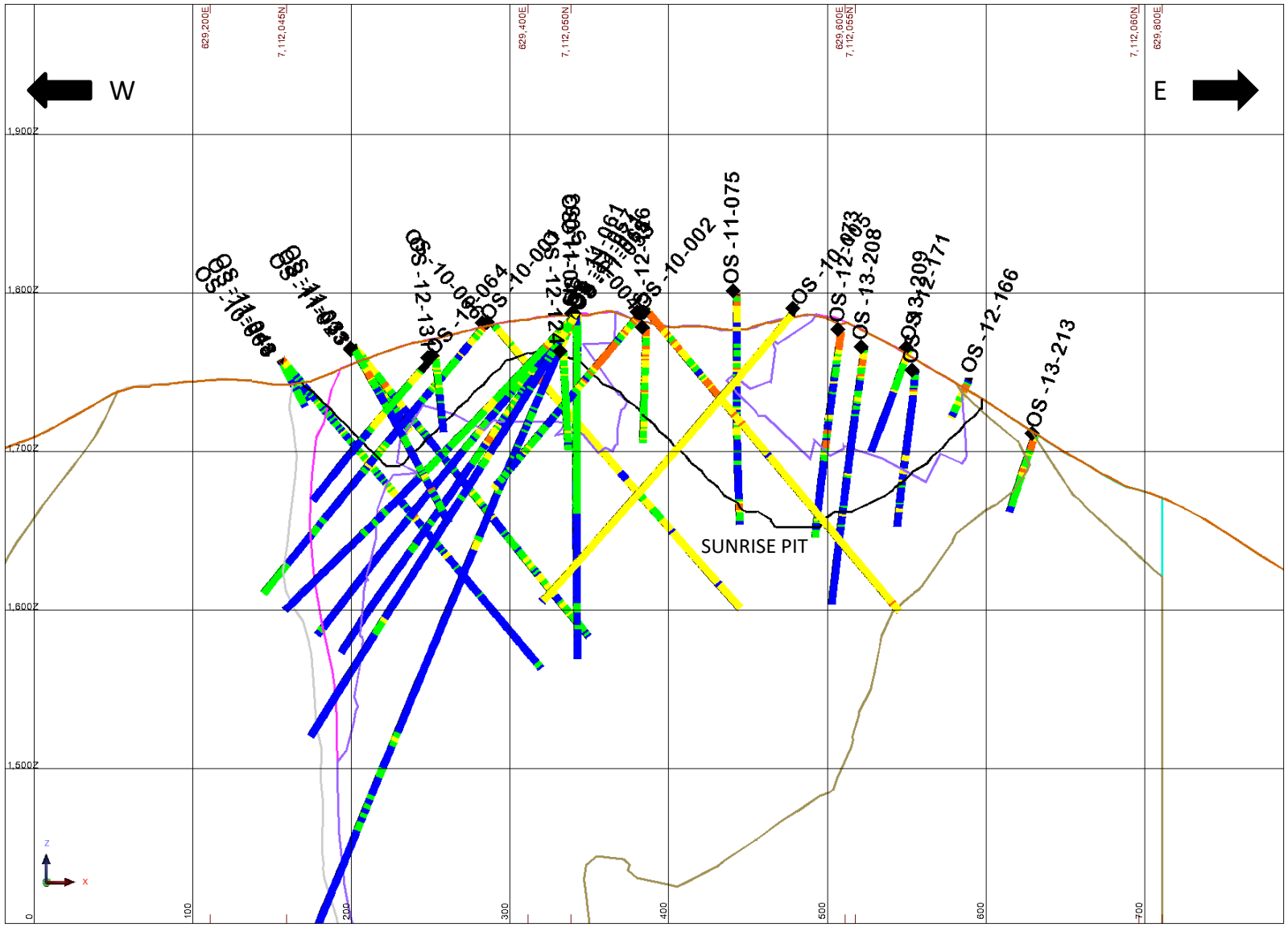
TITLE
SECTION C-C'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

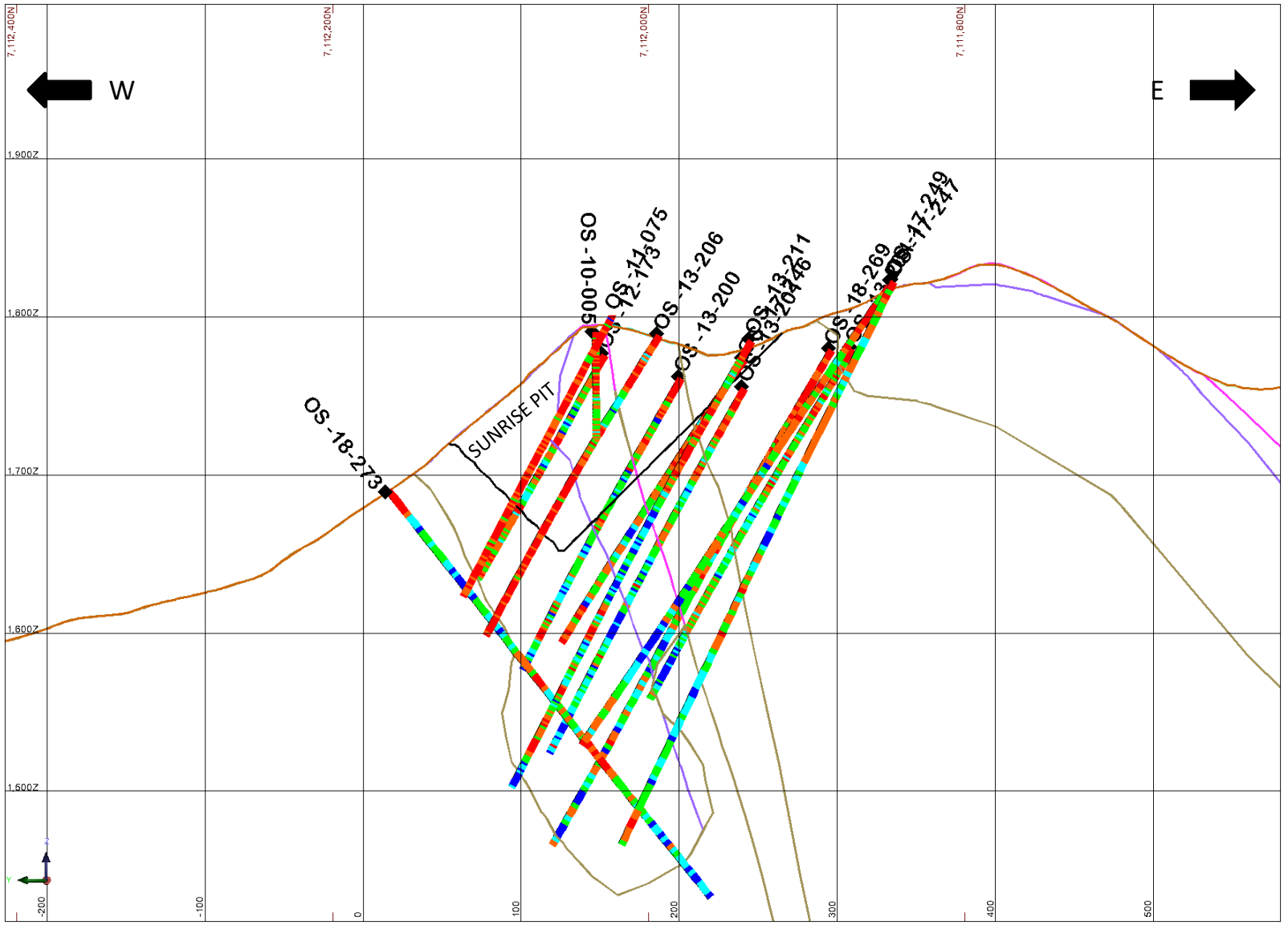
TITLE
SECTION C-C'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-11**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

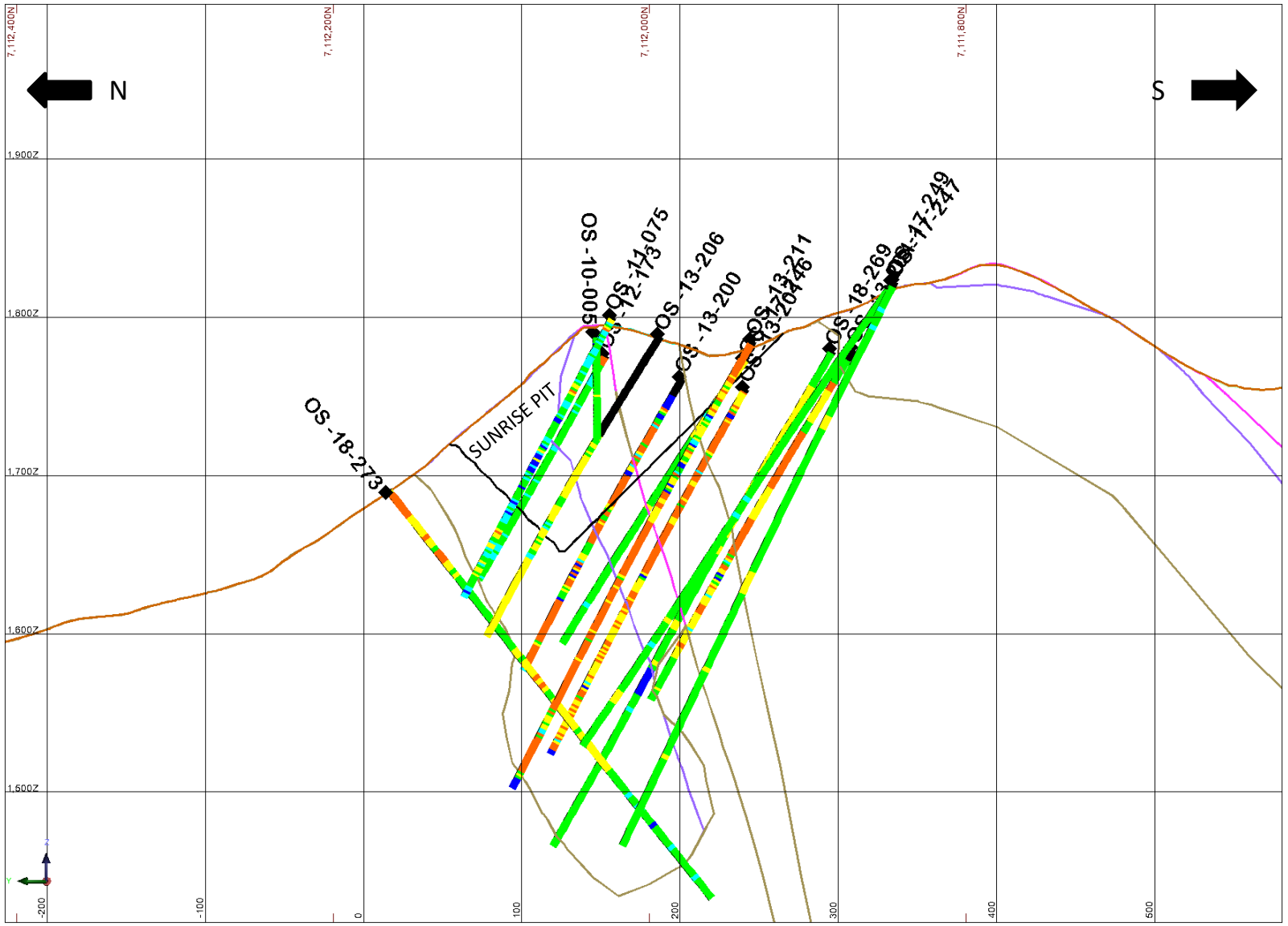
TITLE
SECTION D-D'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-12**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

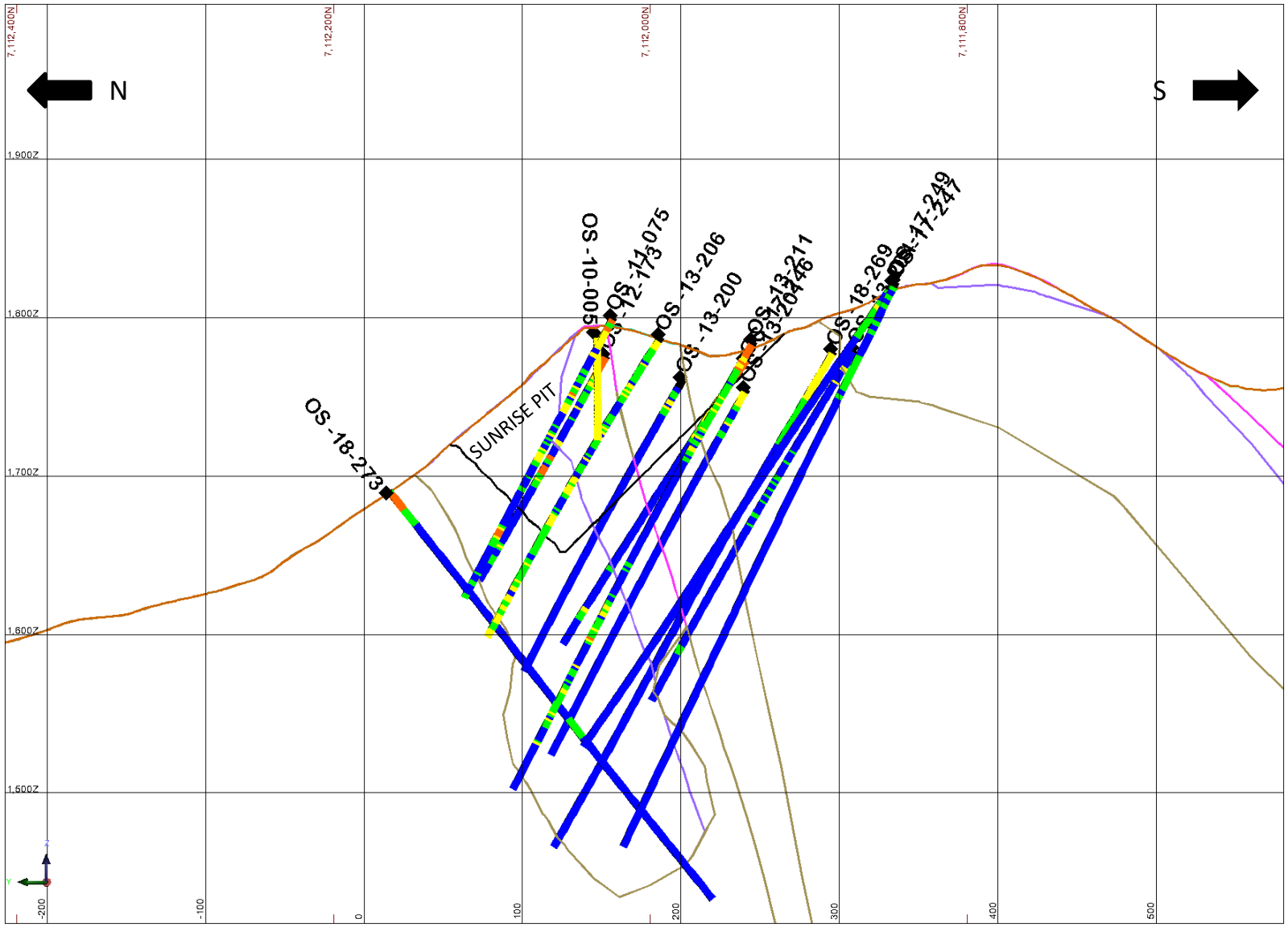
TITLE
SECTION D-D'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-13**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

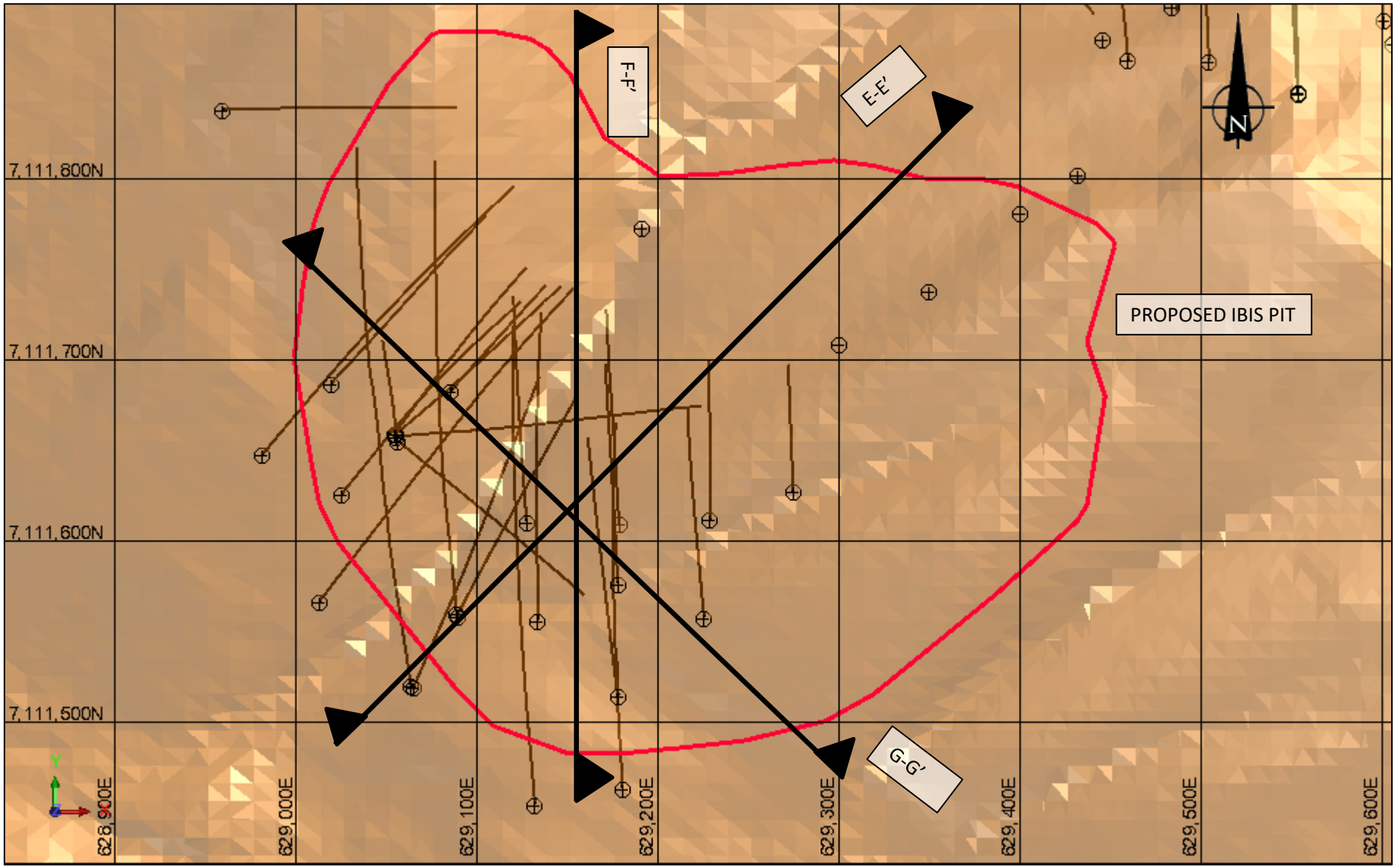
YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION D-D'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-14**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: V:\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris Geotech Data Review – Cross- sections.pptx



LEGEND

- EXPLORATION COREHOLE COLLAR
- EXPLORATION COREHOLE TRACE
- APPROXIMATE PIT OUTLINE
- CROSS SECTION LOCATION
- SITE TOPOGRAPHY

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

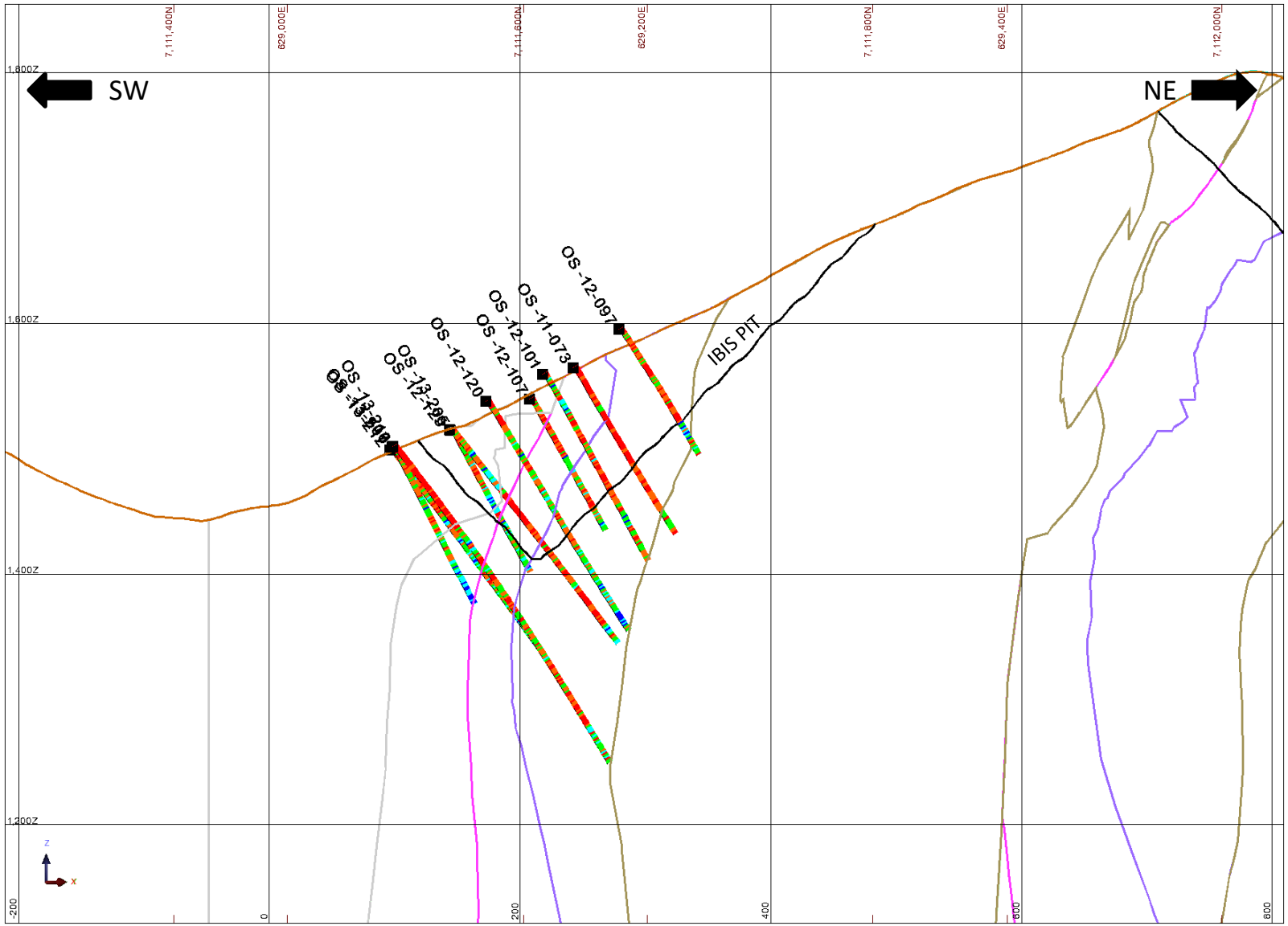
TITLE
CROSS-SECTION LOCATIONS
PROPOSED IBIS PIT

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-15**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION E-E'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

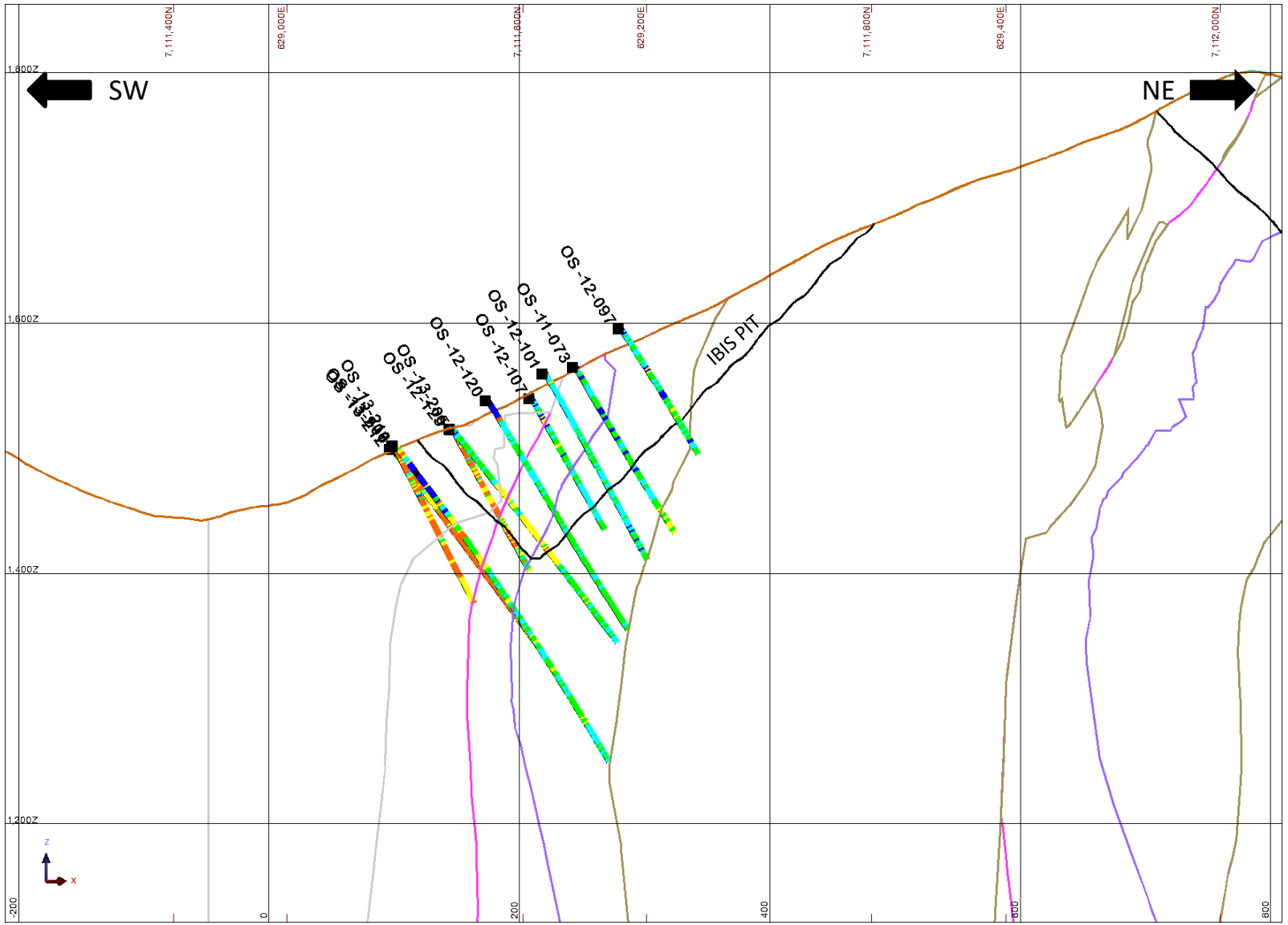
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-16**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: V:\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris Geotech Data Review – Cross- sections.pptx

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION E-E'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

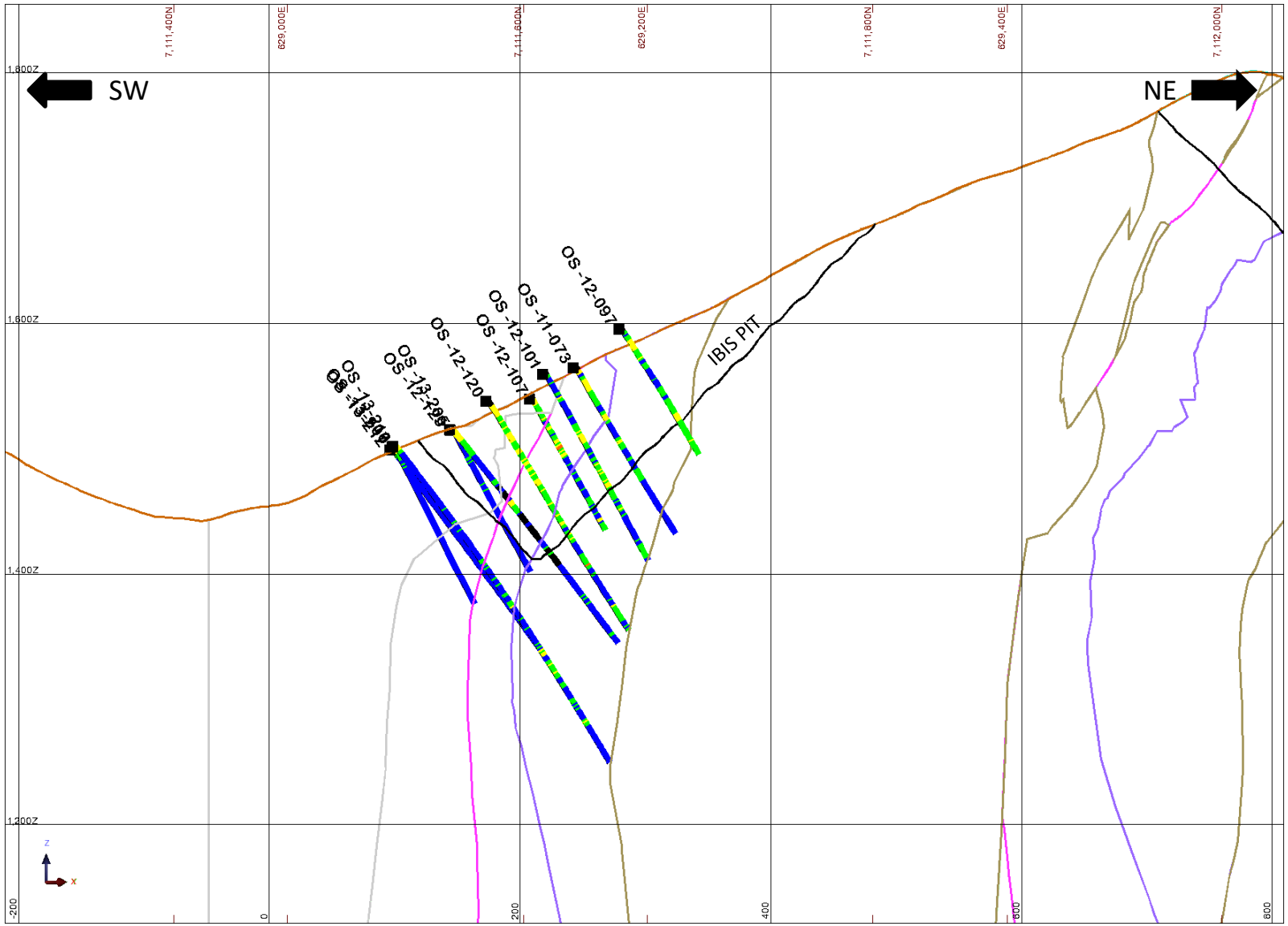
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-17**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

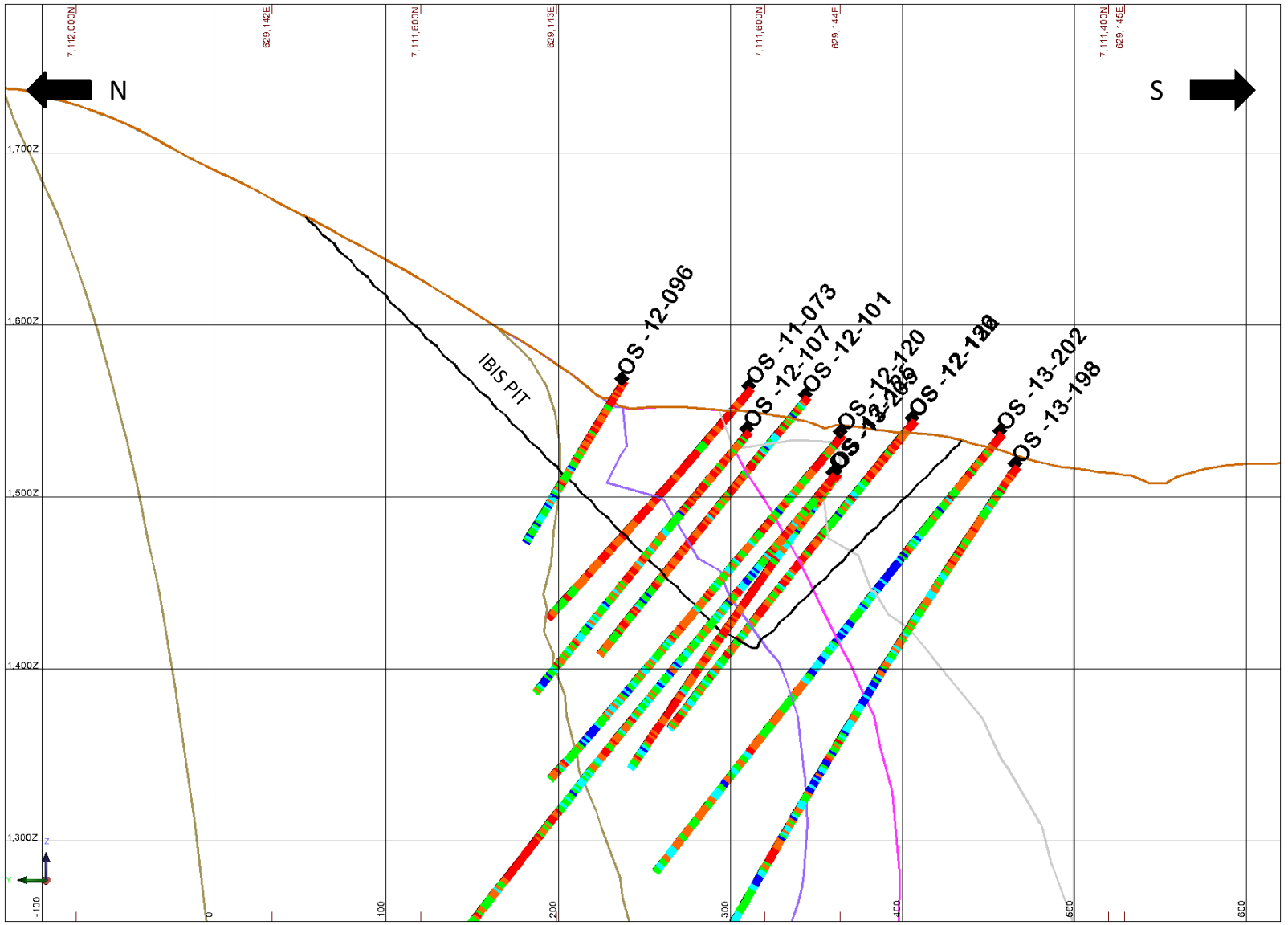
TITLE
SECTION E-E'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-18**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

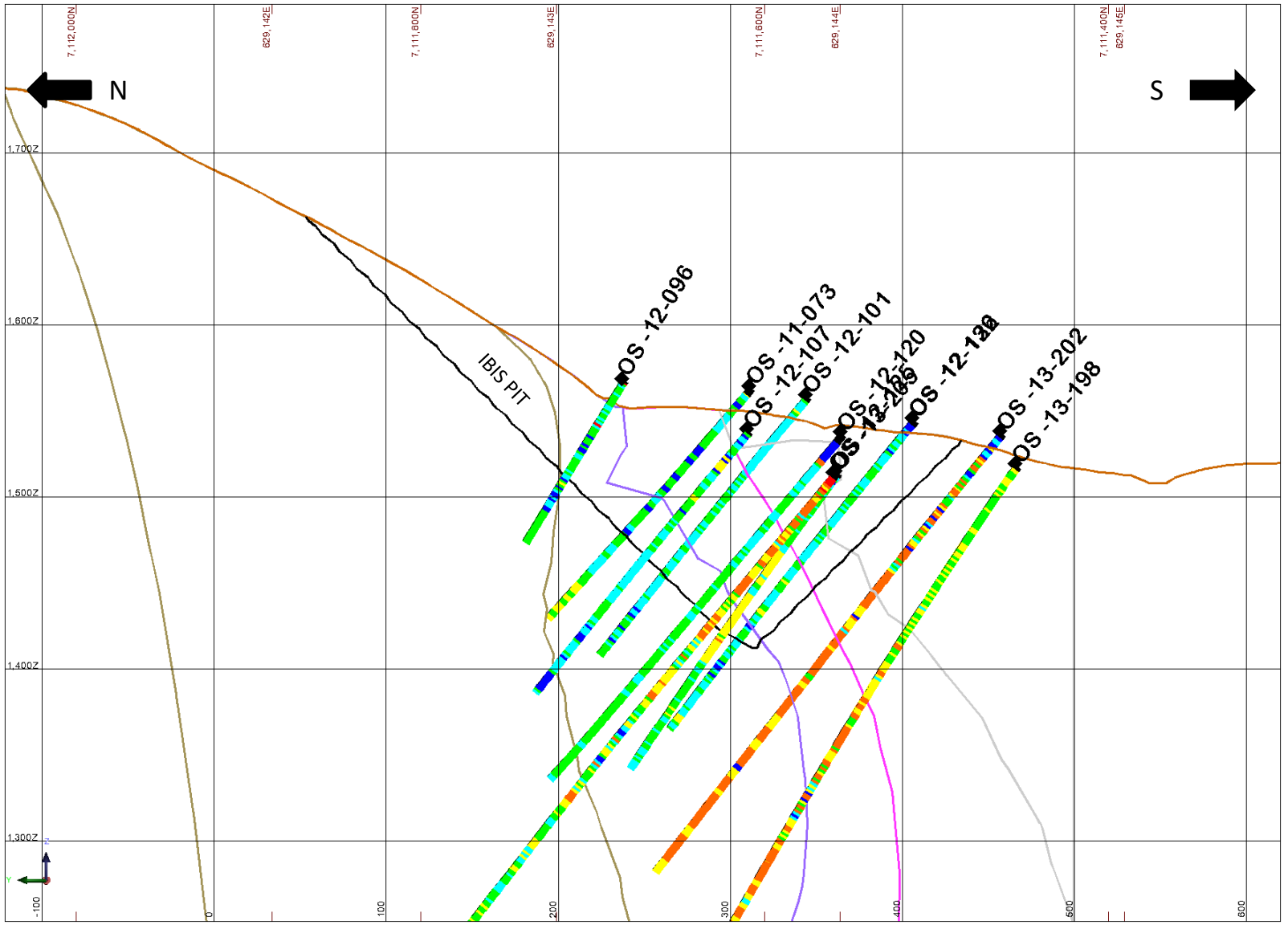
TITLE
SECTION F-F'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-19**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

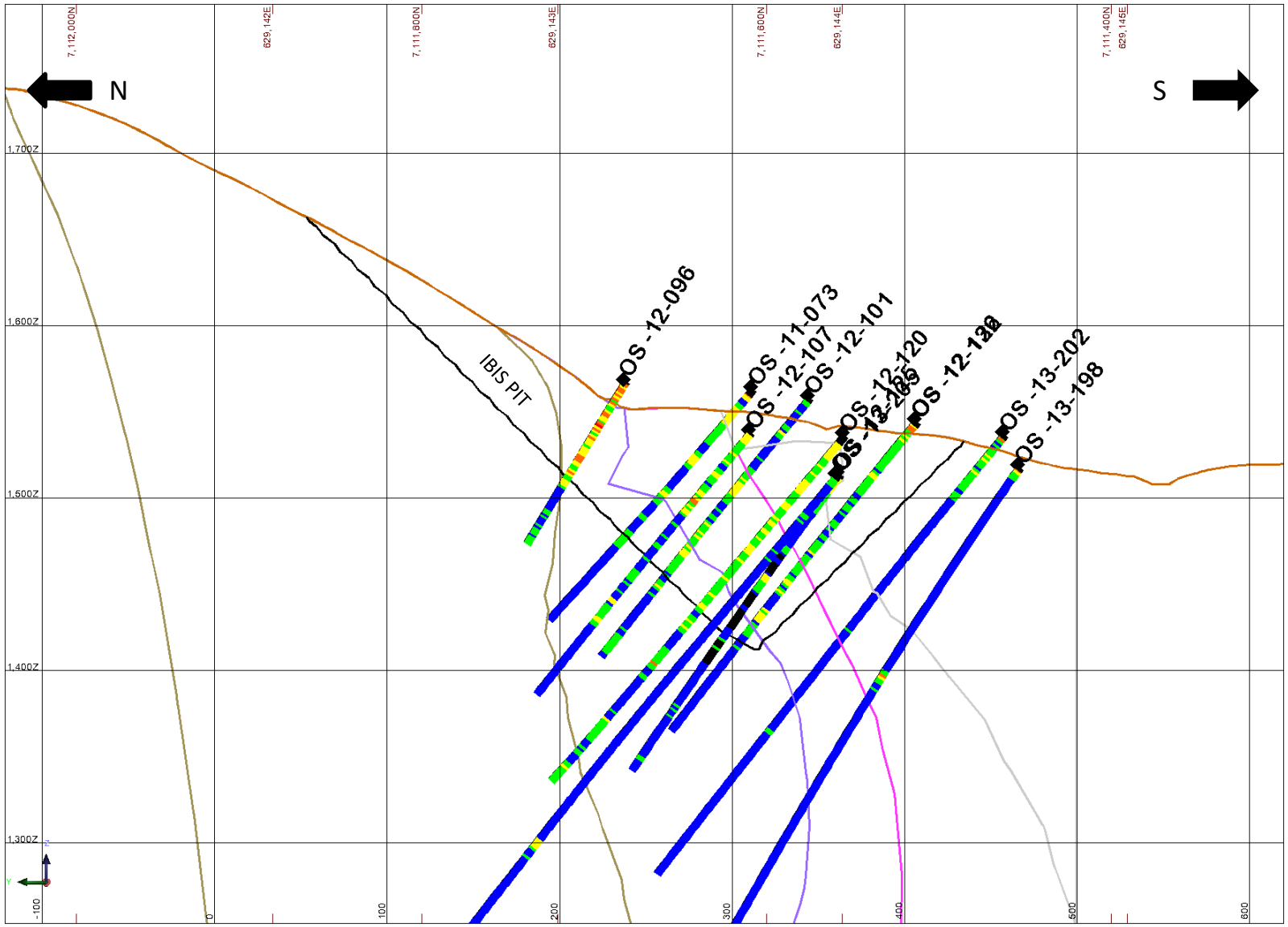
TITLE
SECTION F-F'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-20**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION F-F'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

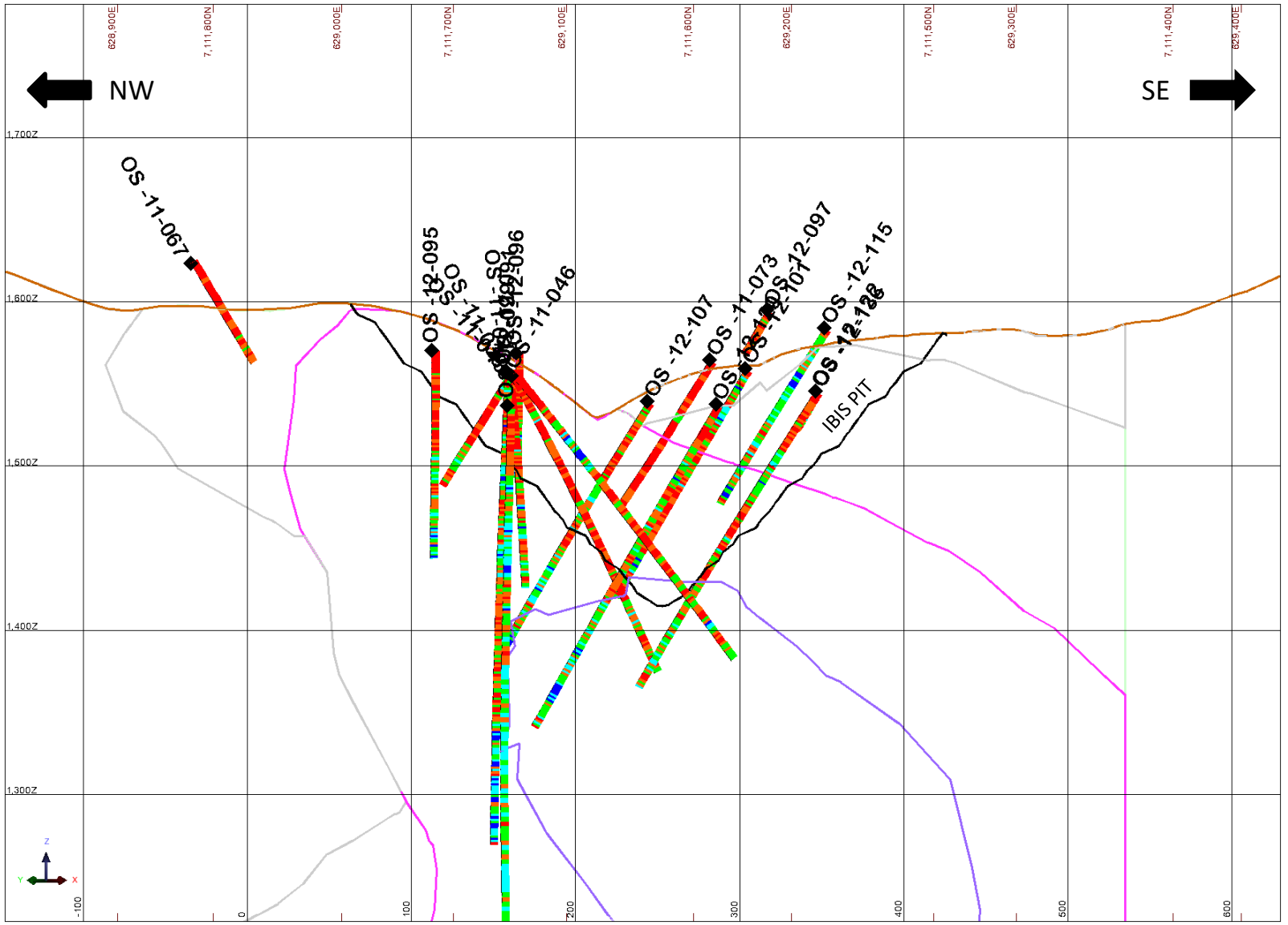
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-21**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: V:\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris Geotech Data Review – Cross- sections.pptx

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

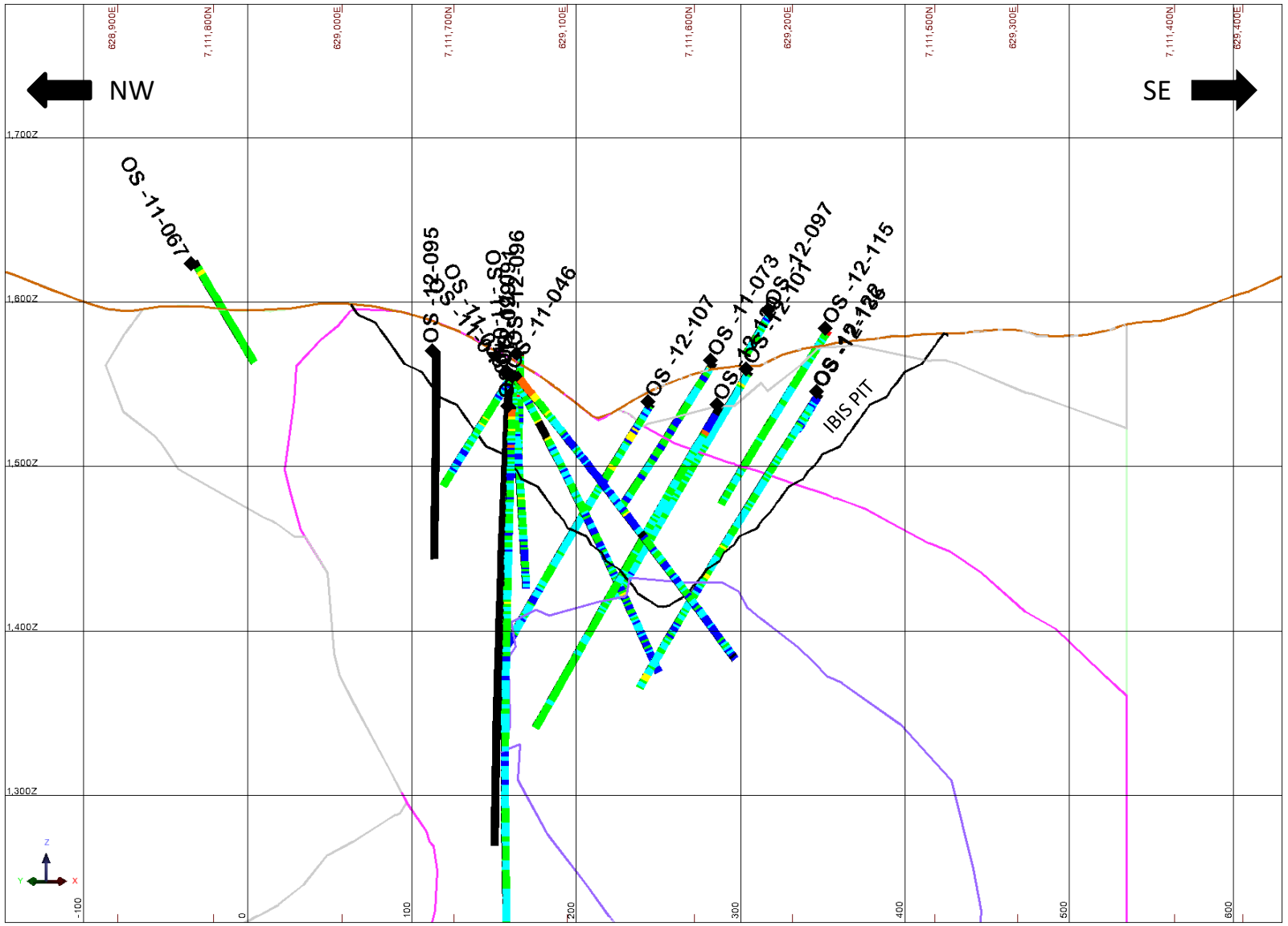
TITLE
SECTION G-G'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-22**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

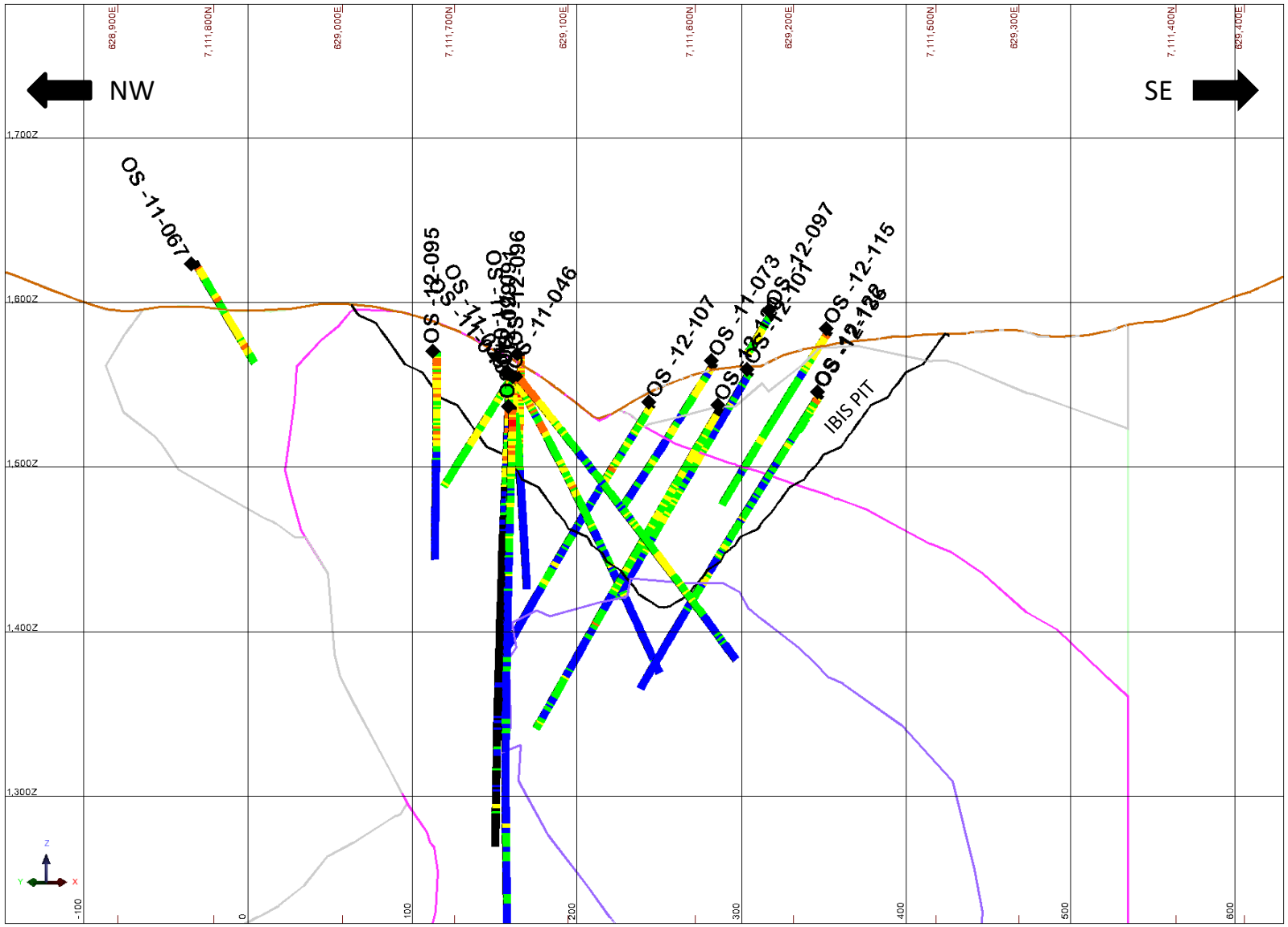
TITLE
SECTION G-G'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-23**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 75 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

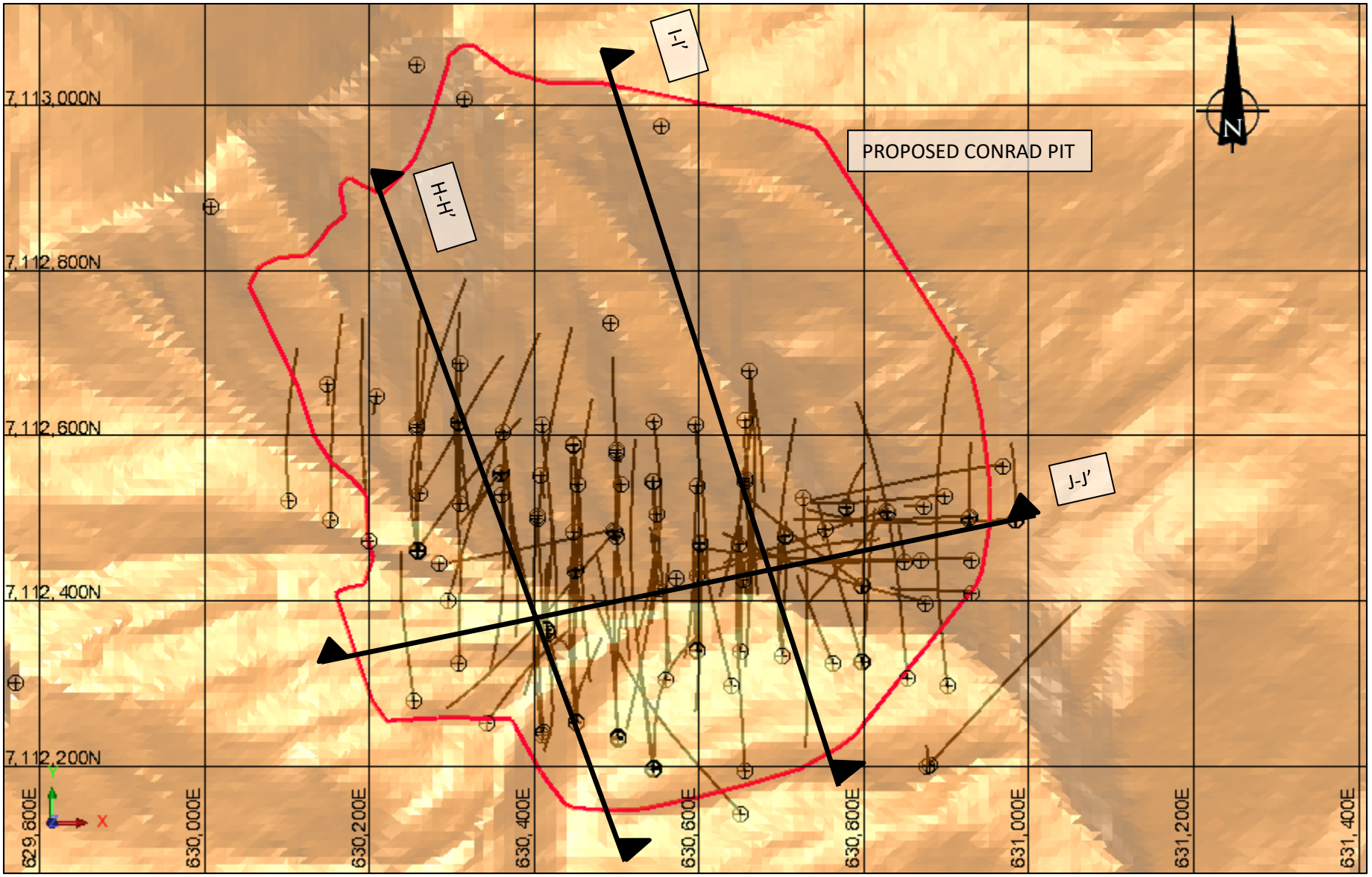
CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION G-G'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-24**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm



LEGEND

- EXPLORATION COREHOLE COLLAR
- EXPLORATION COREHOLE TRACE
- APPROXIMATE PIT OUTLINE
- CROSS SECTION LOCATION
- SITE TOPOGRAPHY

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

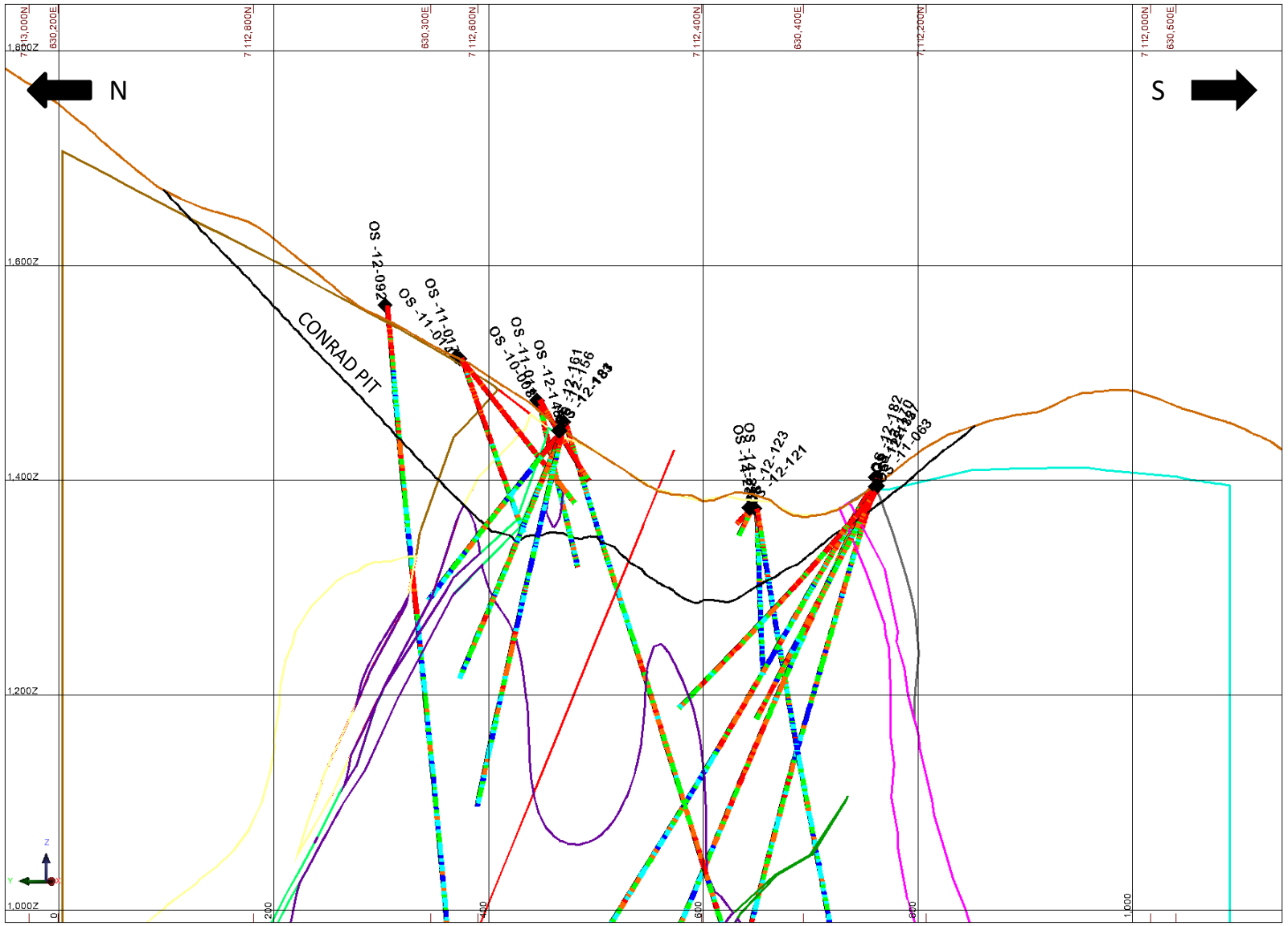
TITLE
CROSS-SECTION LOCATIONS
PROPOSED CONRAD PIT

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-25**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION H-H'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

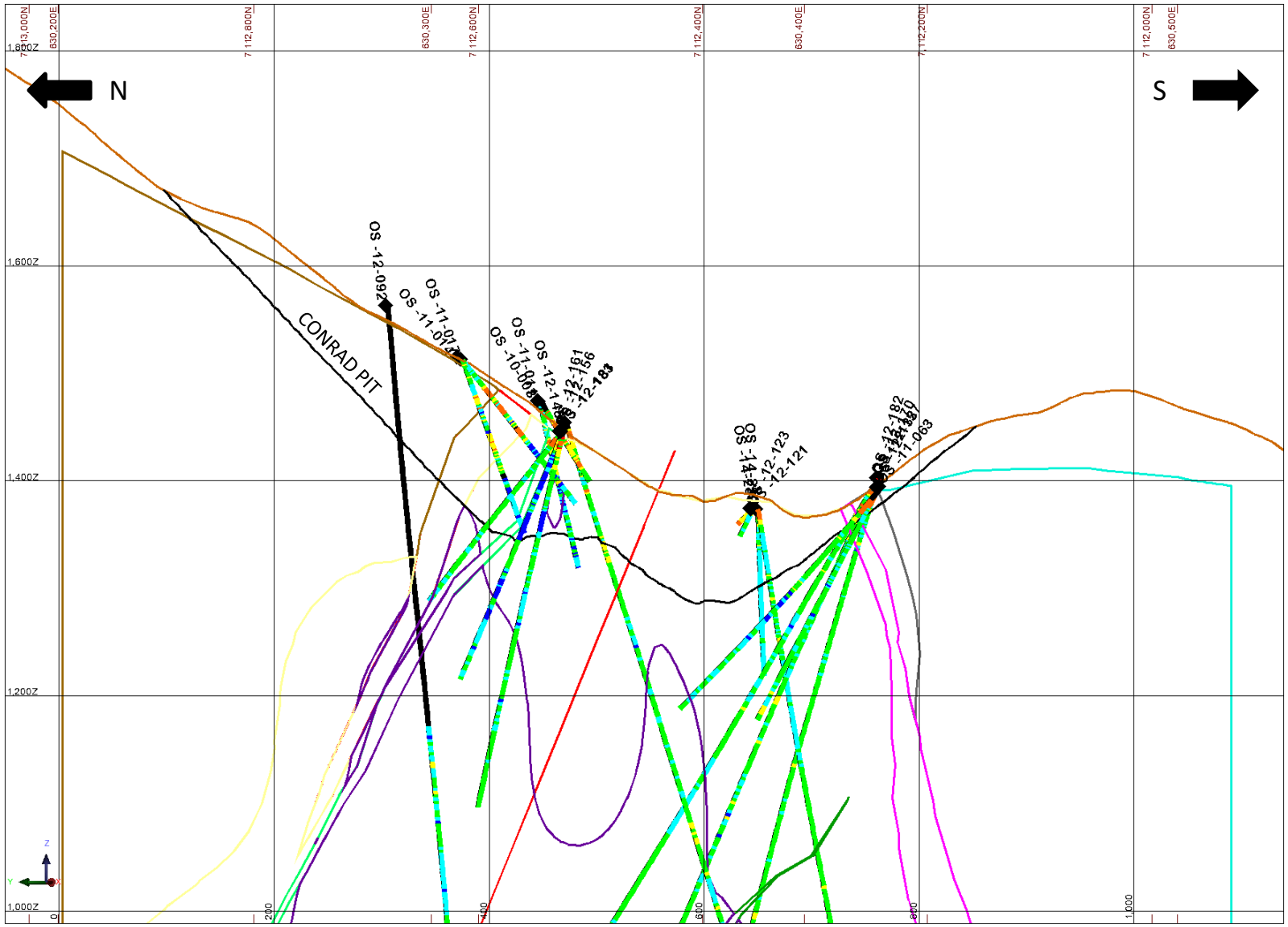
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-26**

Note: Coreholes shown +/- 35 metres of section line

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION H-H'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-27**

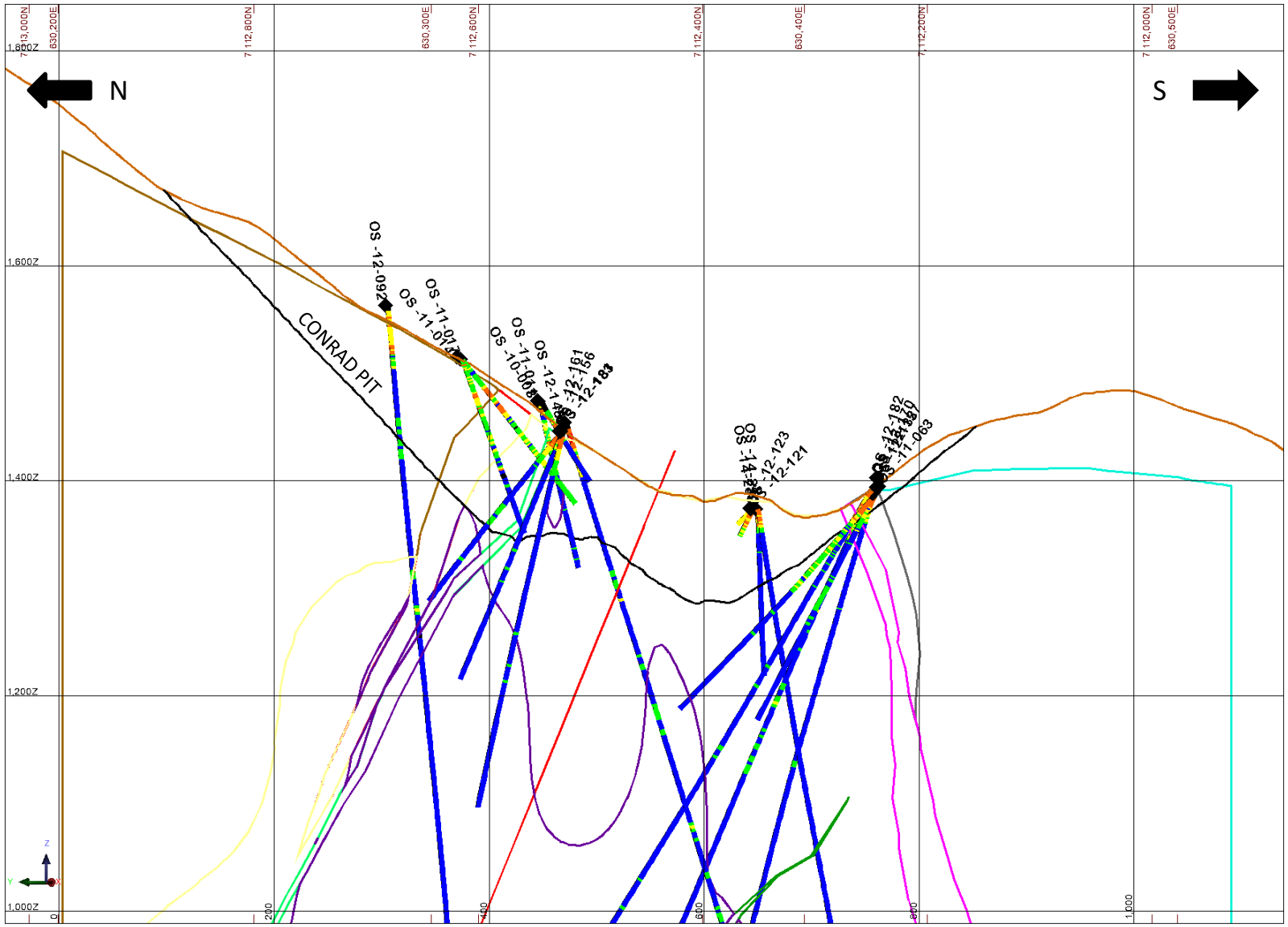
Note: Coreholes shown +/- 35 metres of section line

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 35 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

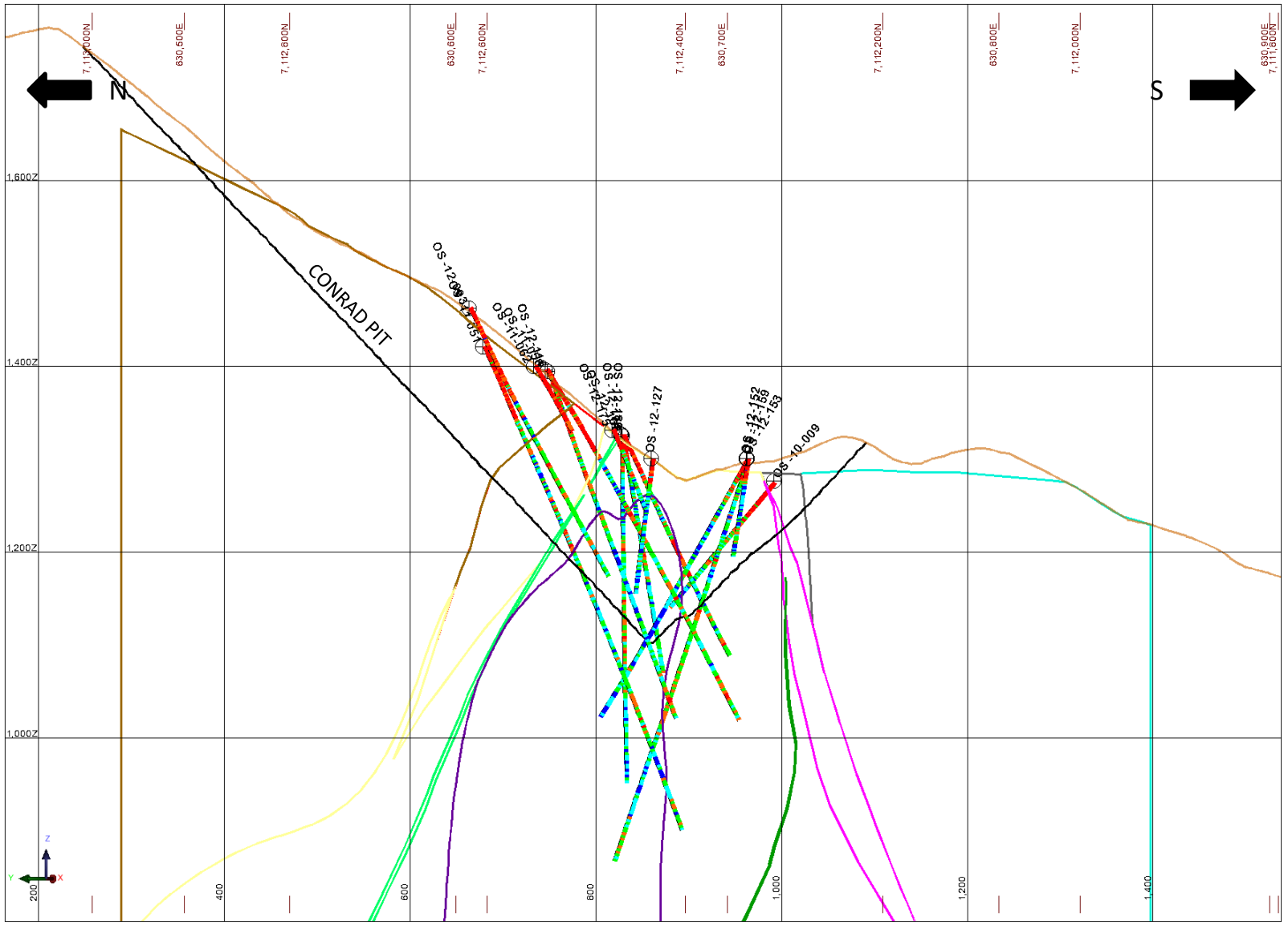
TITLE
SECTION H-H'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-28**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

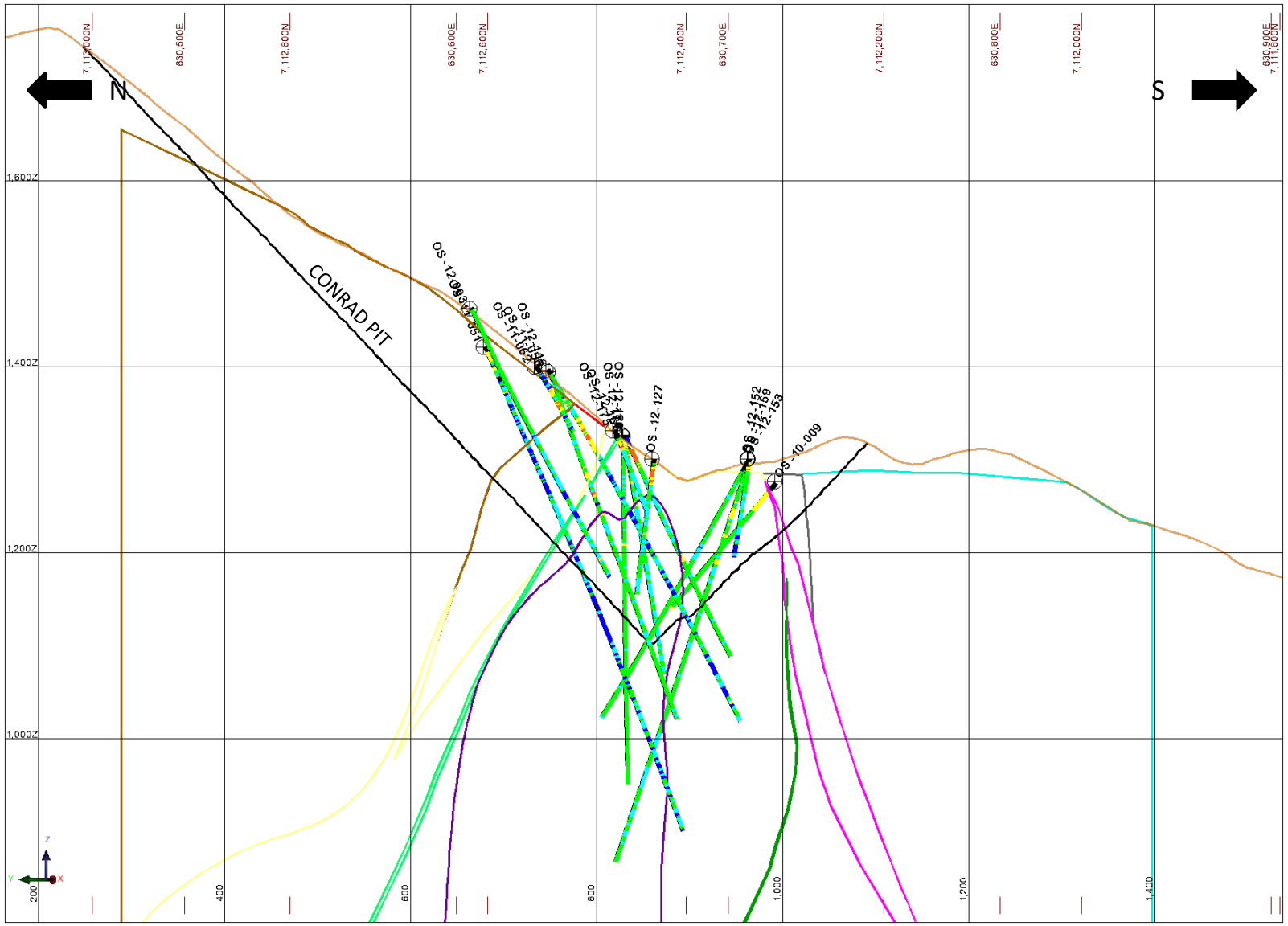
TITLE
SECTION I-I'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-29**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION I-I'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-30**

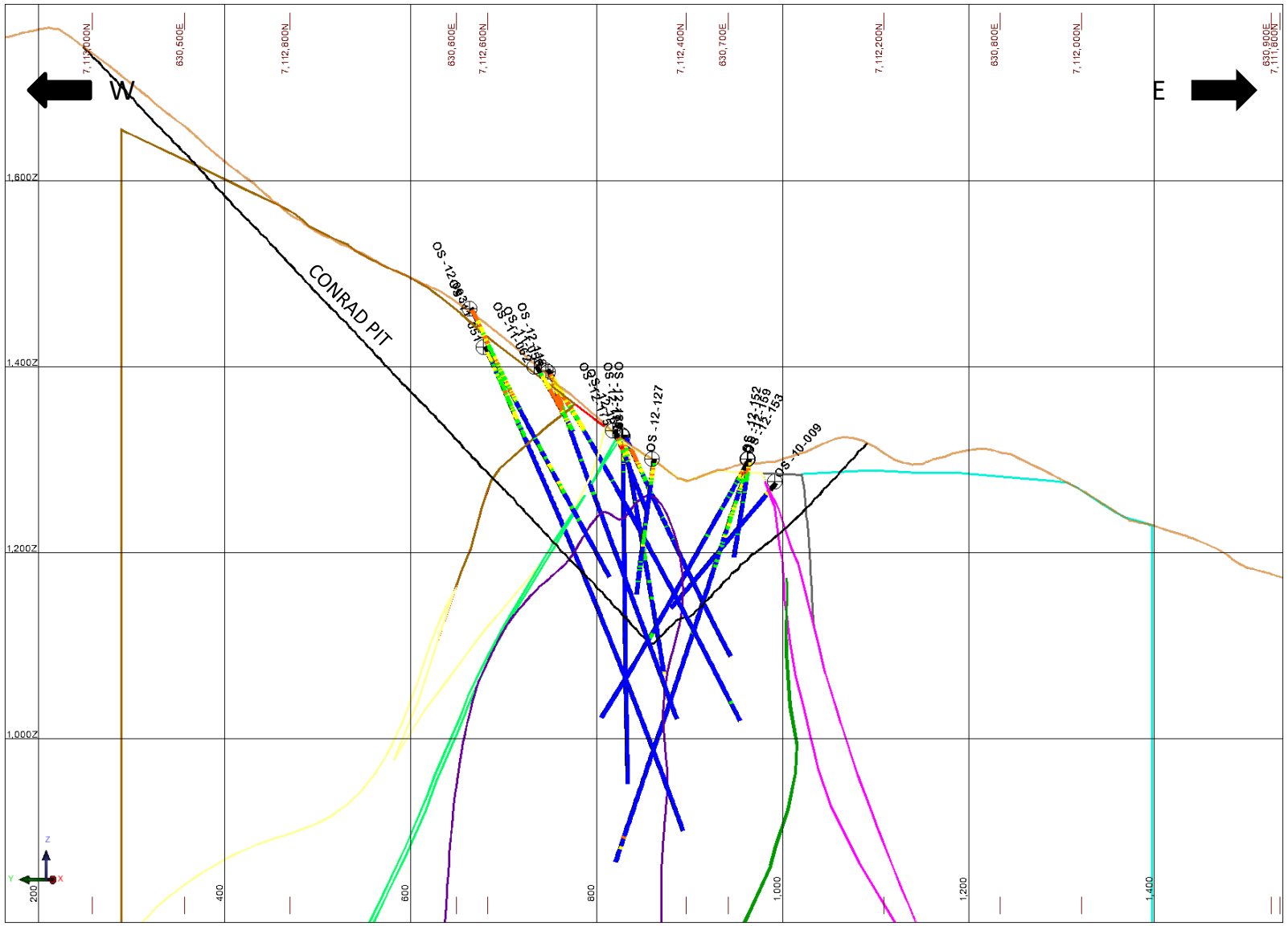
Note: Coreholes shown +/- 50 metres of section line

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Path: V:\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris Geotech Data Review – Cross- sections.pptx

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

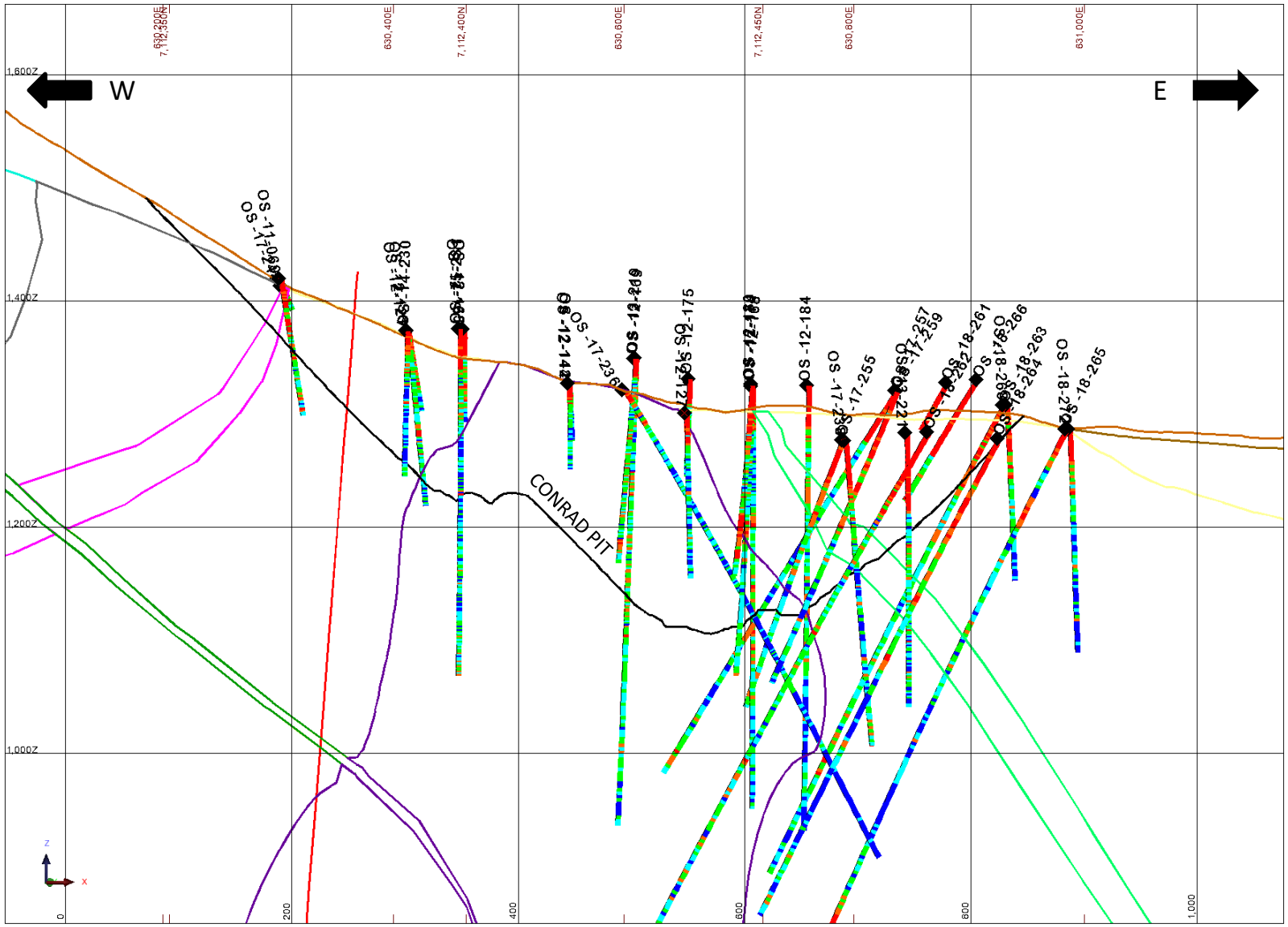
TITLE
SECTION I-I'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-31**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

RQD % LEGEND
0-25
25-50
50-75
75-90
90-100



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

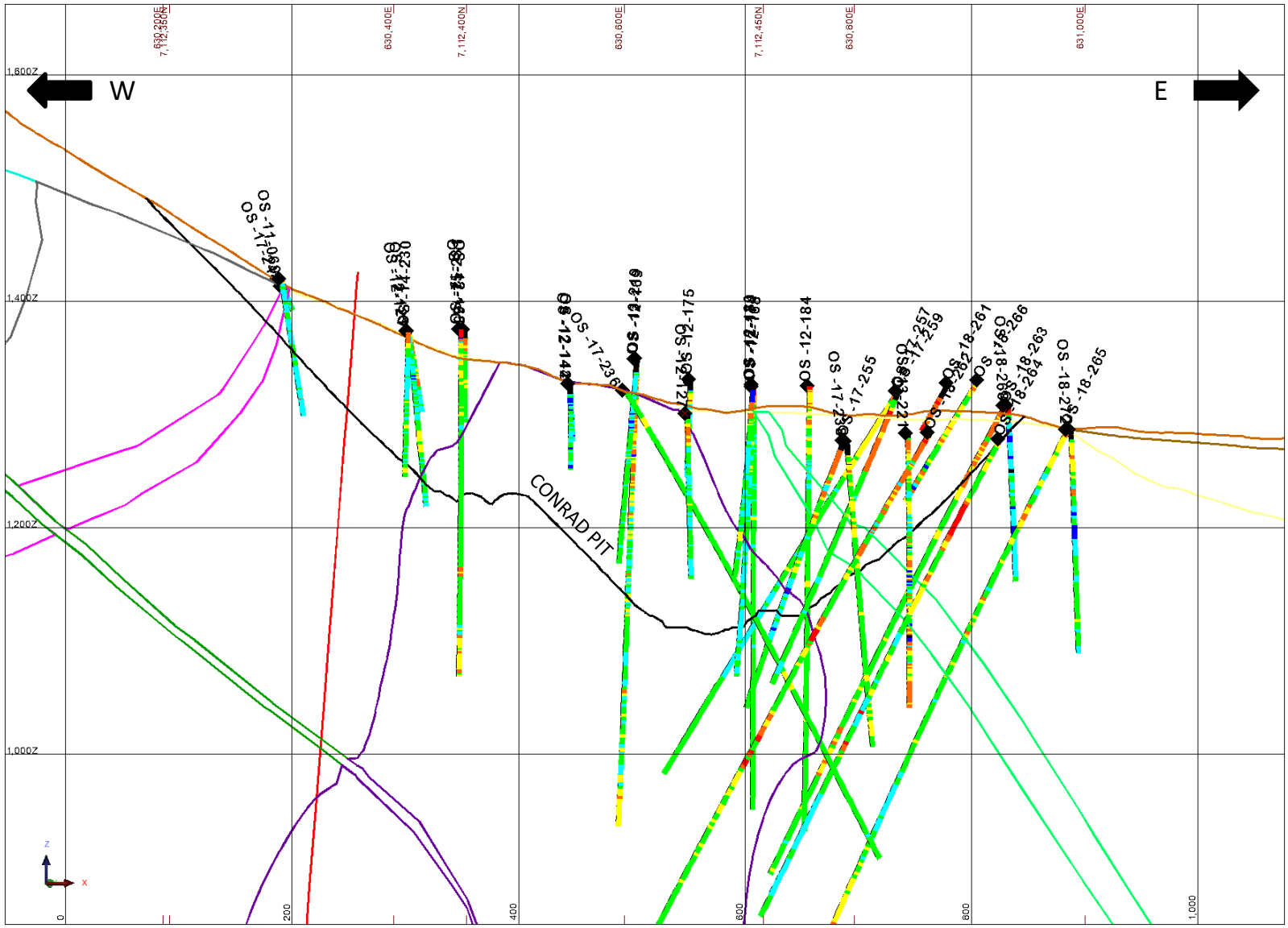
TITLE
SECTION J-J'
LOGGED COREHOLE RQD AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-32**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

ROCK STRENGTH LEGEND
0
1
2
3
4
5&6



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

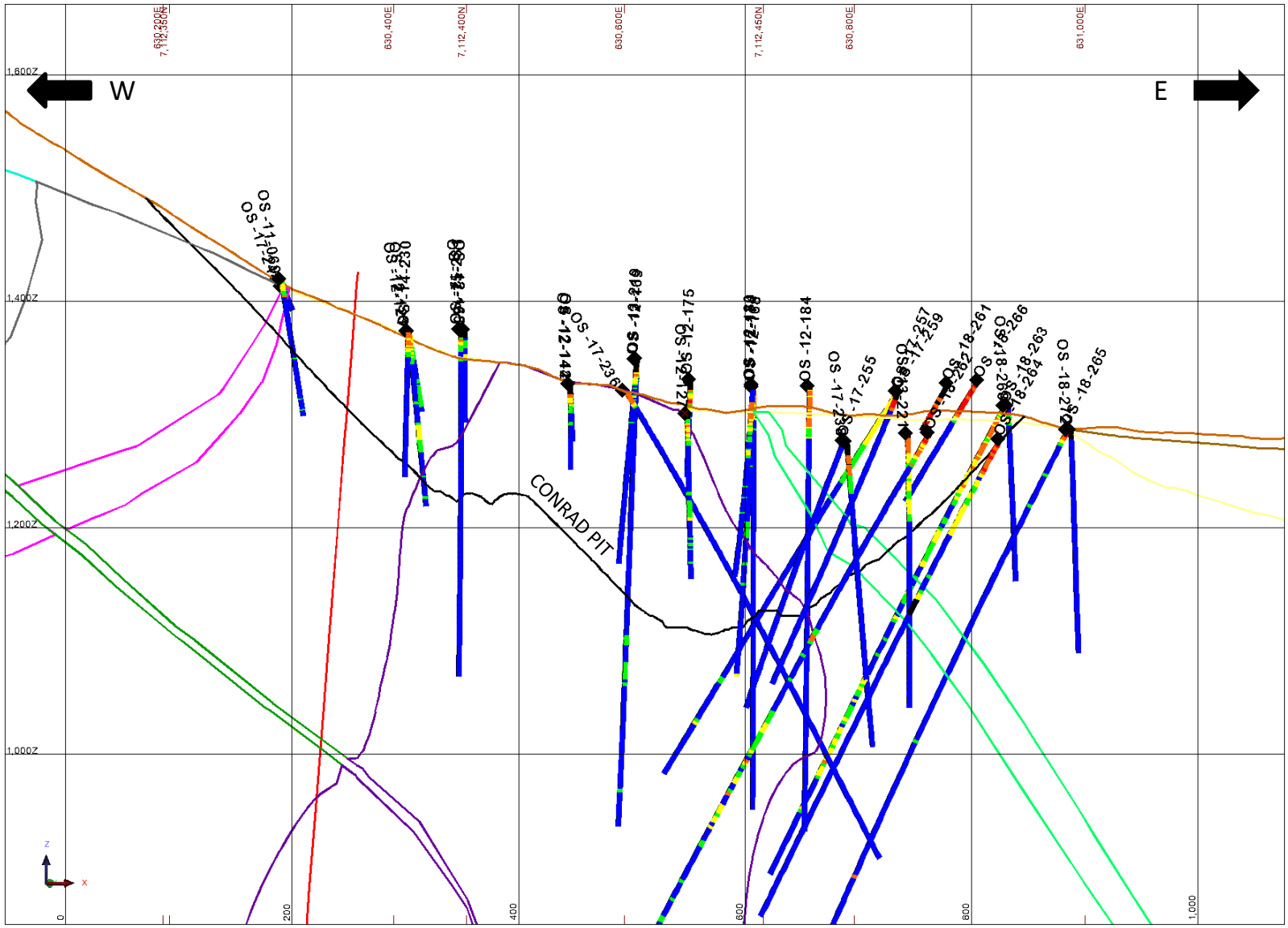
TITLE
SECTION J-J'
LOGGED COREHOLE ROCK STRENGTH AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-33**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

LEGEND
Conrad Dolostone
Conrad Intrusive 1
Conrad Intrusive 2
Conrad Limestone 1
Conrad Limestone 2
Nonad Mudstone
Conrad Black Shale
Conrad Siliciclastic
Osiris Diamictite
Osiris Dolostone
Osiris Gabbro
Osiris Limestone 1
Osiris Limestone 2
Osiris Mudstone
Fault Zone
Pit Area
Overburden

WEATHERING LEGEND
1
2
3
4
5&6



Note: Coreholes shown +/- 50 metres of section line

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-11-19
PREPARED	JDH
DESIGNED	JDH
REVIEWED	TGT
APPROVED	AVC

TITLE
SECTION J-J'
LOGGED COREHOLE WEATHERING AND GEOLOGY MODEL

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**2000**	**0**	**C-34**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

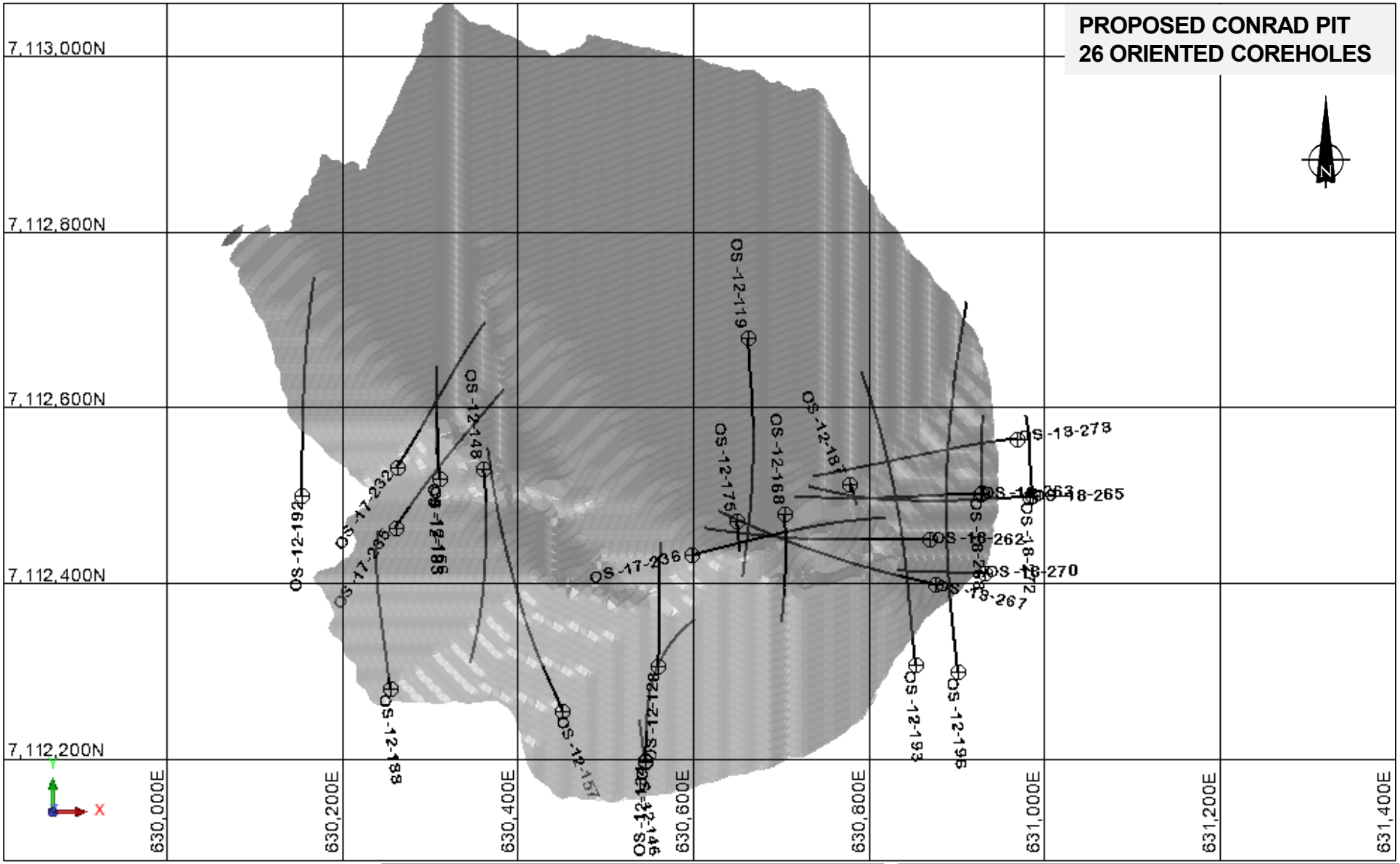
APPENDIX D

Oriented Core Data

APPENDIX D1

Stereographic Projections by Exploration Corehole

Path: V:\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Oriented Core Data | File Name: Osiris_Oriented Core Stereonets_All Boreholes.pptx



Legend

- Corehole Collar
- Corehole Trace

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

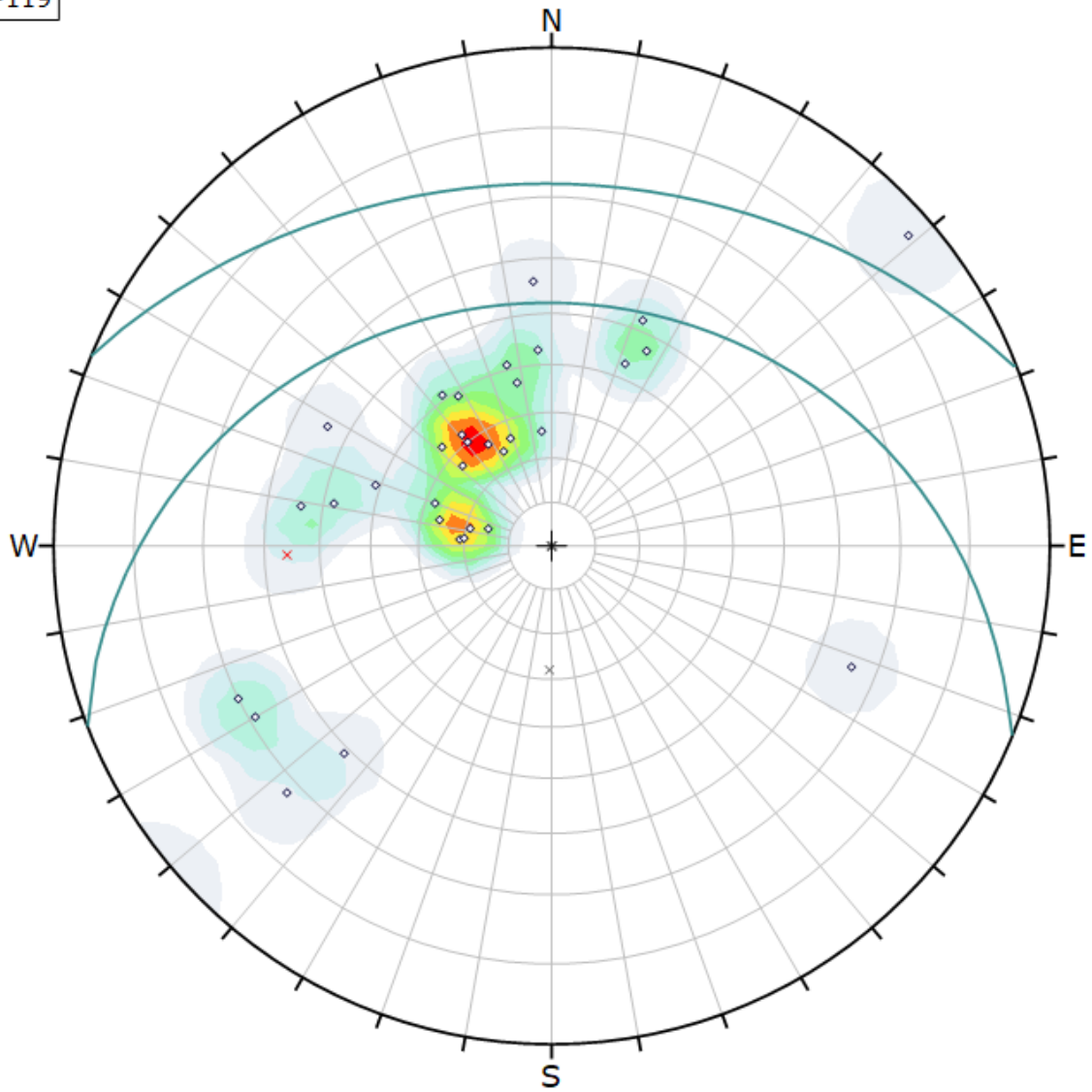
YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED CONRAD PIT
COREHOLES WITH ORIENTED STRUCTURE DATA
PLAN VIEW

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-1**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-119



Symbol	TYPE	Quantity
◇	BD	33
×	FT	1

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.79%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	34 (34 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

× Corehole Trend and Plunge

Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

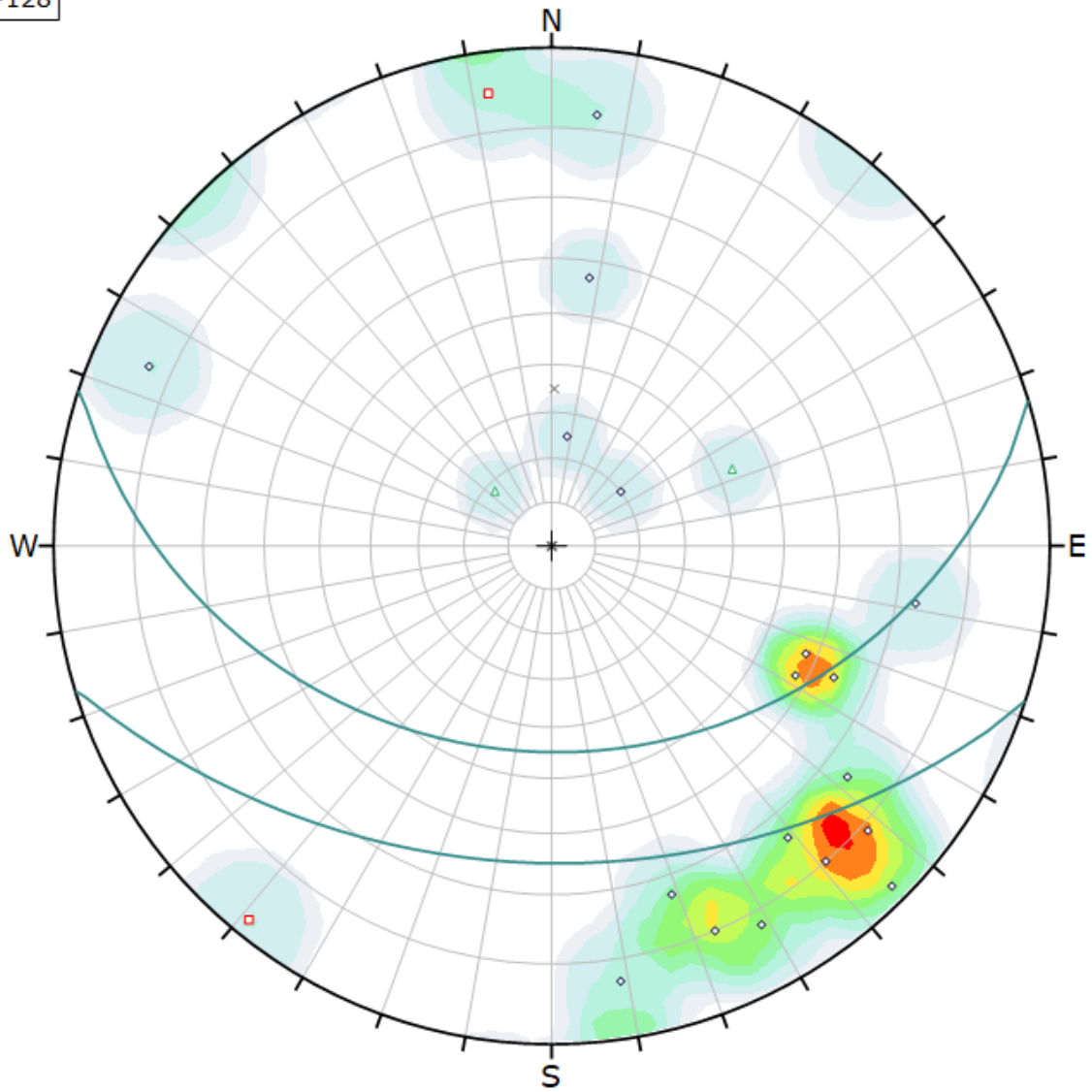
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-119
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-12-128



Symbol	TYPE	Quantity
◇	BD	18
□	SY	2
△	VN	2

Color	Density Concentrations
	0.00 - 1.50
	1.50 - 3.00
	3.00 - 4.50
	4.50 - 6.00
	6.00 - 7.50
	7.50 - 9.00
	9.00 - 10.50
	10.50 - 12.00
	12.00 - 13.50
	13.50 - 15.00

Contour Data	Pole Vectors
Maximum Density	14.68%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	22 (22 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

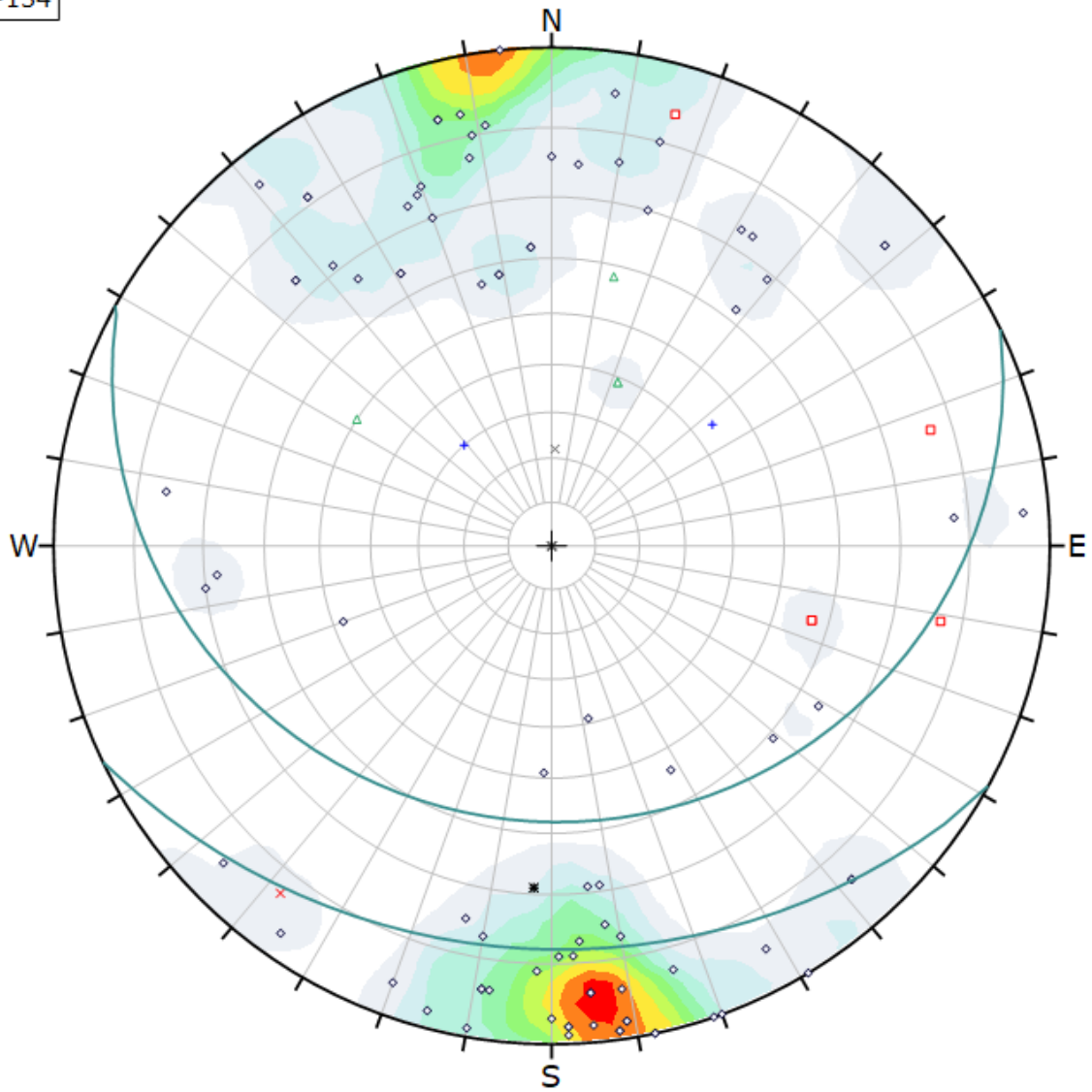
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-128
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-12-134



Symbol	TYPE	Quantity
◇	BD	87
×	FT	1
✱	LI	2
□	SY	5
△	VN	4
+	VT	2

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.07%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	101 (101 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

× Corehole Trend and Plunge

Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

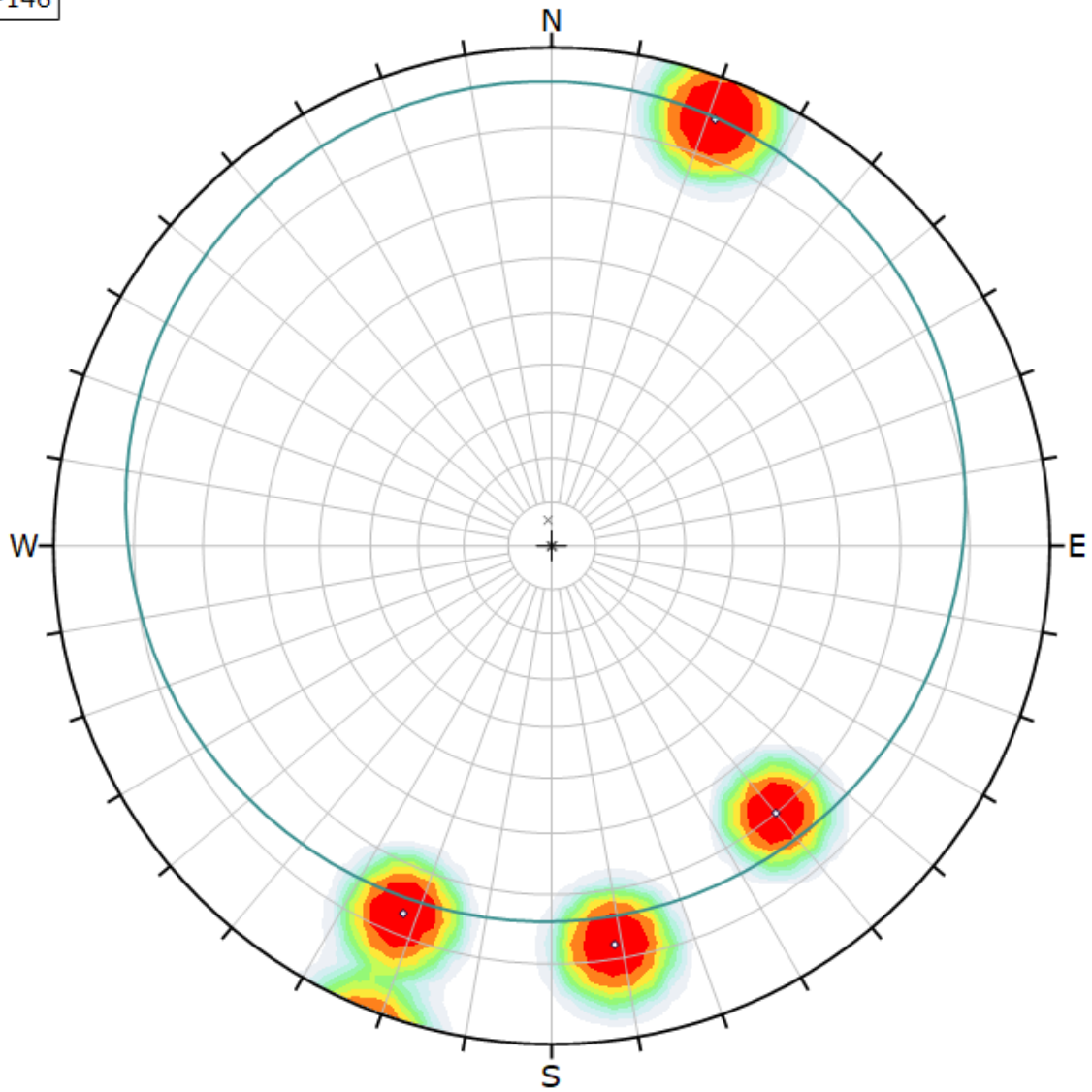
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-134
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-4**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-146



Symbol	TYPE	Quantity
◇	BD	4

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.94%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

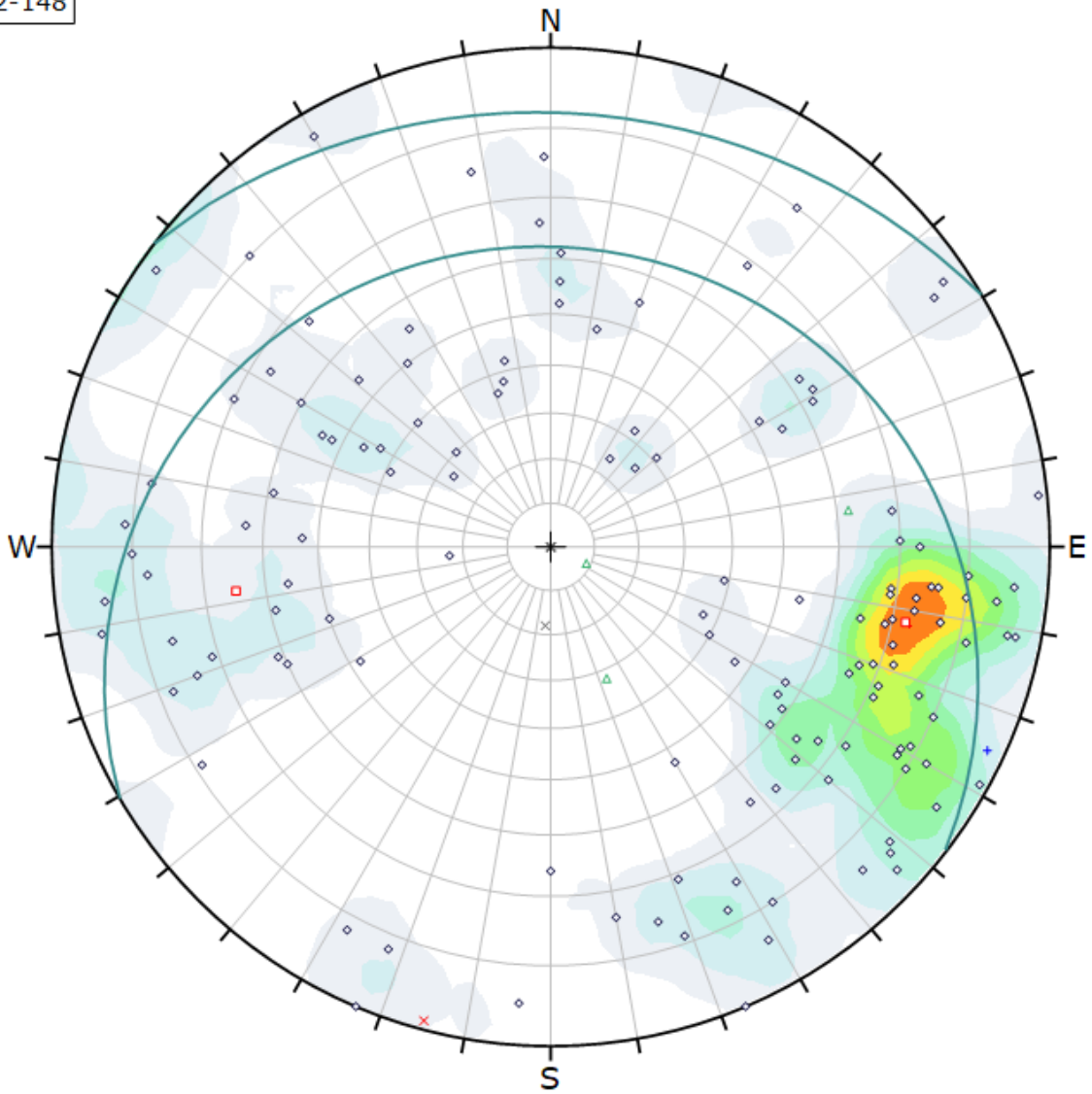
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-146
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-5**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-148



Symbol	TYPE	Quantity
◇	BD	135
×	FT	1
□	SY	2
△	VN	3
+	VT	1

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.04%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	142 (142 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

× Corehole Trend and Plunge

Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

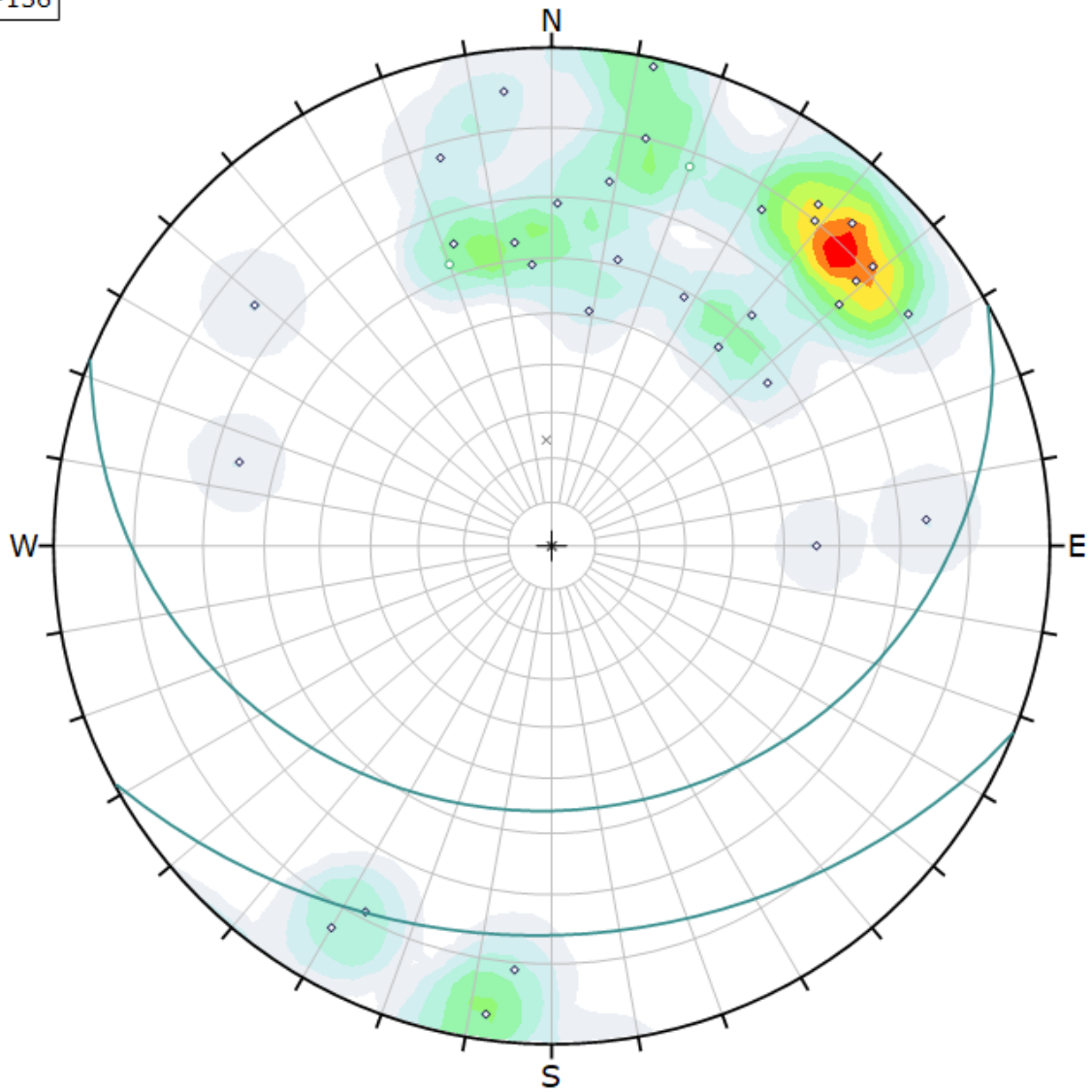
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-148
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-6**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-156



Symbol	TYPE	Quantity
◇	BD	31
○	SH	2

Color	Density Concentrations
	0.00 - 1.50
	1.50 - 3.00
	3.00 - 4.50
	4.50 - 6.00
	6.00 - 7.50
	7.50 - 9.00
	9.00 - 10.50
	10.50 - 12.00
	12.00 - 13.50
	13.50 - 15.00

Contour Data	Pole Vectors
Maximum Density	14.45%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	33 (33 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- ✕ Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

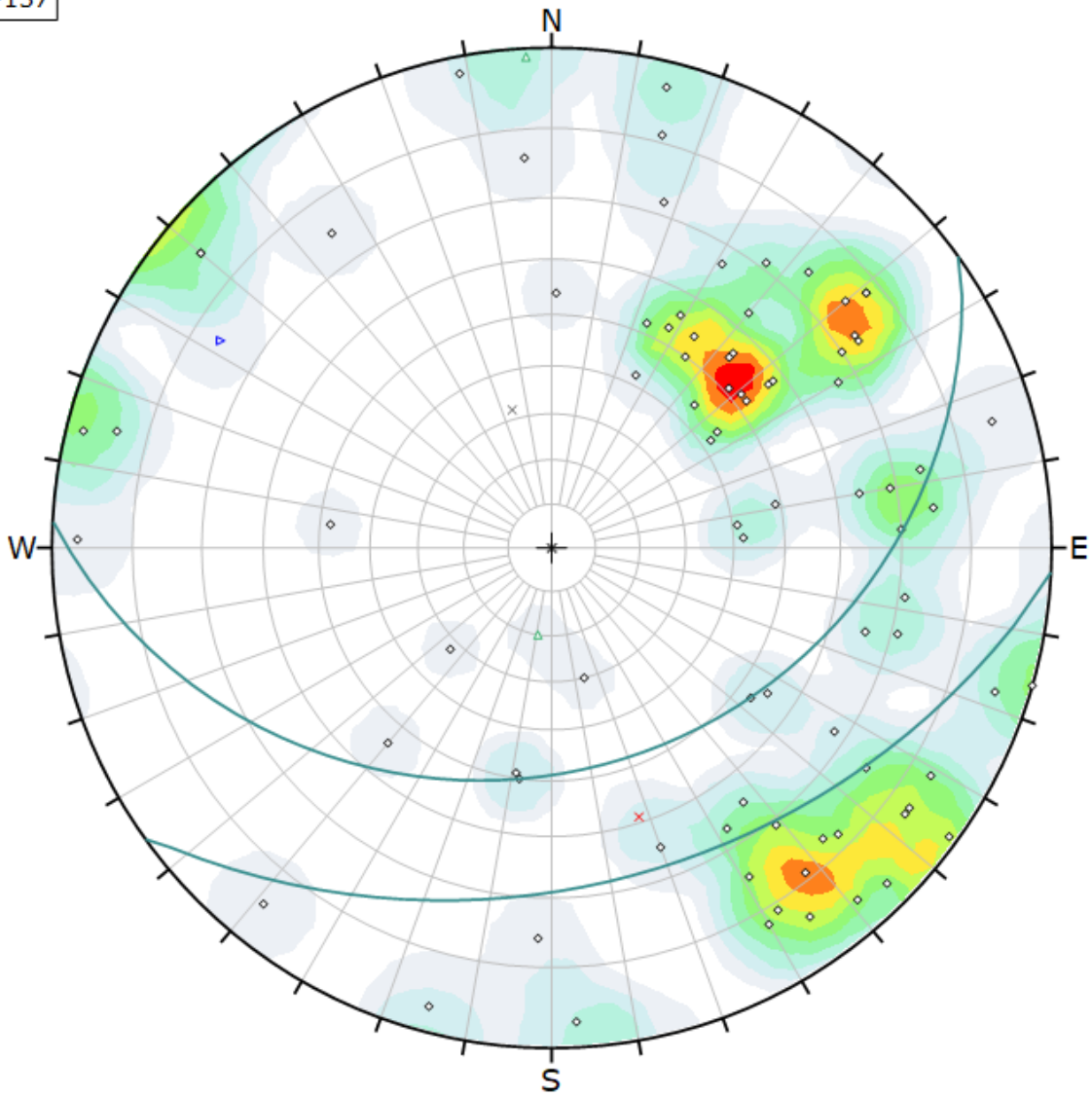
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-156
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-12-157



Symbol	TYPE	Quantity
▷	AP	1
◇	BD	84
×	FT	1
△	VN	2

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.86%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	88 (88 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

× Corehole Trend and Plunge

Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

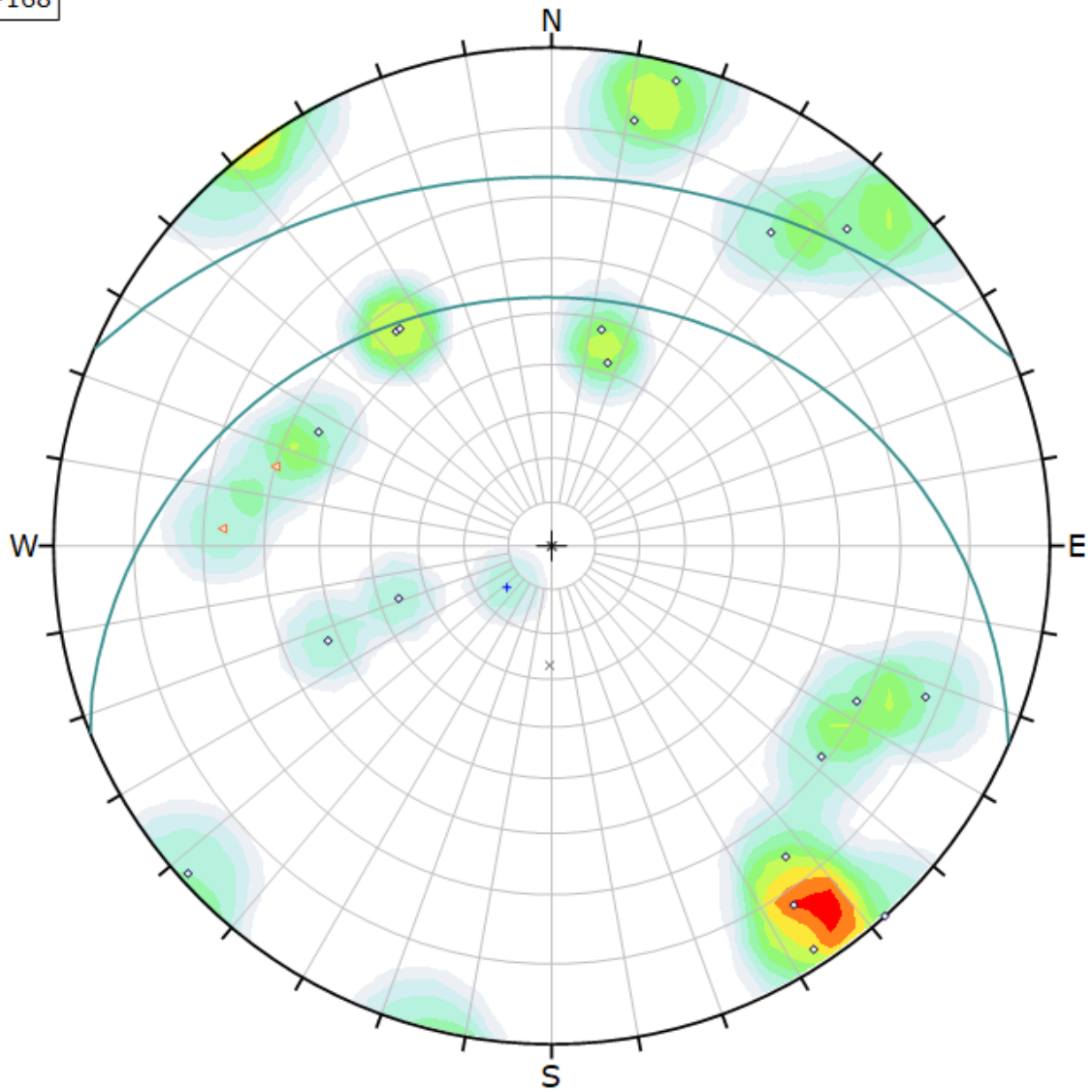
YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-157
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-8**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-168



Symbol	TYPE	Quantity
◇	BD	19
◁	LA	2
+	VT	1

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Contour Data	Pole Vectors
Maximum Density	12.47%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	22 (22 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

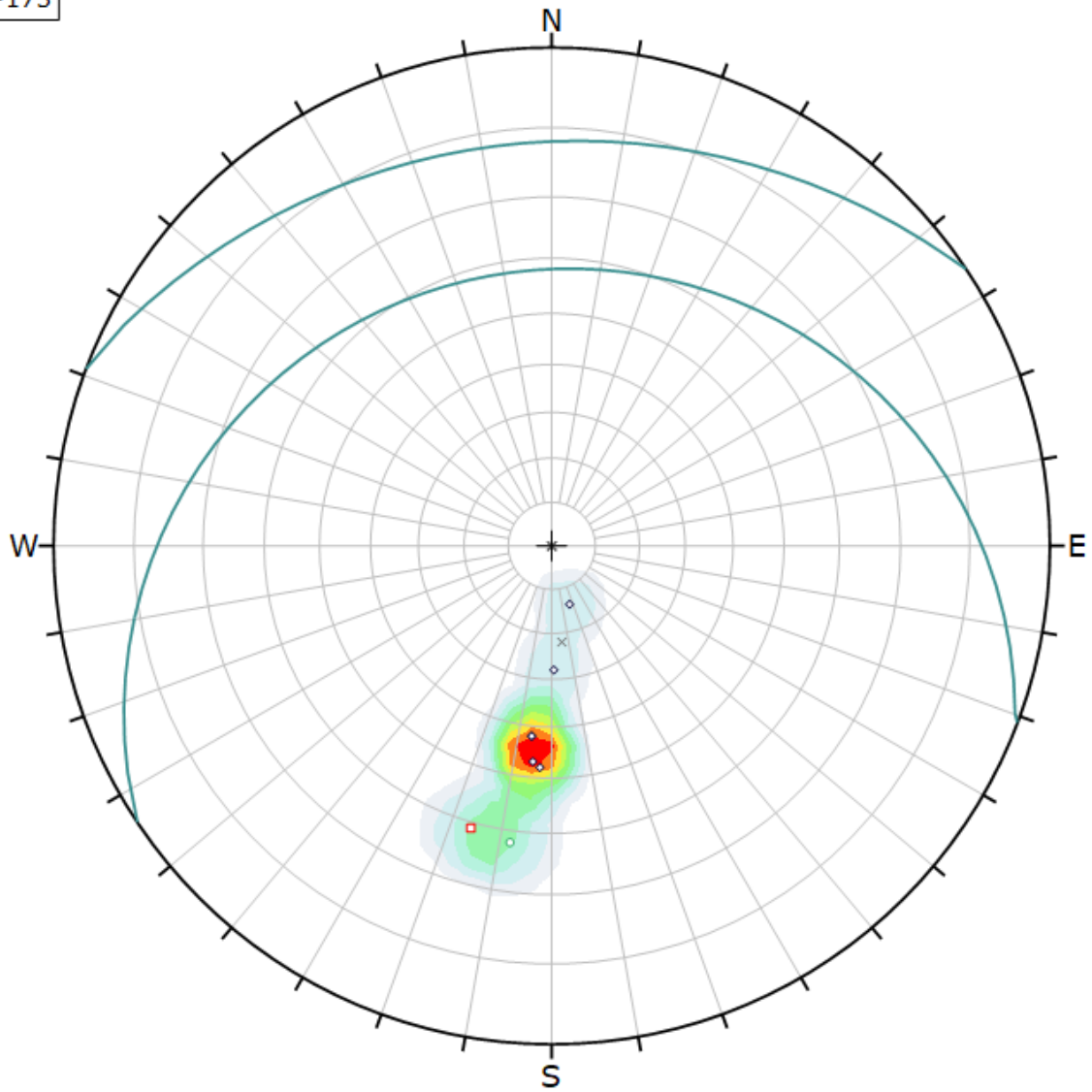
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-168
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-12-175



Symbol	TYPE	Quantity
◇	BD	6
○	SH	1
□	SY	1

Color	Density Concentrations
	0.00 - 4.90
	4.90 - 9.80
	9.80 - 14.70
	14.70 - 19.60
	19.60 - 24.50
	24.50 - 29.40
	29.40 - 34.30
	34.30 - 39.20
	39.20 - 44.10
	44.10 - 49.00

Contour Data	Pole Vectors
Maximum Density	48.00%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	8 (8 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- × Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

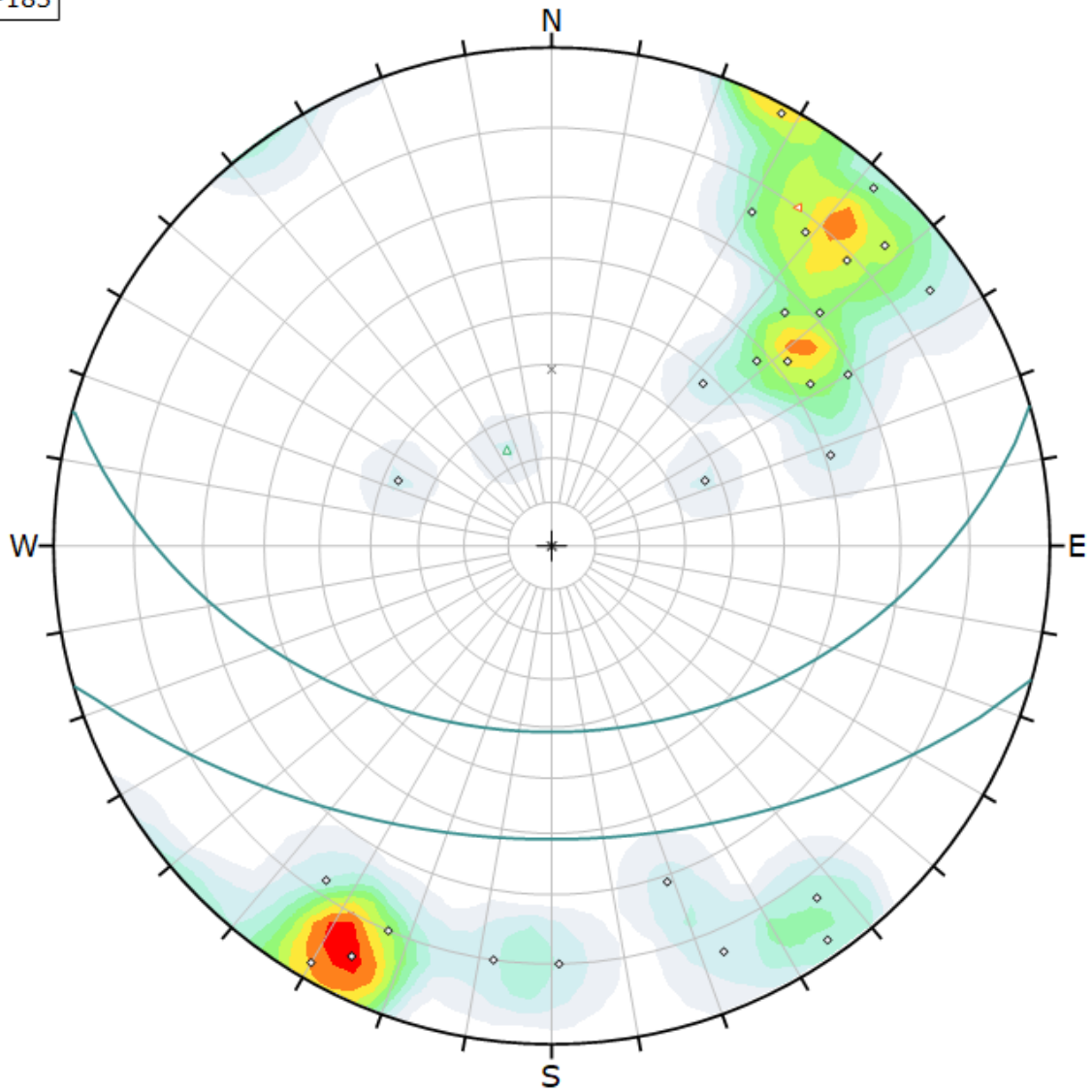
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-175
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-10**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-183



Symbol	TYPE	Quantity
◇	BD	28
◁	LA	1
△	VN	1

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.42%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	30 (30 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- × Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

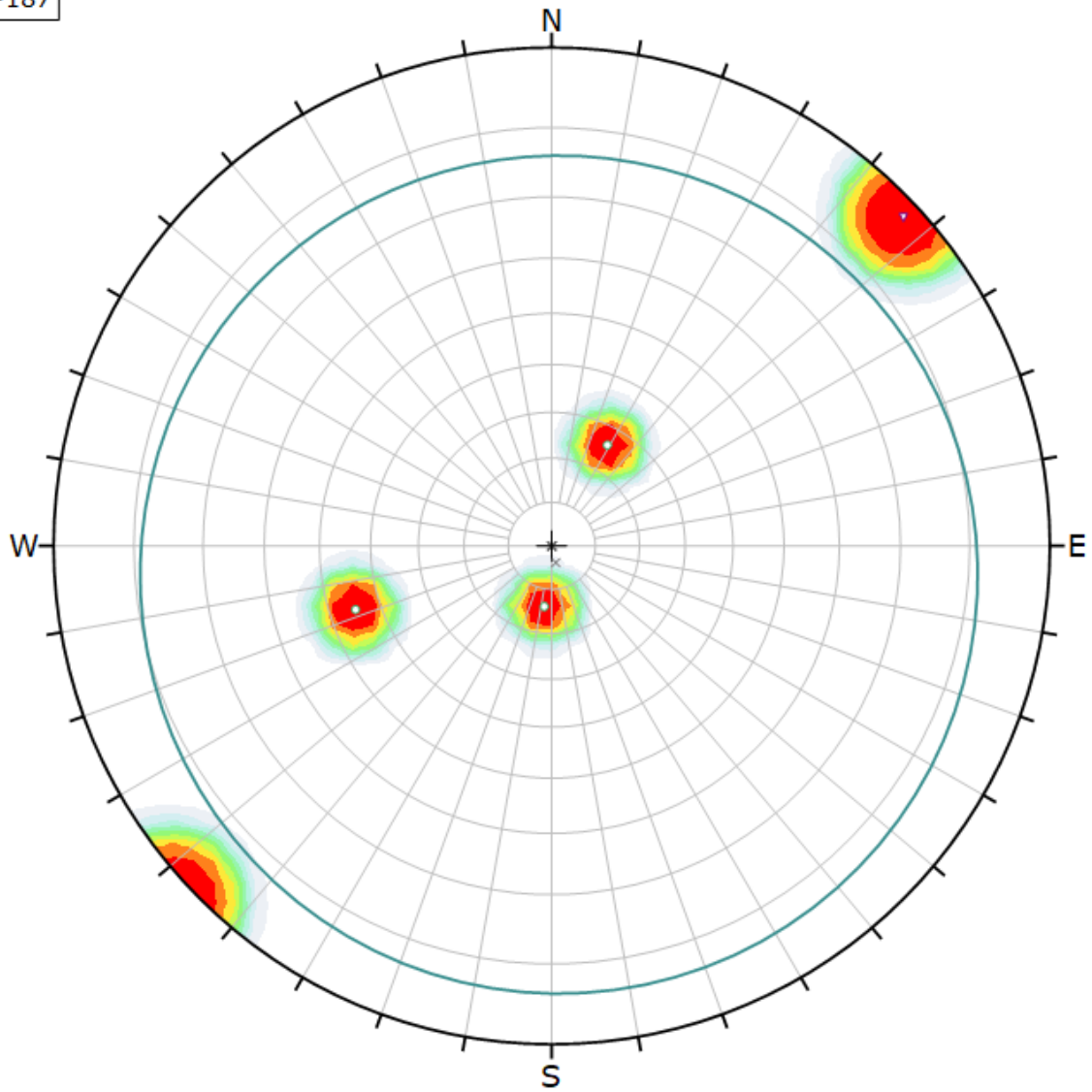
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-183
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-11**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-187



Symbol	TYPE	Quantity
▽	GO	1
○	SH	3

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.88%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	4 (4 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

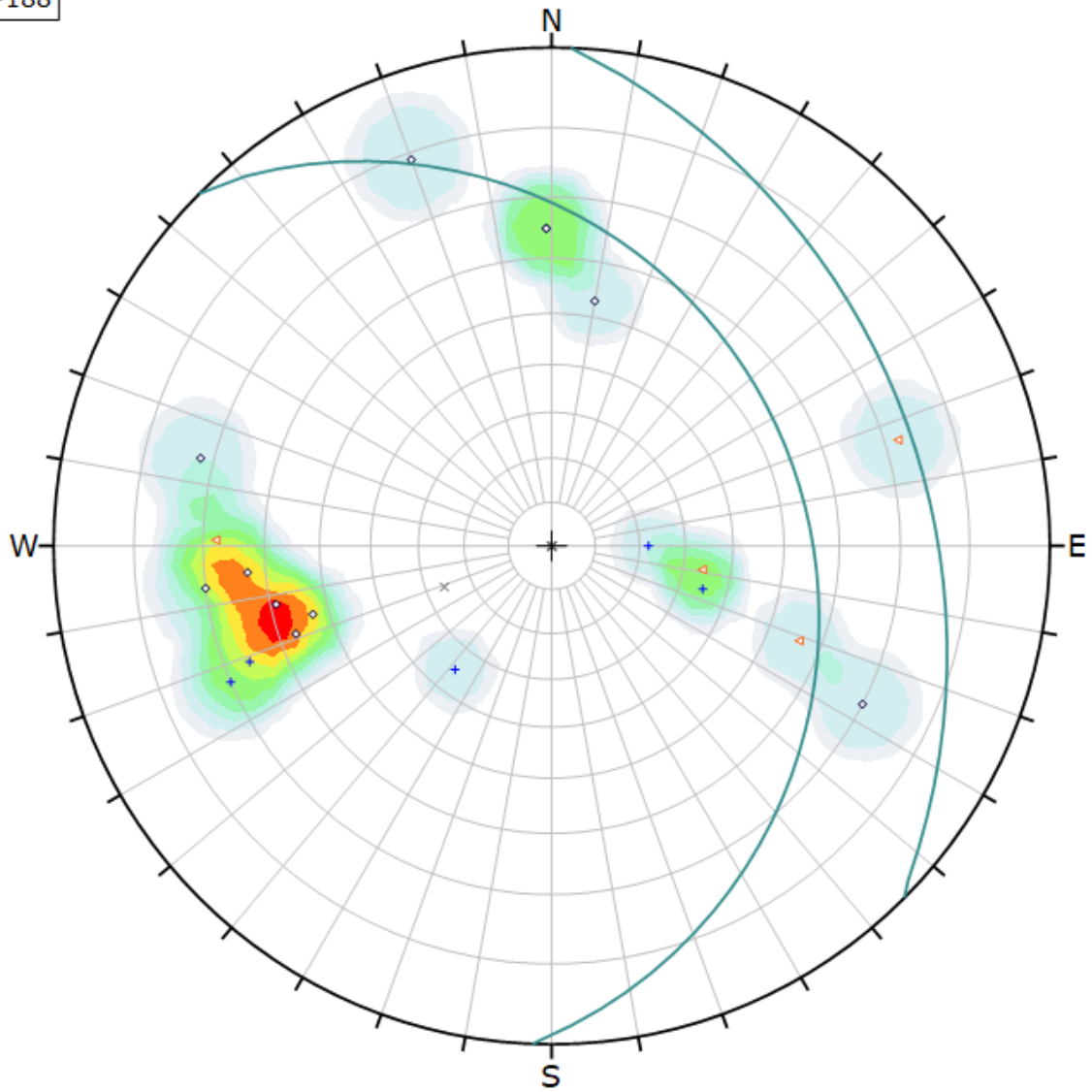
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-187
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-12**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-188



Symbol	TYPE	Quantity
◇	BD	11
◁	LA	4
+	VT	5

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.89%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	20 (20 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

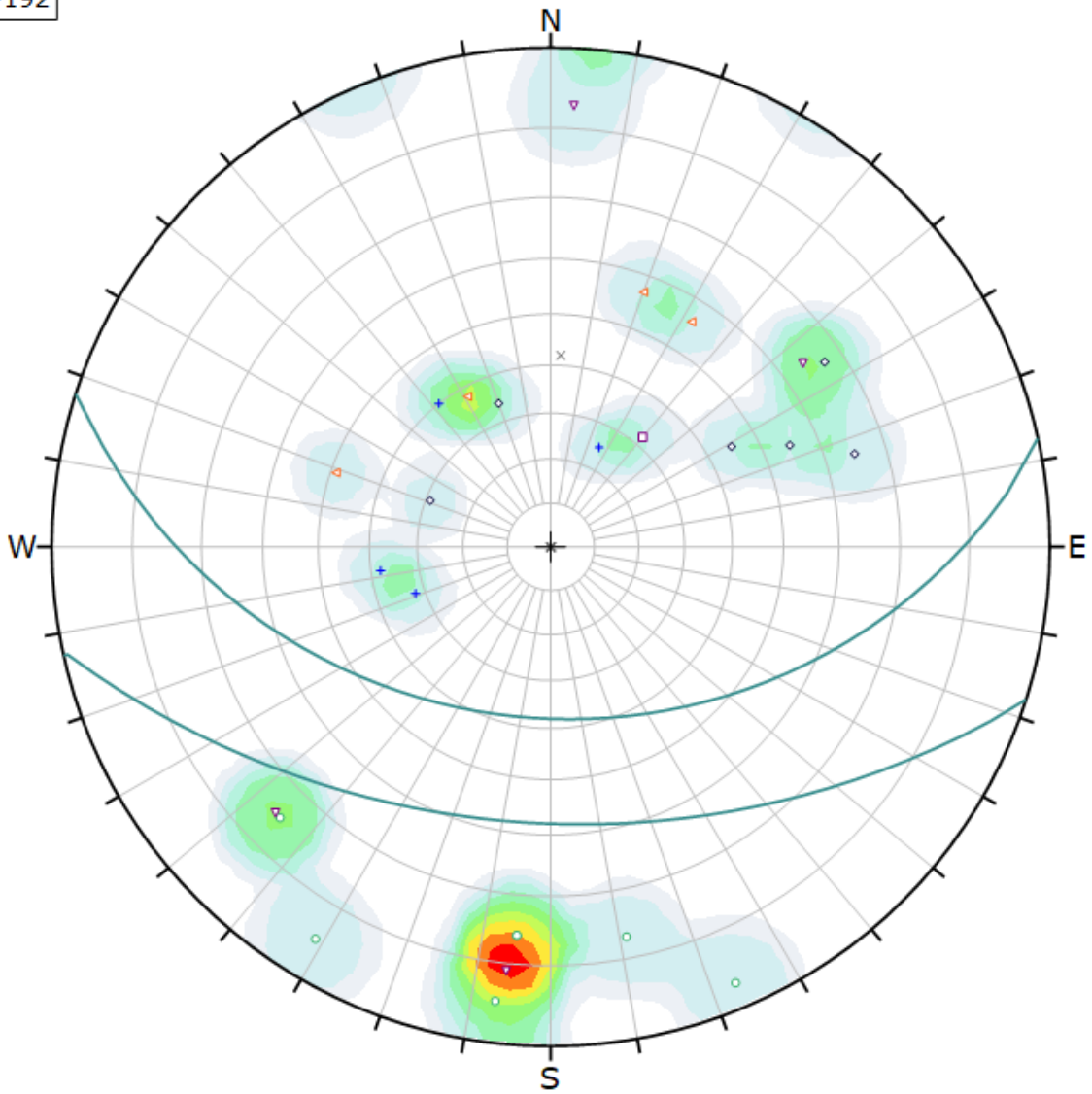
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-188
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-13**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-192



Symbol	TYPE	Quantity
◇	BD	6
□	DY	1
▽	GO	4
◁	LA	4
○	SH	7
+	VT	4

Color	Density Concentrations
	0.00 - 1.50
	1.50 - 3.00
	3.00 - 4.50
	4.50 - 6.00
	6.00 - 7.50
	7.50 - 9.00
	9.00 - 10.50
	10.50 - 12.00
	12.00 - 13.50
	13.50 - 15.00

Contour Data	Pole Vectors
Maximum Density	14.34%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	26 (26 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- × Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

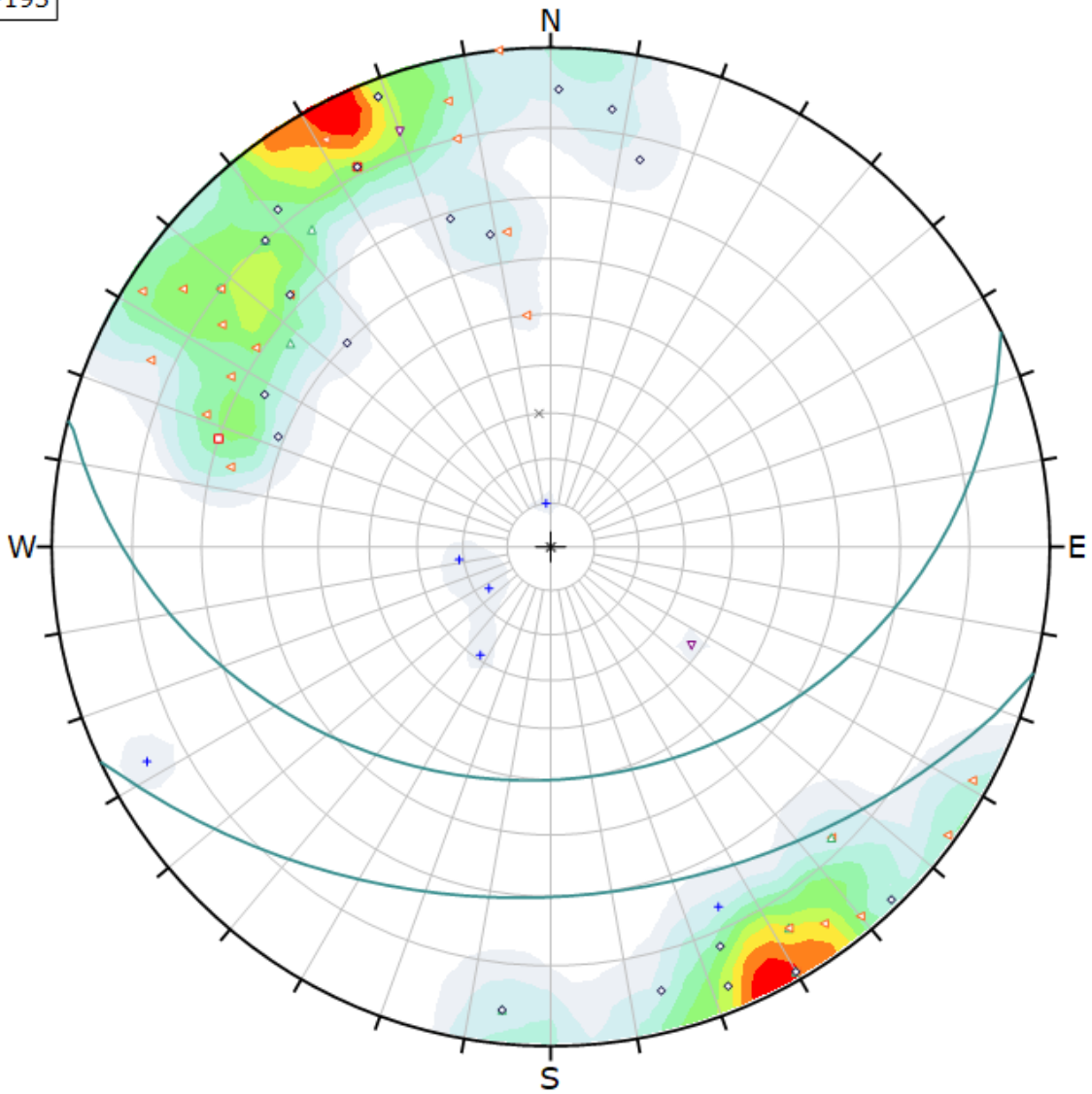
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-192
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-14**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-12-193



Symbol	TYPE	Quantity
◇	BD	21
▽	GO	2
◁	LA	24
○	SH	1
□	SY	2
△	VN	7
+	VT	6

Color	Density Concentrations
	0.00 - 1.50
	1.50 - 3.00
	3.00 - 4.50
	4.50 - 6.00
	6.00 - 7.50
	7.50 - 9.00
	9.00 - 10.50
	10.50 - 12.00
	12.00 - 13.50
	13.50 - 15.00

Contour Data	Pole Vectors
Maximum Density	14.90%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	63 (63 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

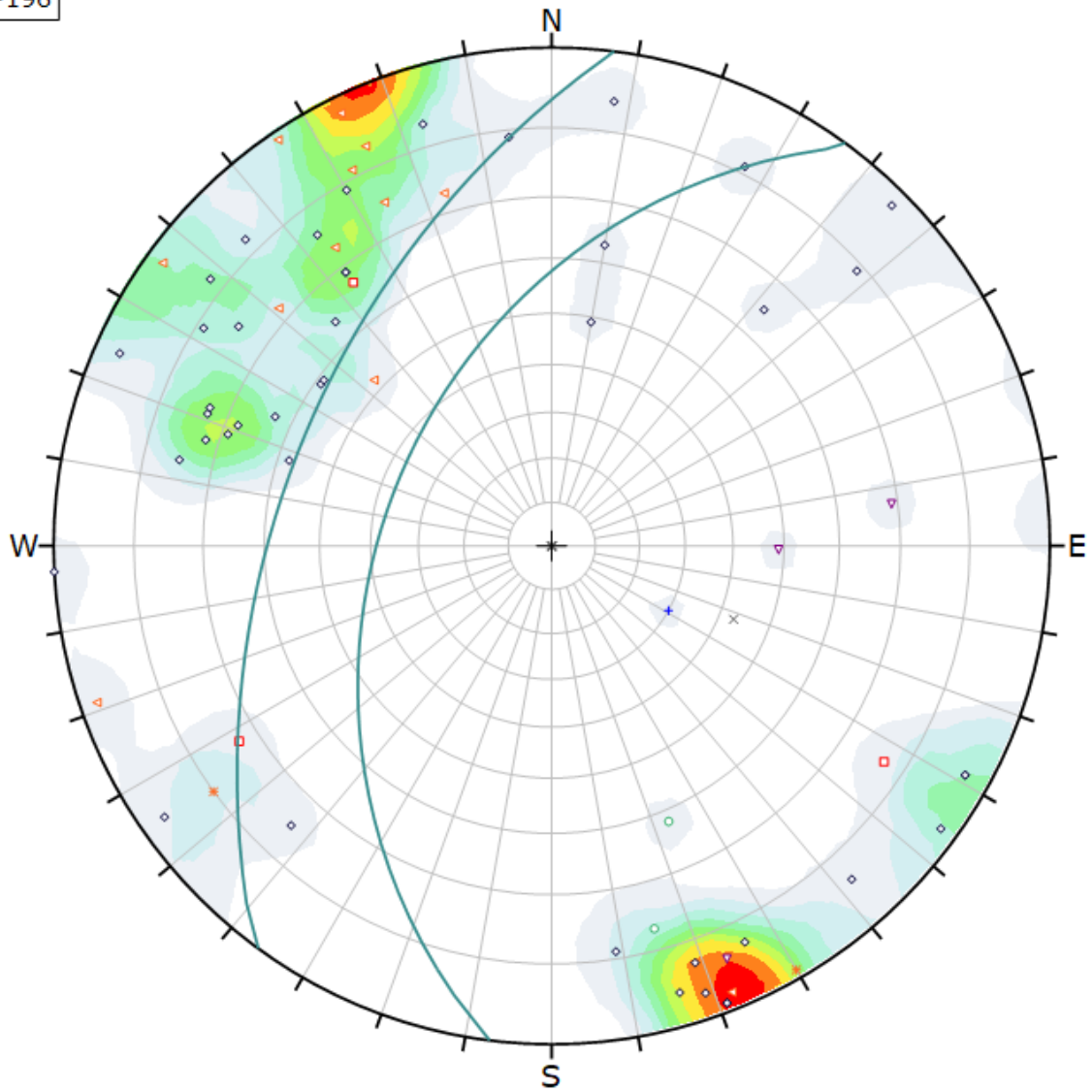
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-193
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-15**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-196



Symbol	TYPE	Quantity
◇	BD	43
▽	GO	3
◁	LA	12
○	SH	2
✳	SN	2
□	SY	3
+	VT	1

Color	Density Concentrations
	0.00 - 1.40
	1.40 - 2.80
	2.80 - 4.20
	4.20 - 5.60
	5.60 - 7.00
	7.00 - 8.40
	8.40 - 9.80
	9.80 - 11.20
	11.20 - 12.60
	12.60 - 14.00

Contour Data	Pole Vectors
Maximum Density	13.50%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	66 (66 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- ✕ Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

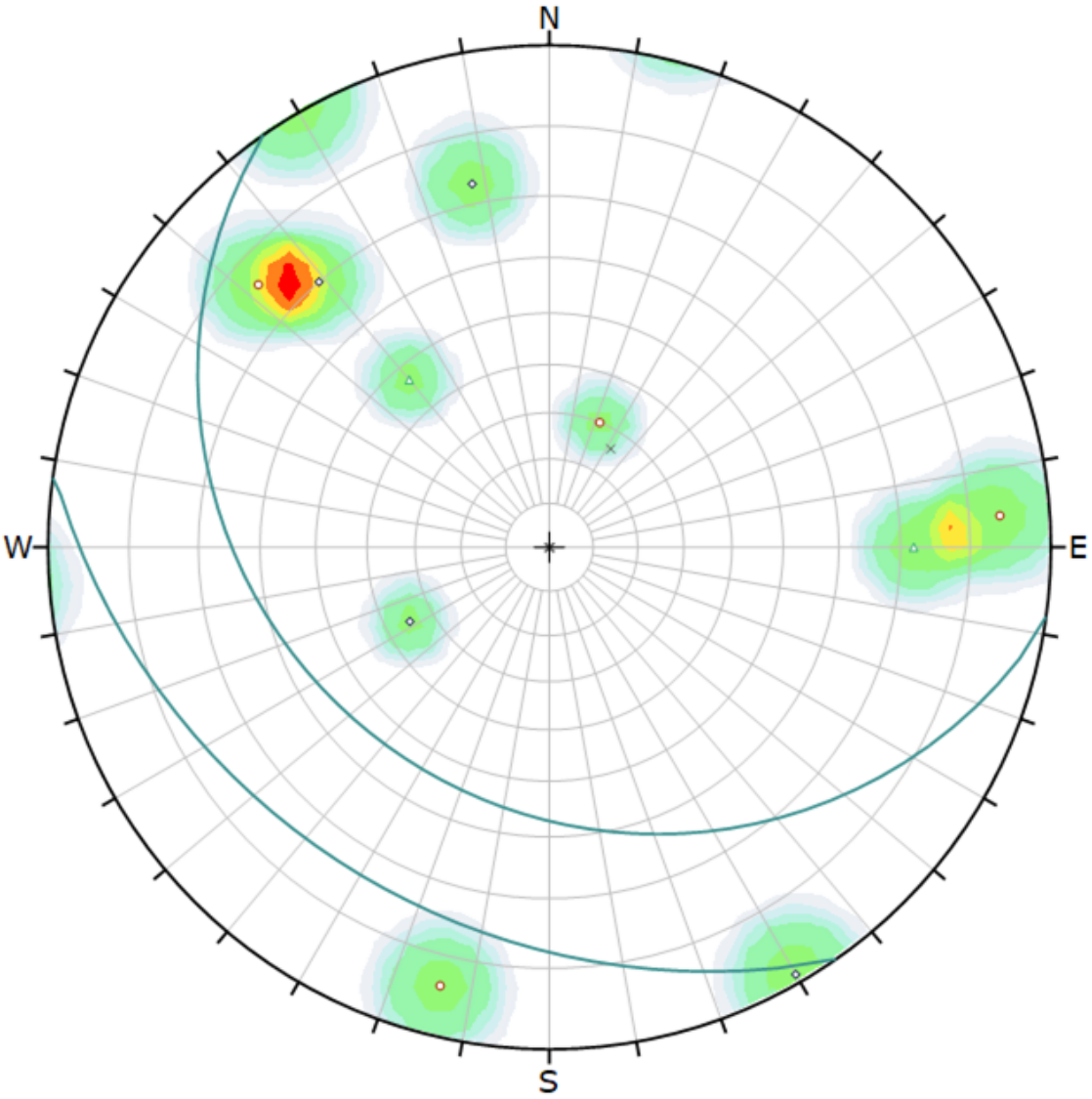
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-12-196
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-16**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-17-232



Symbol	TYPE	Quantity
◇	BD	4
○	FR	4
△	VN	2

Color	Density Concentrations
	0.00 - 1.90
	1.90 - 3.80
	3.80 - 5.70
	5.70 - 7.60
	7.60 - 9.50
	9.50 - 11.40
	11.40 - 13.30
	13.30 - 15.20
	15.20 - 17.10
	17.10 - 19.00

Contour Data	Pole Vectors
Maximum Density	18.24%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	10 (10 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

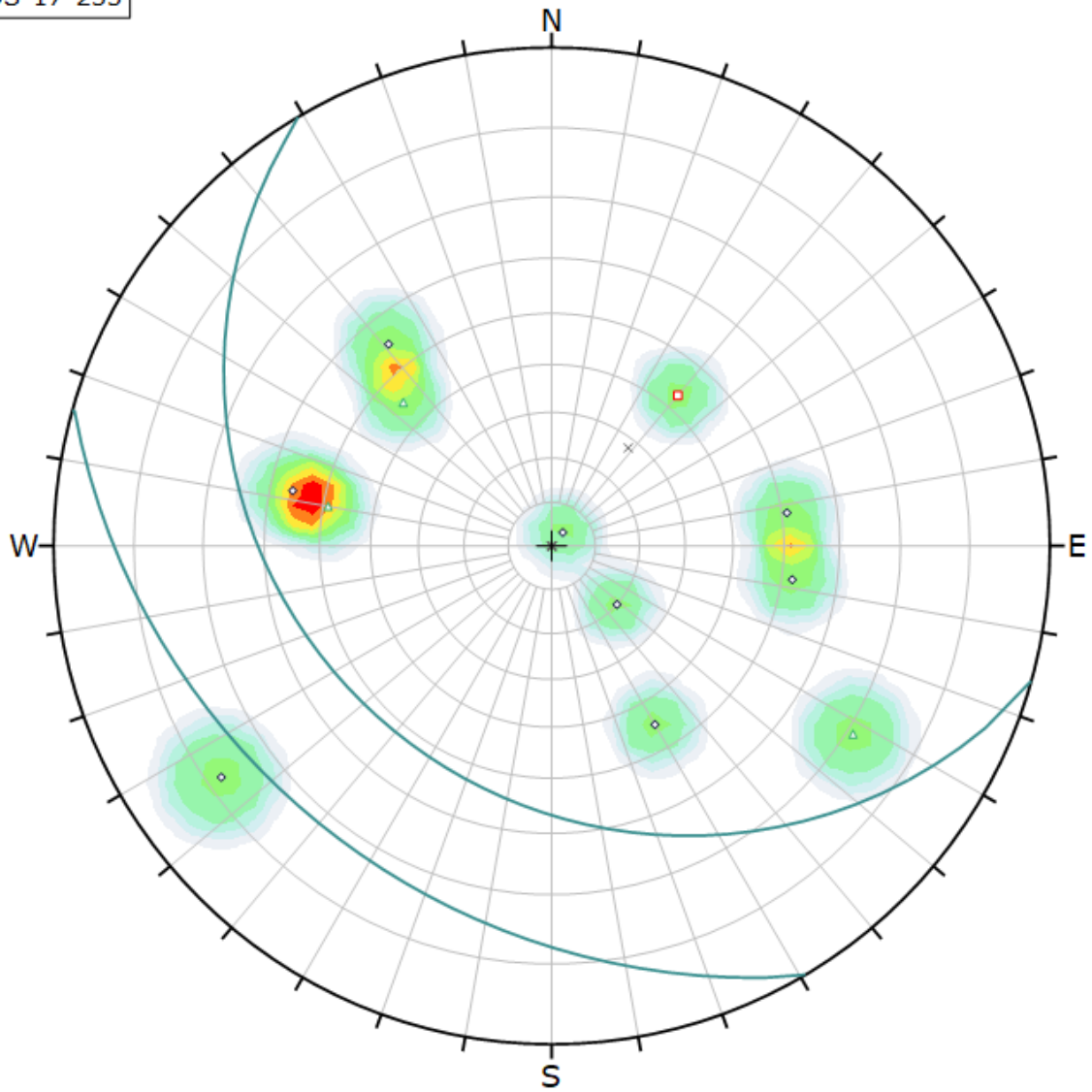
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-17-232
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D1-17

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-235



Symbol	TYPE	Quantity
◇	BD	8
□	SY	1
△	VN	3

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	12 (12 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

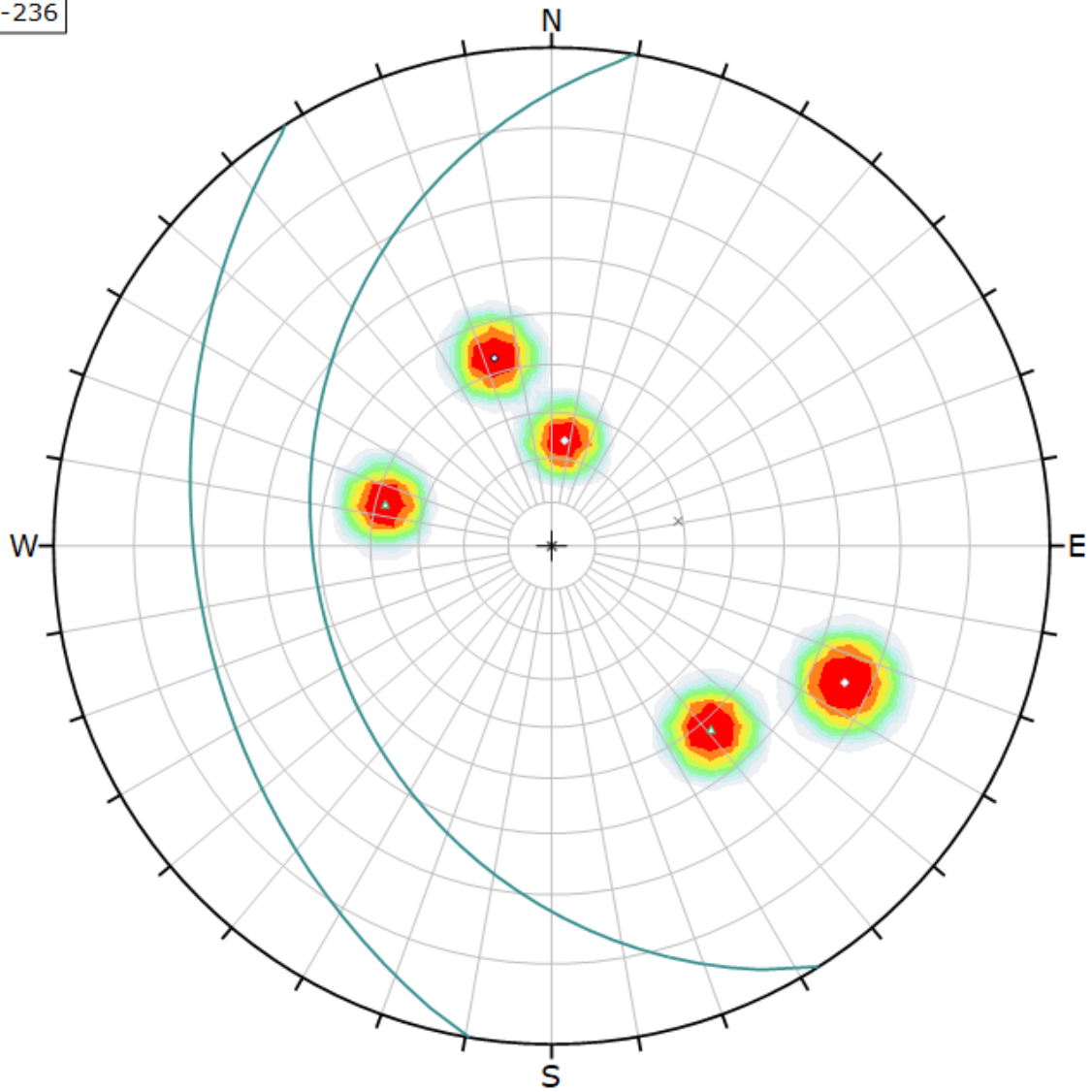
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-17-235
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D1-18

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-236



Symbol	TYPE	Quantity
◇	BD	1
○	RF	2
△	VN	2

Color	Density Concentrations
	0.00 - 2.00
	2.00 - 4.00
	4.00 - 6.00
	6.00 - 8.00
	8.00 - 10.00
	10.00 - 12.00
	12.00 - 14.00
	14.00 - 16.00
	16.00 - 18.00
	18.00 - 20.00

Contour Data	Pole Vectors
Maximum Density	19.92%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	5 (5 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

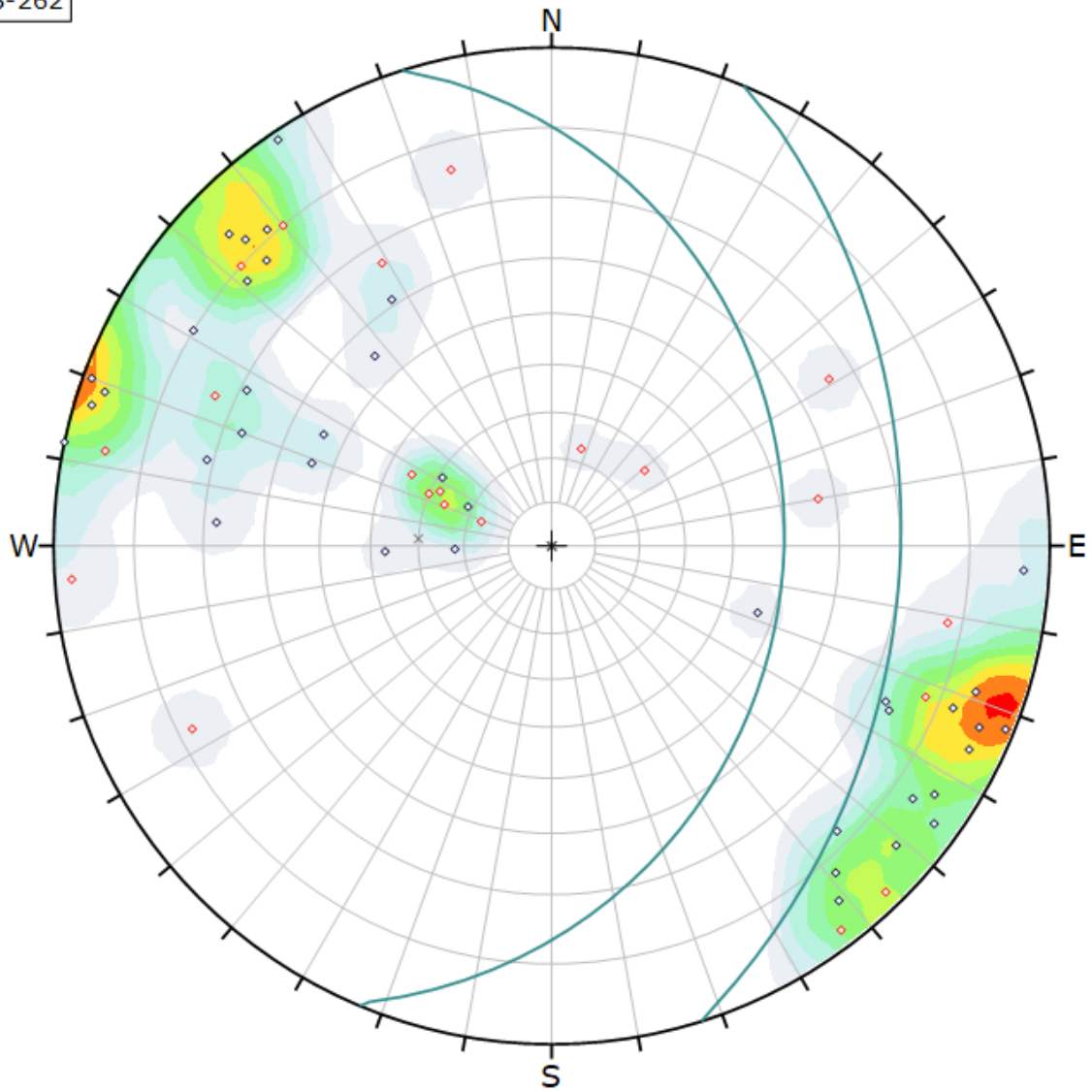
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-17-236
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-19**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-18-262



Symbol	TYPE	Quantity
◇	BD	39
◇	JT	21

Color	Density Concentrations
	0.00 - 1.40
	1.40 - 2.80
	2.80 - 4.20
	4.20 - 5.60
	5.60 - 7.00
	7.00 - 8.40
	8.40 - 9.80
	9.80 - 11.20
	11.20 - 12.60
	12.60 - 14.00

Contour Data	Pole Vectors
Maximum Density	13.09%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	60 (60 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

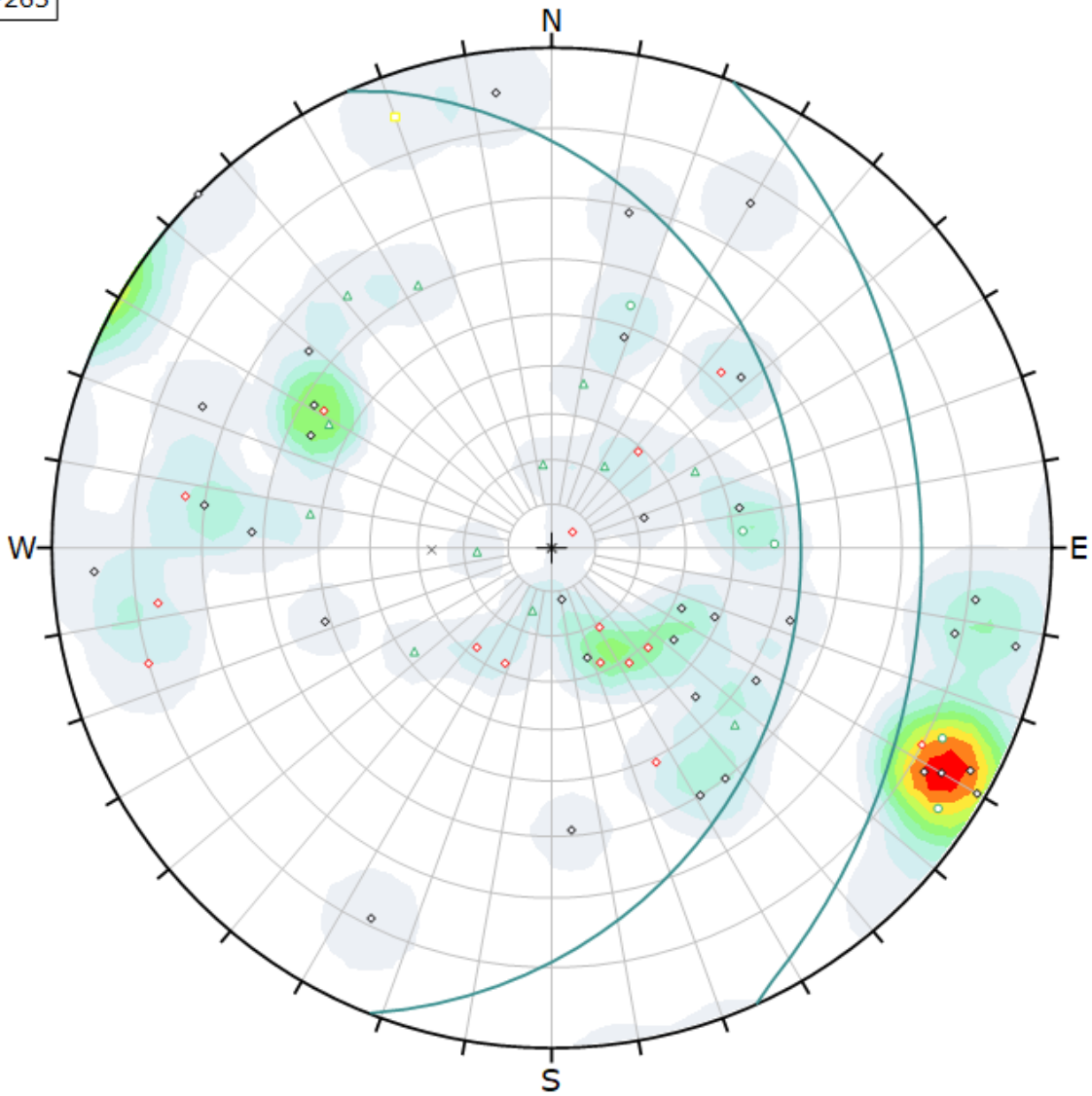
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-18-262
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D1-20

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-263



Symbol	TYPE	Quantity
◇	BD	35
□	CO	1
◇	JT	15
○	SH	5
△	VN	12

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.62%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	68 (68 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

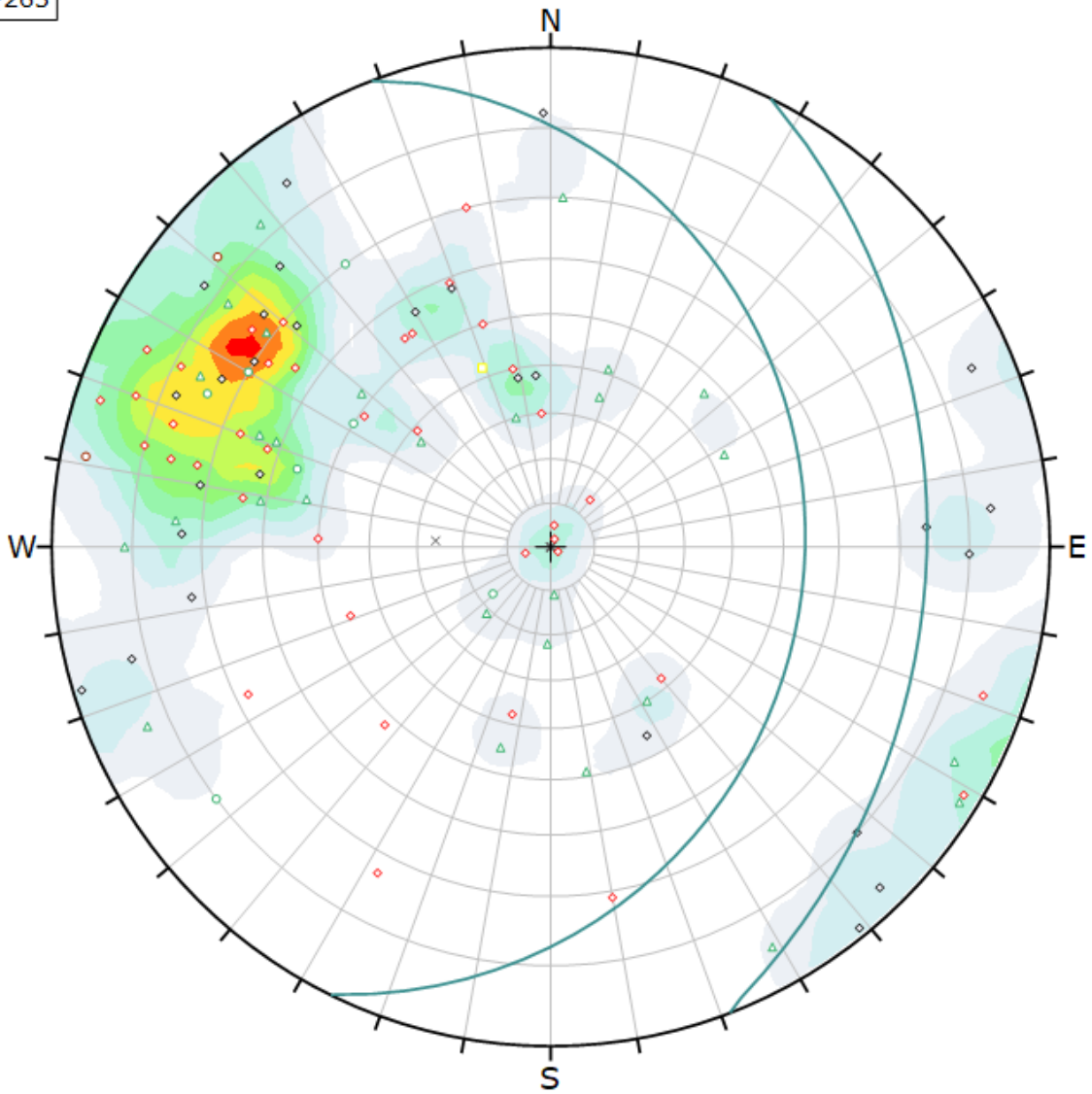
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-18-263
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-21**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-18-265



Symbol	TYPE	Quantity
◇	BD	27
□	CO	1
○	FR	2
◇	JT	39
○	SH	7
△	VN	28

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.40%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	104 (104 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- ✕ Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

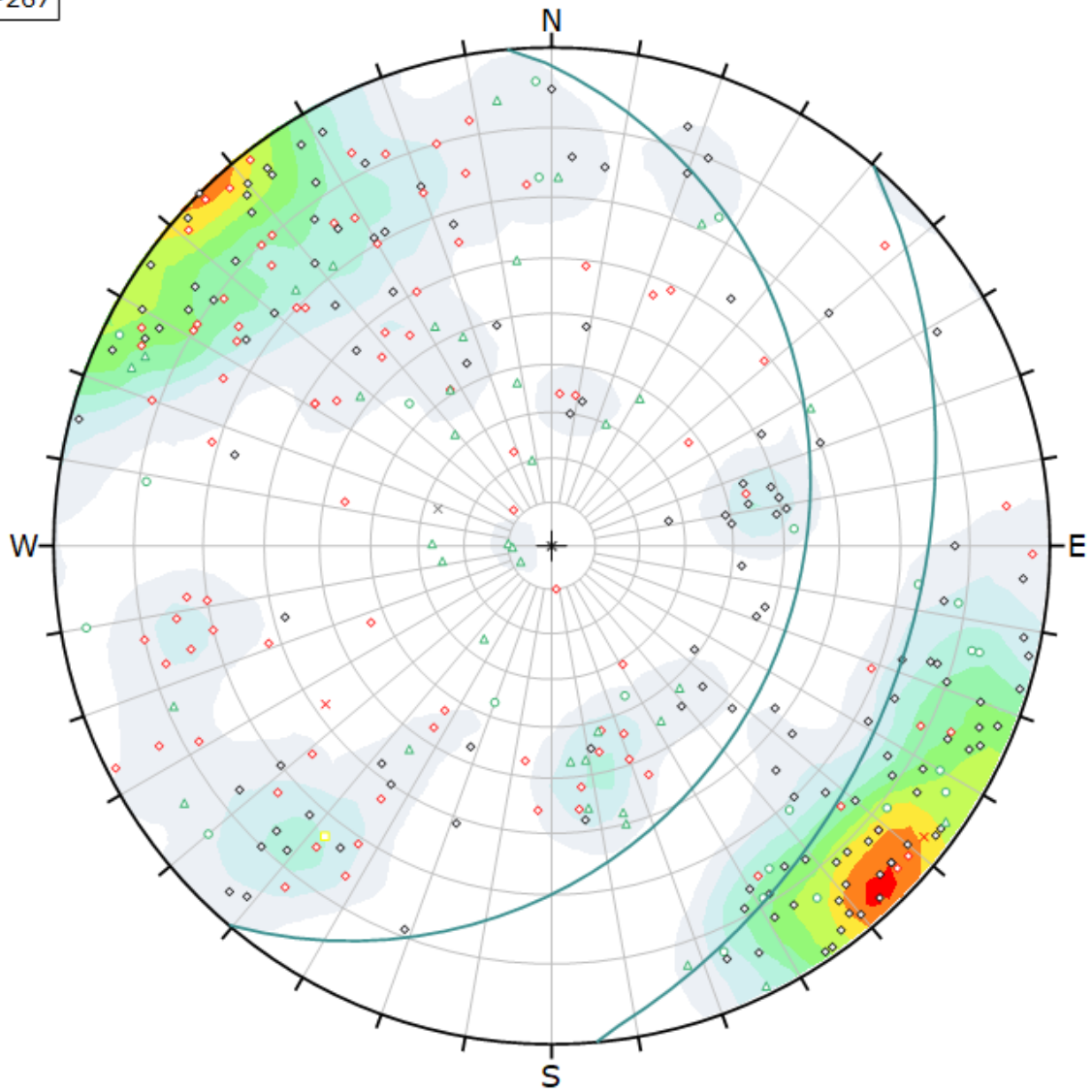
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-18-265
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-22**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-267



Symbol	TYPE	Quantity
◇	BD	138
□	CO	1
×	FT	2
◇	JT	93
○	SH	23
△	VN	38

Color	Density Concentrations
	0.00 - 0.90
	0.90 - 1.80
	1.80 - 2.70
	2.70 - 3.60
	3.60 - 4.50
	4.50 - 5.40
	5.40 - 6.30
	6.30 - 7.20
	7.20 - 8.10
	8.10 - 9.00

Contour Data	Pole Vectors
Maximum Density	8.33%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	295 (295 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

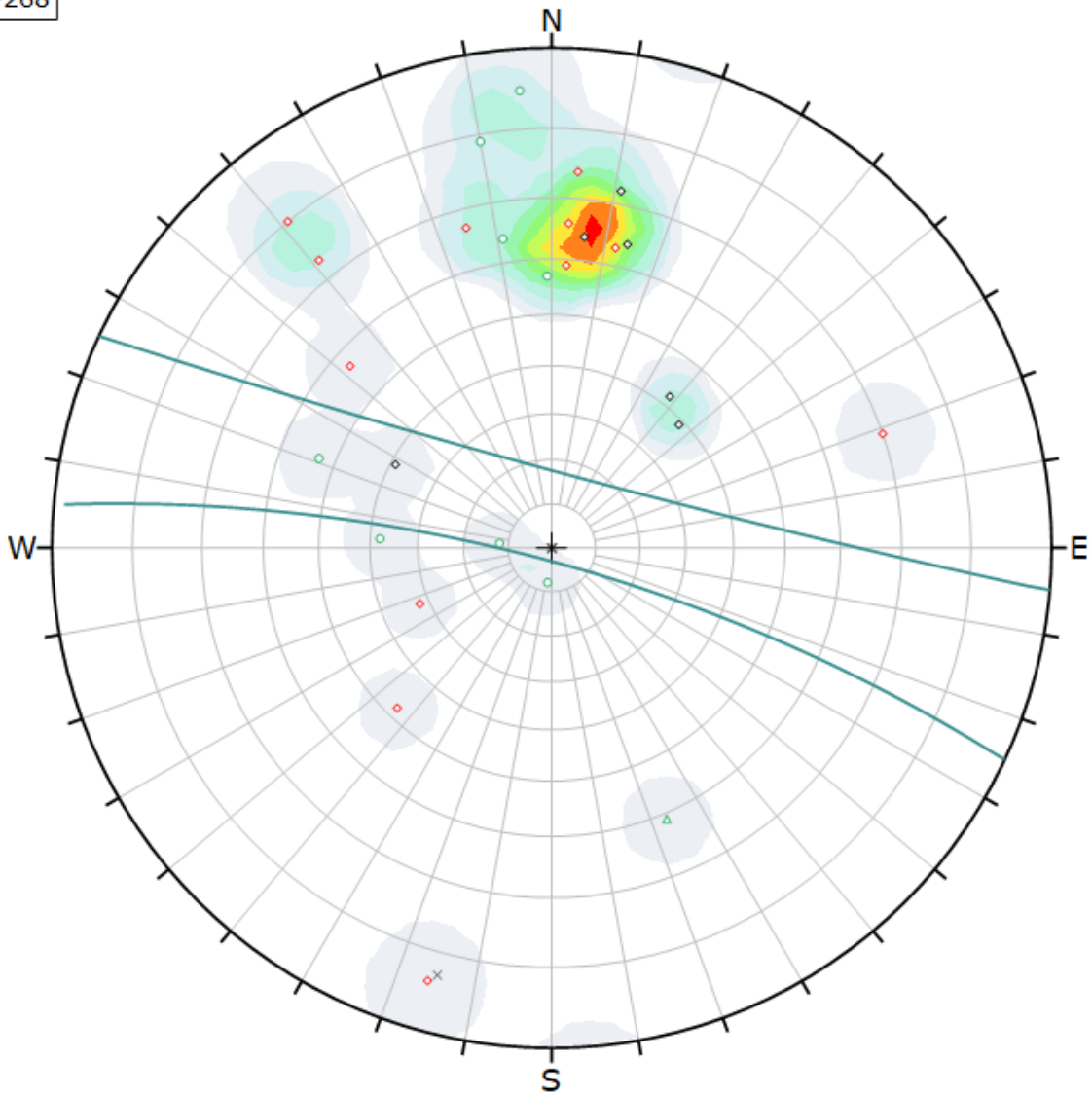
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-18-267
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-23**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-18-268



Symbol	TYPE	Quantity
◇	BD	6
◇	JT	12
○	SH	8
△	VN	1

Color	Density Concentrations
	0.00 - 2.00
	2.00 - 4.00
	4.00 - 6.00
	6.00 - 8.00
	8.00 - 10.00
	10.00 - 12.00
	12.00 - 14.00
	14.00 - 16.00
	16.00 - 18.00
	18.00 - 20.00

Contour Data	Pole Vectors
Maximum Density	19.07%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	27 (27 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- ✕ Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

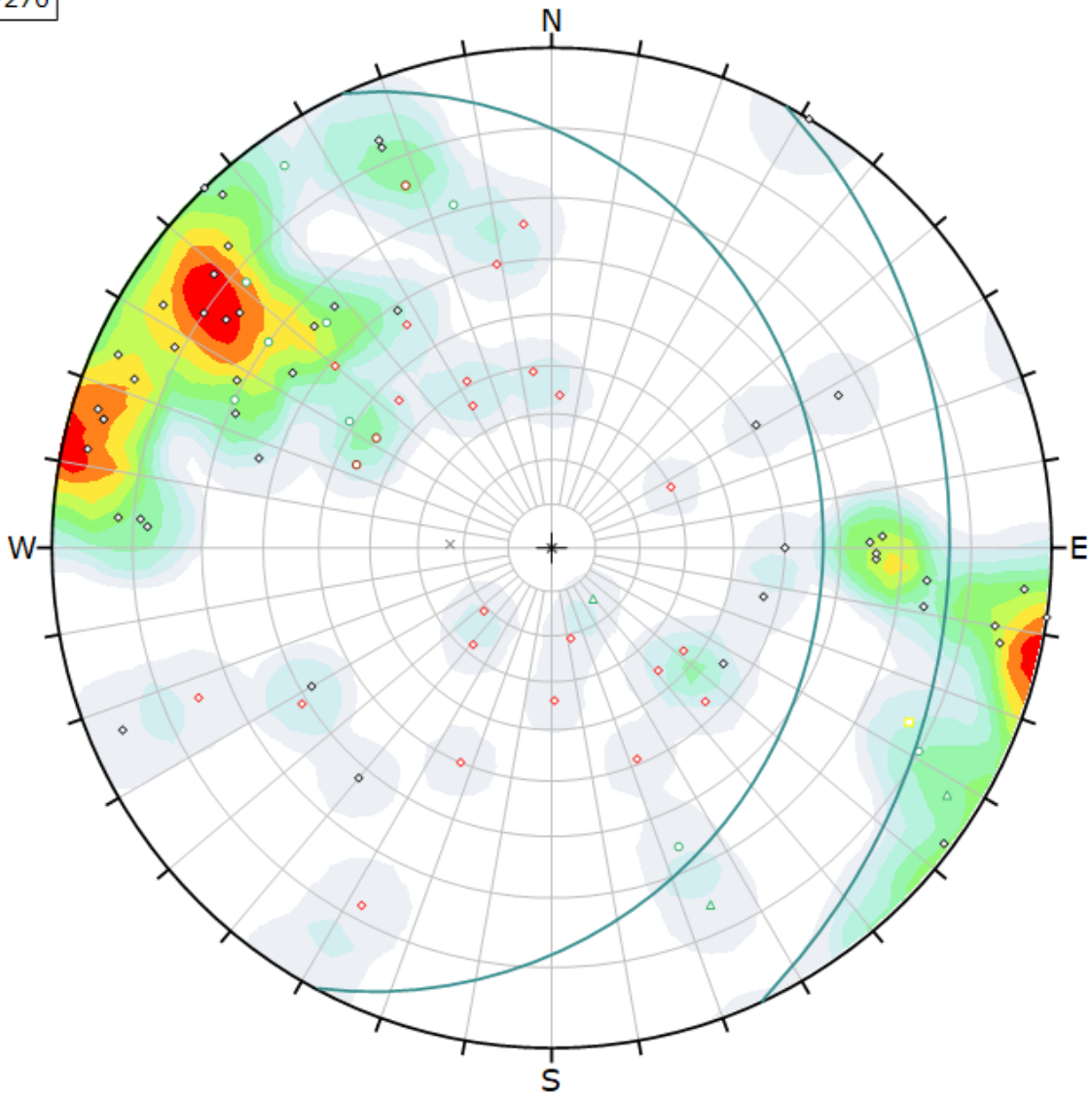
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-18-268
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-24**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-270



Symbol	TYPE	Quantity
◇	BD	47
□	CO	1
○	FR	3
◇	JT	22
○	SH	9
△	VN	3

Color	Density Concentrations
	0.00 - 0.80
	0.80 - 1.60
	1.60 - 2.40
	2.40 - 3.20
	3.20 - 4.00
	4.00 - 4.80
	4.80 - 5.60
	5.60 - 6.40
	6.40 - 7.20
	7.20 - 8.00

Contour Data	Pole Vectors
Maximum Density	7.95%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	85 (85 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- ✕ Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

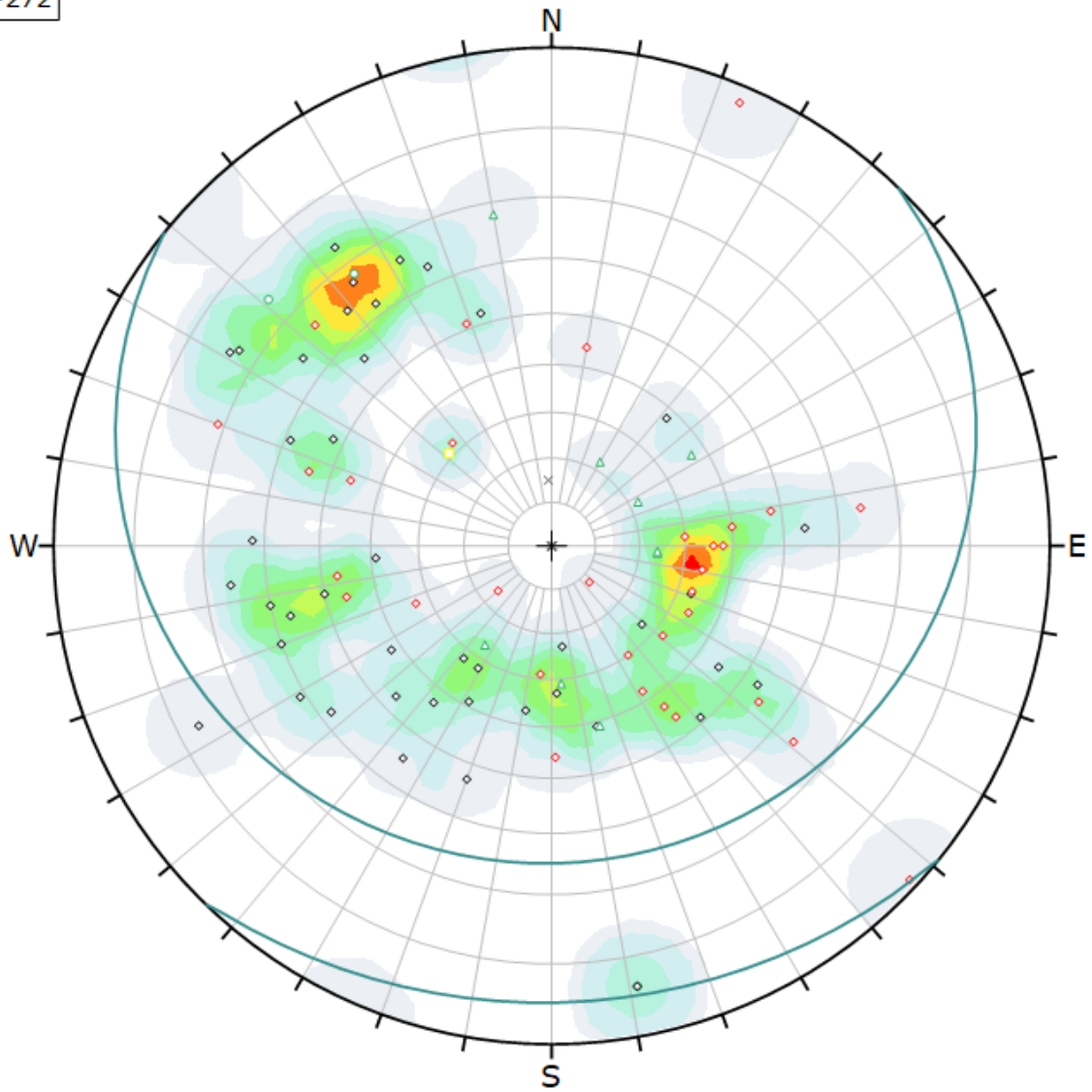
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-18-270
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-25**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-18-272



Symbol	TYPE	Quantity
◇	BD	43
□	CO	1
◇	JT	32
○	SH	3
△	VN	9

Color	Density Concentrations
	0.00 - 0.70
	0.70 - 1.40
	1.40 - 2.10
	2.10 - 2.80
	2.80 - 3.50
	3.50 - 4.20
	4.20 - 4.90
	4.90 - 5.60
	5.60 - 6.30
	6.30 - 7.00

Contour Data	Pole Vectors
Maximum Density	6.74%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	88 (88 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

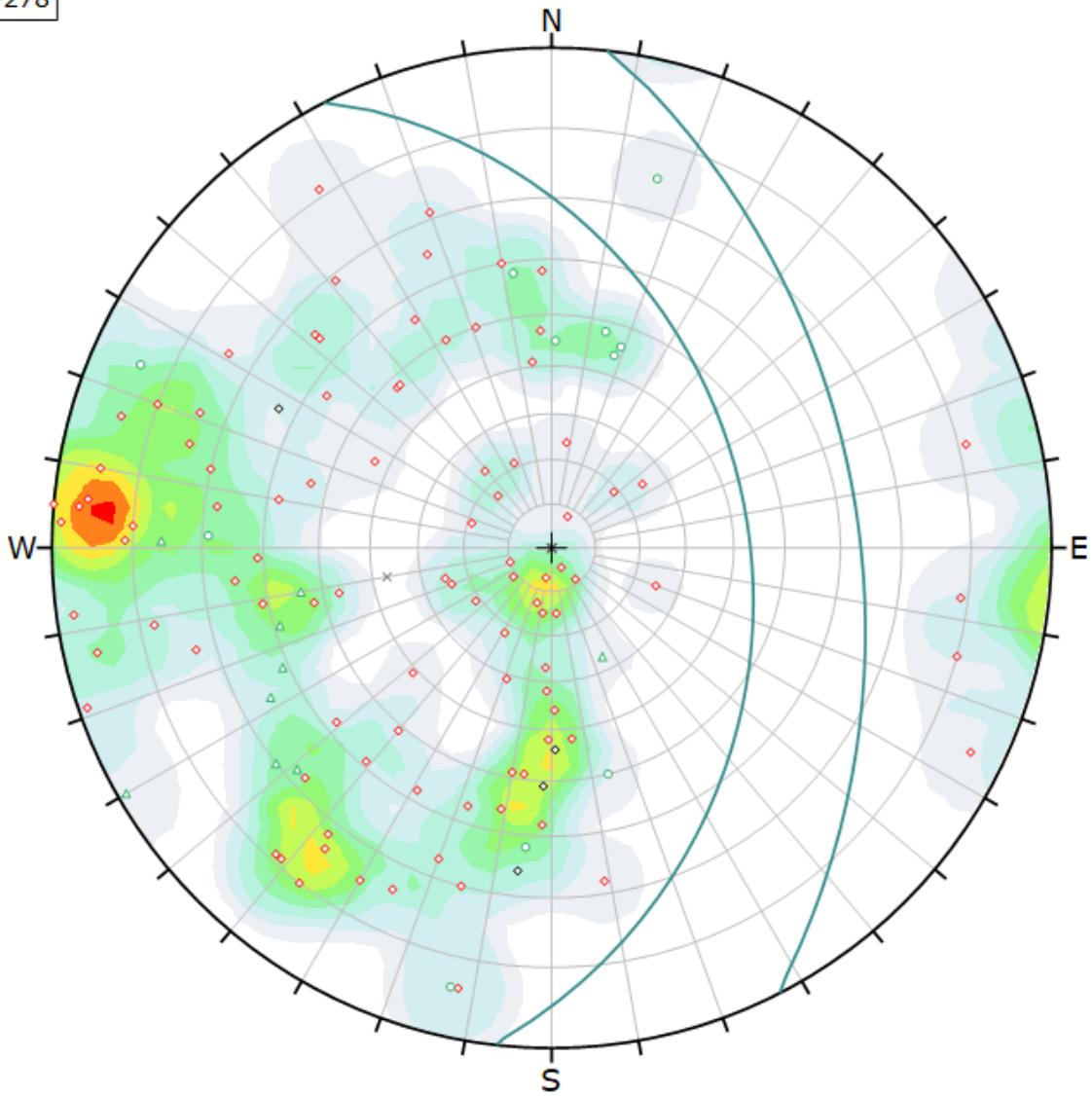
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-18-272
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-26**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-278



Symbol	TYPE	Quantity
◇	BD	4
◇	JT	96
○	SH	11
△	VN	9

Color	Density Concentrations
	0.00 - 0.60
	0.60 - 1.20
	1.20 - 1.80
	1.80 - 2.40
	2.40 - 3.00
	3.00 - 3.60
	3.60 - 4.20
	4.20 - 4.80
	4.80 - 5.40
	5.40 - 6.00

Contour Data	Pole Vectors
Maximum Density	5.50%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	120 (120 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

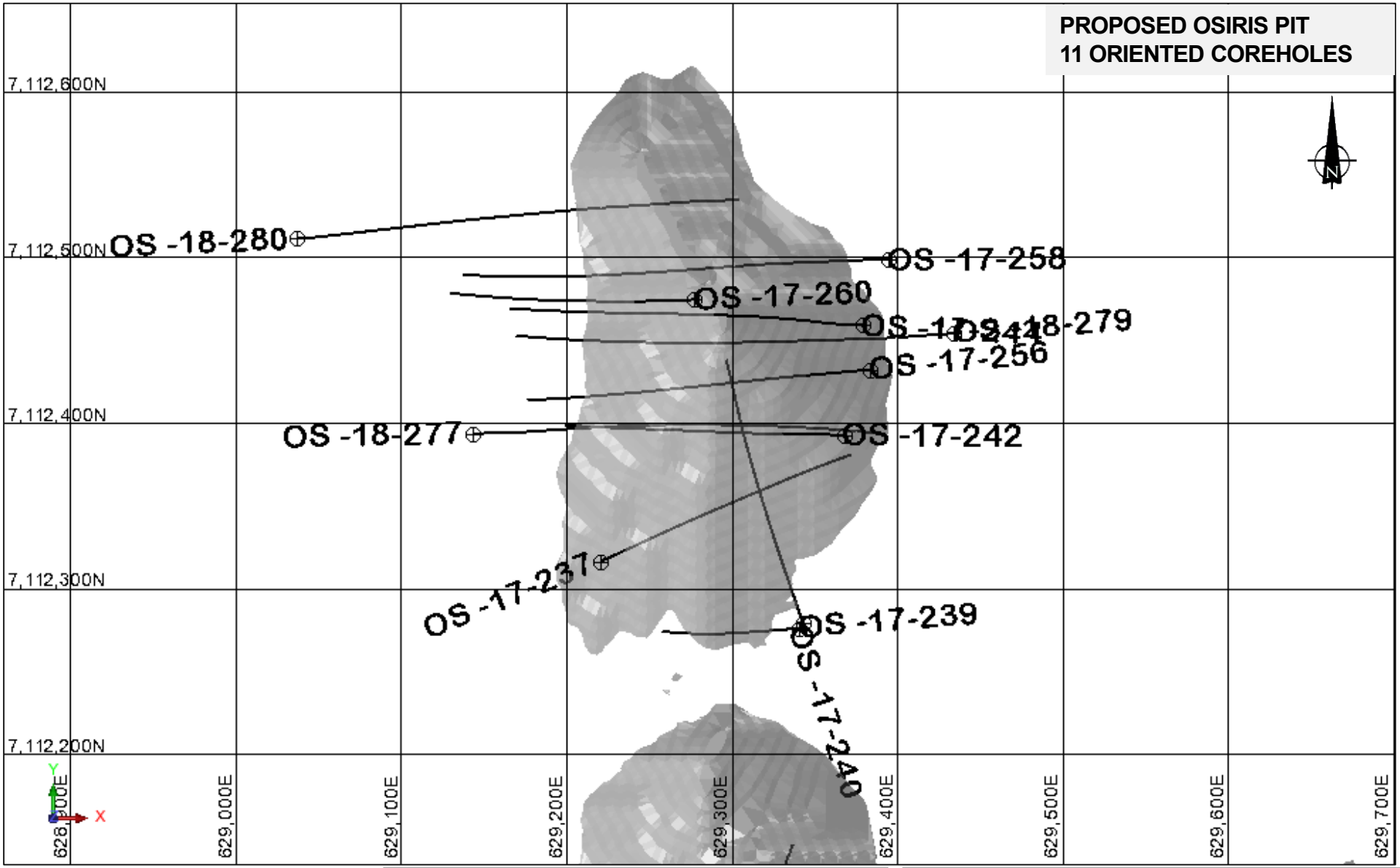
YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD PIT ORIENTED COREHOLE
OS-18-278
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-27**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm



Legend

- Corehole Collar
- Corehole Trace

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

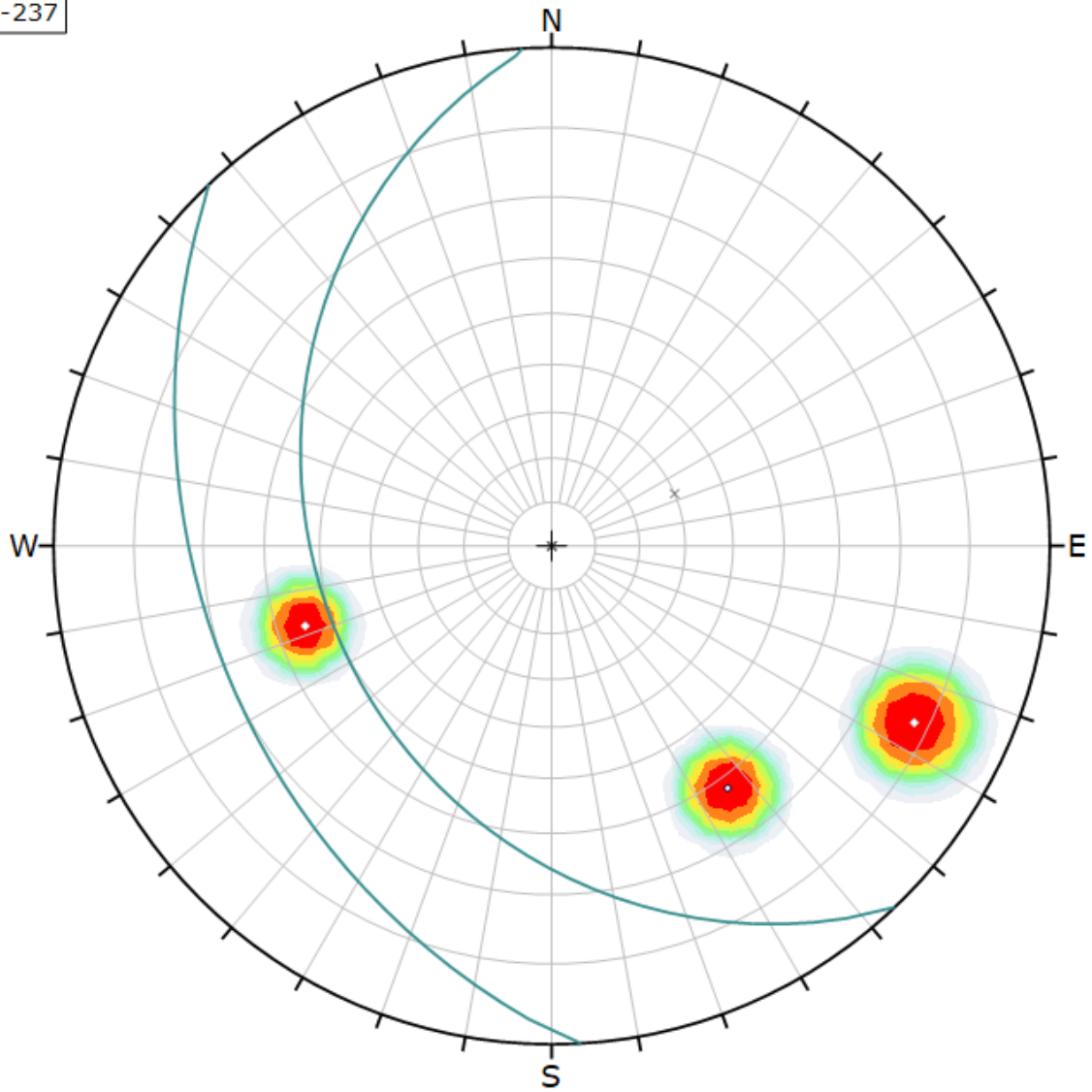
YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED OSIRIS PIT
COREHOLES WITH ORIENTED STRUCTURE DATA
PLAN VIEW

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-28**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-237



Symbol	TYPE	Quantity
◇	BD	1
◇	RF	2

Color	Density Concentrations
	0.00 - 3.40
	3.40 - 6.80
	6.80 - 10.20
	10.20 - 13.60
	13.60 - 17.00
	17.00 - 20.40
	20.40 - 23.80
	23.80 - 27.20
	27.20 - 30.60
	30.60 - 34.00

Contour Data	Pole Vectors
Maximum Density	33.23%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	3 (3 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

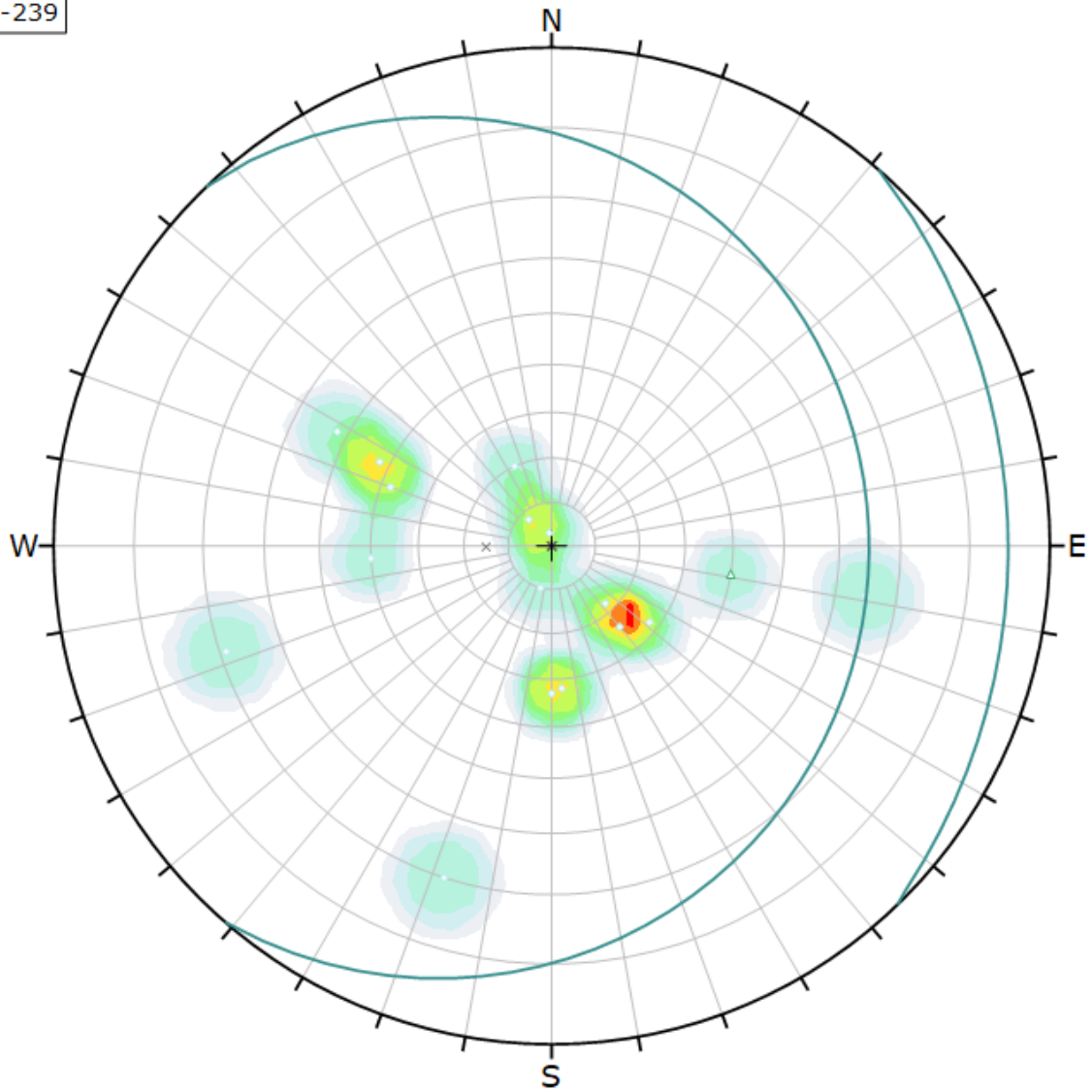
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-17-237
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D1-29

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-17-239



Symbol	TYPE	Quantity
○	RF	16
△	VN	1

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.00%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	17 (17 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

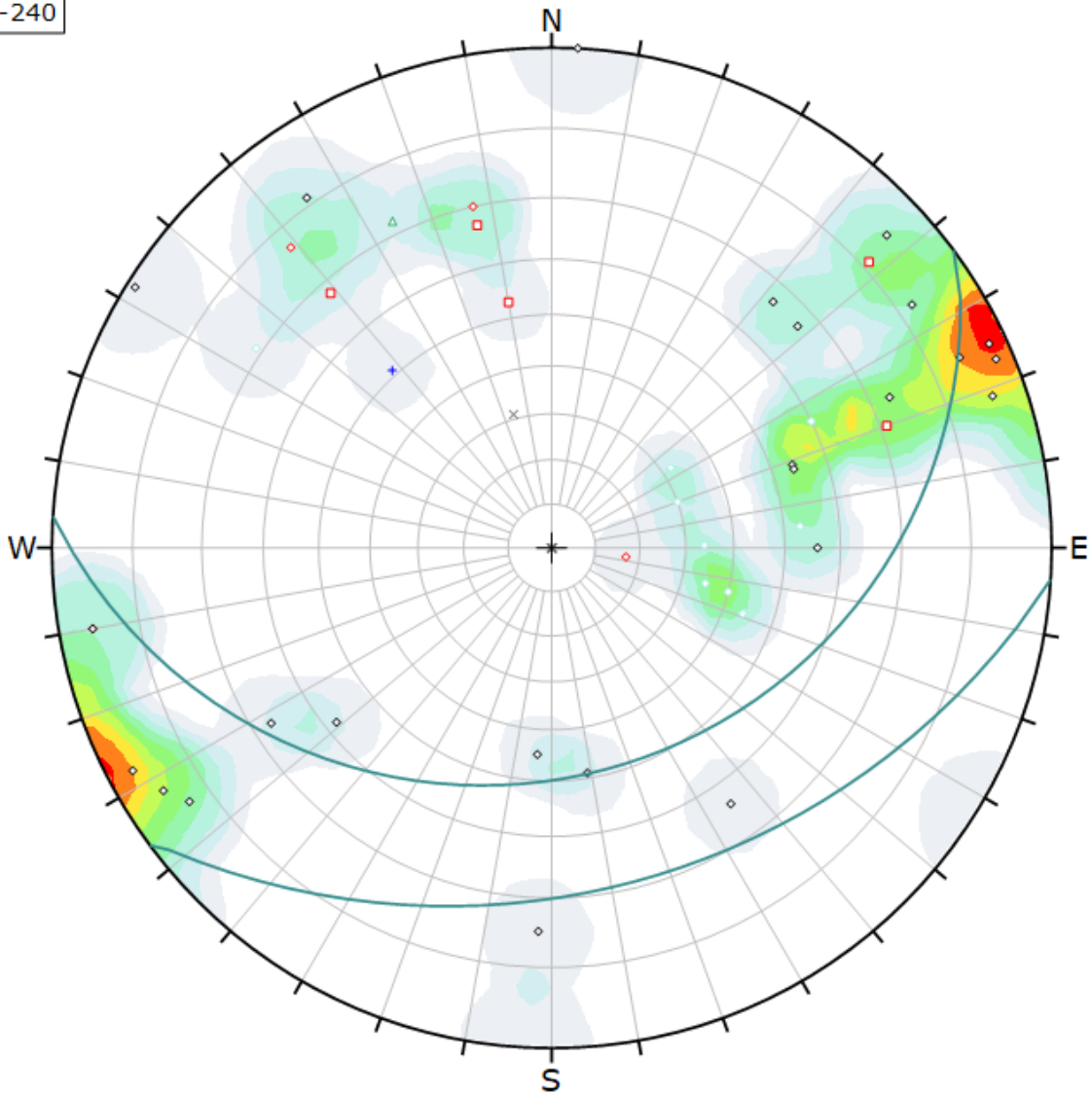
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-17-239
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D1-30

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-17-240



Symbol	TYPE	Quantity
◇	BD	26
◇	JT	4
◇	RF	10
□	SY	5
△	VN	1
+	VT	1

Color	Density Concentrations
	0.00 - 1.10
	1.10 - 2.20
	2.20 - 3.30
	3.30 - 4.40
	4.40 - 5.50
	5.50 - 6.60
	6.60 - 7.70
	7.70 - 8.80
	8.80 - 9.90
	9.90 - 11.00

Contour Data	Pole Vectors
Maximum Density	10.22%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	47 (47 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

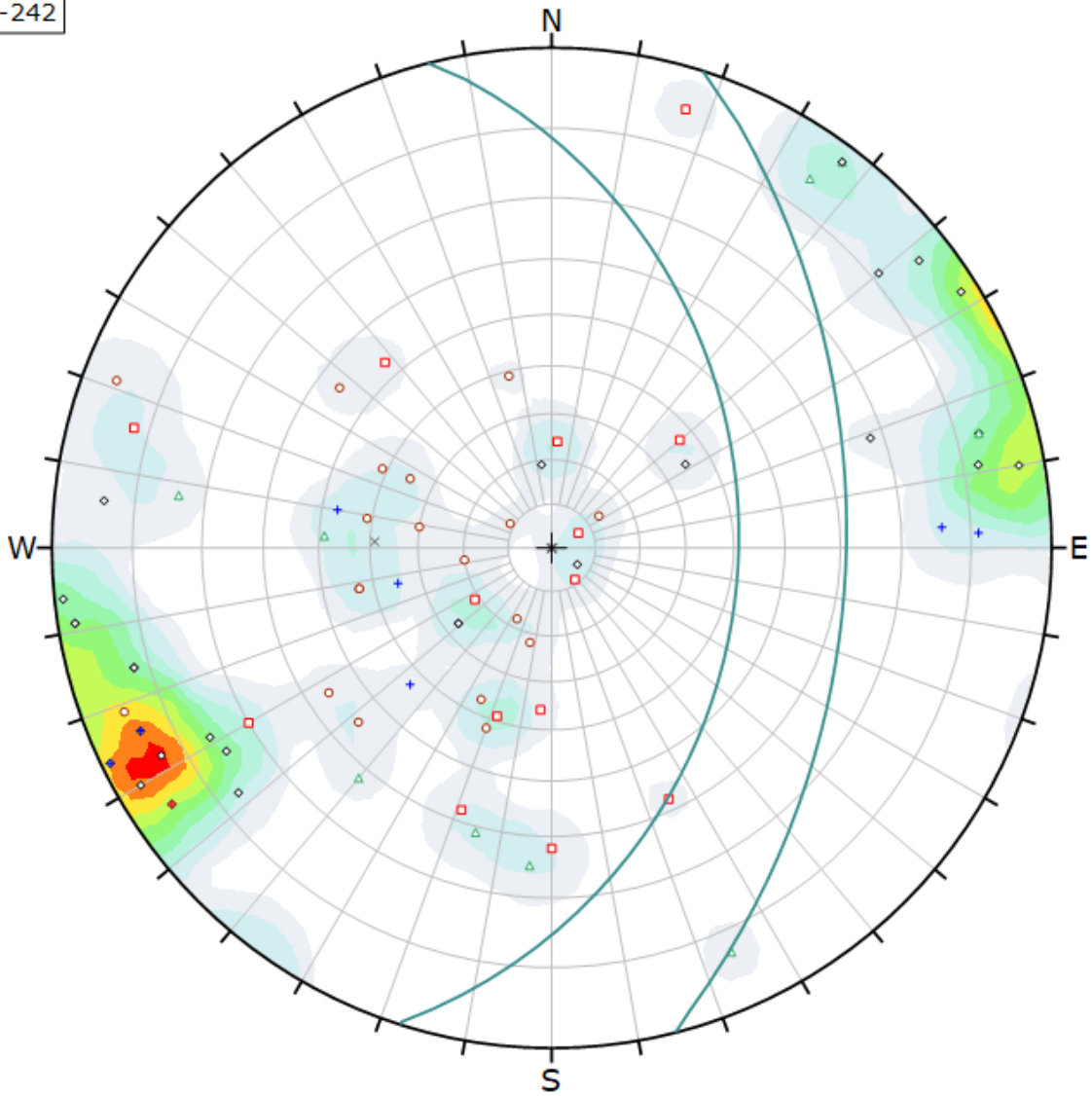
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-17-240
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-31**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-17-242



Symbol	TYPE	Quantity
◇	BD	27
○	FR	19
+	SS	1
□	SY	14
△	VN	10
+	VT	7

Color	Density Concentrations
	0.00 - 1.20
	1.20 - 2.40
	2.40 - 3.60
	3.60 - 4.80
	4.80 - 6.00
	6.00 - 7.20
	7.20 - 8.40
	8.40 - 9.60
	9.60 - 10.80
	10.80 - 12.00

Contour Data	Pole Vectors
Maximum Density	11.32%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	78 (78 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

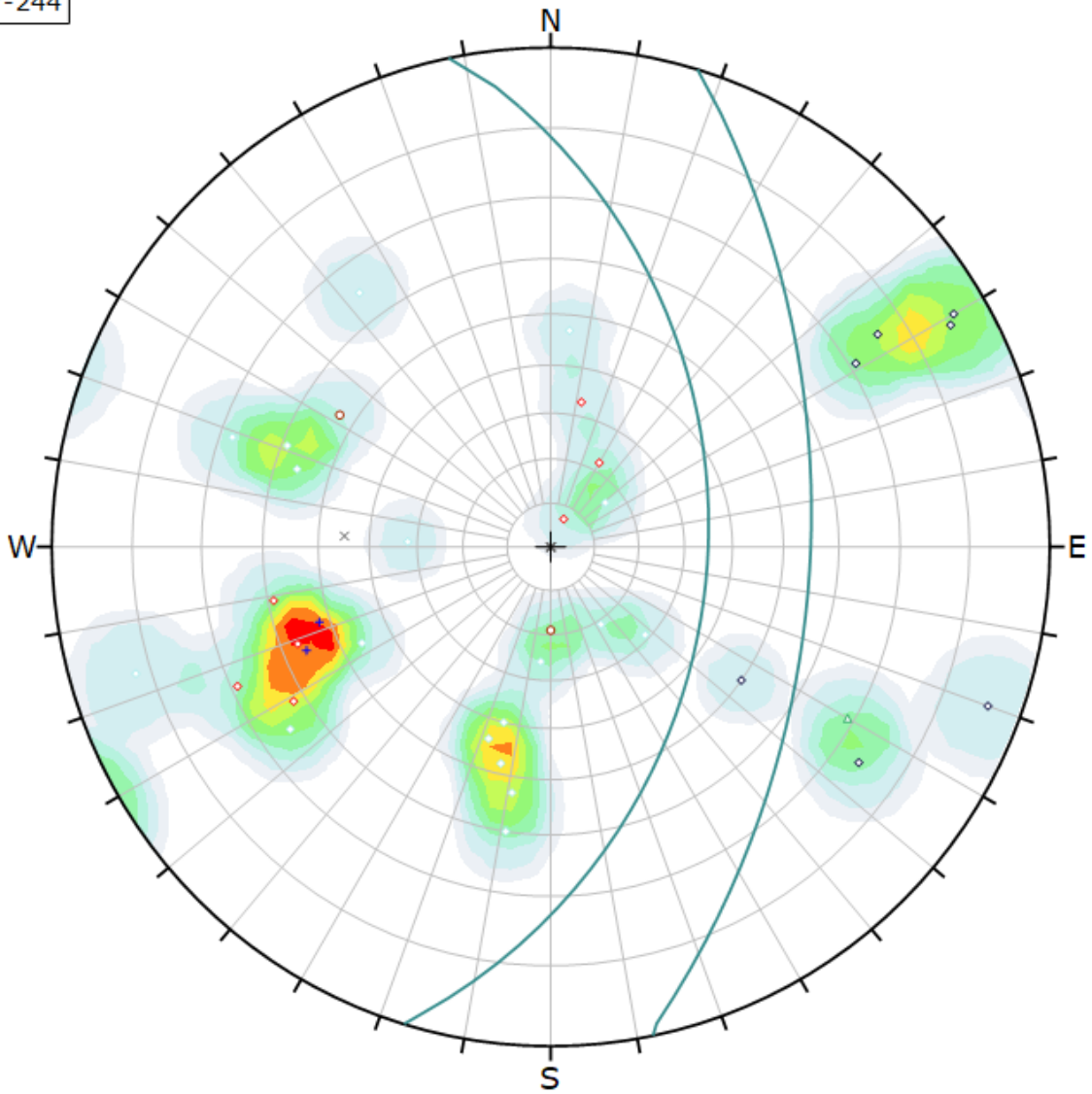
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-17-242
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-32**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-17-244



Symbol	TYPE	Quantity
◇	BD	7
○	FR	2
◇	JT	7
○	RF	18
△	VN	1
+	VT	2

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.76%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	37 (37 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

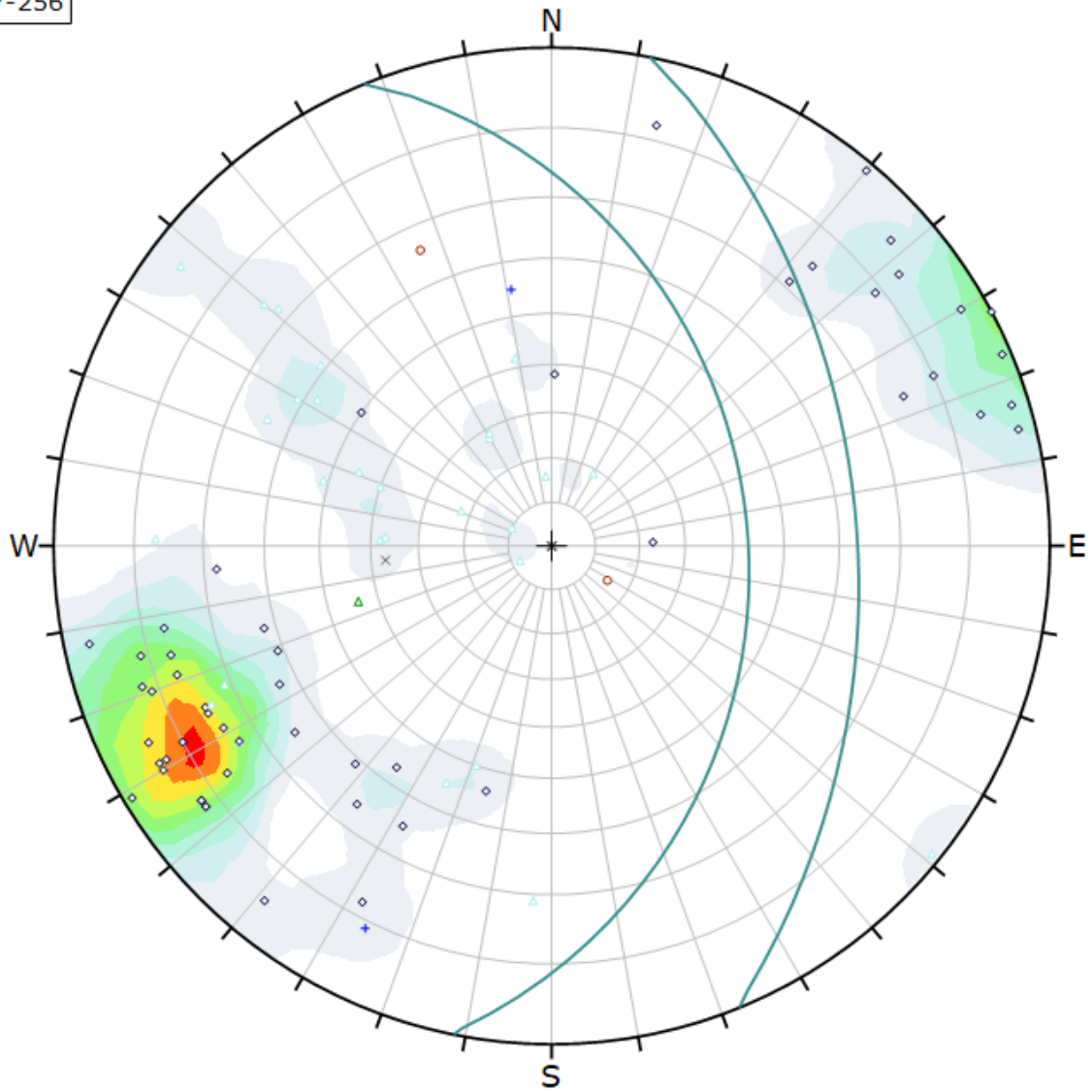
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-17-244
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-33**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-256



Symbol	TYPE	Quantity
◇	BD	52
○	FR	2
△	RF	29
△	VN	1
+	VT	2

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.10%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	86 (86 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

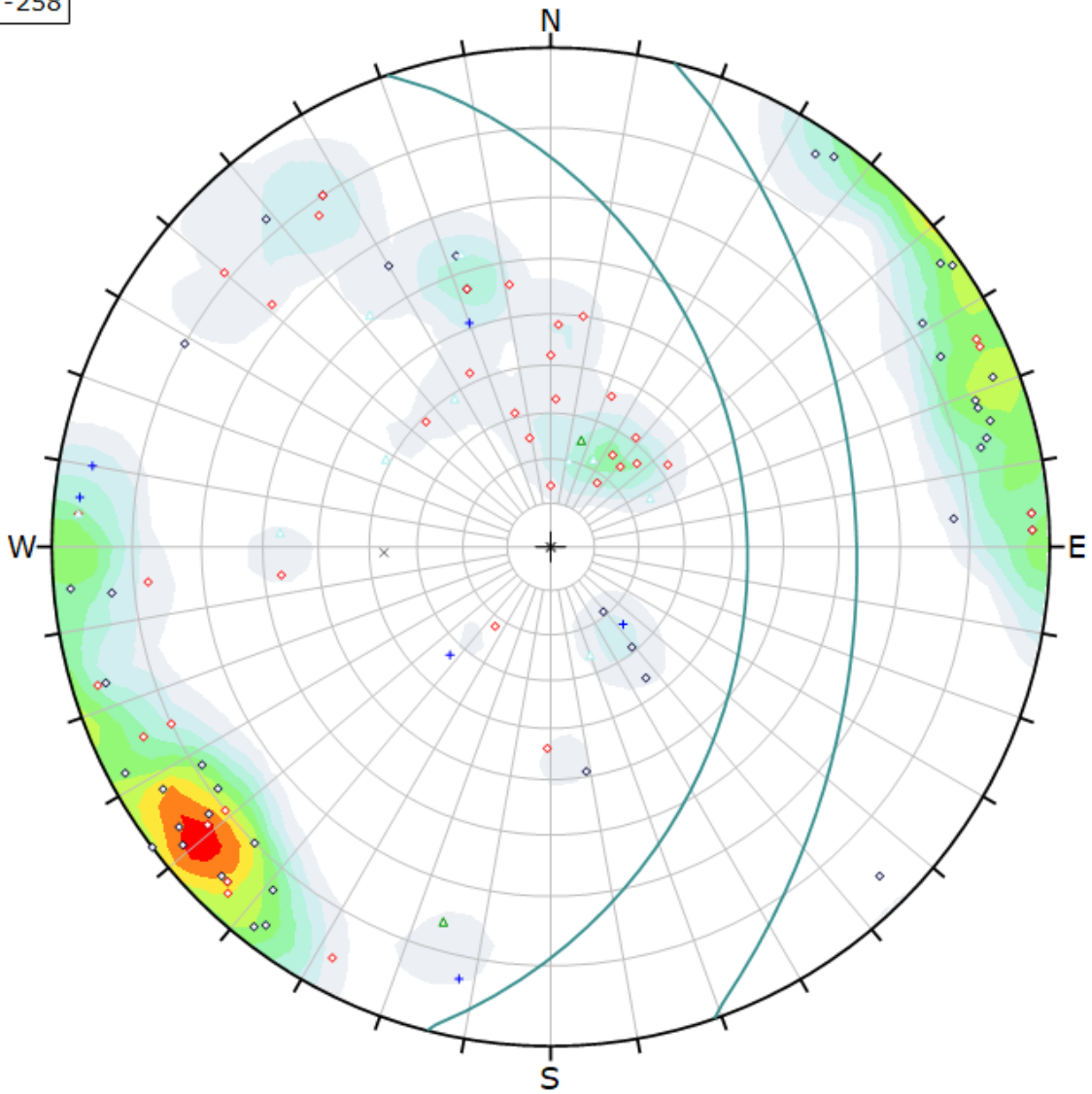
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-17-256
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-34**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-17-258



Symbol	TYPE	Quantity
◇	BD	44
◇	JT	39
△	RF	10
△	VN	2
+	VT	6

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Contour Data	Pole Vectors
Maximum Density	12.51%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	101 (101 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

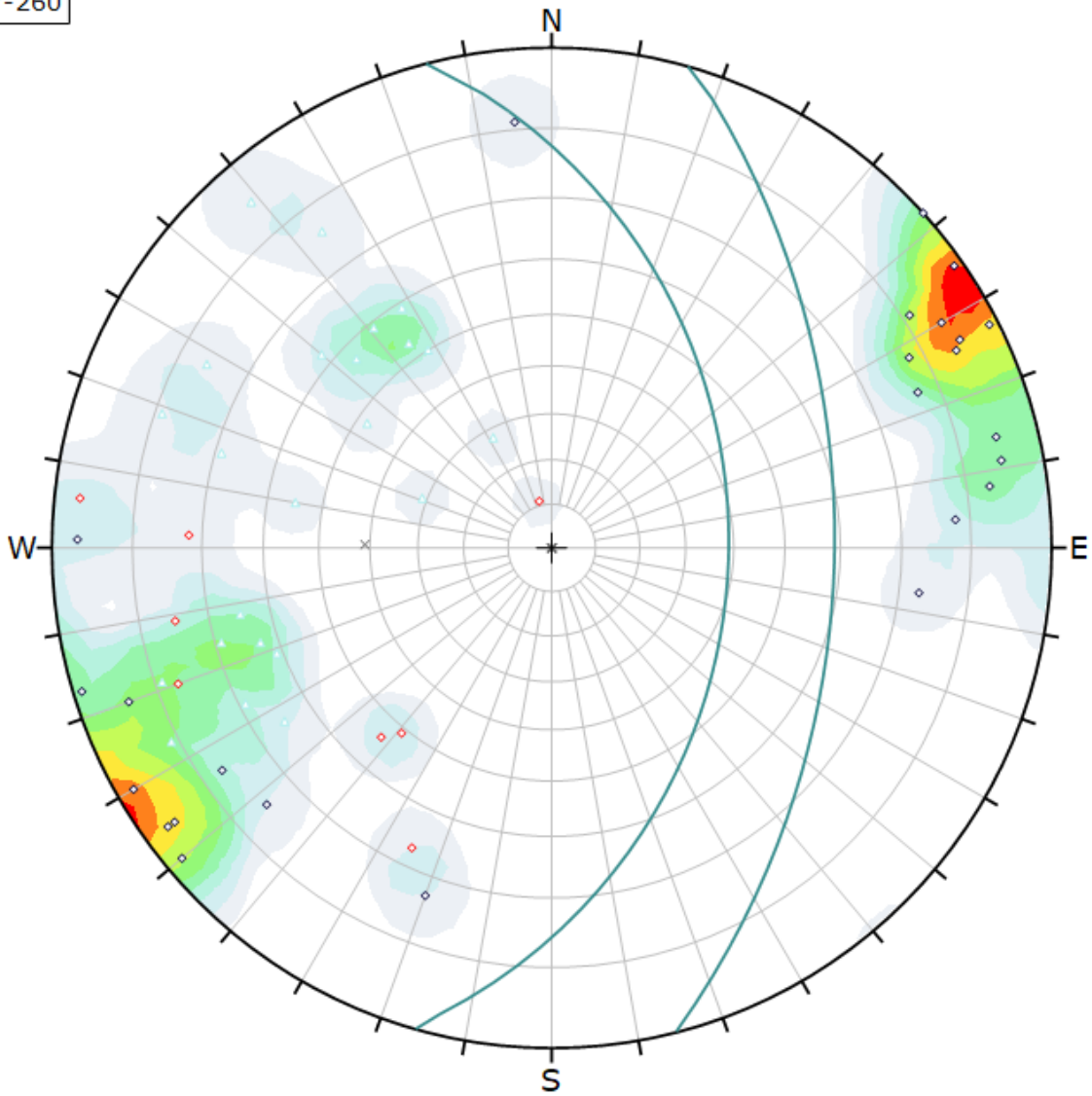
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-17-258
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-35**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-260



Symbol	TYPE	Quantity
◇	BD	25
◇	JT	8
△	RF	23

Color	Density Concentrations
	0.00 - 1.40
	1.40 - 2.80
	2.80 - 4.20
	4.20 - 5.60
	5.60 - 7.00
	7.00 - 8.40
	8.40 - 9.80
	9.80 - 11.20
	11.20 - 12.60
	12.60 - 14.00

Contour Data	Pole Vectors
Maximum Density	13.76%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	56 (56 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- ✕ Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

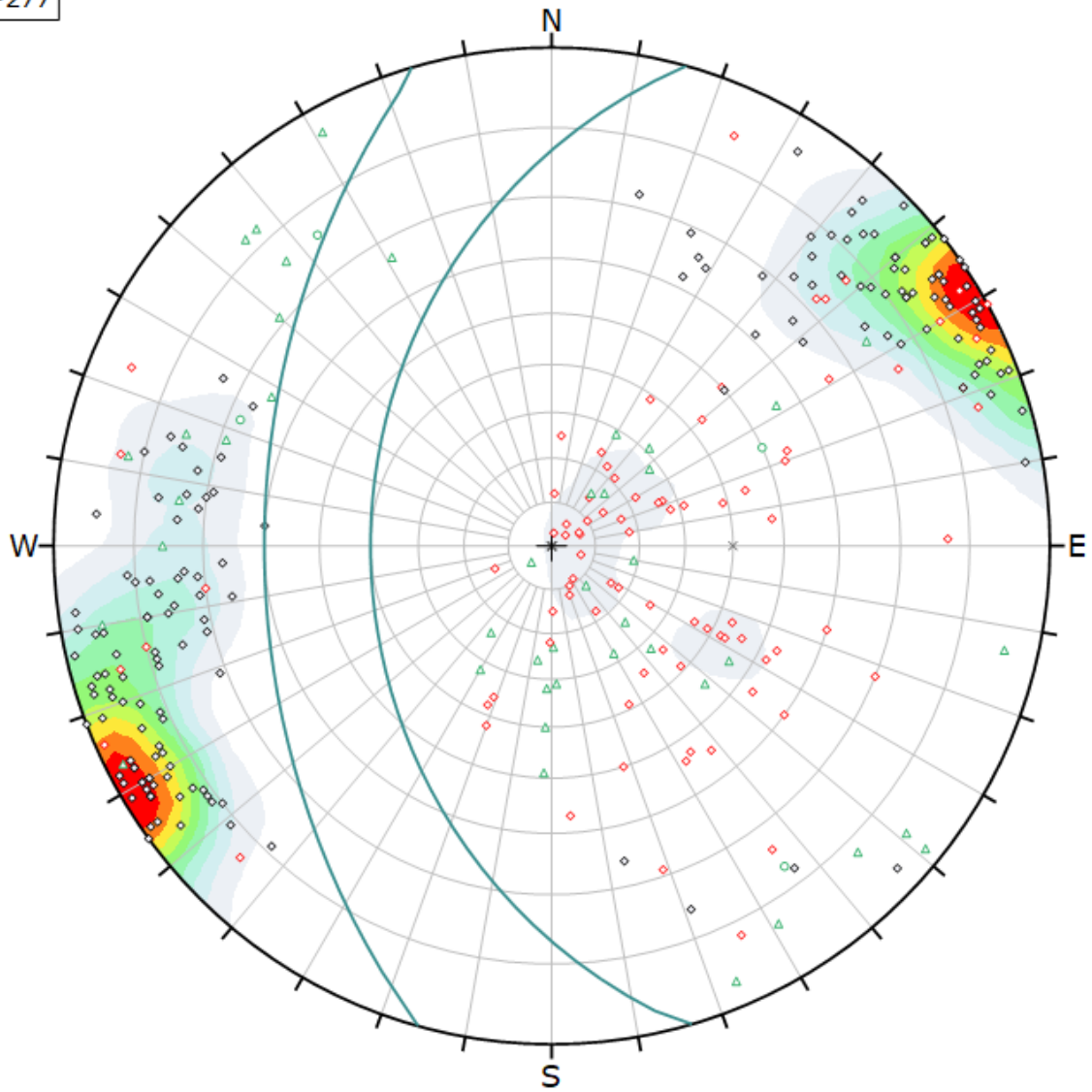
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-17-260
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-36**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-277



Symbol	TYPE	Quantity
◇	BD	161
◇	JT	86
○	SH	4
△	VN	43

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	17.00%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	294 (294 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

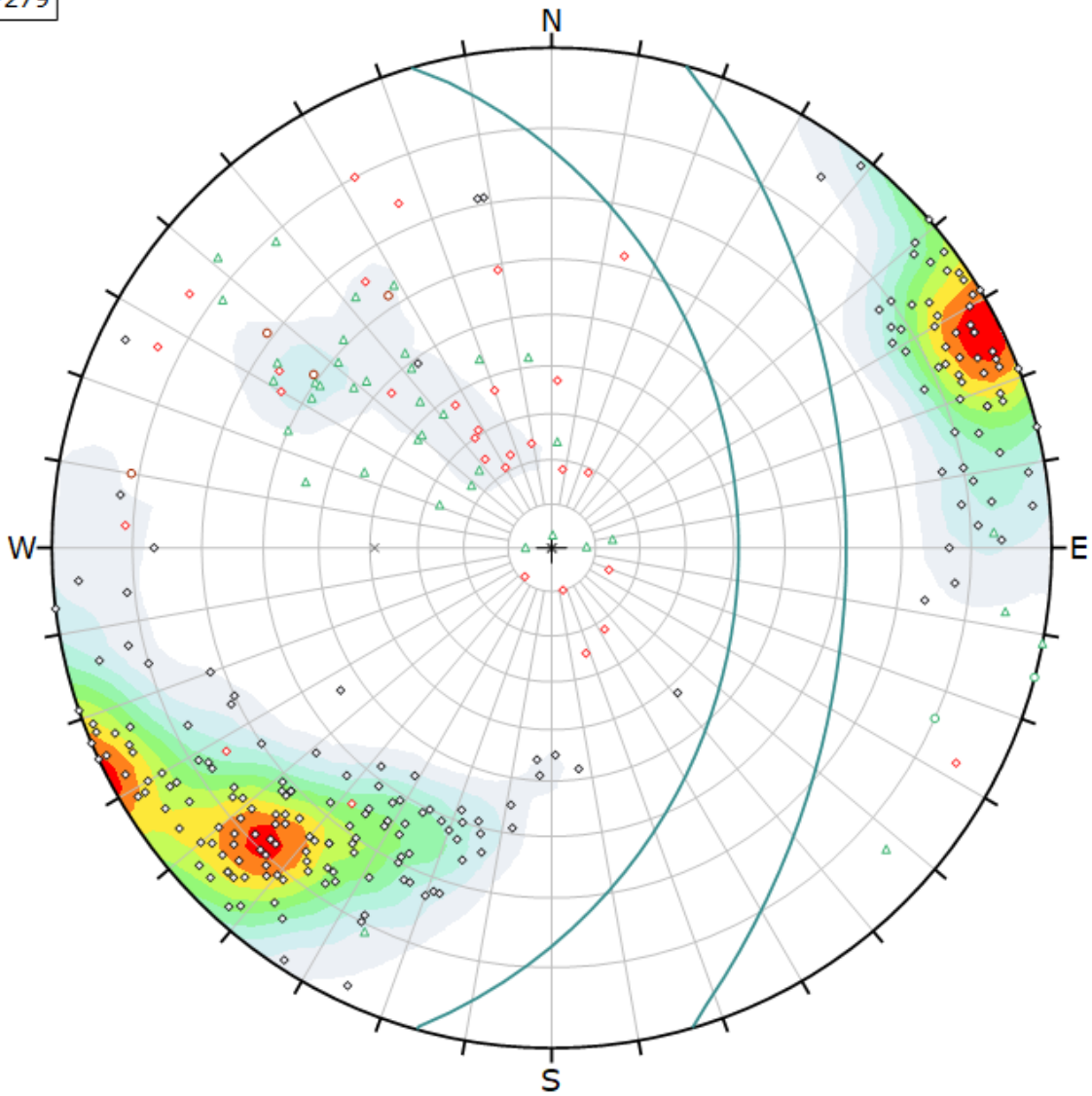
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-18-277
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-37**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-279



Symbol	TYPE	Quantity
◇	BD	203
○	FR	4
◇	JT	30
○	SH	2
△	VN	38

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Contour Data	Pole Vectors
Maximum Density	12.68%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	277 (277 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

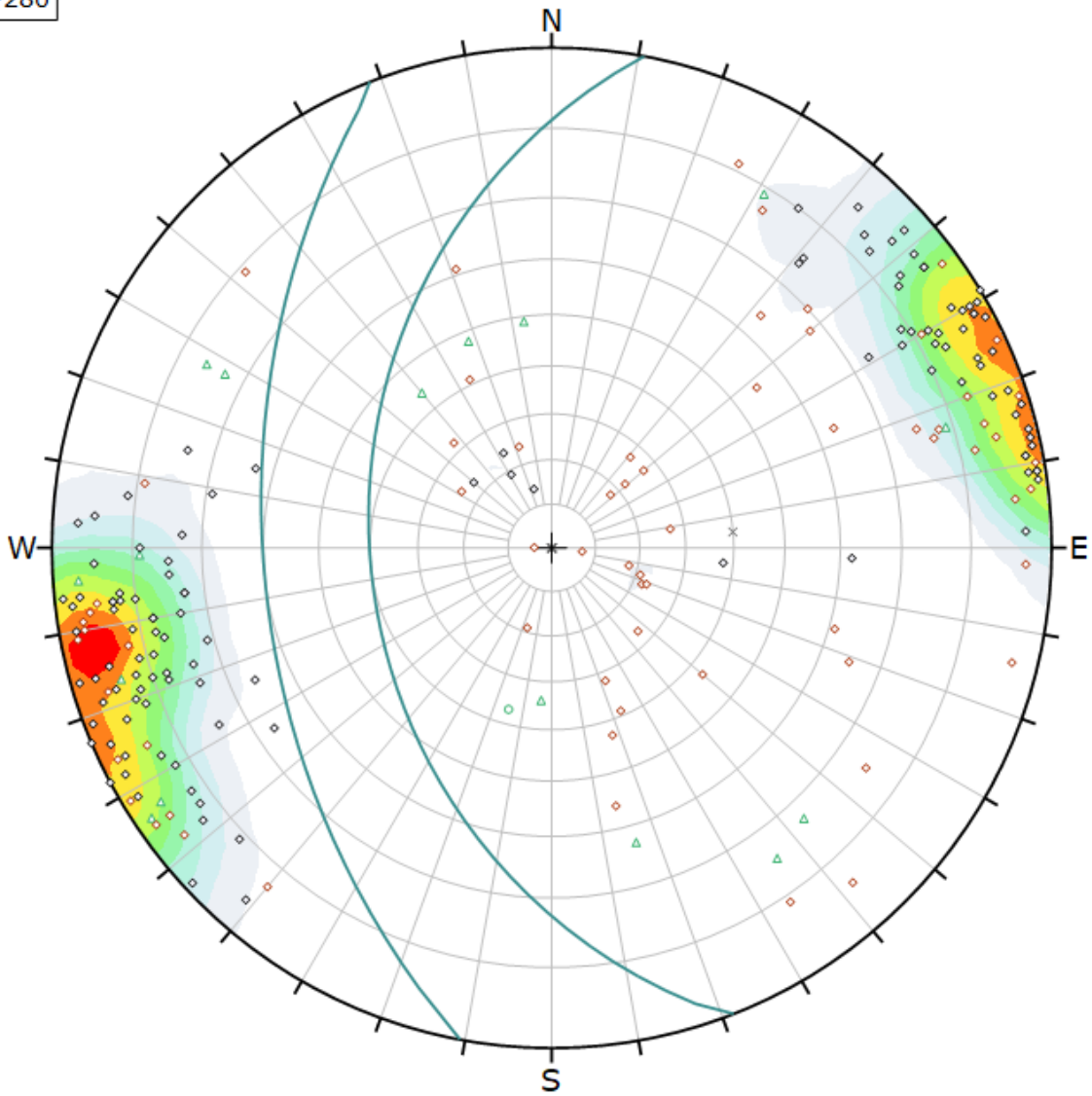
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-18-279
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-38**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-280



Symbol	TYPE	Quantity
◇	BD	120
◇	JT	67
○	SH	1
△	VN	16

Color	Density Concentrations
	0.00 - 1.90
	1.90 - 3.80
	3.80 - 5.70
	5.70 - 7.60
	7.60 - 9.50
	9.50 - 11.40
	11.40 - 13.30
	13.30 - 15.20
	15.20 - 17.10
	17.10 - 19.00

Contour Data	Pole Vectors
Maximum Density	18.64%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	204 (204 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

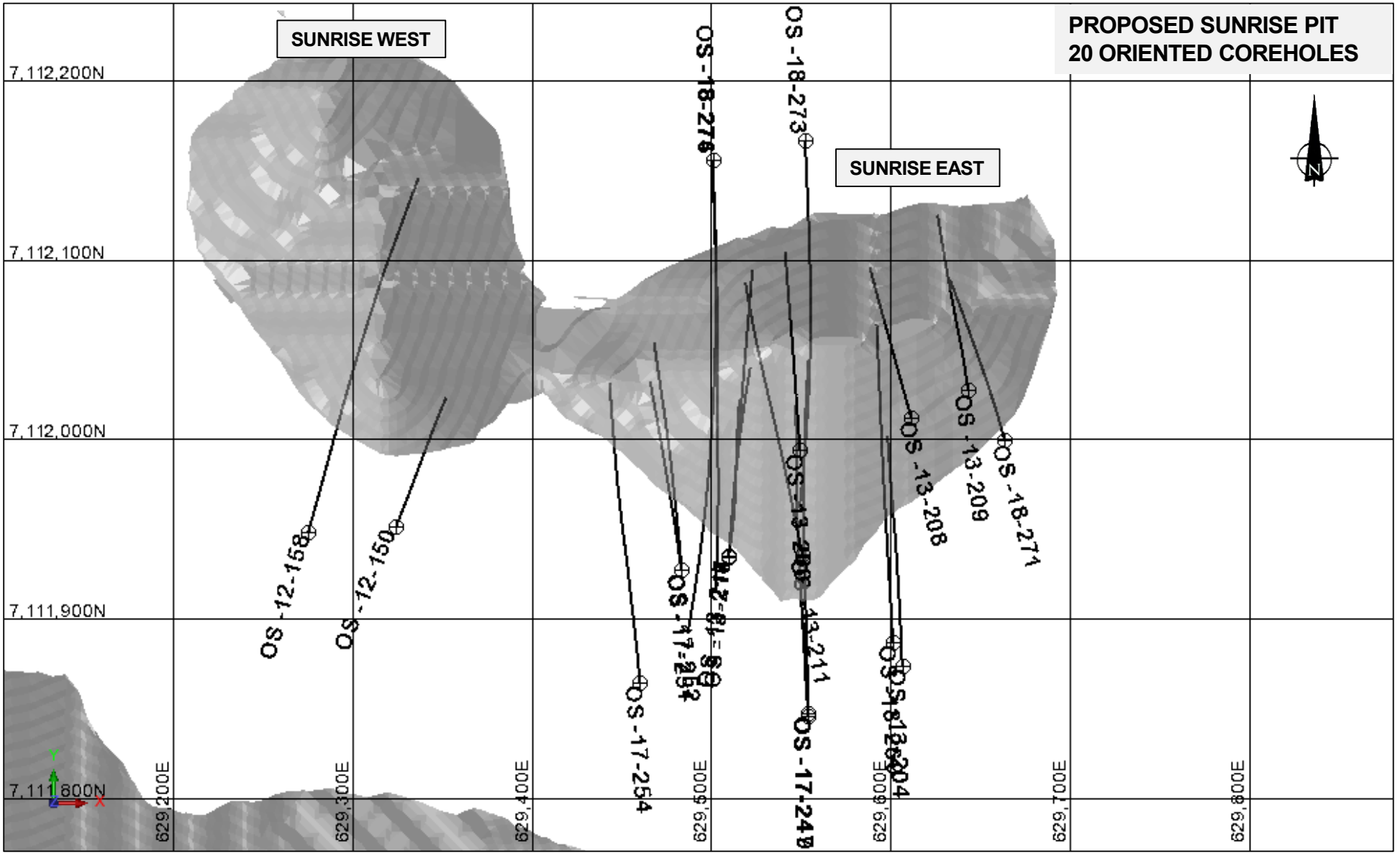
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PIT ORIENTED COREHOLE
OS-18-280
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-39**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: V:\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Oriented Core Data | File Name: Osiris_Oriented Core Stereonets_All Boreholes.pptx



Legend

- Corehole Collar
- Corehole Trace

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

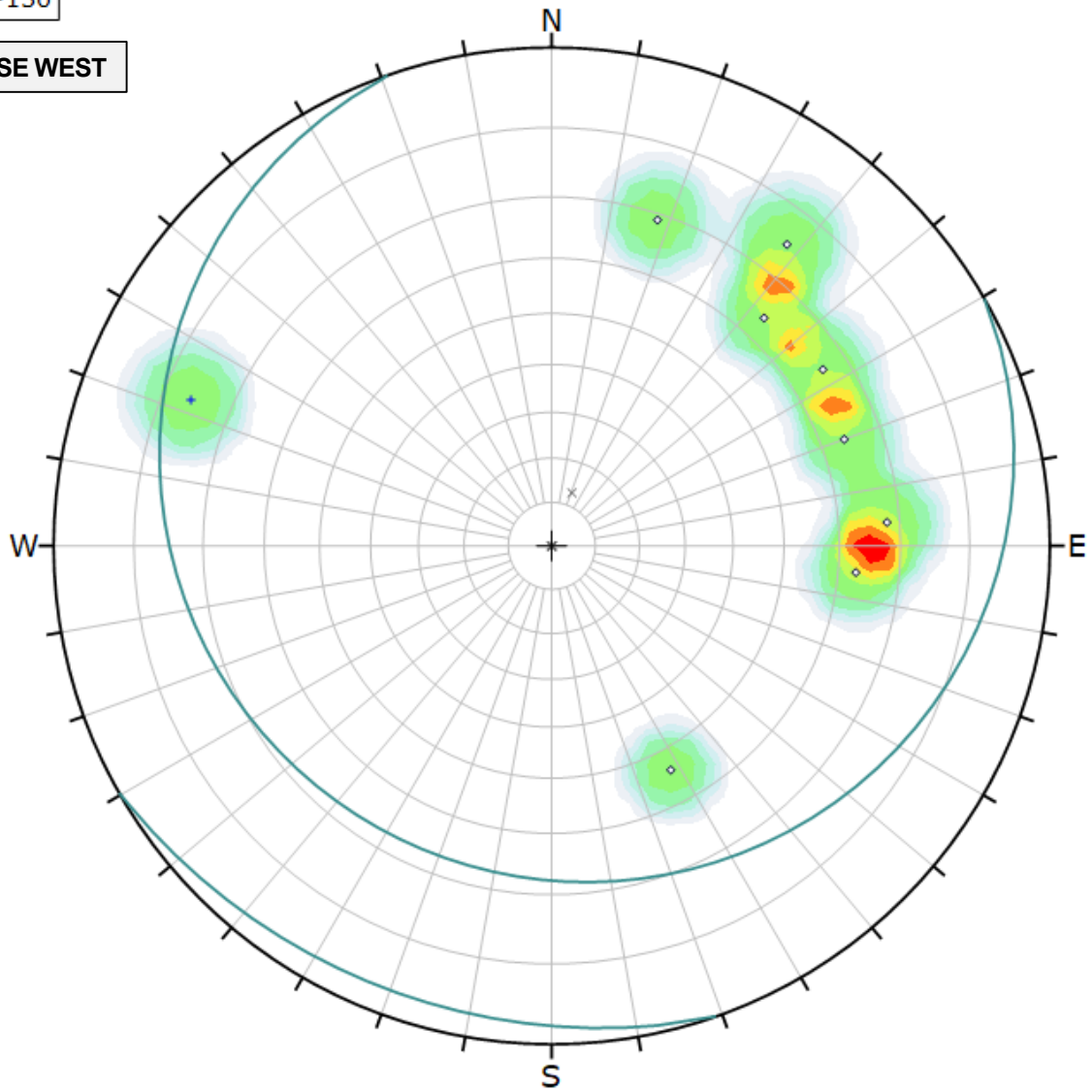
TITLE
PROPOSED SUNRISE PIT
COREHOLES WITH ORIENTED STRUCTURE DATA
PLAN VIEW

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-40**

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-12-150

SUNRISE WEST



Symbol	TYPE	Quantity
◇	BD	8
+	VT	1

Color	Density Concentrations
	0.00 - 2.00
	2.00 - 4.00
	4.00 - 6.00
	6.00 - 8.00
	8.00 - 10.00
	10.00 - 12.00
	12.00 - 14.00
	14.00 - 16.00
	16.00 - 18.00
	18.00 - 20.00

Contour Data	Pole Vectors
Maximum Density	19.93%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	9 (9 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

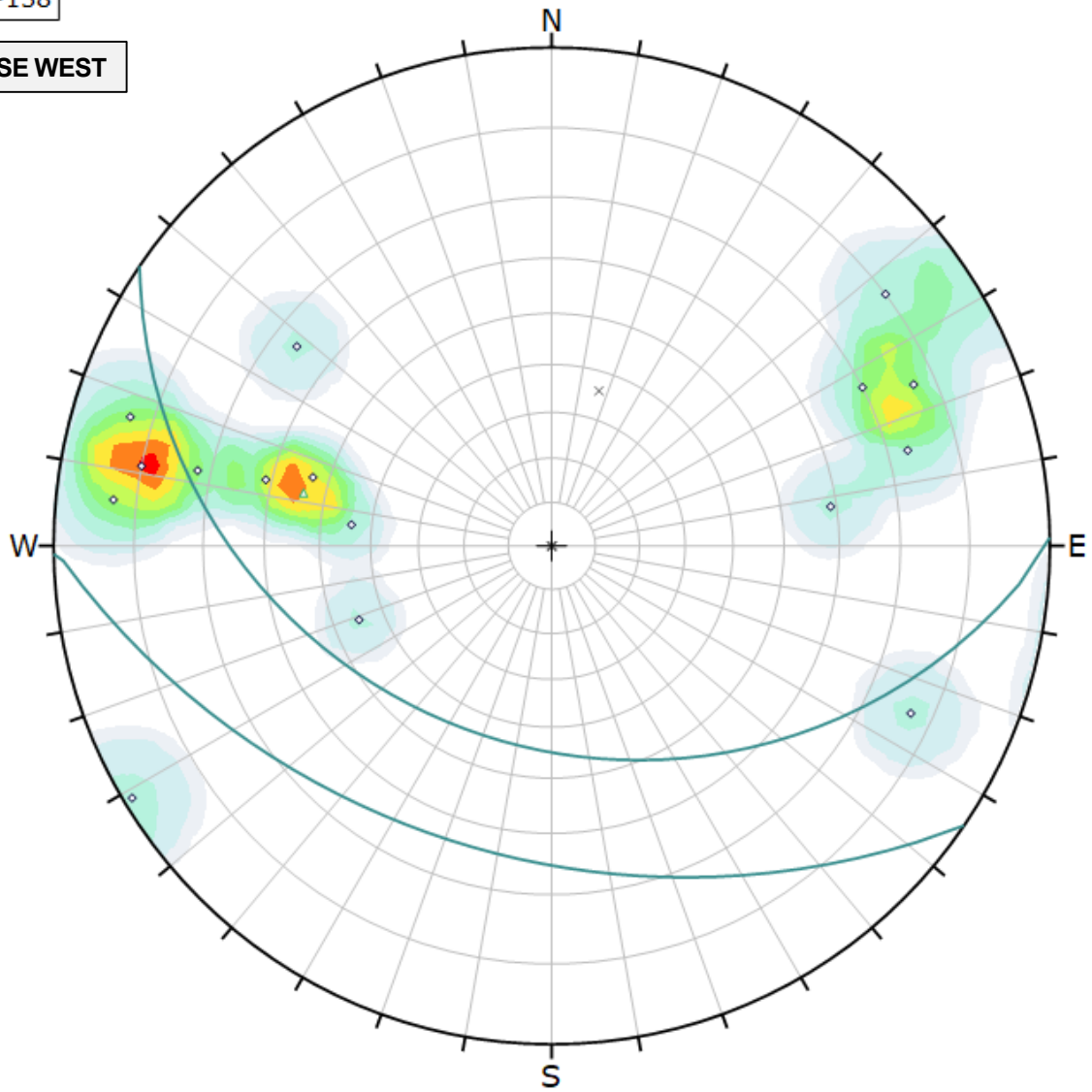
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-12-150
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-41**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-12-158

SUNRISE WEST



Symbol	TYPE	Quantity
◇	BD	16
△	VN	1

Color	Density Concentrations
	0.00 - 1.90
	1.90 - 3.80
	3.80 - 5.70
	5.70 - 7.60
	7.60 - 9.50
	9.50 - 11.40
	11.40 - 13.30
	13.30 - 15.20
	15.20 - 17.10
	17.10 - 19.00

Contour Data	Pole Vectors
Maximum Density	18.27%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	17 (17 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

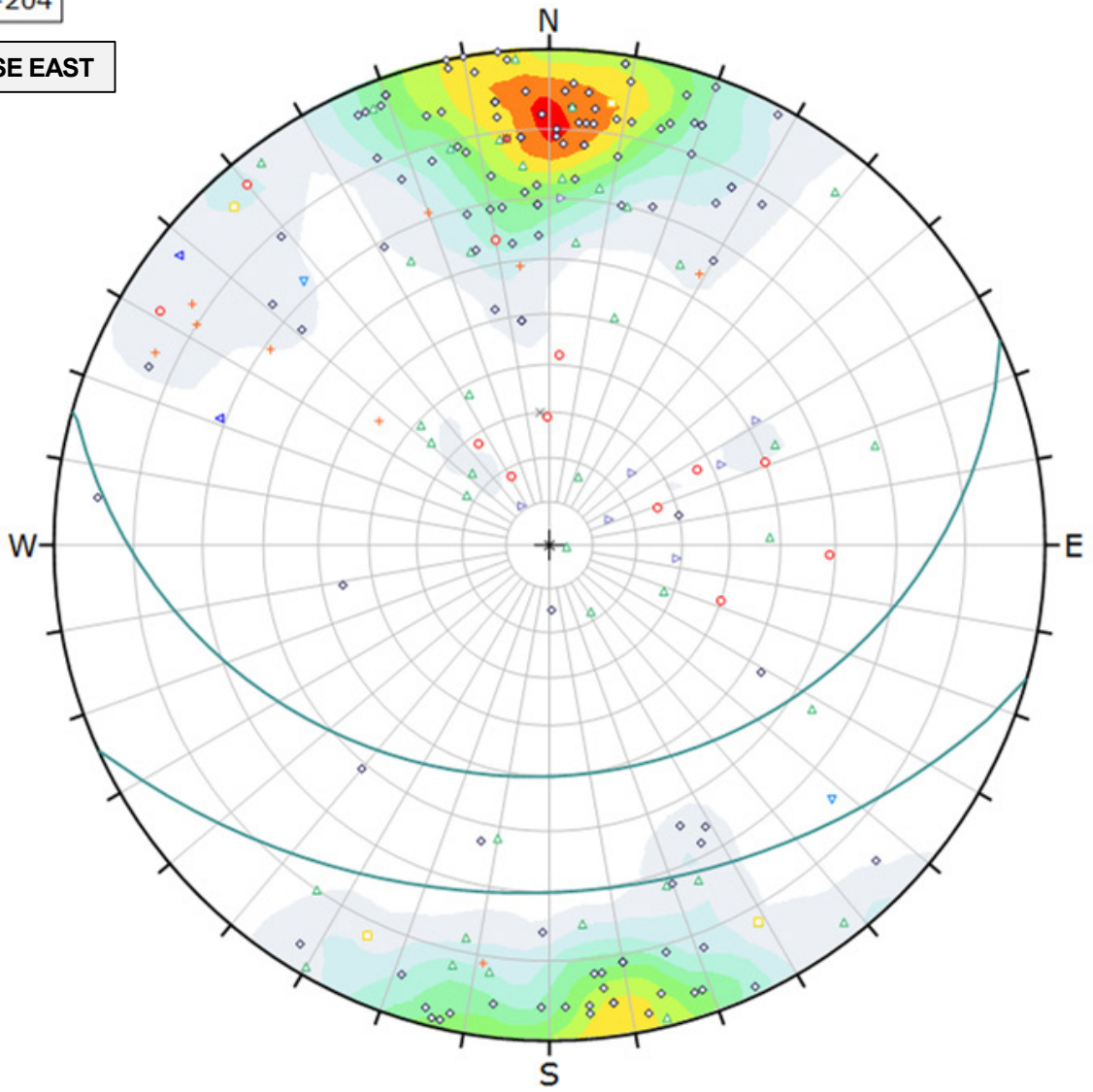
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-12-158
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-42**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-13-204

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	122
×	BX	1
△	FR	41
+	FT	10
▽	SH	2
□	SS	4
◁	SY	2
○	VN	12
▷	VT	7

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Contour Data	Pole Vectors
Maximum Density	12.29%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	201 (201 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

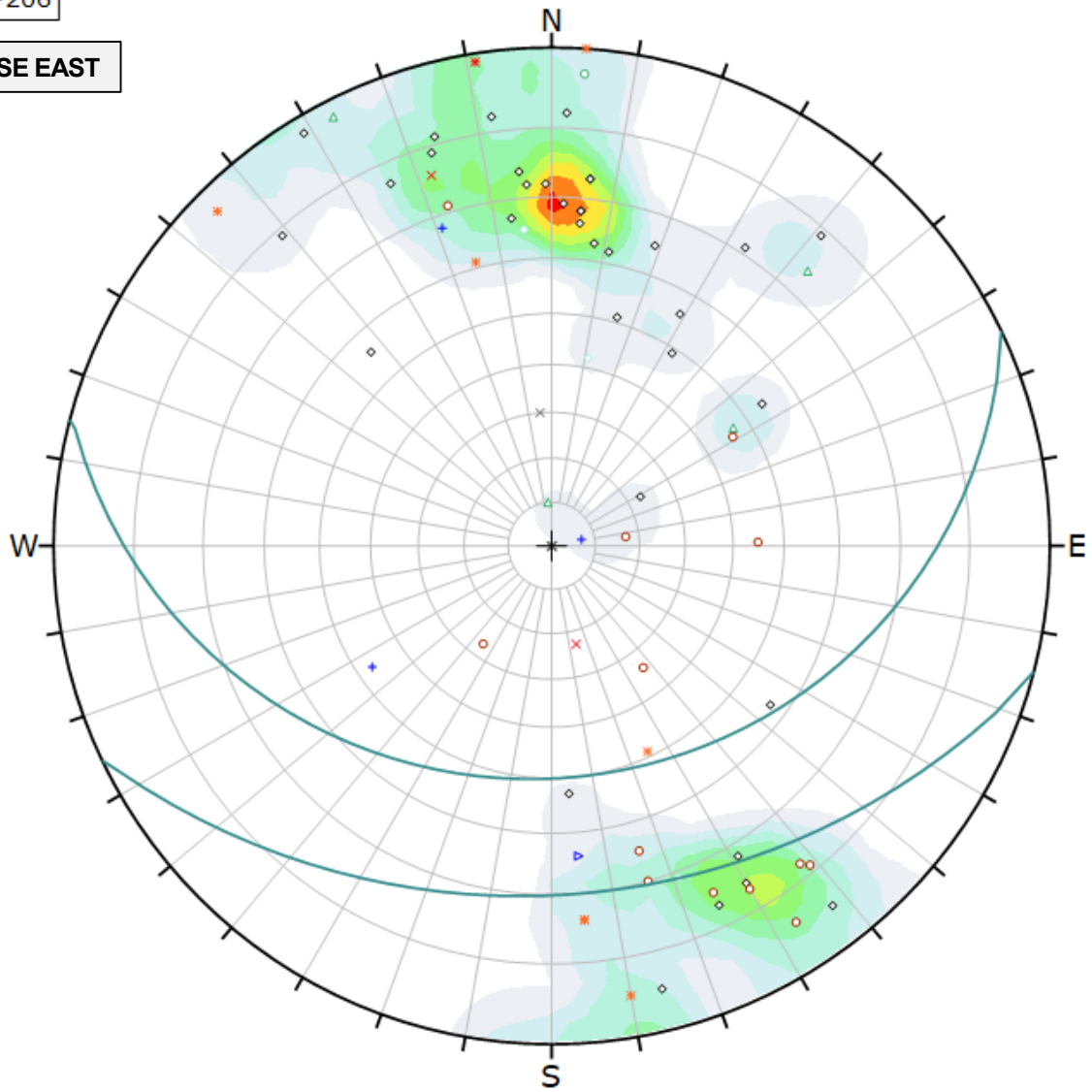
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-13-204
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-43**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-13-206

SUNRISE EAST



Symbol	TYPE	Quantity
▷	AP	1
◇	BD	35
○	FR	13
×	FT	3
○	RF	3
○	SH	1
✳	SN	7
+	SS	1
△	VN	4
+	VT	3

Color	Density Concentrations
	0.00 - 1.40
	1.40 - 2.80
	2.80 - 4.20
	4.20 - 5.60
	5.60 - 7.00
	7.00 - 8.40
	8.40 - 9.80
	9.80 - 11.20
	11.20 - 12.60
	12.60 - 14.00

Contour Data	Pole Vectors
Maximum Density	13.09%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	71 (71 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

× Corehole Trend and Plunge

Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

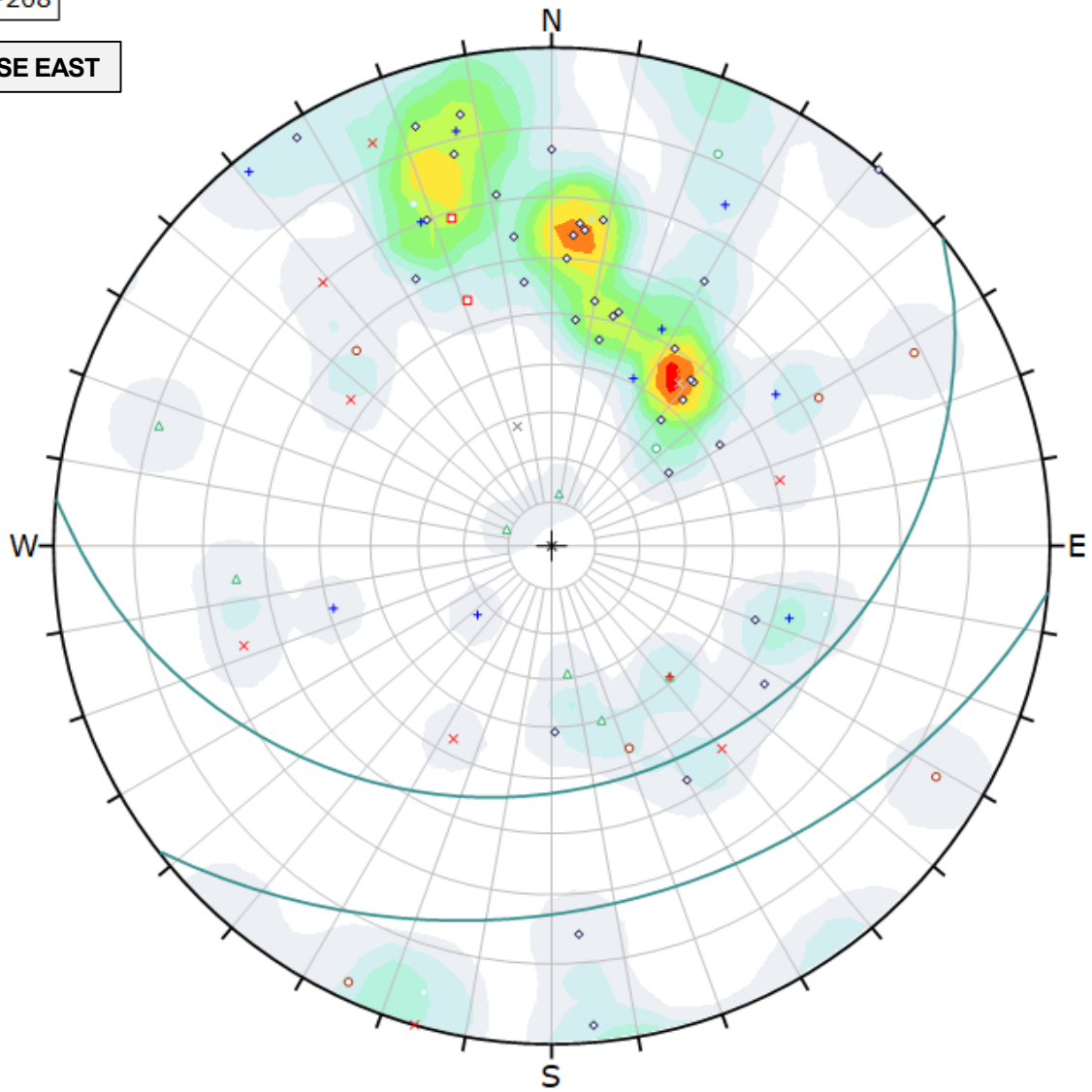
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-13-206
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-44**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-13-208

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	35
×	FO	4
○	FR	6
×	FT	9
○	RF	3
○	SH	2
+	SS	1
□	SY	2
△	VN	7
+	VT	10

Color	Density Concentrations
	0.00 - 0.90
	0.90 - 1.80
	1.80 - 2.70
	2.70 - 3.60
	3.60 - 4.50
	4.50 - 5.40
	5.40 - 6.30
	6.30 - 7.20
	7.20 - 8.10
	8.10 - 9.00

Contour Data	Pole Vectors
Maximum Density	8.51%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	79 (79 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

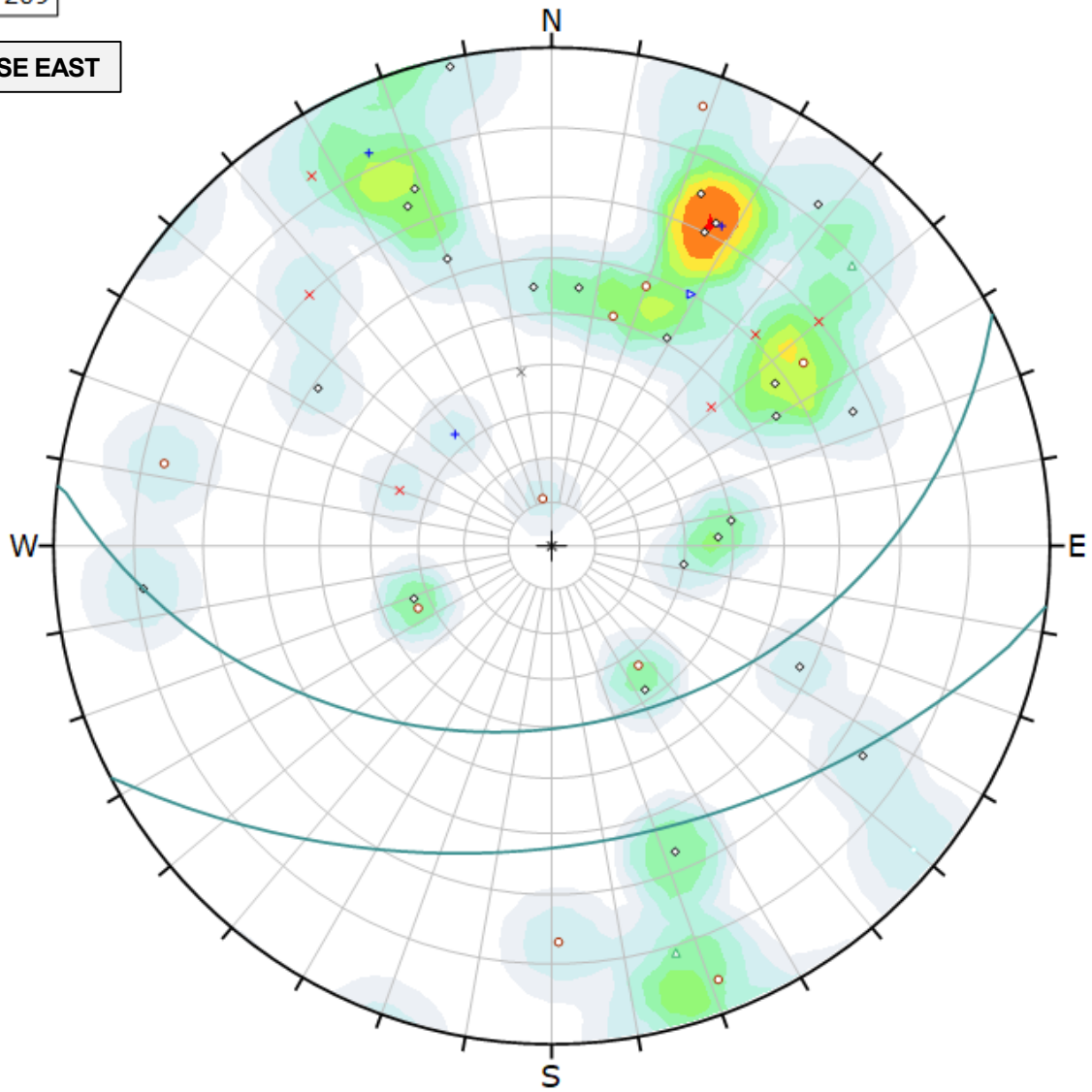
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-13-208
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-45**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-13-209

SUNRISE EAST



Symbol	TYPE	Quantity
▷	AP	1
◇	BD	24
○	FR	10
×	FT	6
◇	RF	2
△	VN	2
+	VT	3

Color	Density Concentrations
	0.00 - 0.90
	0.90 - 1.80
	1.80 - 2.70
	2.70 - 3.60
	3.60 - 4.50
	4.50 - 5.40
	5.40 - 6.30
	6.30 - 7.20
	7.20 - 8.10
	8.10 - 9.00

Contour Data	Pole Vectors
Maximum Density	8.16%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	48 (48 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

× Corehole Trend and Plunge

Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

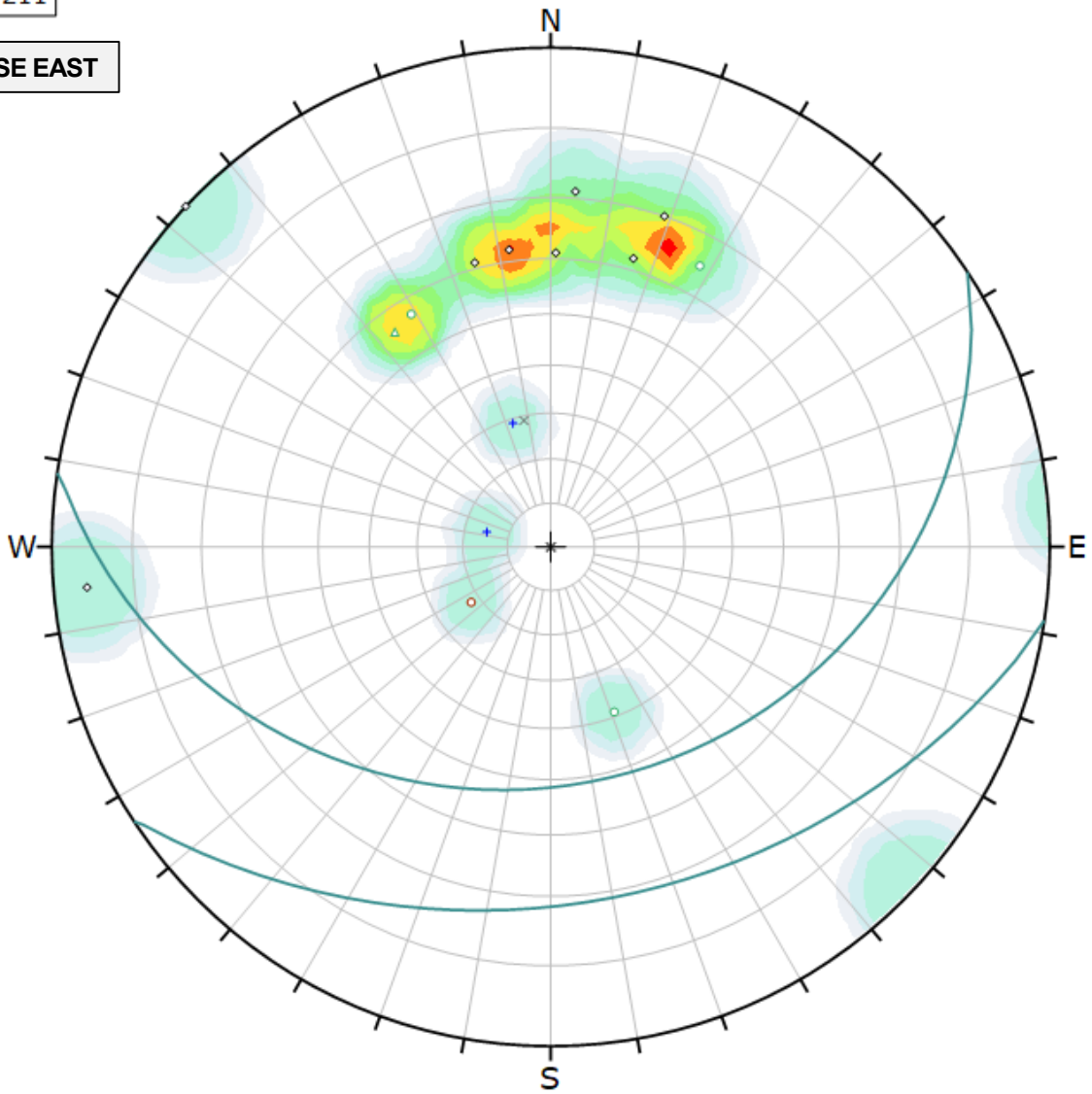
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-13-209
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-46**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-13-211

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	8
○	FR	1
○	SH	3
△	VN	1
+	VT	2

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.62%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	15 (15 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

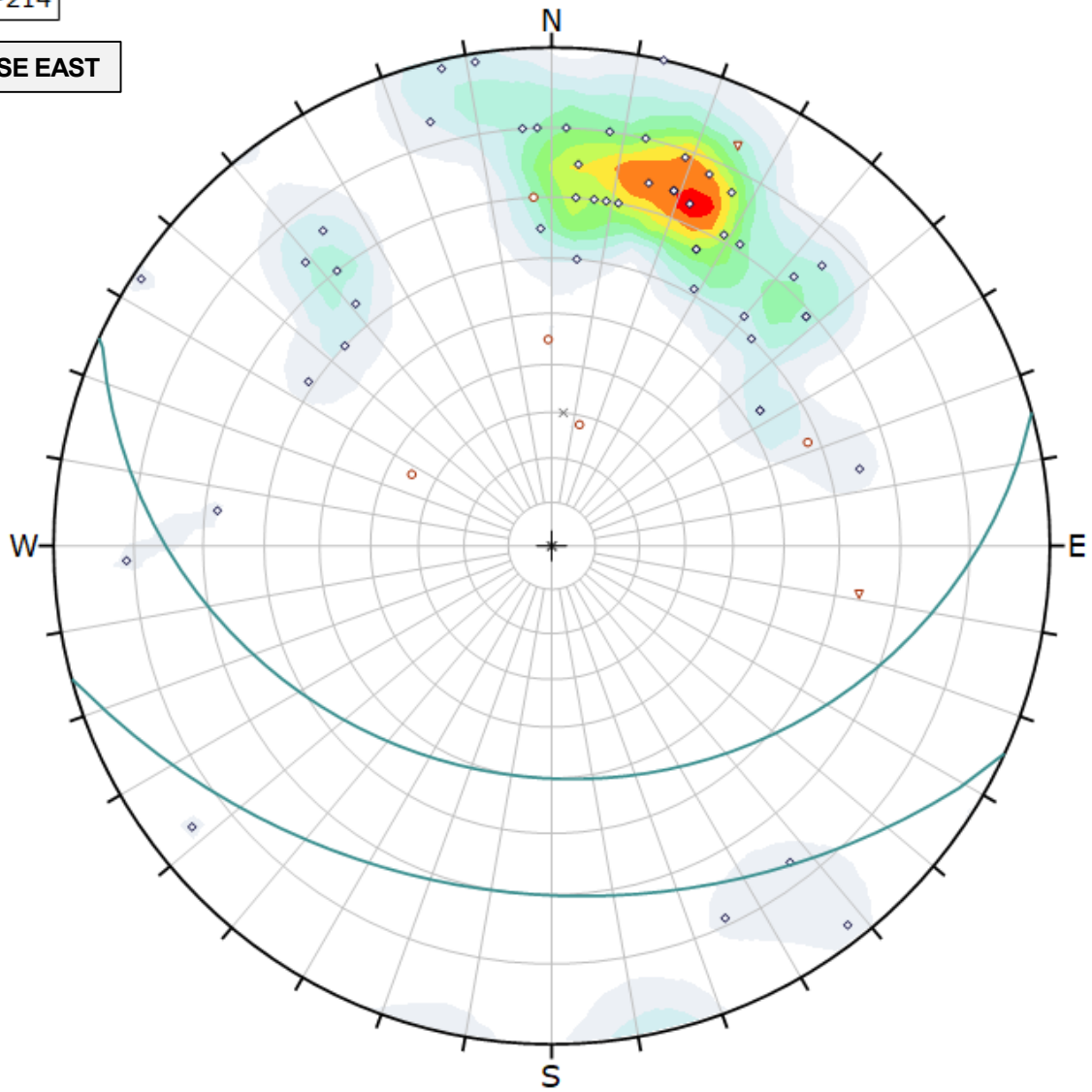
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-13-211
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-47**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-13-214

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	51
▽	FD	2
○	FR	5

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.46%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	58 (58 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

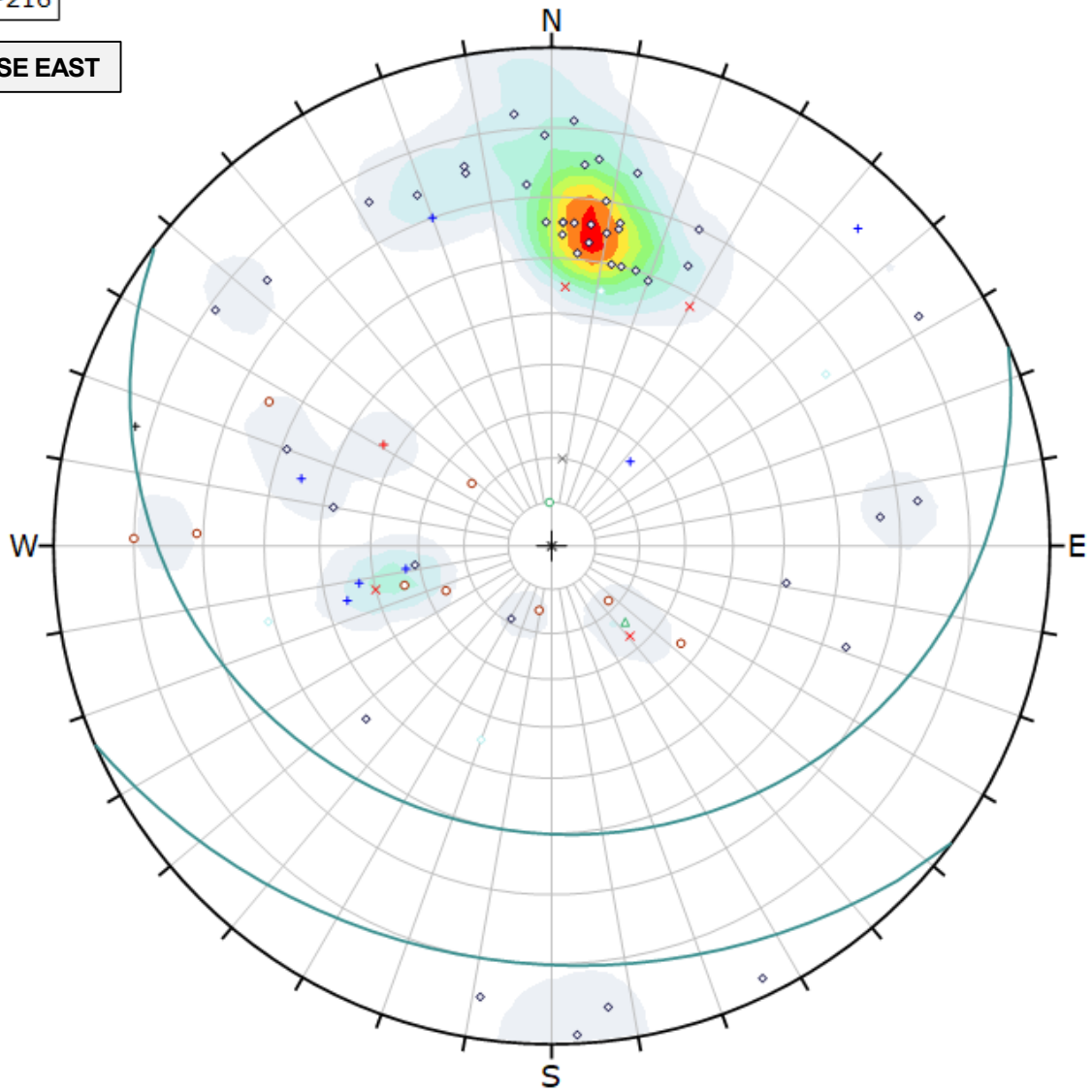
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-13-214
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-48**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-13-216

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	45
○	FR	9
×	FT	4
◦	RF	5
○	SH	1
+	SS	1
+	ST	1
△	VN	1
+	VT	7

Color	Density Concentrations
	0.00 - 1.80
	1.80 - 3.60
	3.60 - 5.40
	5.40 - 7.20
	7.20 - 9.00
	9.00 - 10.80
	10.80 - 12.60
	12.60 - 14.40
	14.40 - 16.20
	16.20 - 18.00

Contour Data	Pole Vectors
Maximum Density	17.28%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	74 (74 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- × Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

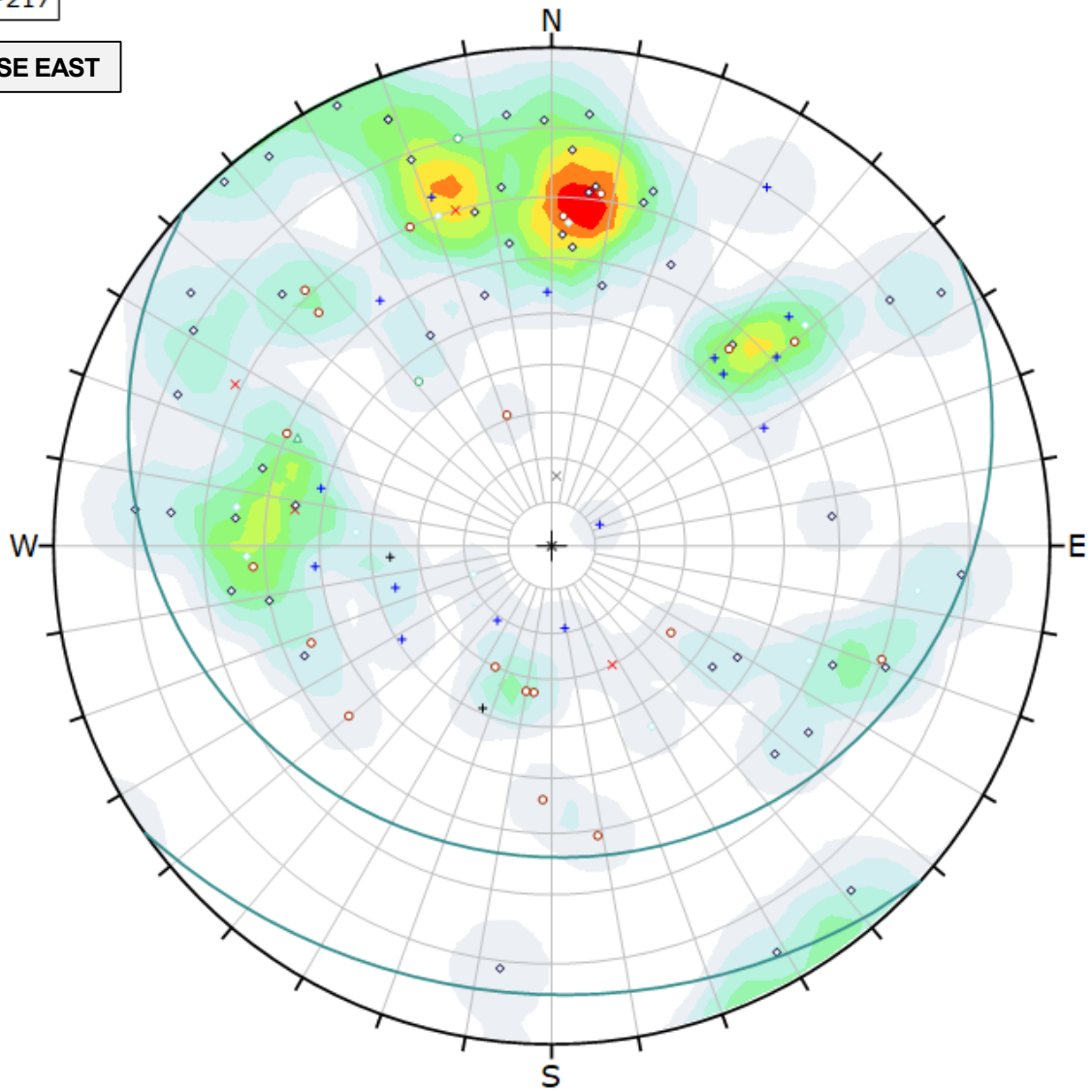
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-13-216
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D1-49

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-13-217

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	49
○	FR	19
×	FT	4
◦	RF	10
○	SH	2
+	ST	2
△	VN	1
+	VT	16

Color	Density Concentrations
	0.00 - 0.70
	0.70 - 1.40
	1.40 - 2.10
	2.10 - 2.80
	2.80 - 3.50
	3.50 - 4.20
	4.20 - 4.90
	4.90 - 5.60
	5.60 - 6.30
	6.30 - 7.00

Contour Data	Pole Vectors
Maximum Density	6.87%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	103 (103 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- × Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

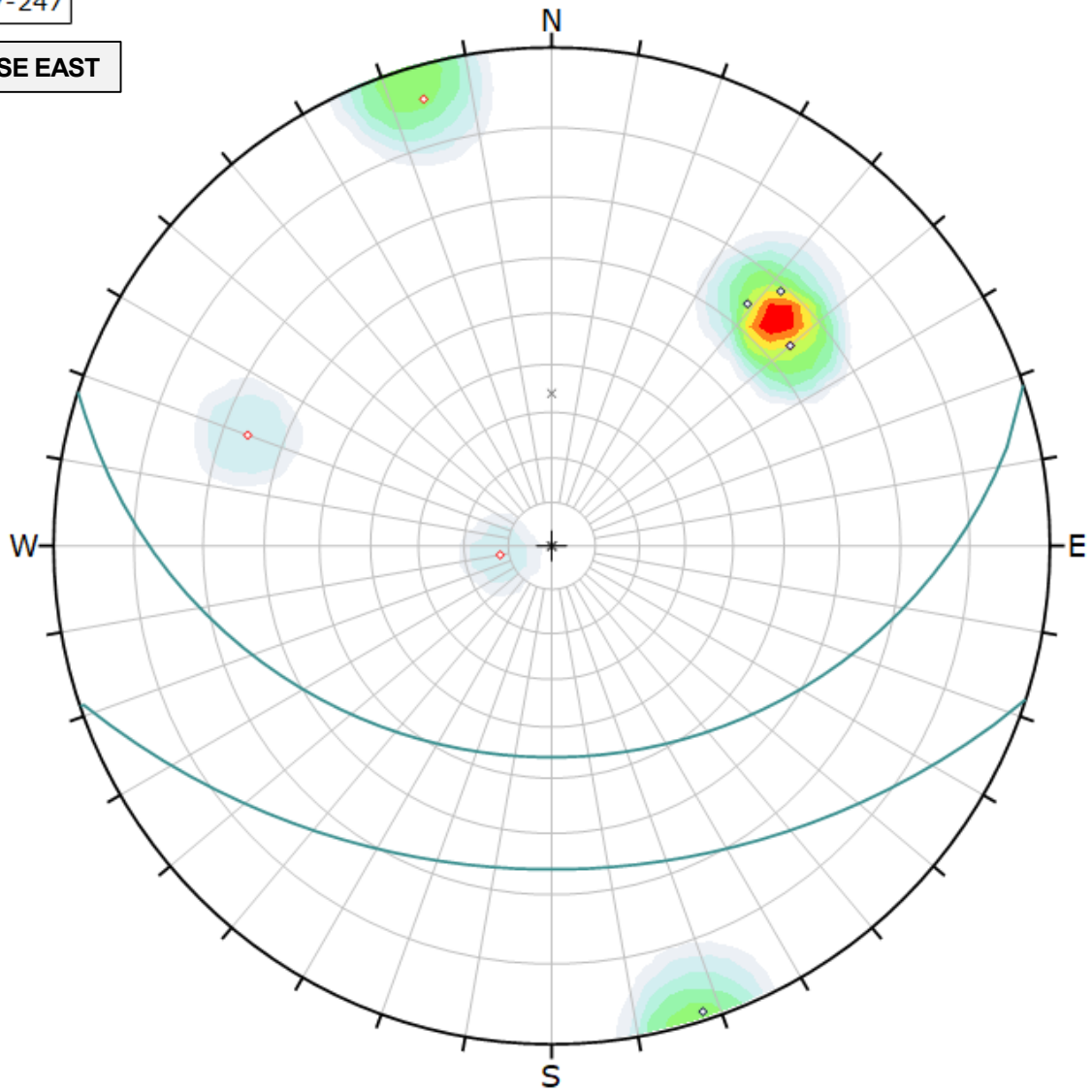
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-13-217
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-50**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-247

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	4
◇	JT	4

Color	Density Concentrations
	0.00 - 4.40
	4.40 - 8.80
	8.80 - 13.20
	13.20 - 17.60
	17.60 - 22.00
	22.00 - 26.40
	26.40 - 30.80
	30.80 - 35.20
	35.20 - 39.60
	39.60 - 44.00

Contour Data	Pole Vectors
Maximum Density	43.84%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	8 (8 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

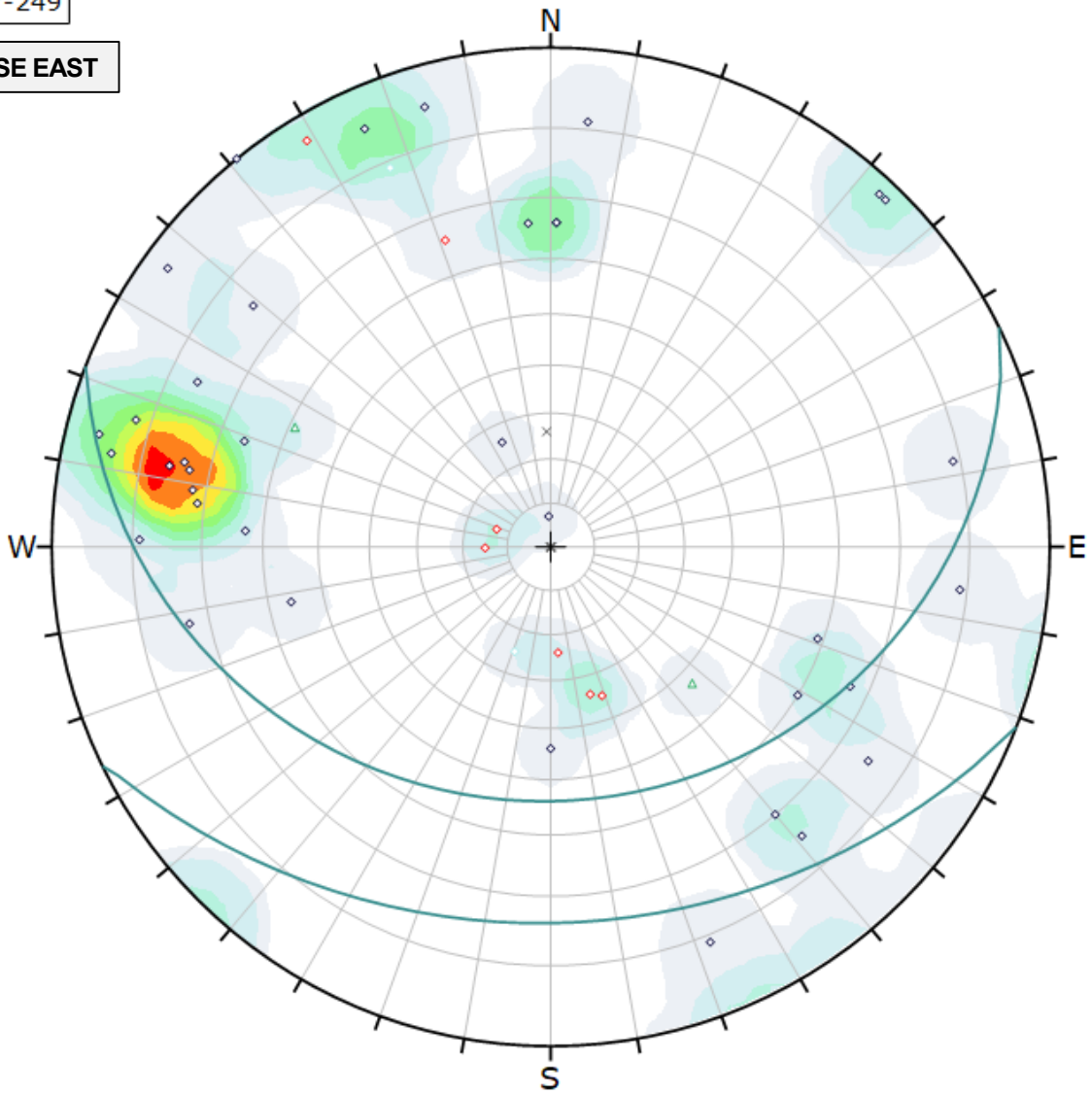
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-17-247
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-51**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-17-249

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	37
◇	JT	7
◇	RF	2
△	VN	2

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Contour Data	Pole Vectors
Maximum Density	12.47%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	48 (48 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- × Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

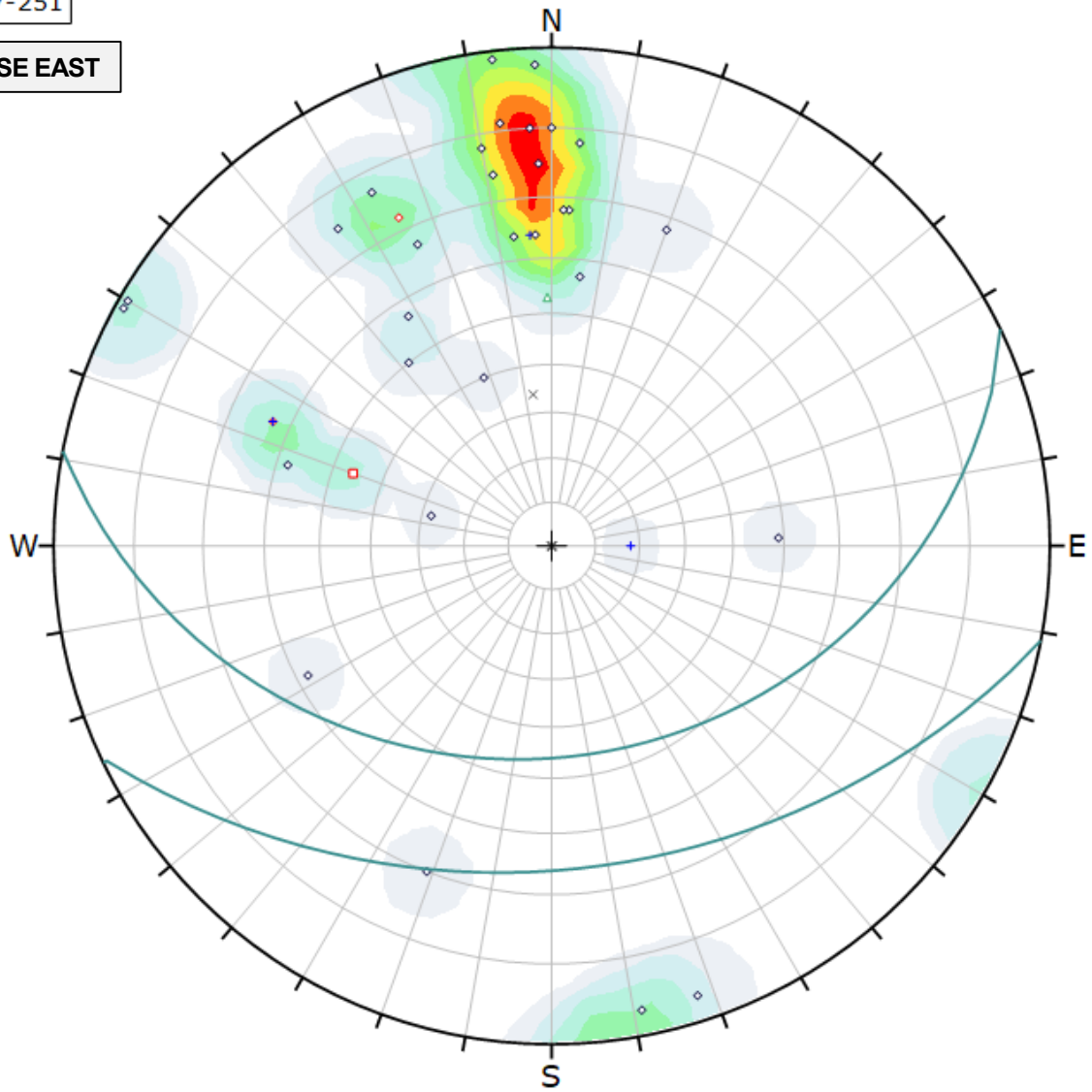
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-17-249
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-52**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-251

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	31
◇	JT	2
□	SY	1
△	VN	1
+	VT	3

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.50%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	38 (38 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

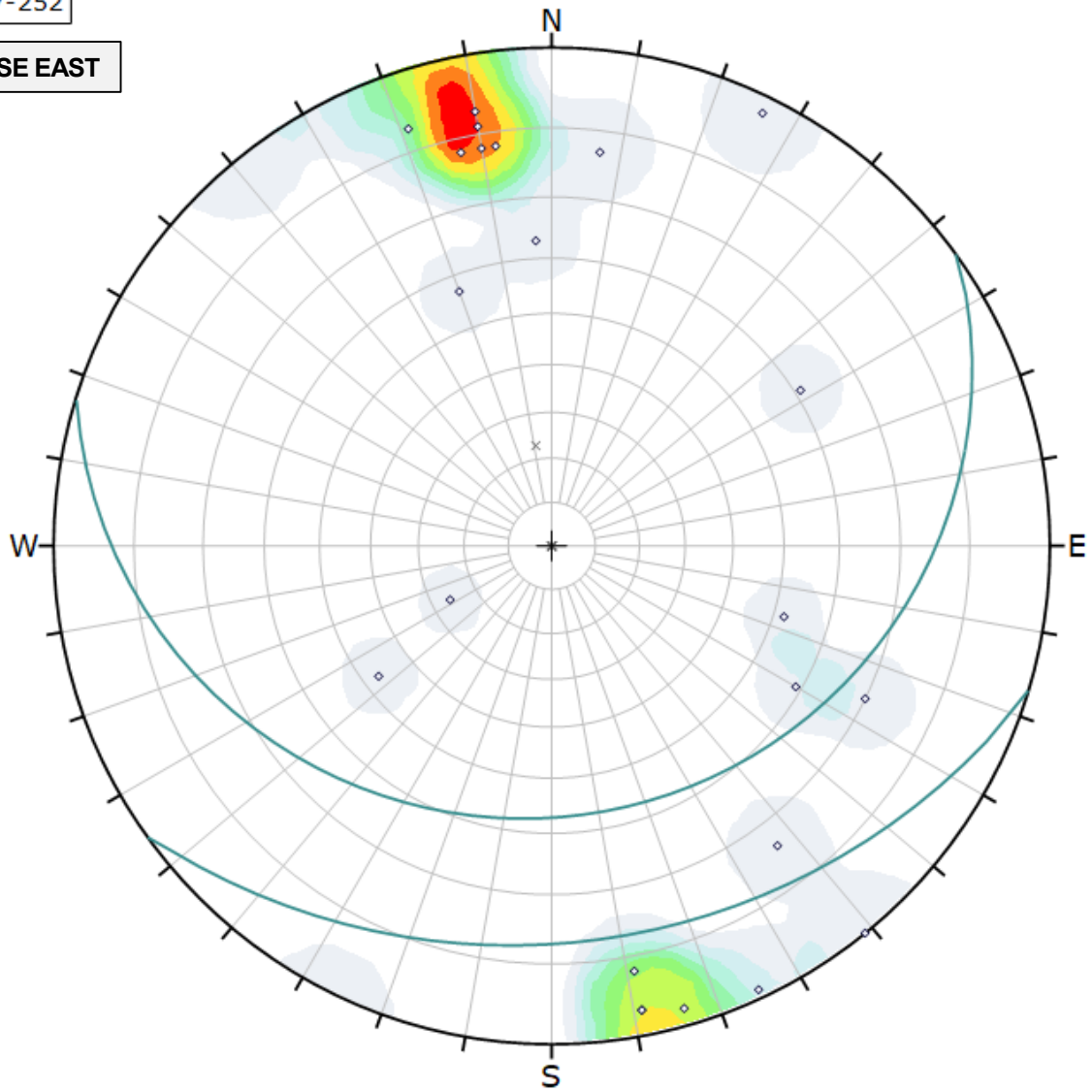
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-17-251
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-53**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-252

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	23

Color	Density Concentrations
	0.00 - 2.50
	2.50 - 5.00
	5.00 - 7.50
	7.50 - 10.00
	10.00 - 12.50
	12.50 - 15.00
	15.00 - 17.50
	17.50 - 20.00
	20.00 - 22.50
	22.50 - 25.00

Contour Data	Pole Vectors
Maximum Density	24.33%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	23 (23 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- × Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

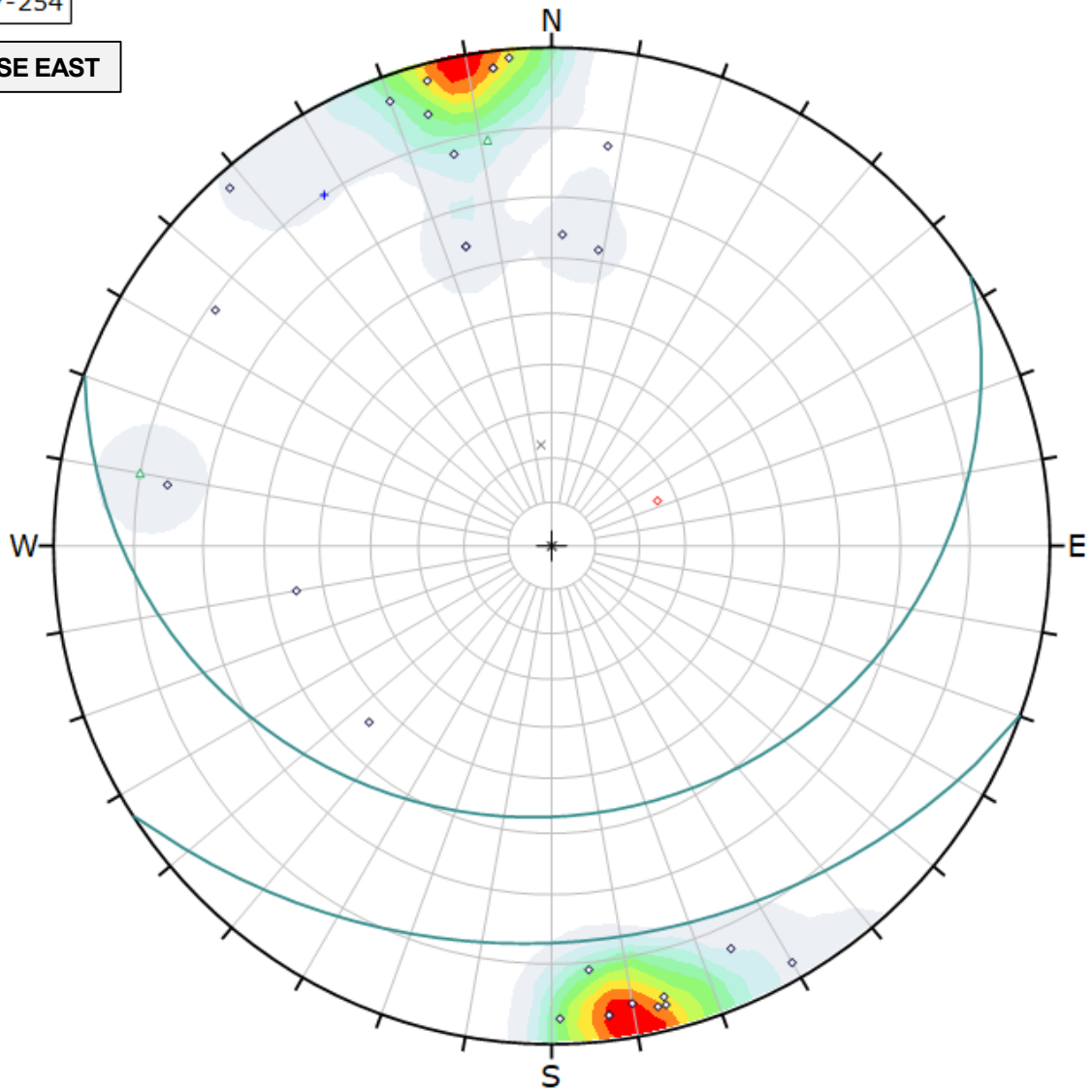
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-17-252
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-54**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-17-254

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	27
◇	JT	1
△	VN	2
+	VT	1

Color	Density Concentrations
	0.00 - 3.30
	3.30 - 6.60
	6.60 - 9.90
	9.90 - 13.20
	13.20 - 16.50
	16.50 - 19.80
	19.80 - 23.10
	23.10 - 26.40
	26.40 - 29.70
	29.70 - 33.00

Contour Data	Pole Vectors
Maximum Density	32.21%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	31 (31 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

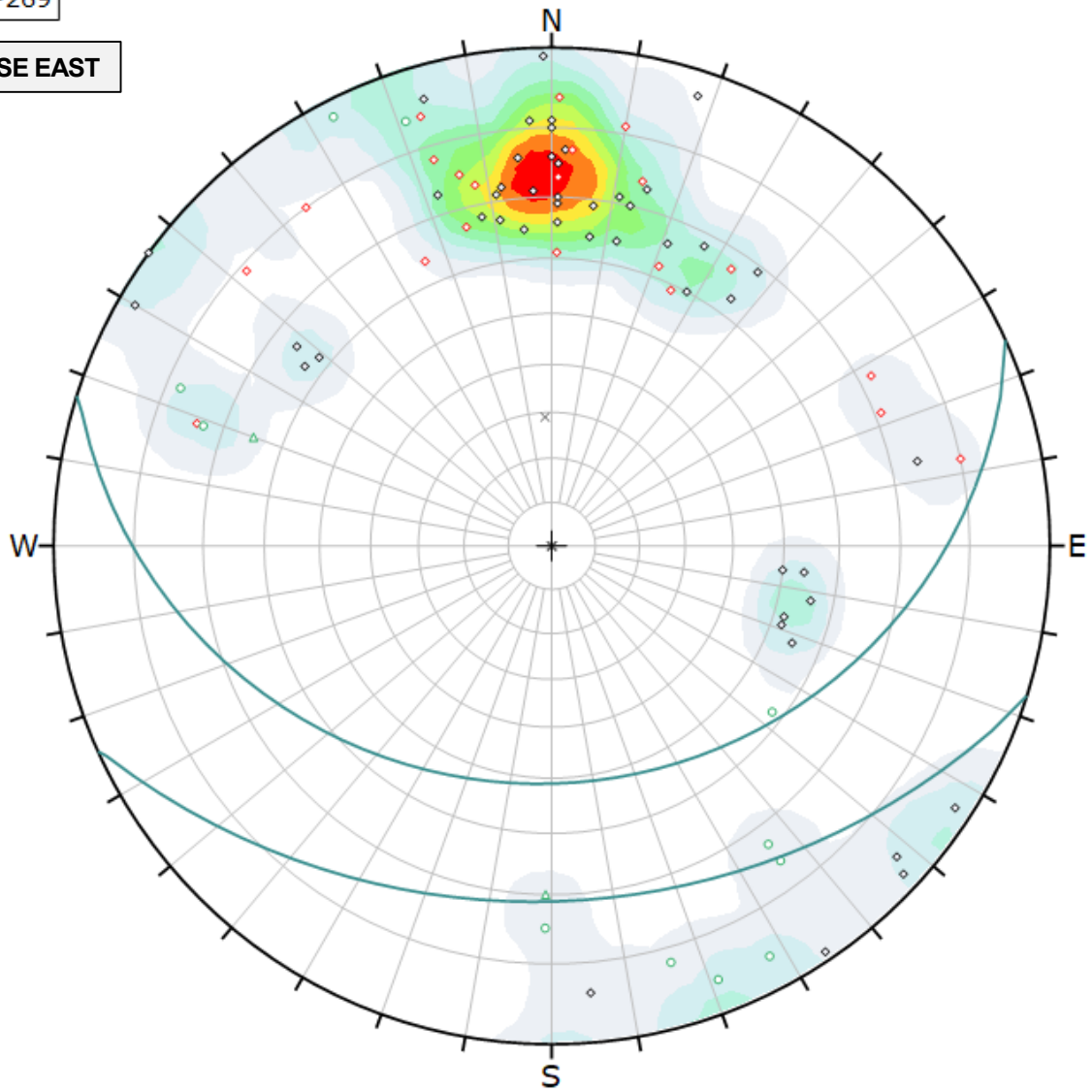
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-17-254
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-55**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

OS-18-269

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	48
◇	JT	21
○	SH	11
△	VN	2

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.89%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	82 (82 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- ✕ Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

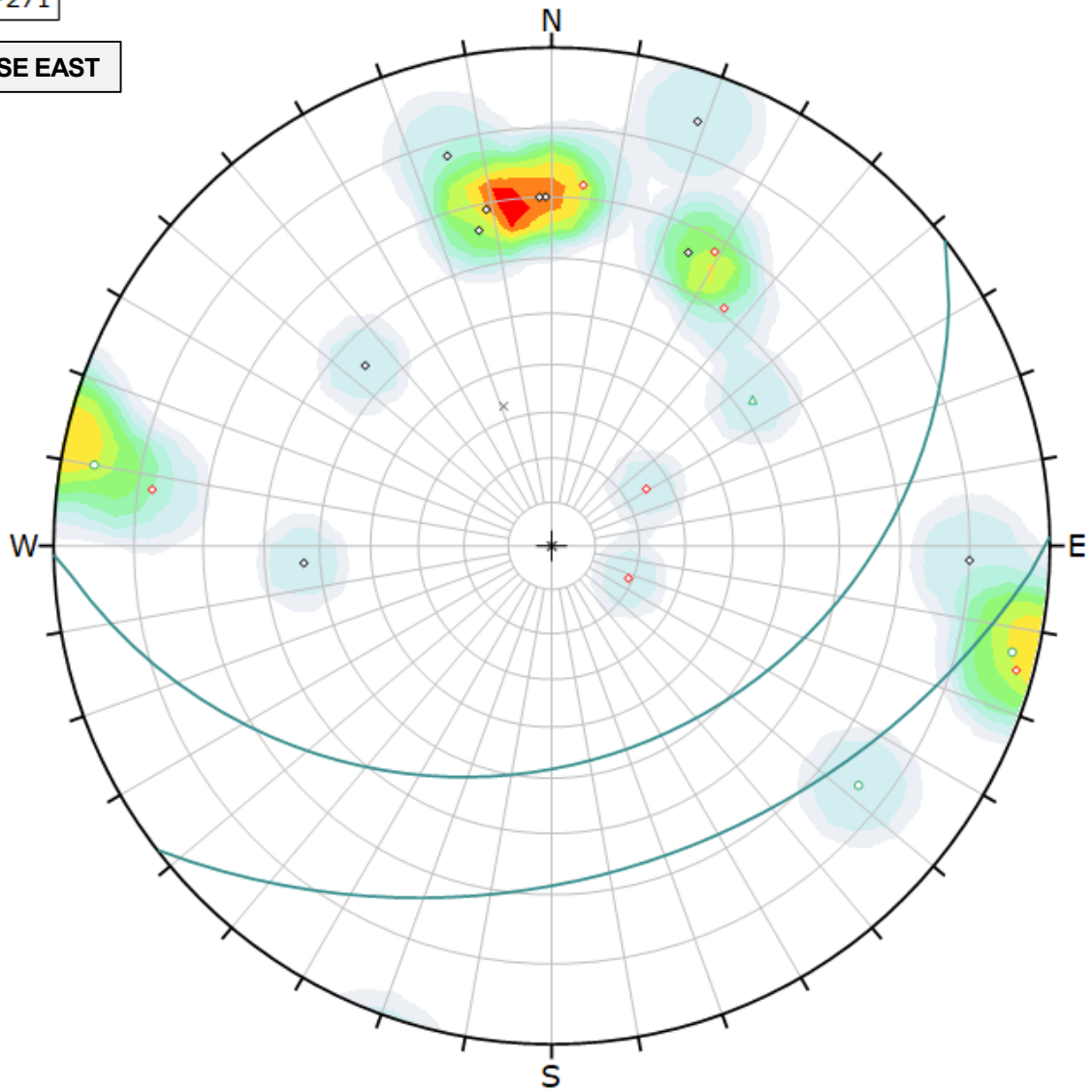
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-18-269
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-56**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-271

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	10
◇	JT	7
○	SH	3
△	VN	1

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.91%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	21 (21 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

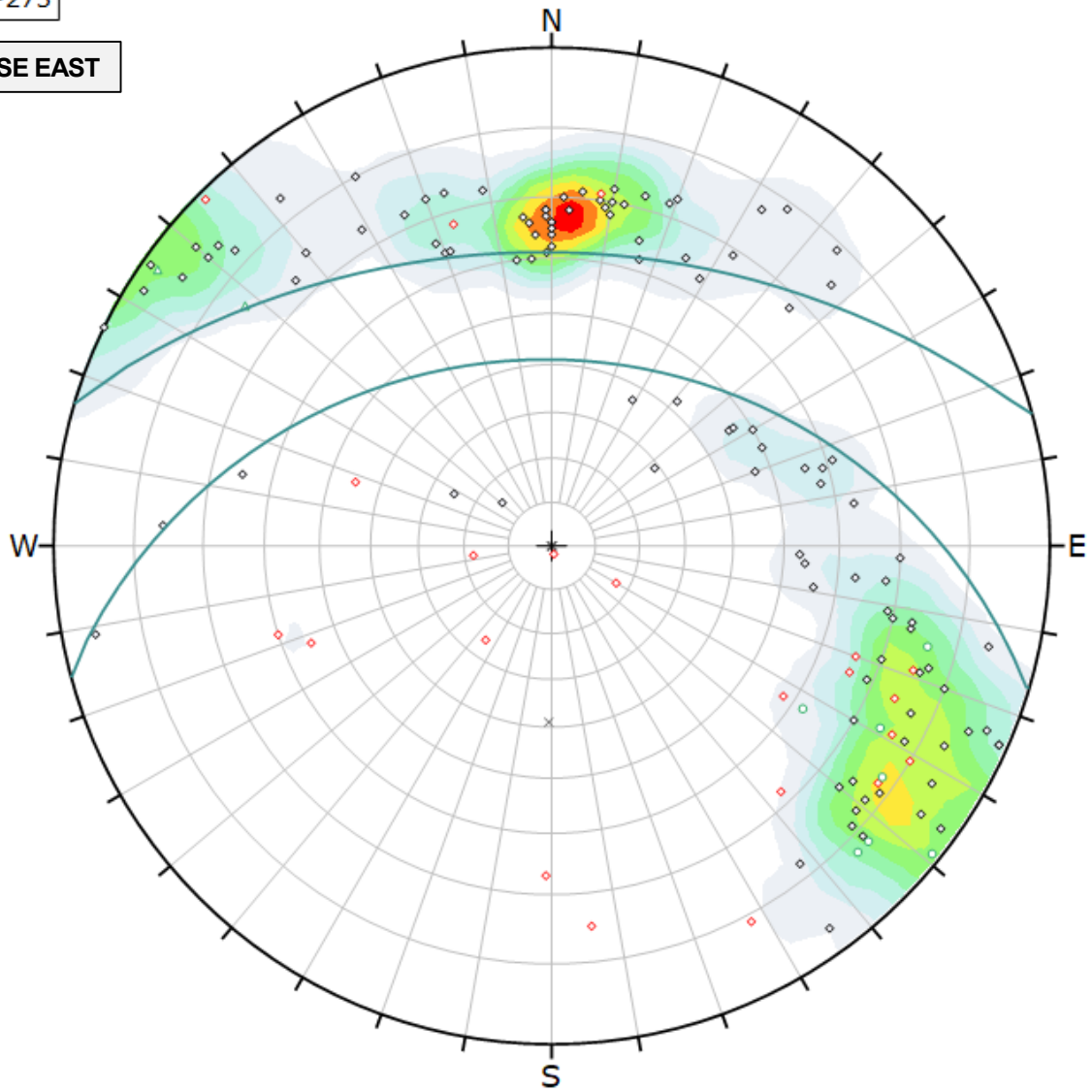
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-18-271
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-57**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-273

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	110
◇	JT	22
○	SH	7
△	VN	2

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Contour Data	Pole Vectors
Maximum Density	12.55%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	141 (141 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

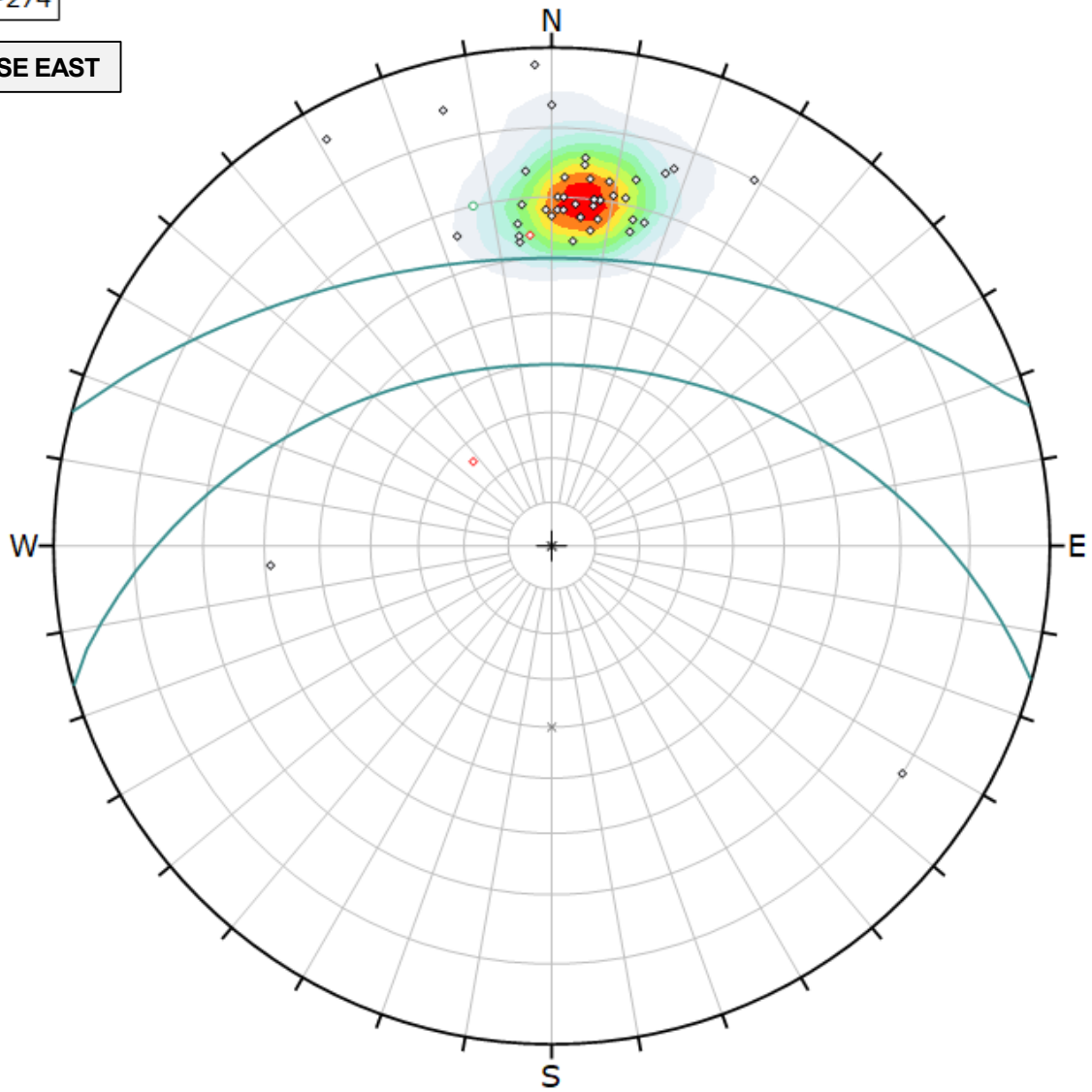
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-18-273
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-58**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-274

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	43
◇	JT	2
○	SH	1

Color	Density Concentrations
	0.00 - 5.20
	5.20 - 10.40
	10.40 - 15.60
	15.60 - 20.80
	20.80 - 26.00
	26.00 - 31.20
	31.20 - 36.40
	36.40 - 41.60
	41.60 - 46.80
	46.80 - 52.00

Contour Data	Pole Vectors
Maximum Density	51.95%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	46 (46 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

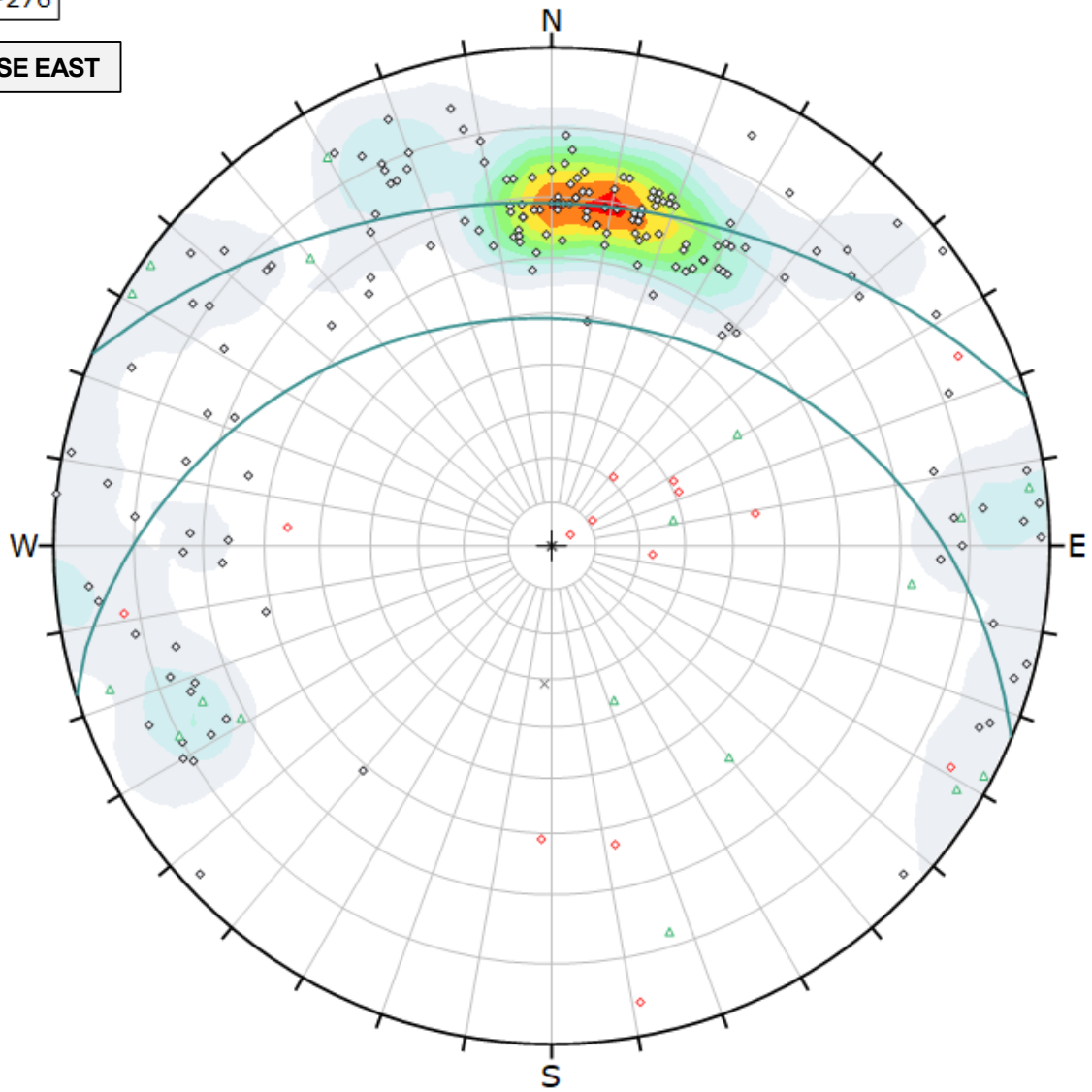
TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-18-274
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-59**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-18-276

SUNRISE EAST



Symbol	TYPE	Quantity
◇	BD	172
◇	JT	14
△	VN	18

Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.26%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	204 (204 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

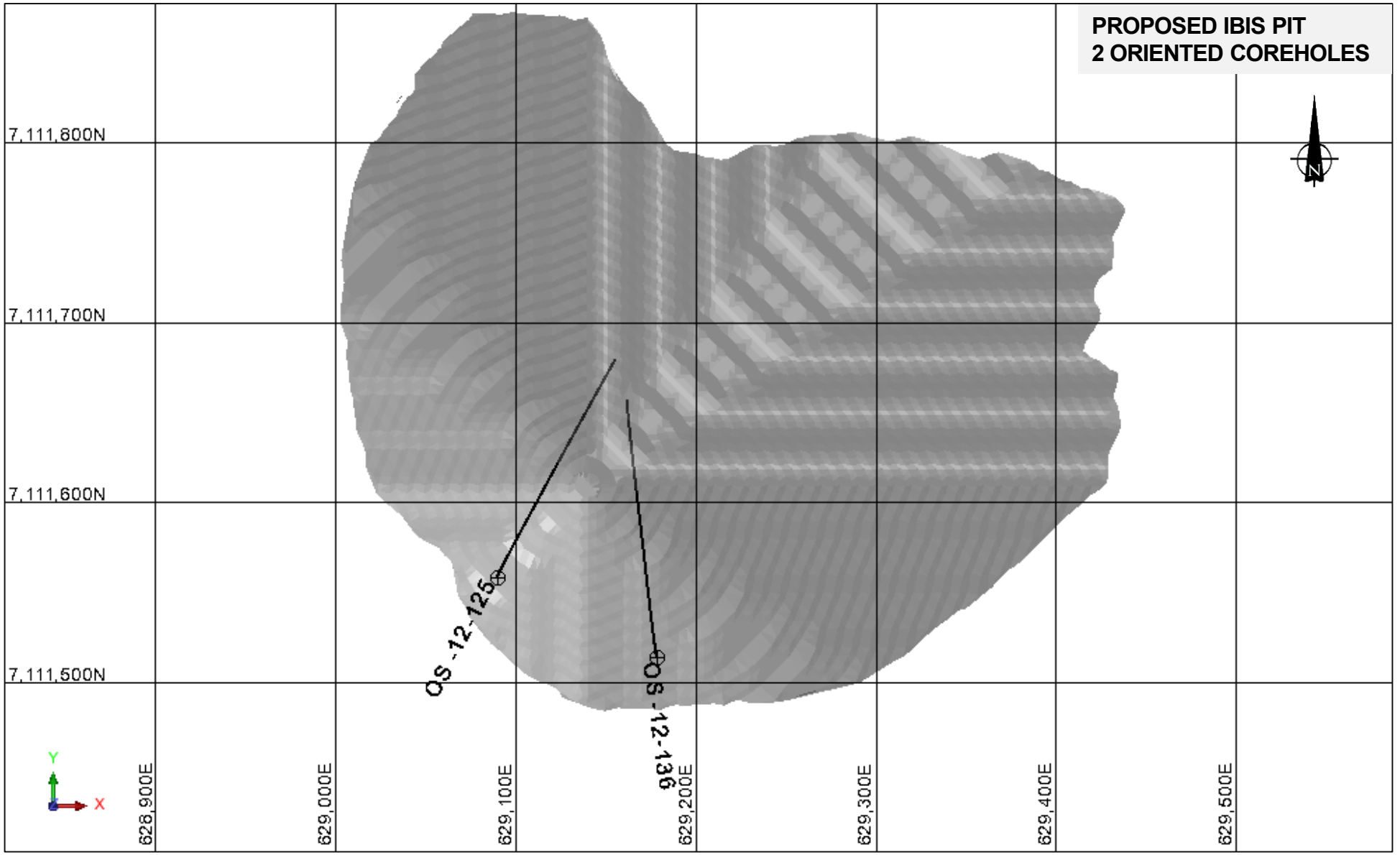
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SUNRISE PIT ORIENTED COREHOLE
OS-18-276
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-60**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Path: V:\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Oriented Core Data | File Name: Osiris_Oriented Core Stereonets_All Boreholes.pptx



Legend

- Corehole Collar
- Corehole Trace

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

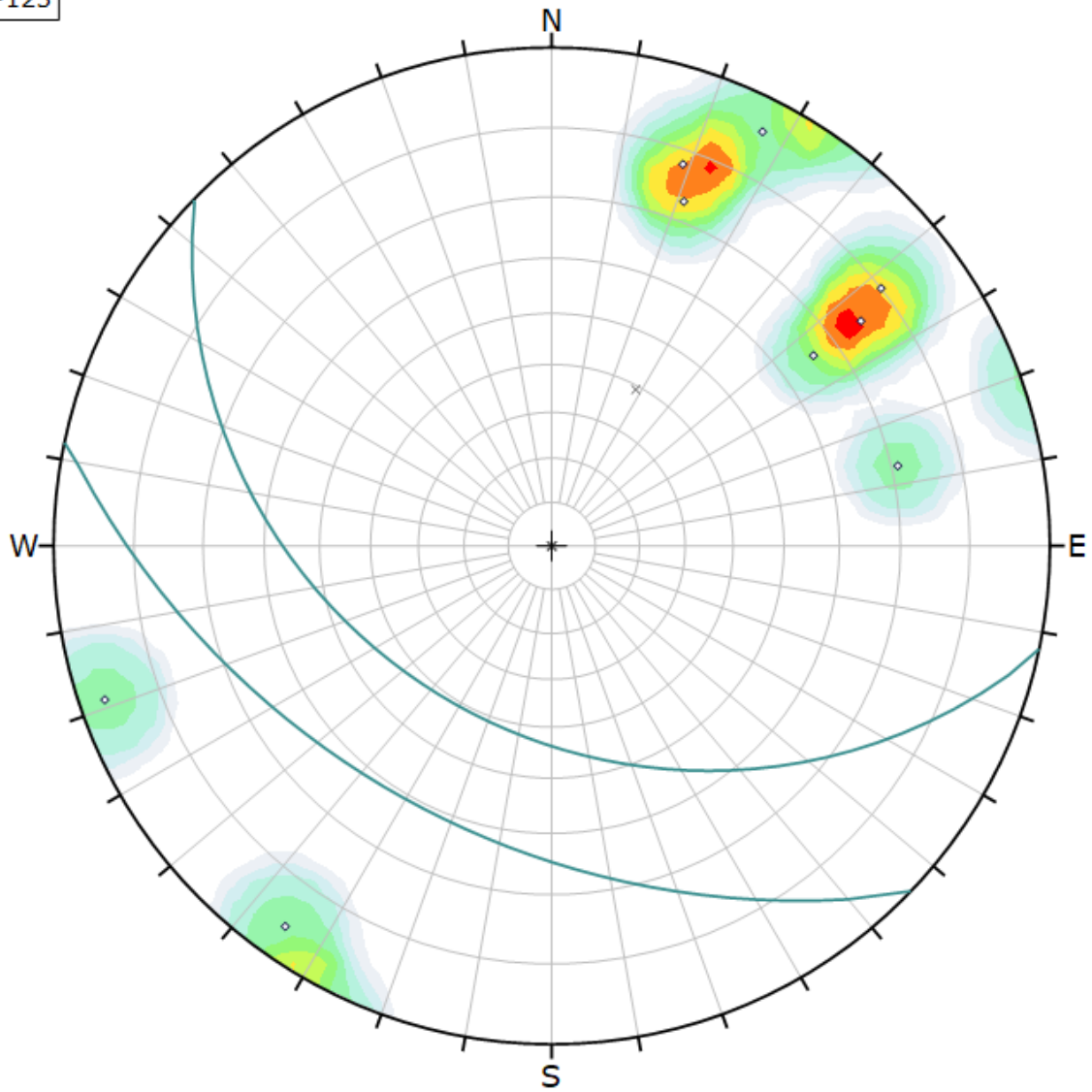
YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED IBIS PIT
COREHOLES WITH ORIENTED STRUCTURE DATA
PLAN VIEW

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D1-61**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-12-125



Symbol	TYPE	Quantity
◇	BD	9

Color	Density Concentrations
	0.00 - 2.60
	2.60 - 5.20
	5.20 - 7.80
	7.80 - 10.40
	10.40 - 13.00
	13.00 - 15.60
	15.60 - 18.20
	18.20 - 20.80
	20.80 - 23.40
	23.40 - 26.00

Contour Data	Pole Vectors
Maximum Density	25.98%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	9 (9 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:
- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

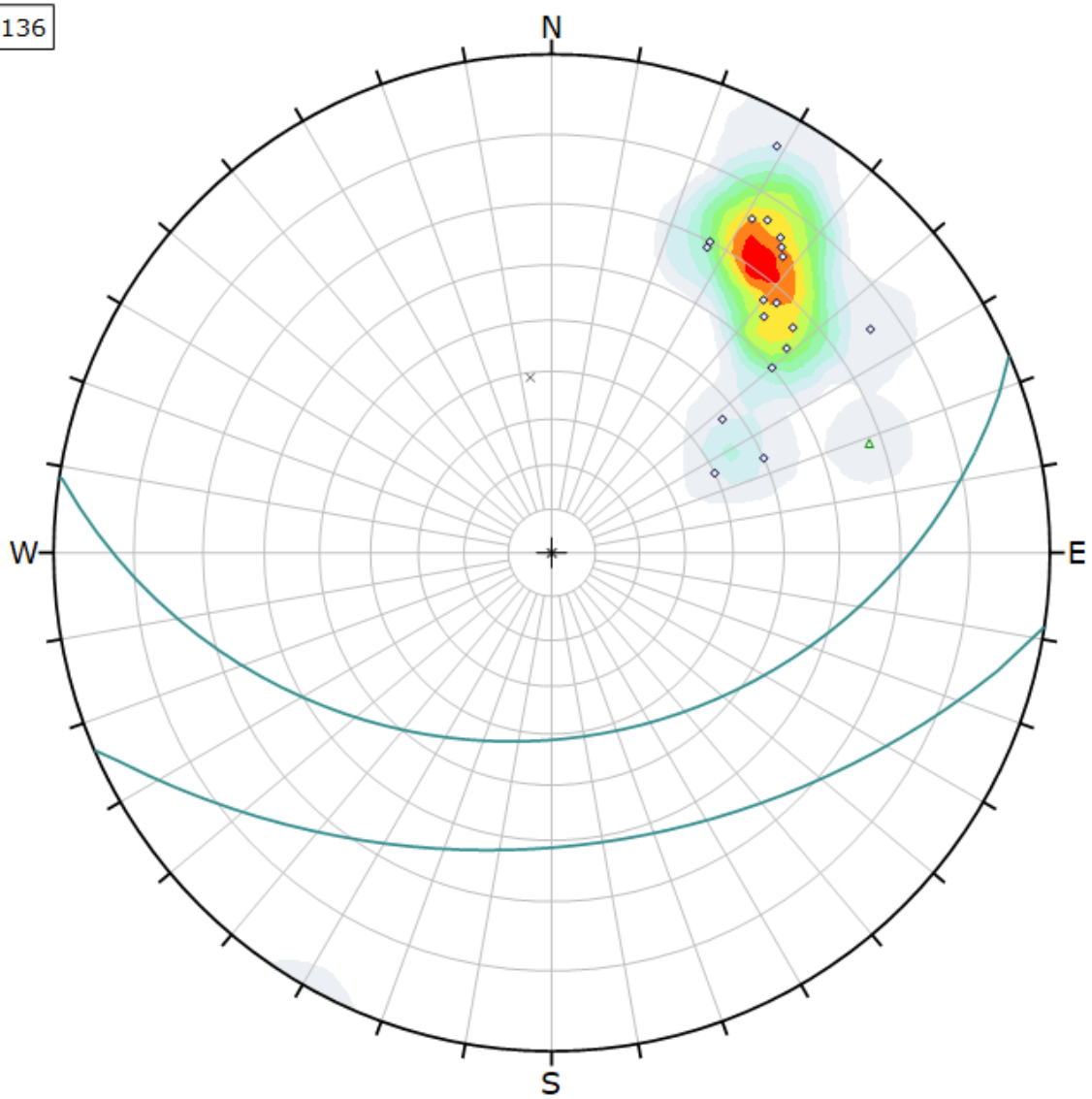
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
IBIS PIT ORIENTED COREHOLE
OS-12-125
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D1-62

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

OS-12-136



Symbol	TYPE	Quantity
◇	BD	18
△	VN	1

Color	Density Concentrations
	0.00 - 3.70
	3.70 - 7.40
	7.40 - 11.10
	11.10 - 14.80
	14.80 - 18.50
	18.50 - 22.20
	22.20 - 25.90
	25.90 - 29.60
	29.60 - 33.30
	33.30 - 37.00

Contour Data	Pole Vectors
Maximum Density	36.76%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	19 (19 Entries)
Hemisphere	Lower
Projection	Equal Angle

Legend

- ✕ Corehole Trend and Plunge
- Corehole Blind Zone Cone Projection

NOTE:

- Oriented core data collected by ATAC and processed by Golder
- Structures oriented to NAD83 UTM Grid North (~2° clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

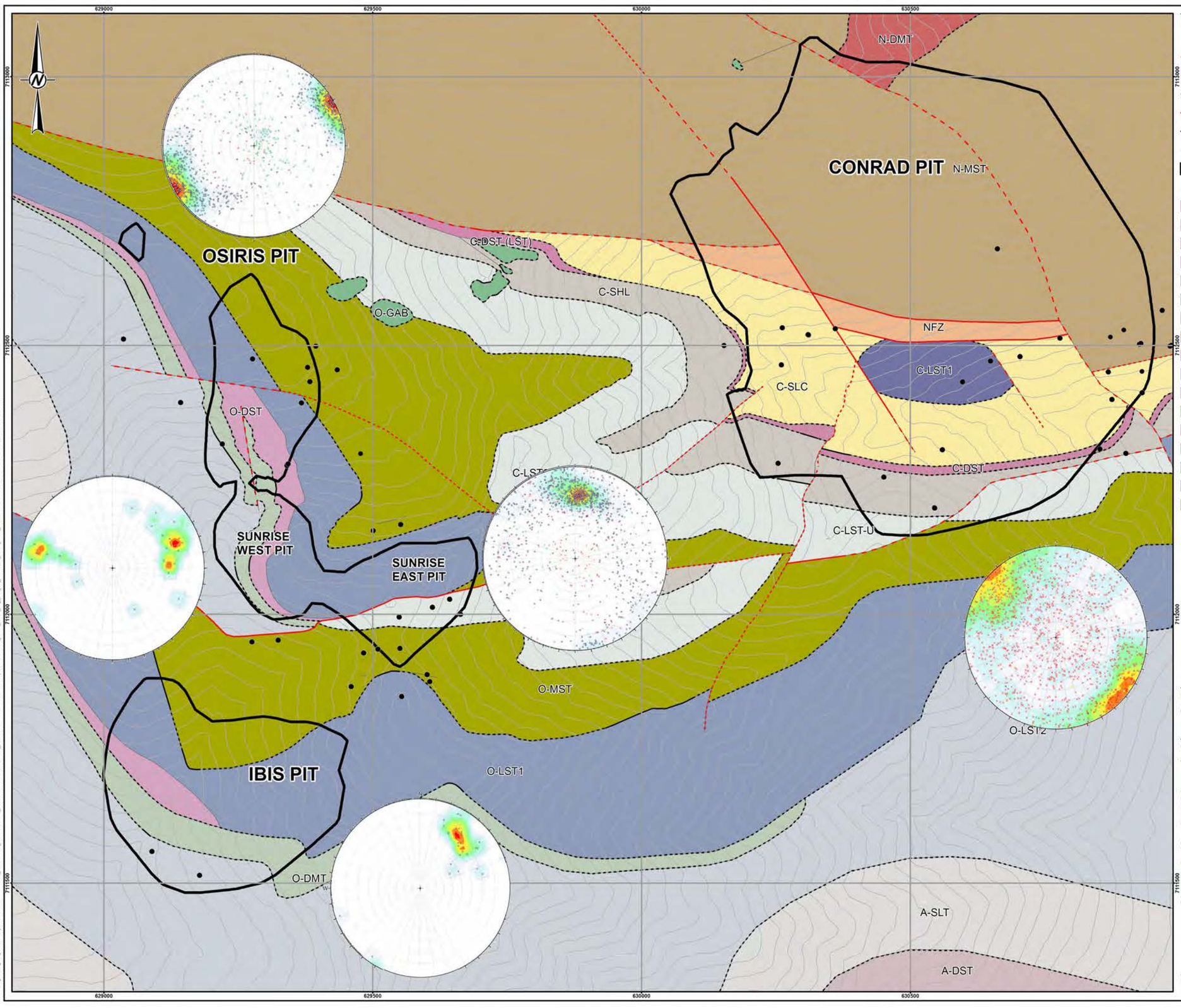
TITLE
IBIS PIT ORIENTED COREHOLE
OS-12-136
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D1-63

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

APPENDIX D2

Stereographic Projections by Proposed Pit



LEGEND

- ORIENTED COREHOLE COLLAR
- APPROXIMATE FAULTS
- INFERRED FAULTS
- INFERRED CONTACTS
- OBSERVED FAULTS
- OBSERVED CONTACTS
- CONTOUR (20 m)
- PIT OUTLINE

SURFACE GEOLOGY

- A-DST, Atum Dolostone
- A-SLT, Atum Siltstone
- C-DST, Conrad Silica Dolostone
- C-DST (LST), Conrad Silica Dolostone (Limestone)
- C-LST1, Conrad Limestone 1
- C-LST2, Conrad Limestone 2
- C-SHL, Conrad Shale
- C-SLC, Conrad Siliciclastics
- N-DMT, Nonad Diamictite
- N-MST, Unclassified Nonad Mudstone
- NFZ, Nadaleen Fault Zone
- O-DMT, Osiris Diamictite
- O-DST, Osiris Dolostone
- O-GAB, Osiris Gabbro
- O-LST1, Osiris Limestone 1
- O-LST2, Osiris Limestone 2
- O-MST, Osiris Mudstone

0 150 300
1:7,000 METRES

REFERENCE(S)
1. BASE DATA PROVIDED BY CLIENT.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 8N

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
ORIENTED CORE DATA COMBINED BY PIT

CONSULTANT
GOLDER

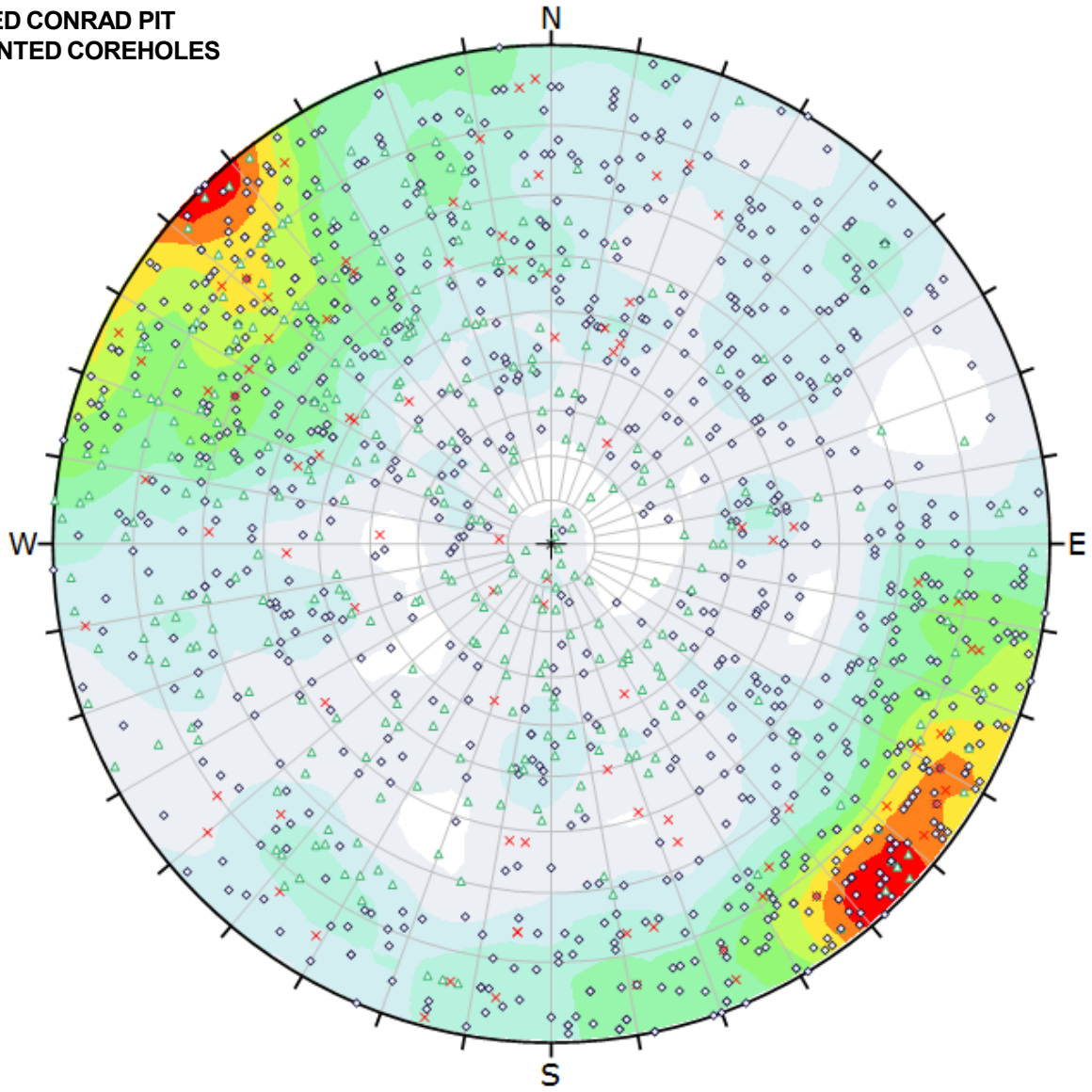
YYYY-MM-DD	2019-09-23
DESIGNED	TT/JH
PREPARED	CC
REVIEWED	TGT
APPROVED	AVC

PROJECT NO.	PHASE	REV.	FIGURE
18100420	4000	0	D2-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

PATH: \\golder.gds\yxt\burnaby\CAD-GIS\Client\ATAC_Resources_Ltd\Yukon\04_PROJECTS\18100420102_PRODUCTION\A2000\MXD\Report\18100420_4000_4100_Fig_D2_01_Oriented_Core_Hole_Collar.mxd PRINTED ON: 2019-09-23 AT 11:10:50 AM

PROPOSED CONRAD PIT
ALL ORIENTED COREHOLES



Symbol	TYPE	Quantity
◇	BD	878
×	FT	88
△	JT	339

Color	Density Concentrations
	0.00 - 0.40
	0.40 - 0.80
	0.80 - 1.20
	1.20 - 1.60
	1.60 - 2.00
	2.00 - 2.40
	2.40 - 2.80
	2.80 - 3.20
	3.20 - 3.60
	3.60 - 4.00

Contour Data	Pole Vectors
Maximum Density	3.90%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	1305 (1305 Entries)
Hemisphere	Lower
Projection	Equal Angle

Notes:
- Oriented core data collected by ATAC
- Dataset filtered by Golder to display only BD, FT, JT, and FO
- Structures labelled as SH are displayed as FT and structures labelled as FR are displayed as JT
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

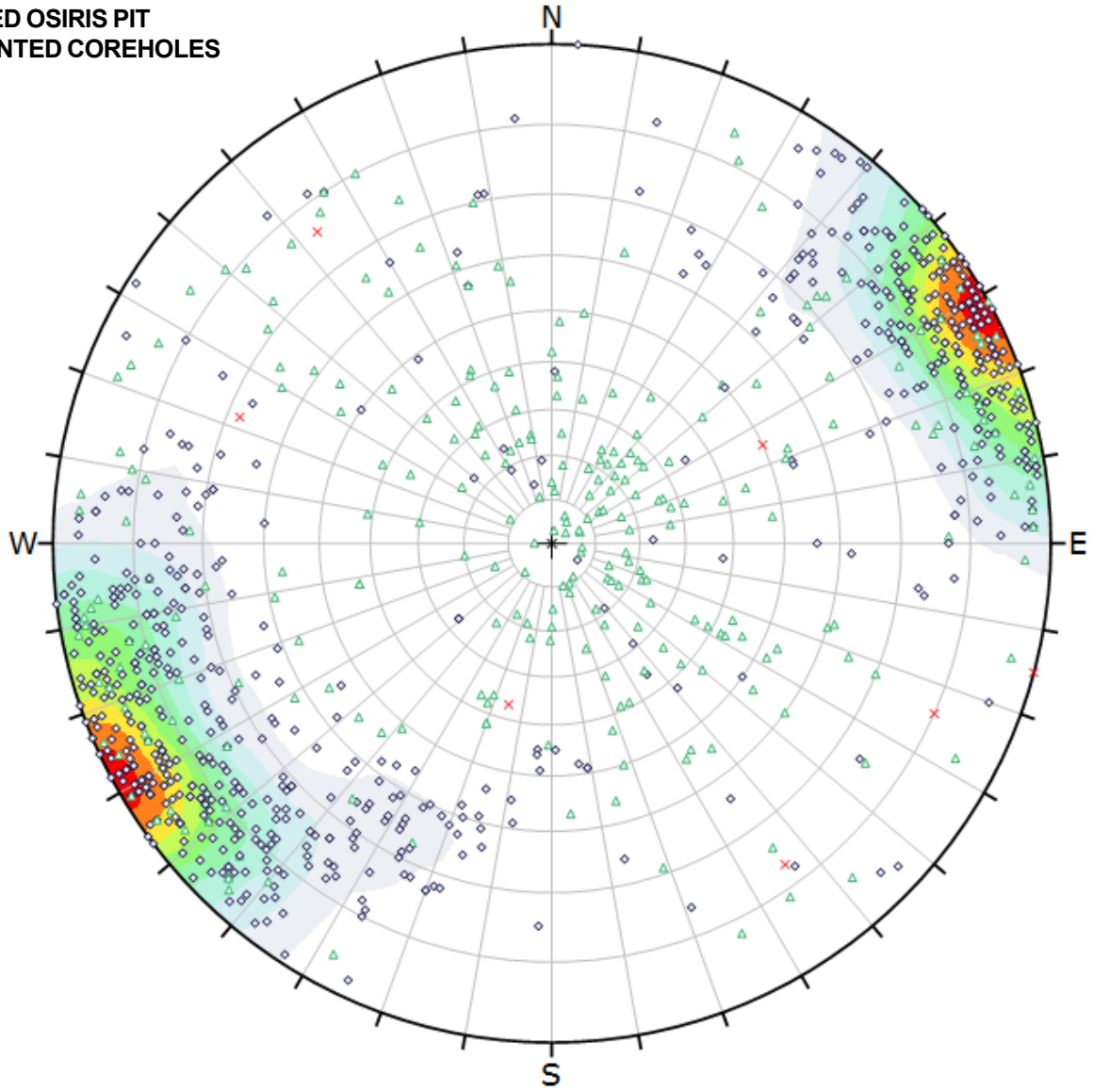
YYYY-MM-DD	2019-03-07
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED CONRAD PIT
COMBINED ORIENTED COREHOLES
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D2-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

PROPOSED OSIRIS PIT
ALL ORIENTED COREHOLES



Symbol	TYPE	Quantity
◇	BD	665
×	FT	7
△	JT	268

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.45%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	940 (940 Entries)
Hemisphere	Lower
Projection	Equal Angle

Notes:
- Oriented core data collected by ATAC
- Dataset filtered by Golder to display only BD, FT, JT, and FO
- Structures labelled as SH are displayed as FT and structures labelled as FR are displayed as JT
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

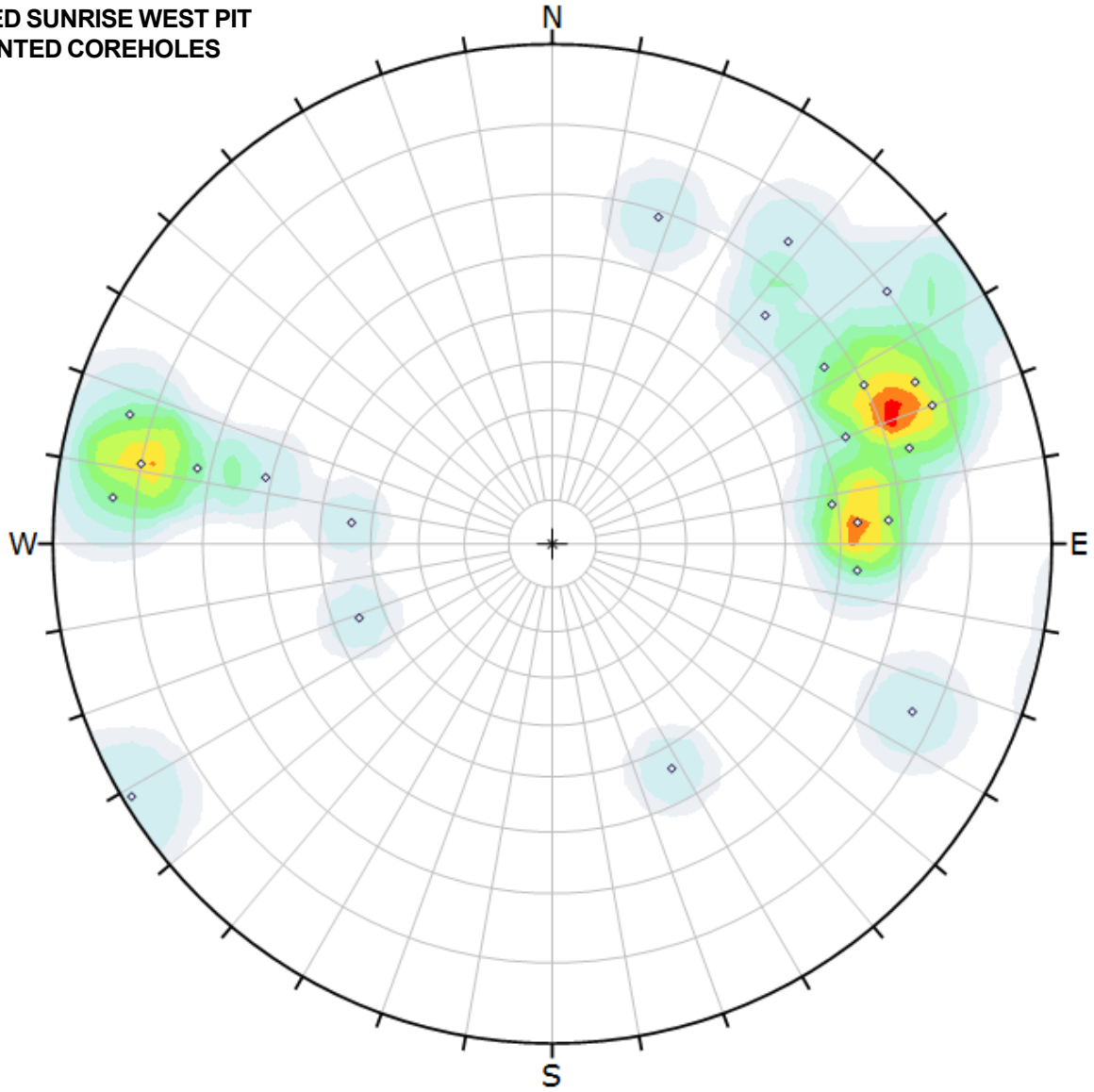
YYYY-MM-DD	2019-03-07
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED OSIRIS PIT
COMBINED ORIENTED COREHOLES
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D2-3

0 25 mm
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PROPOSED SUNRISE WEST PIT
ALL ORIENTED COREHOLES



Symbol	TYPE	Quantity
◇	BD	24

Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.08%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	24 (24 Entries)
Hemisphere	Lower
Projection	Equal Angle

Notes:
- Oriented core data collected by ATAC
- Dataset filtered by Golder to display only BD, FT, JT, and FO
- Structures labelled as SH are displayed as FT and structures labelled as FR are displayed as JT
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

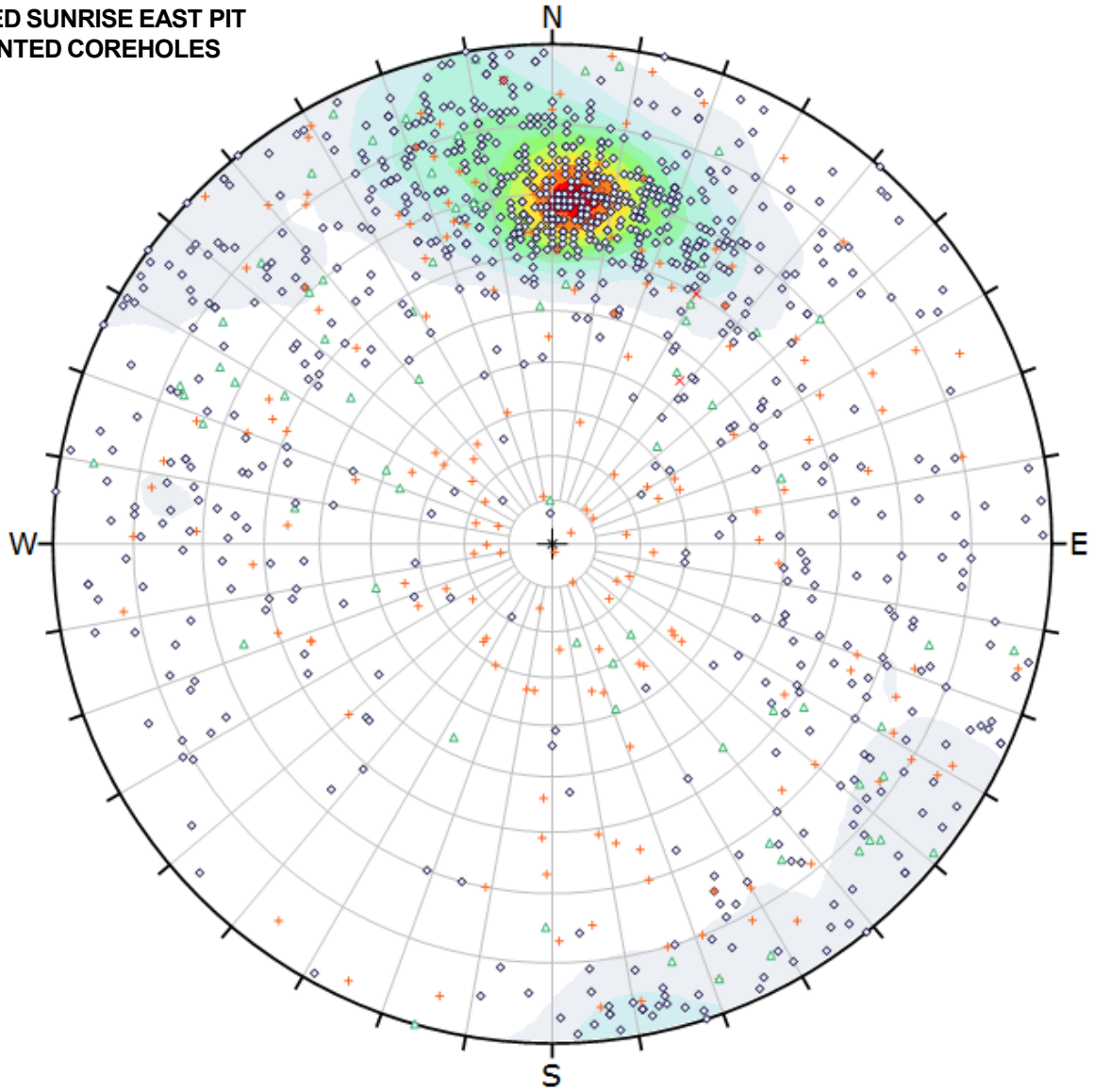
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
PROPOSED SUNRISE WEST PIT
COMBINED ORIENTED COREHOLES
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D2-4**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PROPOSED SUNRISE EAST PIT
ALL ORIENTED COREHOLES



Symbol	TYPE	Quantity
◇	BD	874
×	FO	4
△	FT	69
+	JT	184

Color	Density Concentrations
	0.00 - 1.40
	1.40 - 2.80
	2.80 - 4.20
	4.20 - 5.60
	5.60 - 7.00
	7.00 - 8.40
	8.40 - 9.80
	9.80 - 11.20
	11.20 - 12.60
	12.60 - 14.00

Contour Data	Pole Vectors
Maximum Density	13.55%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	1131 (1131 Entries)
Hemisphere	Lower
Projection	Equal Angle

Notes:
- Oriented core data collected by ATAC
- Dataset filtered by Golder to display only BD, FT, JT, and FO
- Structures labelled as SH are displayed as FT and structures labelled as FR are displayed as JT
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

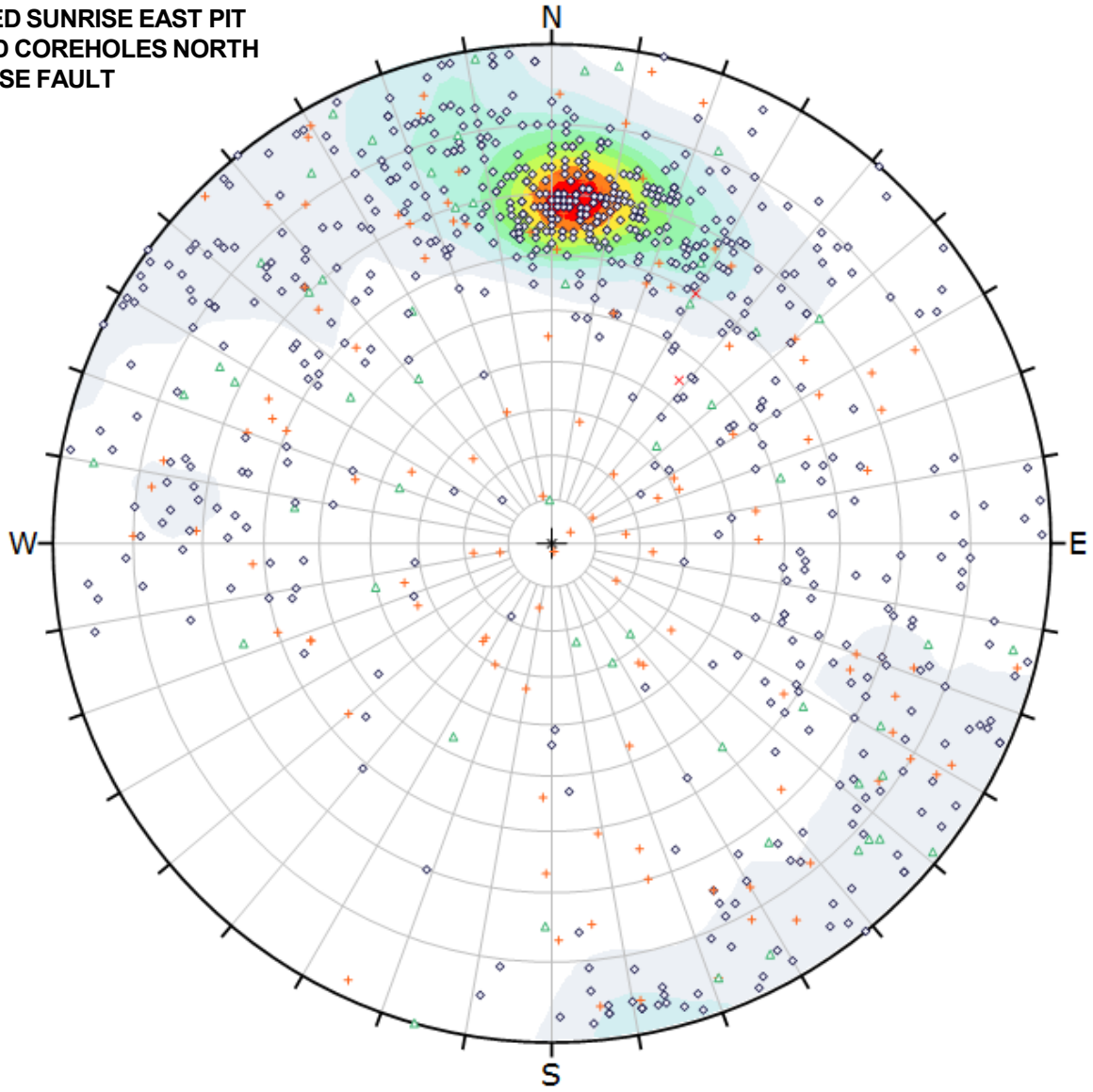
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
PROPOSED SUNRISE EAST PIT – ALL DATA
COMBINED ORIENTED COREHOLES
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D2-5

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PROPOSED SUNRISE EAST PIT ORIENTED COREHOLES NORTH OF SUNRISE FAULT



Symbol	TYPE	Quantity
◇	BD	664
×	FO	2
△	FT	54
+	JT	123

Color	Density Concentrations
	0.00 - 1.40
	1.40 - 2.80
	2.80 - 4.20
	4.20 - 5.60
	5.60 - 7.00
	7.00 - 8.40
	8.40 - 9.80
	9.80 - 11.20
	11.20 - 12.60
	12.60 - 14.00

Contour Data	Pole Vectors
Maximum Density	13.87%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	843 (843 Entries)
Hemisphere	Lower
Projection	Equal Angle

Notes:

- Oriented core data collected by ATAC
- Dataset filtered by Golder to display only BD, FT, JT, and FO
- Structures labelled as SH are displayed as FT and structures labelled as FR are displayed as JT
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

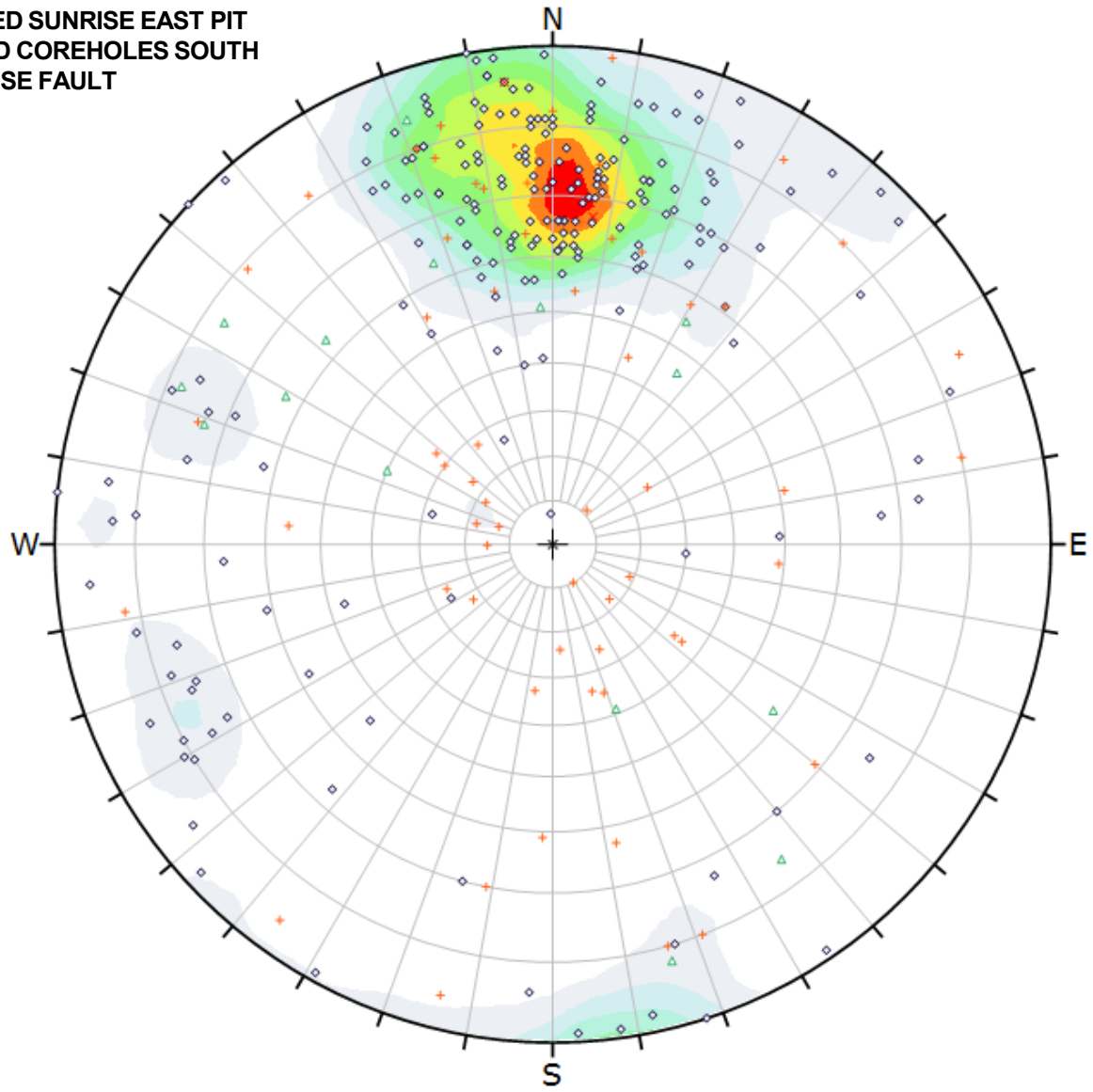
YYYY-MM-DD	2019-03-07
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
PROPOSED SUNRISE EAST PIT – NORTH OF SUNRISE FAULT COMBINED ORIENTED COREHOLES STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D2-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

PROPOSED SUNRISE EAST PIT ORIENTED COREHOLES SOUTH OF SUNRISE FAULT



Symbol	TYPE	Quantity
◇	BD	210
×	FO	2
△	FT	15
+	JT	61

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Contour Data	Pole Vectors
Maximum Density	12.61%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	288 (288 Entries)
Hemisphere	Lower
Projection	Equal Angle

Notes:

- Oriented core data collected by ATAC
- Dataset filtered by Golder to display only BD, FT, JT, and FO
- Structures labelled as SH are displayed as FT and structures labelled as FR are displayed as JT
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

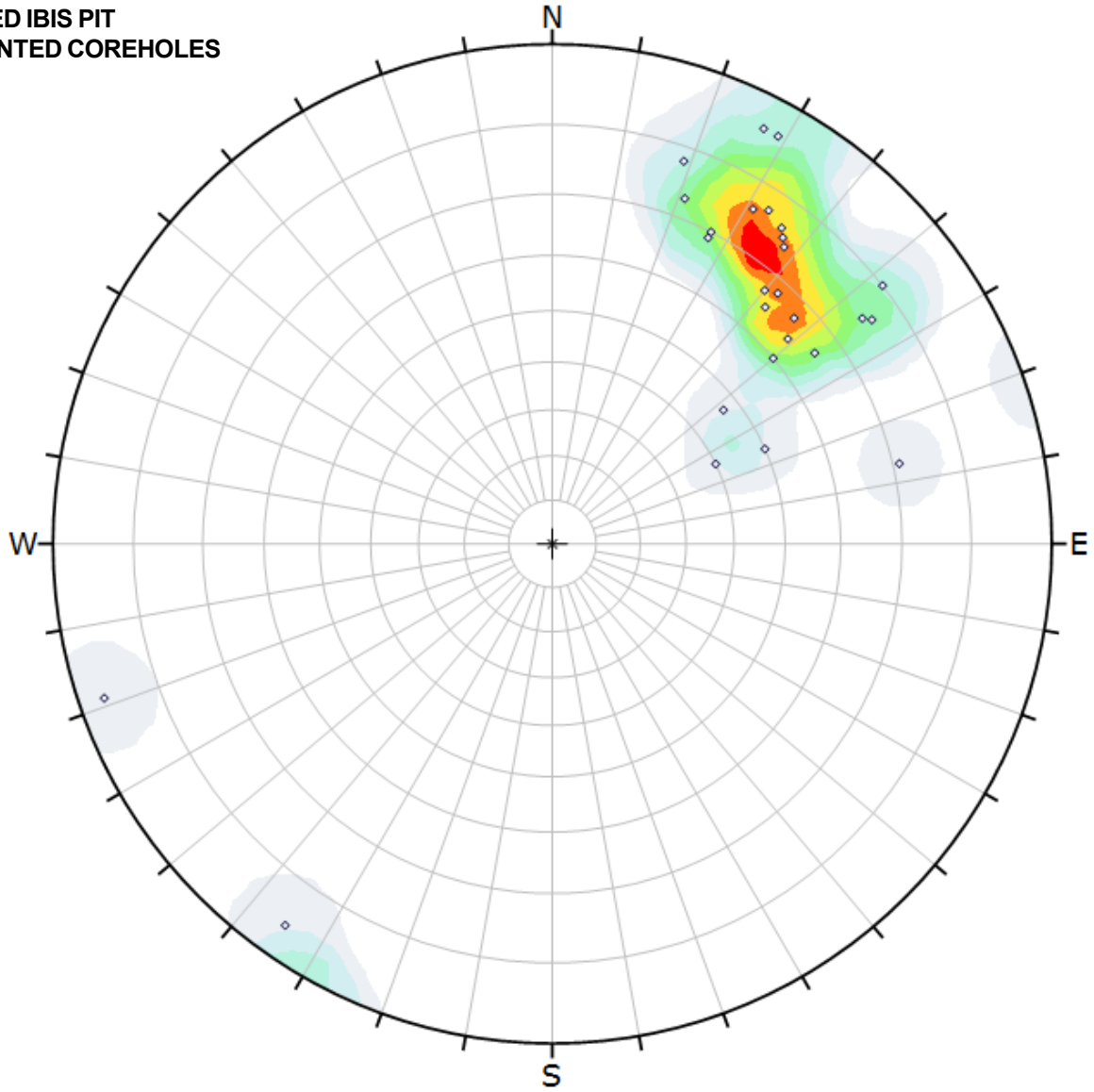
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
PROPOSED SUNRISE EAST PIT – SOUTH OF SUNRISE FAULT COMBINED ORIENTED COREHOLES
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**D2-7**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PROPOSED IBIS PIT
ALL ORIENTED COREHOLES



Symbol	TYPE	Quantity
◇	BD	27

Color	Density Concentrations
	0.00 - 2.60
	2.60 - 5.20
	5.20 - 7.80
	7.80 - 10.40
	10.40 - 13.00
	13.00 - 15.60
	15.60 - 18.20
	18.20 - 20.80
	20.80 - 23.40
	23.40 - 26.00

Contour Data	Pole Vectors
Maximum Density	25.99%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	27 (27 Entries)
Hemisphere	Lower
Projection	Equal Angle

Notes:
- Oriented core data collected by ATAC
- Dataset filtered by Golder to display only BD, FT, JT, and FO
- Structures labelled as SH are displayed as FT and structures labelled as FR are displayed as JT
- Structures oriented to NAD83 UTM Grid North (~2˚ clockwise from true north)

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-07
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

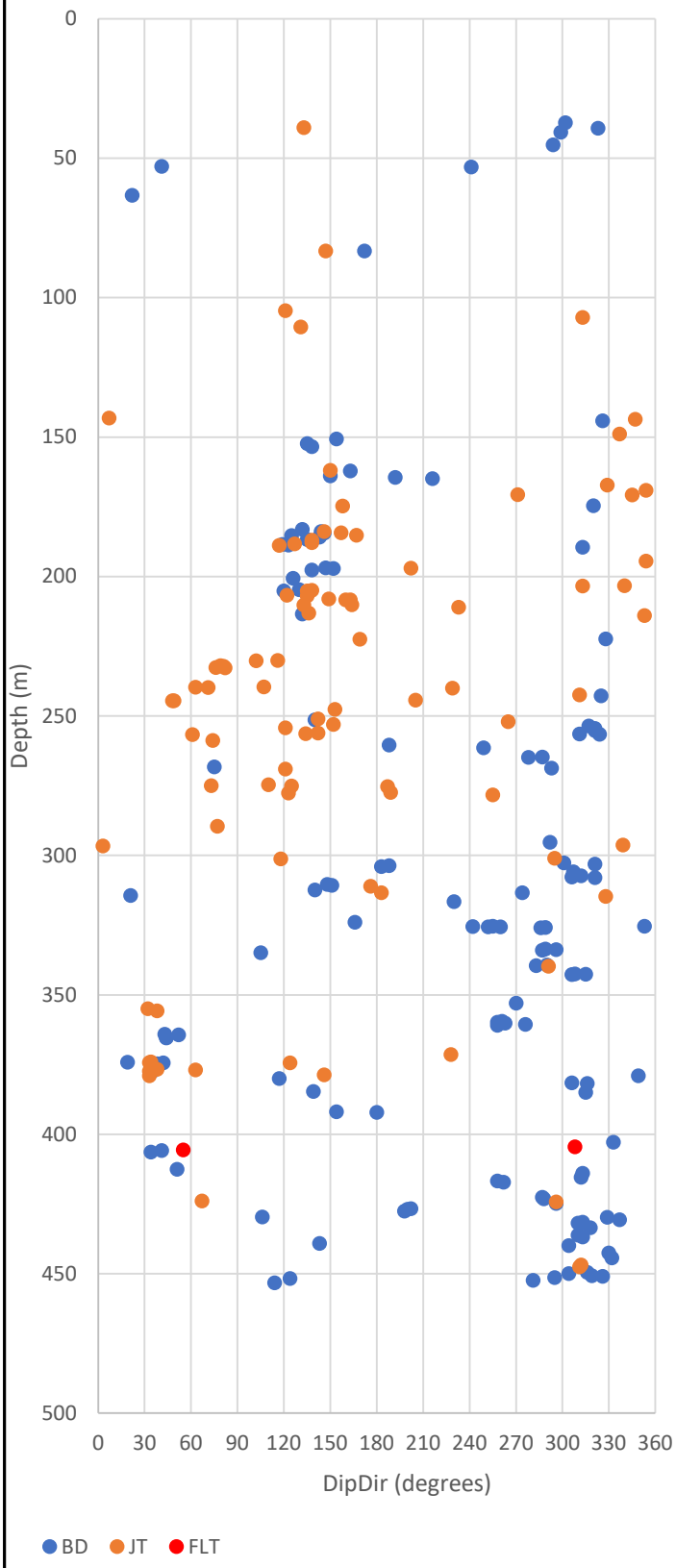
TITLE
PROPOSED IBIS PIT
COMBINED ORIENTED COREHOLES
STRUCTURAL ORIENTATIONS STEREOGRAPHIC PROJECTION

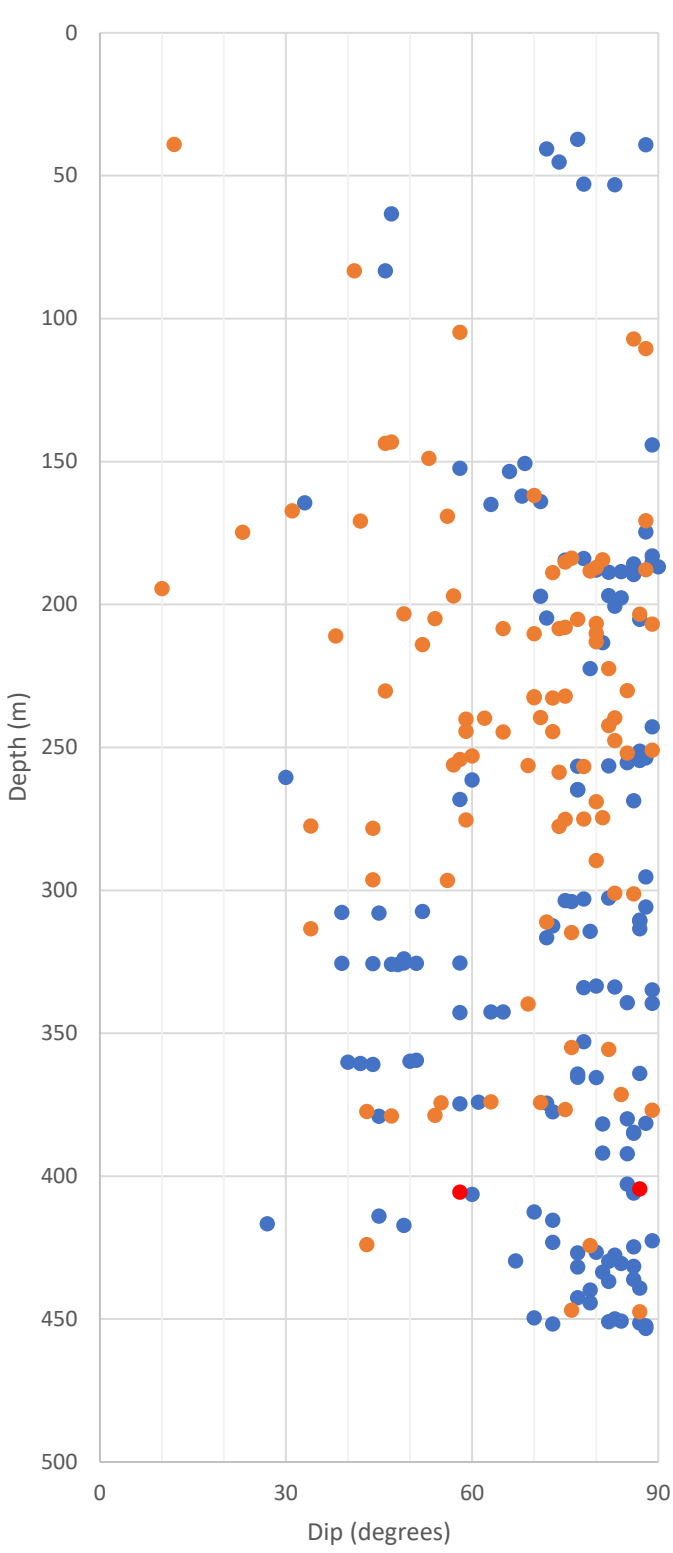
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	D2-8

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

APPENDIX E

Downhole Plots of Oriented Core Data





CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-21
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
ORIENTED COREHOLE DATA
STRUCTURAL ORIENTATIONS VERSUS DEPTH
CONRAD PIT – OS-18-267

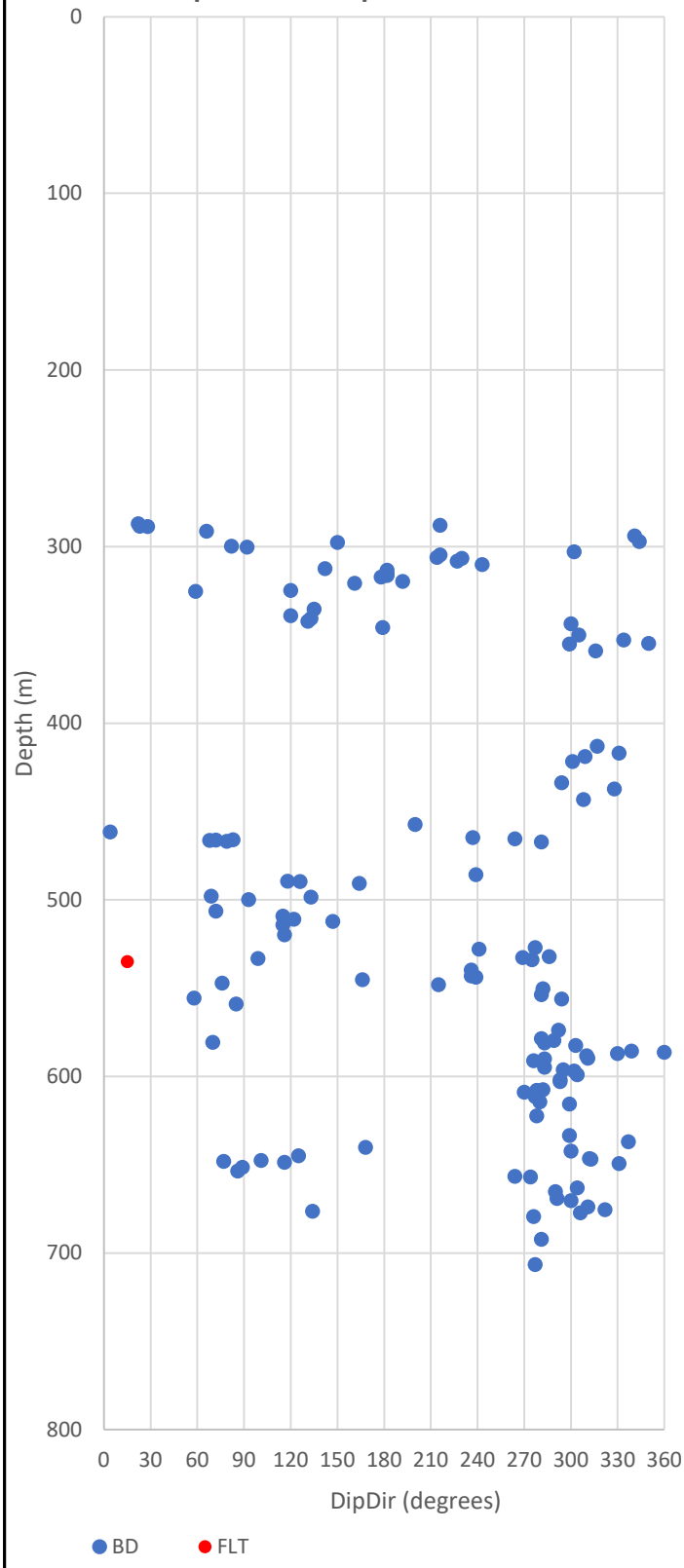
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**E-1**

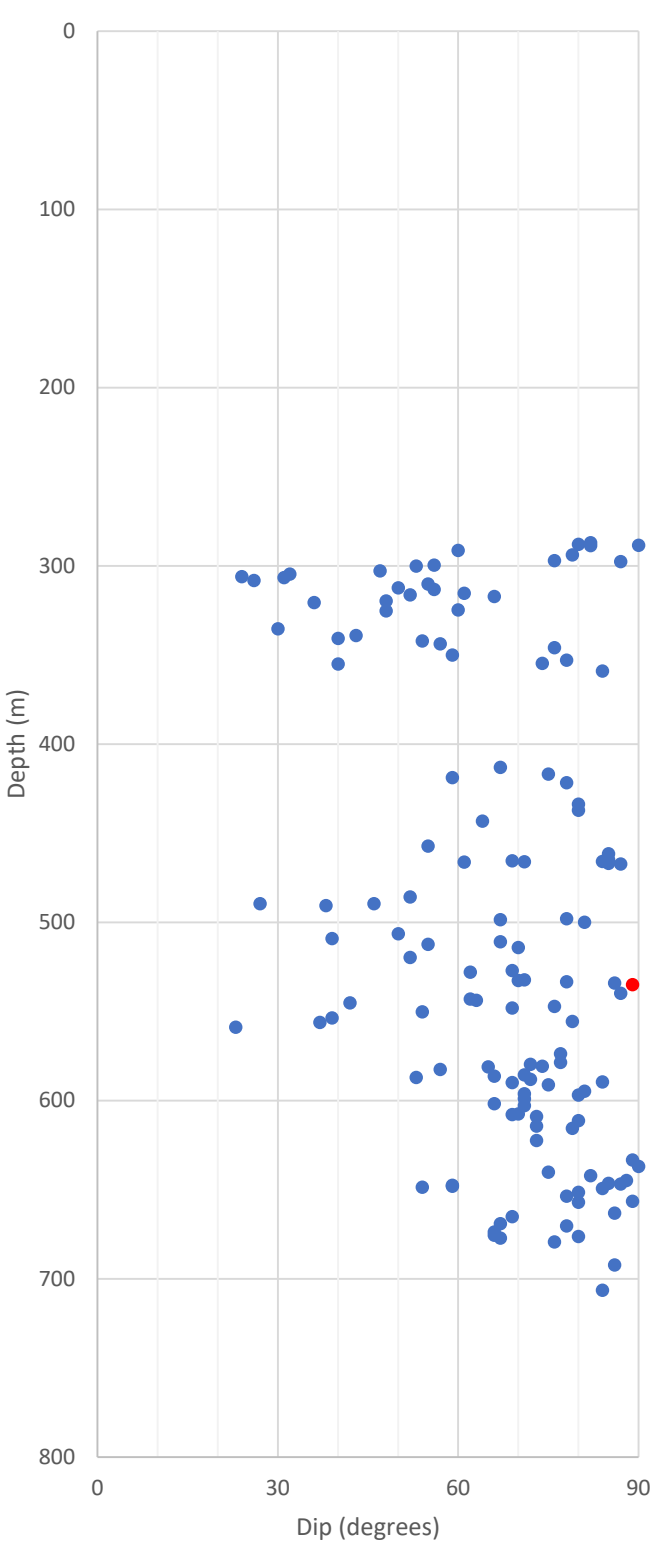
Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Oriented Core Data\ | File Name: Osiris_Oriented Core_Downhole Plots.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm

0





CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-21
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
ORIENTED COREHOLE DATA
STRUCTURAL ORIENTATIONS VERSUS DEPTH
CONRAD PIT – OS-12-148

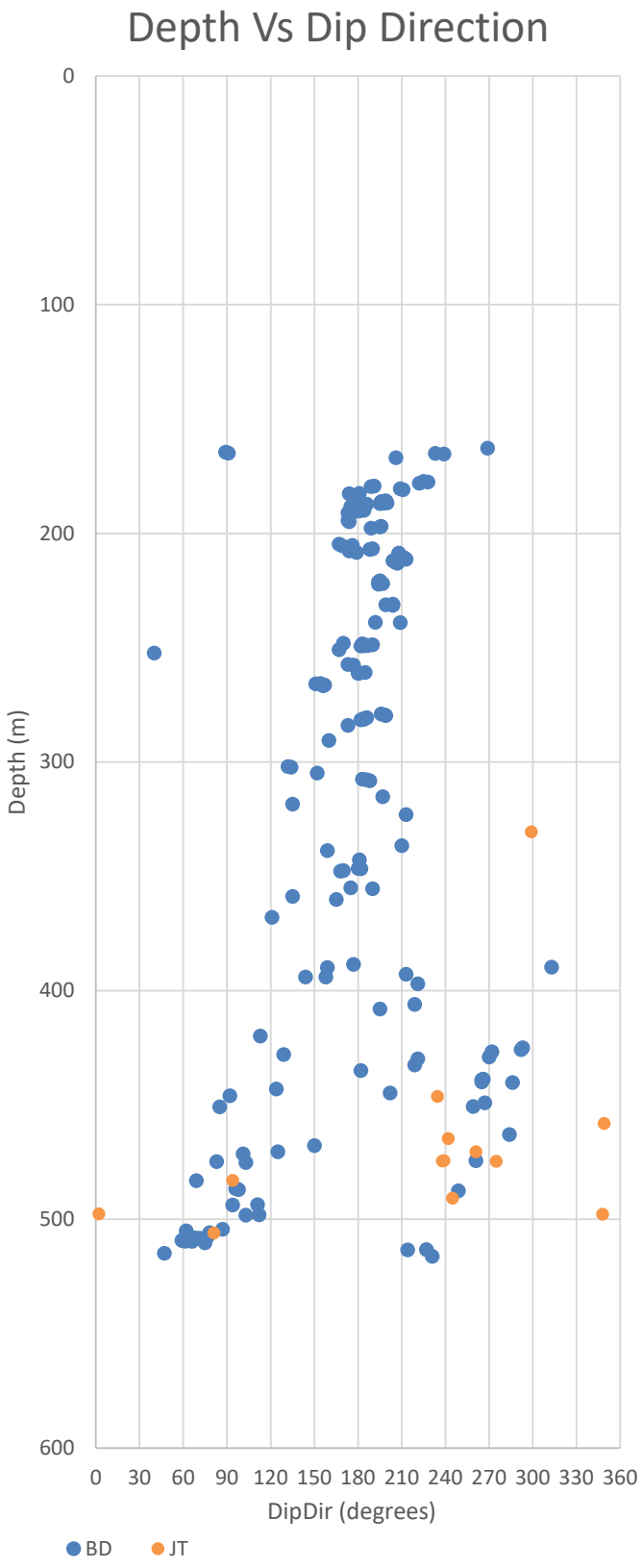
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**E-2**

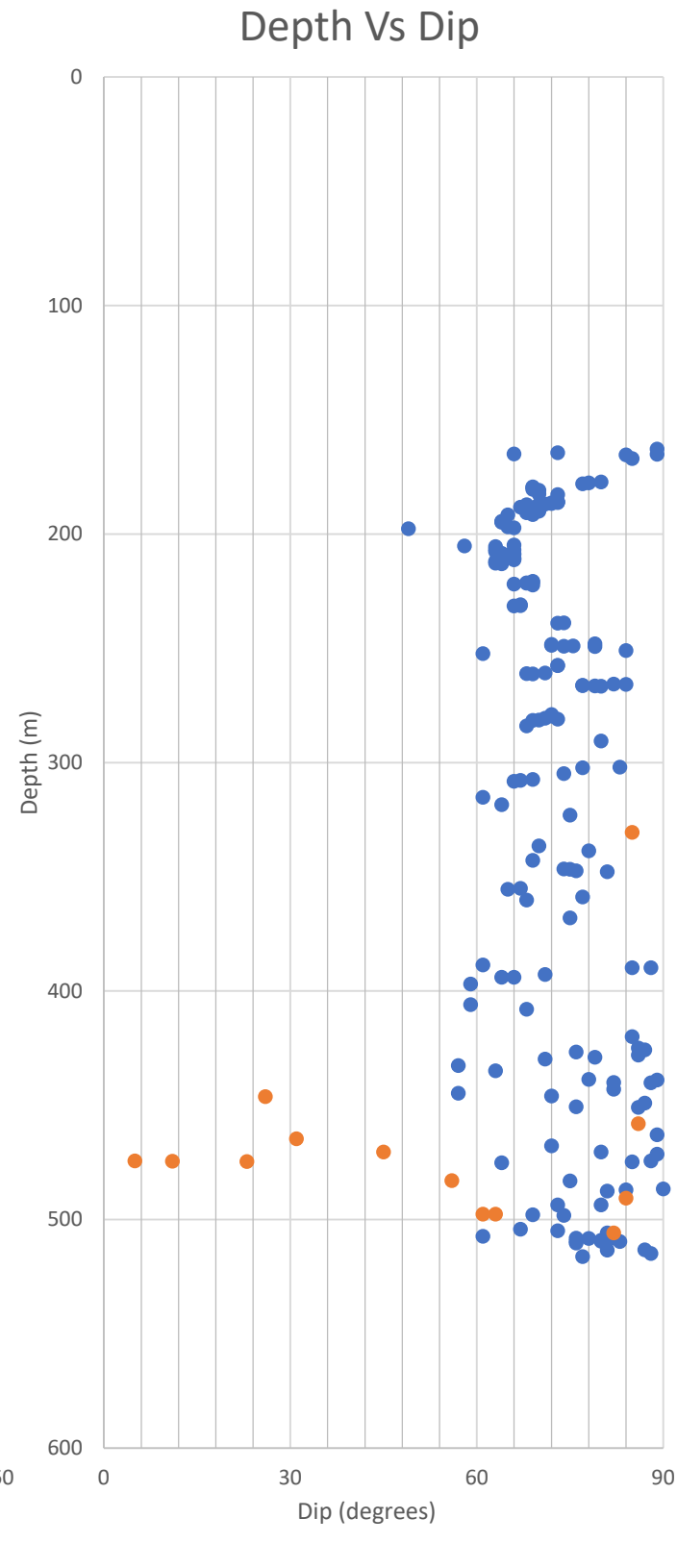
Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Oriented Core Data\ | File Name: Osiris_Oriented Core_Downhole Plots.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm

0





CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-21
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
ORIENTED COREHOLE DATA
STRUCTURAL ORIENTATIONS VERSUS DEPTH
SUNRISE PIT – OS-18-276

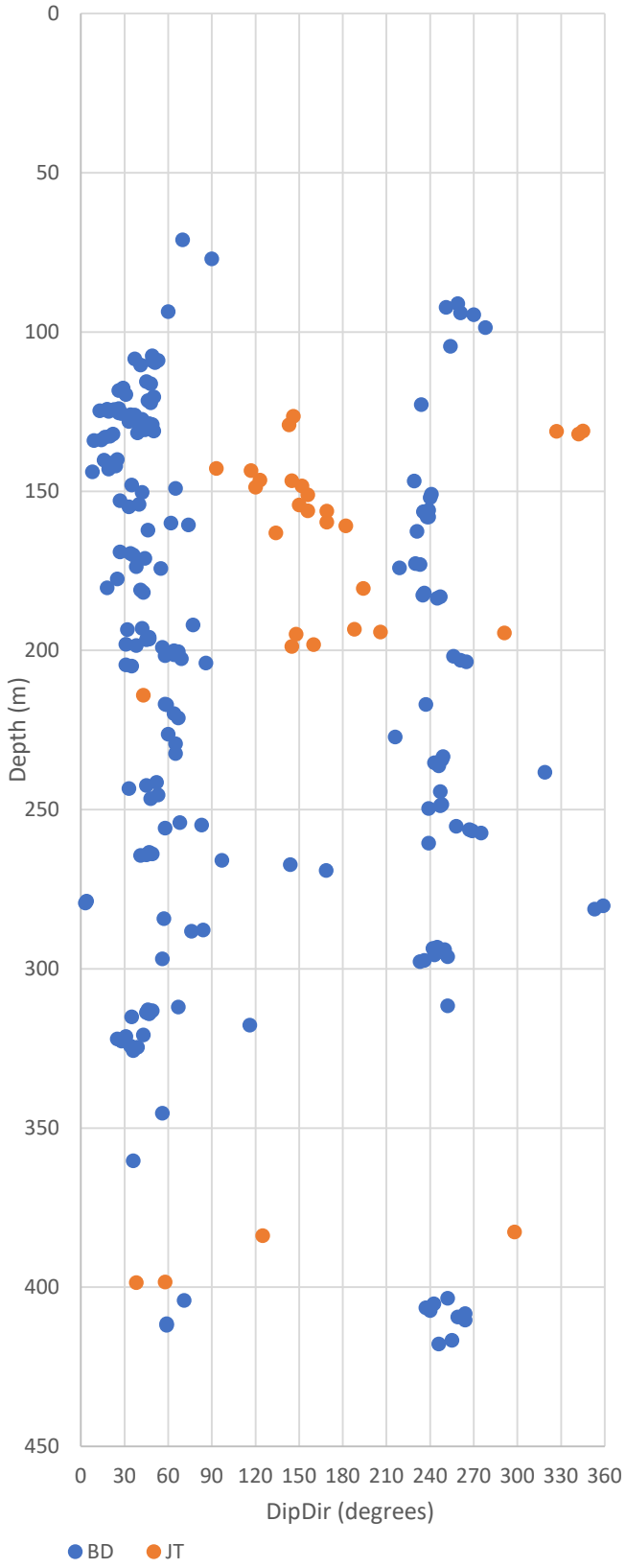
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**E-3**

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Oriented Core Data\ | File Name: Osiris_Oriented Core_Downhole Plots.pptx

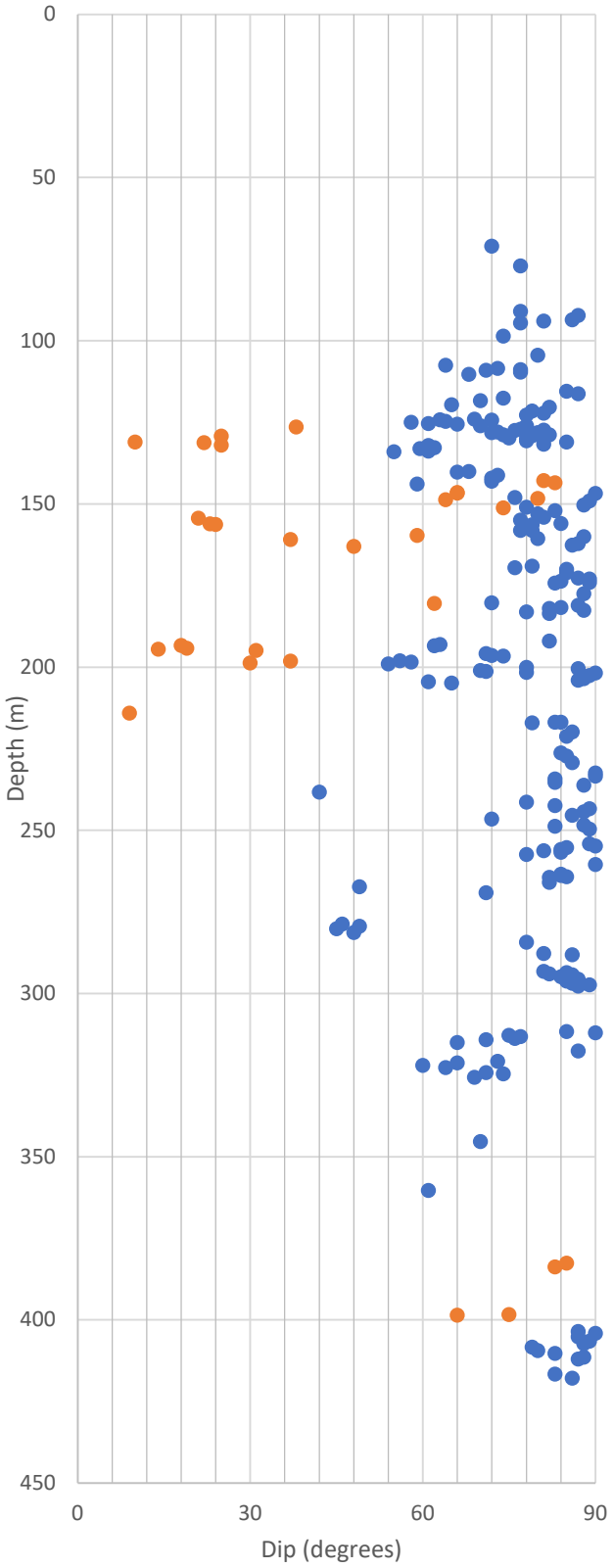
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm
0

Depth Vs Dip Direction



Depth Vs Dip



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-21
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
ORIENTED COREHOLE DATA
STRUCTURAL ORIENTATIONS VERSUS DEPTH
OSIRIS PIT – OS-18-279

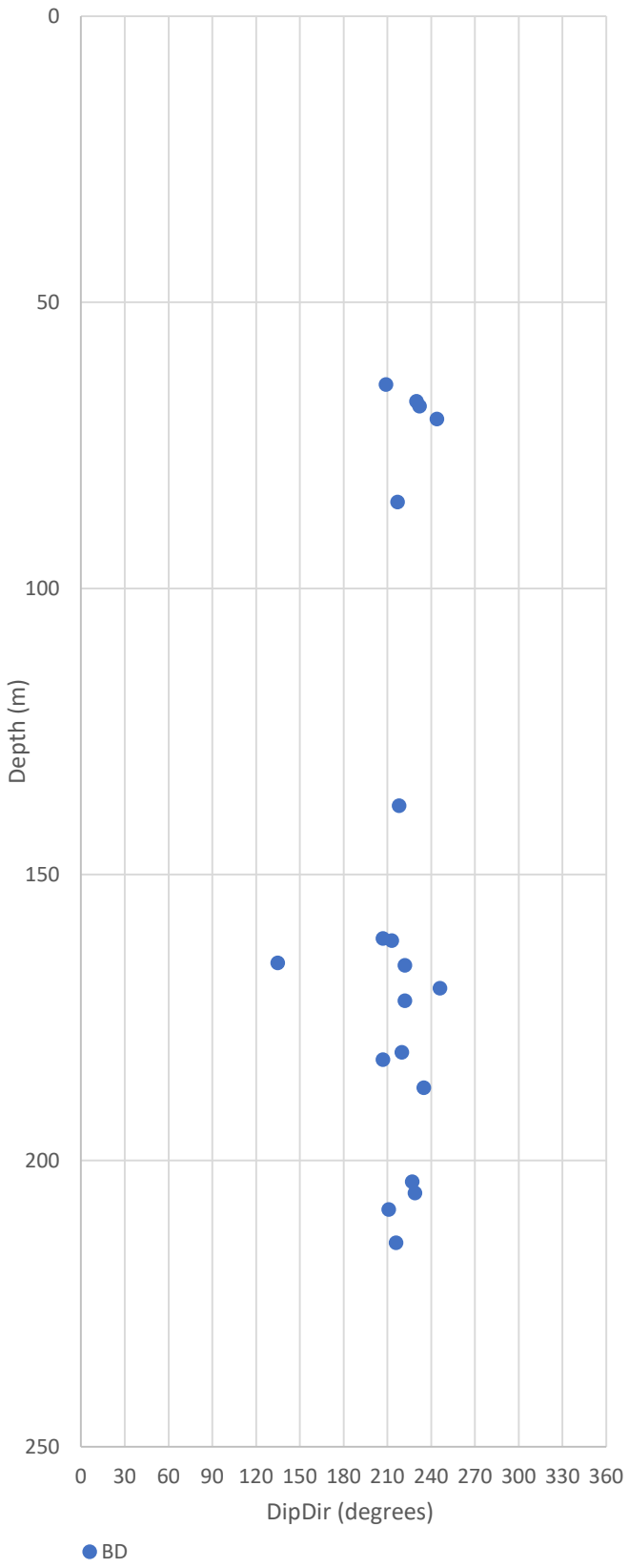
PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**E-4**

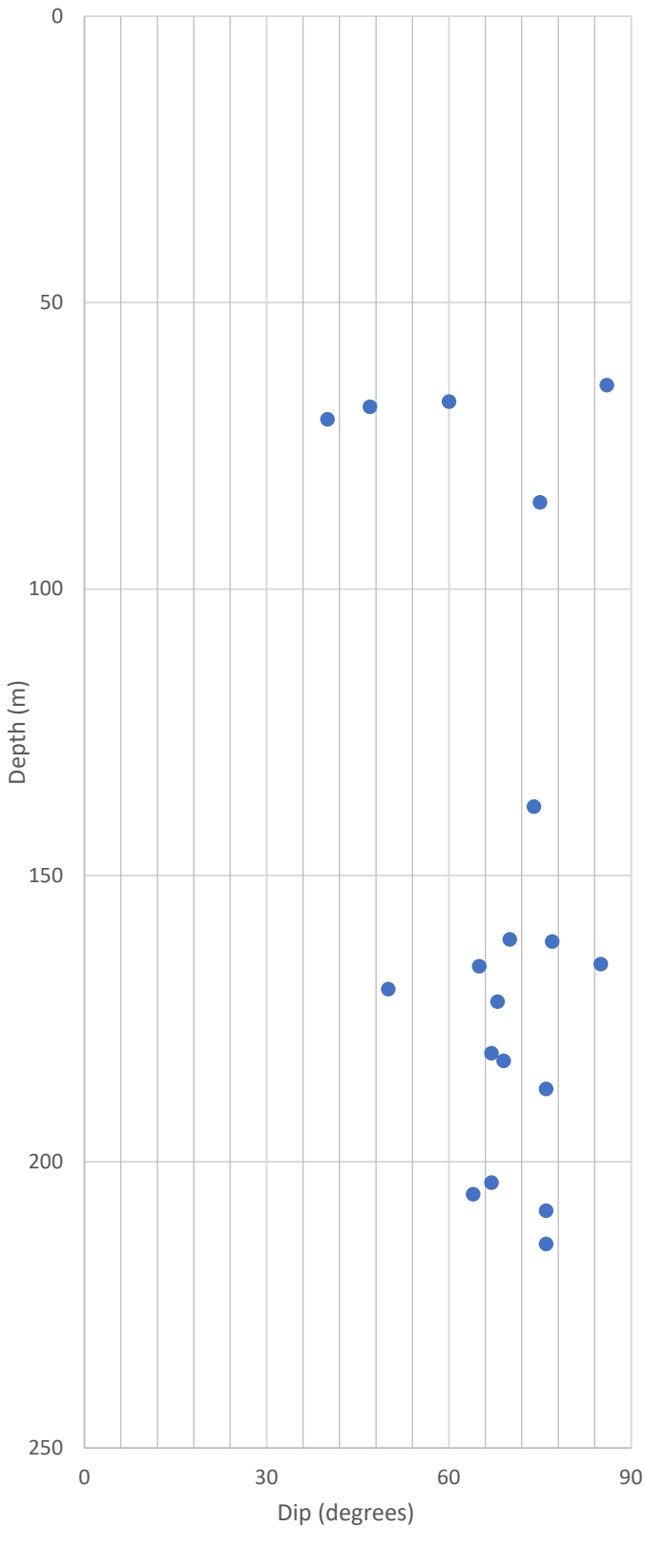
Path: \golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Oriented Core Data\ | File Name: Osiris_Oriented Core_Downhole Plots.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm

0





CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-21
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
ORIENTED COREHOLE DATA
STRUCTURAL ORIENTATIONS VERSUS DEPTH
IBIS PIT – OS-12-136

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**4000**	**0**	**E-5**

Path: \golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Oriented Core Data\ | File Name: Osiris_Oriented Core_Downhole Plots.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm
0

APPENDIX F

Exploration Core Review

RECORD OF ROCK CORE DRILLING AND TESTING - DRILL HOLE NO. OS-12-119

Project No: 18100420 | Project Name: Osiris | Date: June 24, 2018

Northing: | Inclination: | Logger: Trevor Tamburri

Easting: | Azimuth: | Drillers:

Elevation: | Stick Up: | Rods/Bit: 0-152.70m: HQ 152.70-600.76m: PQ

Depth (m)	Description	Interval No. and Depth (from - to) (m)	TCR m/m	RQD m/m	Fractures per ___ m	Strength Index	Weathering Index	Point Load Index, $I_{s(50)}$ (MPa) @ Depth (m)	Fracture Depth (m)	Type & Number (#)	Orientation: DIP (alpha)	Orientation: DIP DIRECTION (beta)	Discontinuity Description: Surface: Shape	Surface: Roughness	Infill/Coating: Type	Infill/Coating: Character	Infill/Coating: Thickness	Fracture/Joint Condition (Jcon) JCR	Jr	Ja	Jn	Fault Breccia/Gouge BC	Broken/Lost Core LC
1.83	• maroon to grey NONAD mudstone • A1 • GSI: 40-50			20 %	50 to 300 mm	R3	W3											• Some rubble zones and weathered rock, discontinuities with soft wall rock. • FeOx staining.	12		Rock Unit		
18.59	• grey to brown NONAD • A2 GSI: 35-40			10 %	< 50 mm	R2	W4											• rubble zone with some intact pieces of core	12				
28.0	• grey NONAD • A1 GSI: 50-55			50 %	0.3 to 1m	R3	W2											• discontinuities have FeOx staining	20				
29.26	• grey to brown NONAD • A2 GSI: 40-45			15 %	< 50 mm	R2	W3											• Some rubble zones and heavily weathered zones • FeOx staining	12				
35.36	• brown to orange NONAD • A2 GSI: 15-20			10 %	< 50 mm	R1	W4											• rubble zone with decomposed zones of rock	6		C-NONAD		
44.90	• teal NONAD mudstone • A1 GSI: 45-55			15 %	0.3 to 1m	R3	W3											• Some rubble zones • FeOx on discontinuities	20				
66.00	• within NONAD, light grey fine to med grained SST • qtz-calcite veining • A1, GSI: 60-65			60 %	0.3 to 1m	R4	W2											• Some rubble zones and disintegrated rock (<10cm wide) • FeOx staining.	20				
78.03	• maroon to teal NONAD mudstone • A2 GSI: 20-30			10 %	< 50 mm	R2	W3											• 30cm rubble zone that is decomposed to clay	6				
81.08	• good quality maroon to teal NONAD mudstone. • A1 GSI: 70-75			80 %	1 to 3m	R3	W2											• Some FeOx staining on joints • weathering penetrates up to 4cm into rock from fractures.	20				
128.32																							

Shape:	Roughness:
PL: Planar	K: Slickensided
CU: Curved	PO: Polished
UN: Undulating	SM: Smooth
ST: Stepped	RO: Rough
IR: Irregular	VR: Very Rough

Infilling:					
Phyllosilicates		Mineral Precipitate/Cement		Physical	
Bt: Biotite	Pg: Phlogopite	Ca: Calcite	Ep: Epidote	Gr: Graphite	Su: Sulphide
Ch: Chlorite	Cl: Clay	Fe: Iron	Mn: Manganese	He: Hematite	Qz: Quartz
Sr: Sericite		Gy: Gypsum		Tc: Talc	
M: Silt					
Sa: Sand					
Gv: Gravel					
Br: Broken					
Go: Gouge					

Joint Roughness (Jr):	
Discontinuous	4.0
Wavy and Rough	3.0
Wavy and Smooth	2.0
Planar/Rough or Wavy/Slickensided	1.5
Planar/smooth OR Filled	1.0
Planar/Slickensided	0.5

Joint Alteration (Ja):					
Unfilled or Coated:		Filled:			
Healed Fractures	0.75	Sand/Crushed Rock < 5mm		4	
Staining only	1	Sand/Crushed Rock > 5mm		5	
Slightly altered walls	2	Cement/Non-softening	< 5 mm	6	
Silty/sandy (Decomposing)	3	Soft Clays/Low friction		8	
Clay (Disintegrating)	4	Hydrating Clays/Chlorite		12	
		Cement/Non-softening	> 5 mm	10	
		Soft Clays/Low friction		15	
		Hydrating Clays/Chlorite		20	

Joint Number (Jn):	
Massive	0.5
Occas. Random	1
One set	2
One plus random	3
Two sets	4
Two plus random	6
Three sets	9
Three plus random	12
Four or more sets	15
Crushed rock	20

Joint Condition (Jcon):	Value
Fractures not continuous or no separation in hard, fresh rock.	25
Separation < 1mm in slightly weathered or medium rock.	20
Separation < 1mm in highly weathered or soft rock.	12
Separation between 1-5 mm OR stiff gouge < 5mm OR Slickensided surfaces.	6
Soft gouge > 5 mm thick OR separation > 5 mm.	0

Type:			
Fracture:	FR	Bedding:	BD
Joint:	JN	Foliation:	FO
Fault:	FLT	Cleavage:	CL
Vein:	VN	Brkn Core:	BC
Open Vein:	VNO	Contact:	CON
Open Contact:			CONO

Infilling/Coating Character	
Clean	–
Staining Only	ST
Slightly Altered	SA
Continuous Coating <= 1 mm	CC
Discontinuous Coating <= 2 mm	DC
Continuous Infill > 1 mm	IN

Golder Associates

RECORD OF ROCK CORE DRILLING AND TESTING - DRILL HOLE NO. 05-12-119

Project No: 1810042O | Project Name: Osiris | Date: June 24, 2018

Northing: | Inclination: | Logger: Trevor Tamburri

Easting: | Azimuth: | Drillers:

Elevation: | Stick Up: | Rods/Bit: 0-152.70m = HQ 152.70-600.76m = PQ

Depth (m)	Description	Interval No. and Depth (from - to) (m)	TCR m/m	RQD m/m	Fractures per m	Strength Index	Weathering Index	Point Load Index, $I_{s(50)}$ (MPa) @ Depth (m)	Fracture Depth (m)	Type & Number (#)	Orientation: Dip (alpha)	Orientation: Dip DIRECTION (beta)	Discontinuity Description: Surface: Shape	Surface: Roughness	Infill/Coating: Type	Infill/Coating: Character	Infill/Coating: Thickness	Fracture/Joint Condition Jcon/JCR	Jr	Ja	Jn	Fault Breccia/Gouge	BC / LC Broken/Lost Core
128.32	• within NONAD, grey siltstone rubble zone. • A2 GSI= 15-20			0 %	< 50 mm	R1	W3											6					
129.50	• grey to teal, mudstone to siltstone, lots of bedding parallel veining, some long joints • A1 GSI= 70-75			80 %	1 to 3 m	R3 to R4	W2											20			C-NONAD		
177.09	• maroon to teal siltstone to sandstone • veining and ductile deformation visible, particularly towards bottom of interval • A1 • GSI=80-85			> 90 %	1 to 3 m	R3 to R4	W1											25					
204.52	• Nadaleen Fault Zone (NFZ) • grey to black healed breccia, lots of veining • Healed ductile deformation visible. • A3 • GSI= 40-50			60 %	0.3 to 1 m	R2 to R3	W1											12			NFZ		
215.00	• teal mudstone fragment within NFZ • A1 • GSI= 80-85			> 90 %	1 to 3 m	R3	W1											25					
227.00	• grey to black healed breccia • visible ductile deformation • A3 GSI=40-50			60 %	0.3 to 1 m	R2 to R3	W1											12					
259.38																							

- Fe Ox staining on discontinuities Rock unit
- rubble/shear zone, some rock decomposed to clay
- Fe Ox staining on discontinuities
- Minor rubble zones/clay
- discontinuities are mostly bedding parallel.
- Minor amounts of Fe Ox staining on joints
- surfaces generally clean
- Micro fracture in rock indicated large shear zone is close.
- zones of rubble and fault gouge up to 10cm wide
- some soft wall rock on discontinuities.
- Minor Fe Ox staining
- rubble zones up to 0.7m
- heavily altered zones up to 0.3m

Shape:	Roughness:
PL: Planar	K: Slickensided
CU: Curved	PO: Polished
UN: Undulating	SM: Smooth
ST: Stepped	RO: Rough
IR: Irregular	VR: Very Rough

Infilling: Phyllosilicates		Mineral Precipitate/Cement		Physical	
Bt: Biotite		Ca: Calcite	Gr: Graphite	M: Silt	
Pg: Phlogopite		Ep: Epidote	Su: Sulphide	Sa: Sand	
Ch: Chlorite		Fe: Iron	He: Hematite	Gv: Gravel	
Cl: Clay		Mn: Manganese	Qz: Quartz	Br: Broken	
Sr: Sericite		Gy: Gypsum	Tc: Talc	Go: Gouge	

Joint Roughness (Jr):	
Discontinuous	4.0
Wavy and Rough	3.0
Wavy and Smooth	2.0
Planar/Rough or Wavy/Slickenside	1.5
Planar/smooth OR Filled	1.0
Planar/Slickensided	0.5

Joint Alteration (Ja): Unfilled or Coated:		Filled:			
Healed Fractures	0.75	Sand/Crushed Rock < 5mm		4	Occas. Random
Staining only	1	Sand/Crushed Rock > 5mm		5	One set
Slightly altered walls	2	Cement/Non-softening	> 5 mm	6	One plus random
Silty/sandy (Decomposing)	3	Soft Clays/Low friction		8	Two sets
Clay (Disintegrating)	4	Hydrating Clays/Chlorite		12	Two plus random
		Cement/Non-softening	< 5 mm	9	Three sets
		Soft Clays/Low friction		15	Three plus random
		Hydrating Clays/Chlorite		20	Four or more sets
					Crushed rock

Joint Number (Jn):	
Massive	0.5
One set	2
One plus random	3
Two sets	4
Two plus random	6
Three sets	9
Three plus random	12
Four or more sets	15
Crushed rock	20

Joint Condition (Jcon):	Value
Fractures not continuous or no separation in hard, fresh rock	25
Separation < 1mm in slightly weathered or medium rock	20
Separation < 1mm in highly weathered or soft rock,	12
Separation between 1-5 mm OR stiff gouge < 5mm OR Slickensided surfaces	6
Soft gouge > 5 mm thick OR separation > 5 mm	0

Type:			
Fracture:	FR	Bedding:	BD
Joint:	JN	Foliation:	FO
Fault:	FLT	Cleavage:	CL
Vein:	VN	Brkn Core:	BC
Open Vein:	VNO	Contact:	CON
		Open Contact:	CONO

Infilling/Coating Character	
Clean	–
Staining Only	ST
Slightly Altered	SA
Continuous Coating <= 1 mm	CC
Discontinuous Coating <= 2 mm	DC
Continuous Infill > 1 mm	IN

Golder Associates

RECORD OF ROCK CORE DRILLING AND TESTING - DRILL HOLE NO. 05-12-119

Project No: 18100420 | Project Name: Osiris | Date: June 26, 2018

Northing: | Inclination: | Logger: Trevor Tambur

Easting: | Azimuth: | Drillers:

Elevation: | Stick Up: | Rods/Bit: 152.70 to 600.76 m = PQ

Depth (m)	Description	Interval No. and Depth (from - to) (m)	TCR m/m	RQD m/m	Fractures per ___ m	Strength Index	Weathering Index	Point Load Index, $I_{s(50)}$ (MPa) @ Depth (m)	Fracture Depth (m)	Type & Number (#)	Orientation: DIP/alpha	Orientation: DIP DIRECTION (beta)	Discontinuity Description: Surface: Shape	Surface: Roughness	Infill/Coating: Type	Infill/Coating: Character	Infill/Coating: Thickness	Fracture/Joint Condition (Jcon)	Jr	Ja	Jn	Fault Breccia/Gouge	SC / LC	Broken/Lost Core
259.38	• grey to black NFZ cataclasite • A4 • GSI: 30-35		/	70 %	0.3 to 1 m	R1	W2											• rock is decomposed and weaker than adjacent runs.	6			Rock Unit		
267.35	• grey NFZ, likely dominated by mudstone • A3 • GSI: 55-60		/	80 %	0.3 to 1m	R3	W1											• few natural discontinuities • breaks occur along fabric of ductile deformation • undulating and smooth	20					
280.72	• grey NFZ • A2		/	/	/	R3	W1											• Not much core in box • Likely due to sampling	/			NFZ		
283.77	• light brown to grey NFZ • likely dominated by SLC cataclasite unit. • intervals of pebble CGL • healed breccia and sheared fabric throughout • A2 • GSI: 55-60		/	80 %	0.3 to 1 m	R3	W1											• discontinuities are undulating some with soft coatings • Some are clean and rough.	20					
334.80	• light brown to teal conrad intrusive • A2 GSI: 75-80		/	≥ 90 %	1 to 3 m	R3	W1											• few discontinuities observed • planar rough to undulating smooth.	25		C-INT			
343.94	• light grey conrad limestone • heavily veined, some micro fracturing. • A1 • GSI: 65 - 70		/	70%	0.3 to 1 m	R3	W1											• fractures are undulating and rough, mostly clean • locally slickensided • breaks along minor fractures	20					
353.87	• grey conrad limestone • variable veining • small scale folding • minor micro fracturing • A1, GSI: 70-75		/	≥ 90%	0.3 to 1 m	R4	W1											• fractures are typically clean, undulating rough • mostly along bedding • local slickensided.	25		C-LST1			
401.31																								

End of borehole review.

Shape:	Roughness:
PL: Planar	K: Slickensided
CU: Curved	PO: Polished
UN: Undulating	SM: Smooth
ST: Stepped	RO: Rough
IR: Irregular	VR: Very Rough

Infilling:					
Phyllosilicates		Mineral Precipitate/Cement		Physical	
Bt: Biotite		Ca: Calcite	Gr: Graphite	M: Silt	
Pg: Phlogopite		Ep: Epidote	Su: Sulphide	Sa: Sand	
Ch: Chlorite		Fe: Iron	He: Hematite	Gv: Gravel	
Cl: Clay		Mn: Manganese	Qz: Quartz	Br: Broken	
Sr: Sericite		Gy: Gypsum	Tc: Talc	Go: Gouge	

Joint Roughness (Jr):	
Discontinuous	4.0
Wavy and Rough	3.0
Wavy and Smooth	2.0
Planar/Rough or Wavy/Slickenside	1.5
Planar/smooth OR Filled	1.0
Planar/Slickensided	0.5

Joint Alteration (Ja):			
Unfilled or Coated:		Filled:	
Healed Fractures	0.75	Sand/Crushed Rock < 5mm	4
Staining only	1	Sand/Crushed Rock > 5mm	5
Slightly altered walls	2	Cement/Non-softening (< 5 mm)	6
Silty/sandy (Decomposing)	3	Soft Clays/Low friction (< 5 mm)	8
Clay (Disintegrating)	4	Hydrating Clays/Chlorite (< 5 mm)	12
		Cement/Non-softening (> 5 mm)	10
		Soft Clays/Low friction (> 5 mm)	15
		Hydrating Clays/Chlorite (> 5 mm)	20

Joint Number (Jn):	
Massive	0.5
Occas. Random	1
One set	2
One plus random	3
Two sets	4
Two plus random	6
Three sets	9
Three plus random	12
Four or more sets	15
Crushed rock	20

Joint Condition (Jcon):	Value
Fractures not continuous or no separation in hard, fresh rock.	25
Separation < 1mm in slightly weathered or medium rock.	20
Separation < 1mm in highly weathered or soft rock.	12
Separation between 1-5 mm OR stiff gouge < 5mm OR Slickensided surfaces.	6
Soft gouge > 5 mm thick OR separation > 5 mm.	0

Type:			
Fracture:	FR	Bedding:	BD
Joint:	JN	Foliation:	FO
Fault:	FLT	Cleavage:	CL
Vein:	VN	Brkn Core:	BC
Open Vein:	VNO	Contact:	CON
Open Contact:	CONO		

Infilling/Coating Character	
Clean	--
Staining Only	ST
Slightly Altered	SA
Continuous Coating <= 1 mm	CC
Discontinuous Coating <= 2 mm	DC
Continuous Infill > 1 mm	IN

Golder Associates

RECORD OF ROCK CORE DRILLING AND TESTING - DRILL HOLE NO. OS-12-126

Project No: 181001120 | Project Name: Osiris | Date: June 26, 2018

Northing: | Inclination: | Logger: Trevor Tamburri

Easting: | Azimuth: | Drillers:

Elevation: | Stick Up: | Rods/Bit: HQ

Depth (m)	Description	Interval No. and Depth (from - to) (m)	TCR m/m	RQD m/m	Fractures per ___ m	Strength Index	Weathering Index	Point Load Index, $I_{s(50)}$ (MPa) @ Depth (m)	Fracture Depth (m)	Type & Number (#)	Orientation: DIP (alpha)	Orientation: DIP DIRECTION (beta)	Discontinuity Description: Surface: Shape	Surface: Roughness	Infill/Coating: Type	Infill/Coating: Character	Infill/Coating: Thickness	Fracture/Joint Condition (Jcon) JCR	Jr	Ja	Jn	Fault Breccia/Gouge FC	Broken/Lost Core LC
3.05	• grey diamictite (medium grained) • A2 • GSI = 60-65			0 to 30 %	0.1 to 0.7 m	R4	W3		mostly bedding, Fe Ox staining				• discontinuities are planer and rough					12		Rock Unit			
8.00	• grey interbedded SLT-MST • A2 • GSI = 50-60			0 to 20 %	0.05 to 0.2 m	R3	W3		• bedding discontinuities are planar smooth to rough, clean or Fe Ox Stained.									12					
14.63	• grey interbedded CGL-SLT-MST • A2 • GSI = 55-60			10 to 35 %	0.2 to 0.3 m	R3	W3		• discontinuities are Fe Ox Stained									12		0-Ja+2			
23.77	• grey interbedded CGL-SLT-MST • A2 • GSI = 55-65			10 to 30 %	0.2 to 0.4 m	R3	W2		• planer discontinuities are smooth to rough, clean to Fe Ox stained									12 to 20					
35.97	• dark grey SLT • A3 • GSI: 45-55			0 to 10 %	0.05 to 0.1 m	R2	W2		• discontinuities are undulating and smooth. mostly clean however, minor Fe Ox staining is observed									20					
40.54	• grey diamictite/SLT • Not much core in boxes					R3	W2																
45.11	• grey SLT, minor diamictite • A1 • GSI = 65-75			70 to 80 %	+ 0.2 m	R3	W2		• planer bedding discontinuities are smooth to rough, Some Fe Ox Stained.									20		0-Ja+1			
57.75	• grey diamictite/SLT - weathered, A2 • GSI = 50-60			25 to 35 %	0.05 to 0.15 m	R3	W3		• discontinuities are undulating rough and Fe Ox Stained									20					
60.0	• grey SLT, heavily fractured • potentially heavily downgraded since first logged • A2 GSI: 50-55			20 to 40 %	0.05 to 0.1 m	R3	W2		•				"					20					
63.0																							

Shape:	Roughness:	Infilling: Phyllosilicates	Mineral Precipitate/Cement		Physical
PL: Planar	K: Slickensided	Bt: Biotite	Ca: Calcite	Gr: Graphite	M: Silt
CU: Curved	PO: Polished	Pg: Phlogopite	Ep: Epidote	Su: Sulphide	Sa: Sand
UN: Undulating	SM: Smooth	Ch: Chlorite	Fe: Iron	He: Hematite	Gv: Gravel
ST: Stepped	RO: Rough	Cl: Clay	Mn: Manganese	Qz: Quartz	Br: Broken
IR: Irregular	VR: Very Rough	Sr: Sericite	Gy: Gypsum	Tc: Talc	Go: Gouge

Joint Roughness (Jr):	
Discontinuous	4.0
Wavy and Rough	3.0
Wavy and Smooth	2.0
Planar/Rough or Wavy/Slickenside	1.5
Planar/smooth OR Filled	1.0
Planar/Slickensided	0.5

Joint Alteration (Ja): Unfilled or Coated:		Filled:			Joint Number (Jn):	
Healed Fractures	0.75	Sand/Crushed Rock < 5mm		4	Massive	0.5
Staining only	1	Sand/Crushed Rock > 5mm		5	One set	2
Slightly altered walls	2	Cement/Non-softening	< 5 mm	6	One plus random	3
Silty/sandy (Decomposing)	3	Soft Clays/Low friction		8	Two sets	4
Clay (Disintegrating)	4	Hydrating Clays/Chlorite		12	Two plus random	6
		Cement/Non-softening	> 5 mm	10	Three sets	9
		Soft Clays/Low friction		15	Three plus random	12
		Hydrating Clays/Chlorite		20	Four or more sets	15
					Crushed rock	20

Joint Condition (Jcon):	Value
Fractures not continuous or no separation in hard, fresh rock.	25
Separation < 1mm in slightly weathered or medium rock.	20
Separation < 1mm in highly weathered or soft rock.	12
Separation between 1-5 mm OR stiff gouge < 5mm OR Slickensided surfaces.	6
Soft gouge > 5 mm thick OR separation > 5 mm.	0

Type:			
Fracture:	FR	Bedding:	BD
Joint:	JN	Foliation:	FO
Fault:	FLT	Cleavage:	CL
Vein:	VN	Brkn Core:	BC
Open Vein:	VNO	Contact:	CON
		Open Contact:	CONO

Infilling/Coating Character	
Clean	--
Staining Only	ST
Slightly Altered	SA
Continuous Coating <= 1 mm	CC
Discontinuous Coating <= 2 mm	DC
Continuous Infill > 1 mm	IN

Golder Associates

RECORD OF ROCK CORE DRILLING AND TESTING - DRILL HOLE NO. OS-17-136

Project No: 18100420 | Project Name: OSIRIS | Date: June 26, 2018

Northing: | Inclination: | Logger: Trevor Tamburri

Easting: | Azimuth: | Drillers:

Elevation: | Stick Up: | Rods/Bit: HQ

Depth (m)	Description	Interval No. and Depth (from - to) (m)	TCR m/m	RQD m/m	Fractures per ___ m	Strength Index	Weathering Index	Point Load Index, $I_{S(50)}$ (MPa) @ Depth (m)	Fracture Depth (m)	Type & Number (#)	Orientation: DIP (alpha)	Orientation: DIP DIRECTION (beta)	Discontinuity Description: Surface: Shape	Surface: Roughness	Infill/Coating: Type	Infill/Coating: Character	Infill/Coating: Thickness	Fracture/Joint Condition/Jcon/JCR	Jr	Ja	Jn	Fault Breccia/Gouge	Broken/Lost Core: BC	Broken/Lost Core: LC
63.0	• grey to brown diamictite and SLC, interbedded • weathering/oxidization penetrating into rock mass along joints • A1 • GSI: 65-75		/	65 to 75 %	0.1 to 0.4 m	R3	W2		• discontinuities range from planer to undulating, smooth to very rough • clean to FeOx stained. • oxidization penetrates into rock at joints up to 3cm.									20			Rock unit. 0-DMT			
80.46	• light to dark diamictite and SLC • A2 • GSI: 55-65		/	45 to 50 %	0.1 to 0.3 m	R3	W2		• bedding discontinuity are planer and clean Some FeOx									20			↓			
88.09	• grey dolostone with some laminated SLC • A1 • GSI: 50-60		/	30 to 40 %	0.01 to 0.1 m	R3	W2		• planer smooth/polished bedding in SLC									12			↓			
91.14	• grey dolostone • A1 • GSI: 70-80		/	40 to 50 %	0.2 to 0.4 m	R3	W2		• discontinuities are undulating rough to very rough Clean to FeOx stained									25			↓			
94.0	• tan to brown dolostone A2 • GSI: 40-50		/	0 to 10 %	0.01 to m	R3	W2		• Same as previous interval									25			↓			
98.76	• grey dolostone • A2 GSI: 75-80		/	50 to 60 %	0.1 to 0.2 m	R3	W2		• rough to very rough discontinuity Minor FeOx stain									25			↓			
101.80	• light brown to grey dolostone, weathered and oxidized • pervasive rubble zones. • A2 GSI: 40-50		/	+/- 10 %	.01 to 0.1 m	R3	W2		• discontinuities are rough to very rough, FeOx staining • rubble zones are composed of subangular dolostone clasts, silt size to 3cm is average minor clay in zones									20			↓ 0-DST			
112.47	• grey dolostone • A1 • GSI: 75 to 80		/	60 to 70 %	0.1 to 0.3 m	R3	W1		• rough to very rough									25			↓			
116.5																								

Shape:	Roughness:
PL: Planar	K: Slickensided
CU: Curved	PO: Polished
UN: Undulating	SM: Smooth
ST: Stepped	RO: Rough
IR: Irregular	VR: Very Rough

Infilling:					
Phyllosilicates		**Mineral Precipitate/Cement**		**Physical**	
Bt: Biotite	Ca: Calcite	Gr: Graphite	M: Silt		
Pg: Phlogopite	Ep: Epidote	Su: Sulphide	Sa: Sand		
Ch: Chlorite	Fe: Iron	He: Hematite	Gv: Gravel		
Cl: Clay	Mn: Manganese	Qz: Quartz	Br: Broken		
Sr: Sericite	Gy: Gypsum	Tc: Talc	Go: Gouge		

Joint Roughness (Jr):	
Discontinuous	4.0
Wavy and Rough	3.0
Wavy and Smooth	2.0
Planar/Rough or Wavy/Slickenside	1.5
Planar/Smooth OR Filled	1.0
Planar/Slickensided	0.5

Joint Alteration (Ja):					
Unfilled or Coated:		**Filled:**			
Healed Fractures	0.75	Sand/Crushed Rock < 5mm		4	
Staining only	1	Sand/Crushed Rock > 5mm		5	
Slightly altered walls	2	Cement/Non-softening	< 5 mm	6	
Silty/sandy (Decomposing)	3	Soft Clays/Low friction		8	
Clay (Disintegrating)	4	Hydrating Clays/Chlorite		12	
		Cement/Non-softening	> 5 mm	10	
		Soft Clays/Low friction		15	
		Hydrating Clays/Chlorite		20	

Joint Number (Jn):	
Massive	0.5
Occas. Random	1
One set	2
One plus random	3
Two sets	4
Two plus random	6
Three sets	9
Three plus random	12
Four or more sets	15
Crushed rock	20

Joint Condition (Jcon):	Value
Fractures not continuous or no separation in hard, fresh rock.	25
Separation < 1mm in slightly weathered or medium rock.	20
Separation < 1mm in highly weathered or soft rock.	12
Separation between 1-5 mm OR stiff gouge < 5mm OR Slickensided surfaces	6
Soft gouge > 5 mm thick OR separation > 5 mm.	0

Type:			
Fracture:	FR	Bedding:	BD
Joint:	JN	Foliation:	FO
Fault:	FLT	Cleavage:	CL
Vein:	VN	Brkn Core:	BC
Open Vein:	VNO	Contact:	CON
Open Contact:			CONO

Infilling/Coating Character	
Clean	--
Staining Only	ST
Slightly Altered	SA
Continuous Coating <= 1 mm	CC
Discontinuous Coating <= 2 mm	DC
Continuous Infill > 1 mm	IN

Golder Associates

RECORD OF ROCK CORE DRILLING AND TESTING - DRILL HOLE NO. C-12-126

Project No: 181004-20 | Project Name: Osiris | Date: June 24, 2019

Northing: | Inclination: | Logger: Trevor Tamburri

Easting: | Azimuth: | Drillers:

Elevation: | Stick Up: | Rods/Bit: HQ

Depth (m)	Description	Interval No. and Depth (from - to) (m)	TCR m/m	RQD m/m	Fractures per m	Strength Index	Weathering Index	Point Load Index, $I_{S(50)}$ (MPa) @ Depth (m)	Fracture Depth (m)	Type & Number (#)	Orientation: DIP (alpha)	Orientation: DIP DIRECTION (beta)	Discontinuity Description: Surface: Shape	Surface: Roughness	Infill/Coating: Type	Infill/Coating: Character	Infill/Coating: Thickness	Fracture/Joint Condition (Jcon)	Jr	Ja	Jn	Fault Breccia/Gouge	SC / LC / Broken/Lost Core
116.5	• grey dolostone • A2 • GSI = 60 to 70		/	0 to 20 %	0.01 to 0.1 m	R3	W2		•	rough to very rough undulating discontinuities Fe Ox								25				ROLL	UN / IT
119.0	• brown - orange dolostone • rubble zone A2 GSI: 20-30			0 %	0.01 m	R2	W3		•	rubble zone, silt to 1cm gradation								6		0 - 0.5	T		
120.0	End of borehole review.																						

Shape:	Roughness:	Infilling:					
PL: Planar	K: Slickensided	Phyllosilicates	Mineral Precipitate/Cement			Physical	
CU: Curved	PO: Polished	Bt: Biotite	Ca: Calcite	Gr: Graphite	M: Silt		
UN: Undulating	SM: Smooth	Pg: Phlogopite	Ep: Epidote	Su: Sulphide	Sa: Sand		
ST: Stepped	RO: Rough	Ch: Chlorite	Fe: Iron	He: Hematite	Gv: Gravel		
IR: Irregular	VR: Very Rough	Cl: Clay	Mn: Manganese	Qz: Quartz	Br: Broken		
		Sr: Sericite	Gy: Gypsum	Tc: Talc	Go: Gouge		

Joint Roughness (Jr):	
Discontinuous	4.0
Wavy and Rough	3.0
Wavy and Smooth	2.0
Planar/Rough or Wavy/Slickenside	1.5
Planar/Smooth OR Filled	1.0
Planar/Slickensided	0.5

Joint Alteration (Ja):			
Unfilled or Coated:		Filled:	
Healed Fractures	0.75	Sand/Crushed Rock < 5mm	4
Staining only	1	Sand/Crushed Rock > 5mm	6
Slightly altered walls	2	Cement/Non-softening (< 5 mm)	6
Silty/sandy (Decomposing)	3	Soft Clays/Low friction (< 5 mm)	8
Clay (Disintegrating)	4	Hydrating Clays/Chlorite (< 5 mm)	12
		Cement/Non-softening (> 5 mm)	10
		Soft Clays/Low friction (> 5 mm)	15
		Hydrating Clays/Chlorite (> 5 mm)	20

Joint Number (Jn):	
Massive	0.5
Occas. Random	1
One set	2
One plus random	3
Two sets	4
Two plus random	6
Three sets	9
Three plus random	12
Four or more sets	15
Crushed rock	20

Joint Condition (Jcon):	Value
Fractures not continuous or no separation in hard, fresh rock.	25
Separation < 1mm in slightly weathered or medium rock.	20
Separation < 1mm in highly weathered or soft rock.	12
Separation between 1-5 mm OR stiff gouge < 5mm OR Slickensided surfaces	6
Soft gouge > 5 mm thick OR separation > 5 mm.	0

Type:			
Fracture:	FR	Bedding:	BD
Joint:	JN	Foliation:	FO
Fault:	FLT	Cleavage:	CL
Vein:	VN	Brkn Core:	BC
Open Vein:	VNO	Contact:	CON
Open Contact:			CONO

Infilling/Coating Character	
Clean	--
Staining Only	ST
Slightly Altered	SA
Continuous Coating <= 1 mm	CC
Discontinuous Coating <= 2 mm	DC
Continuous Infill > 1 mm	IN

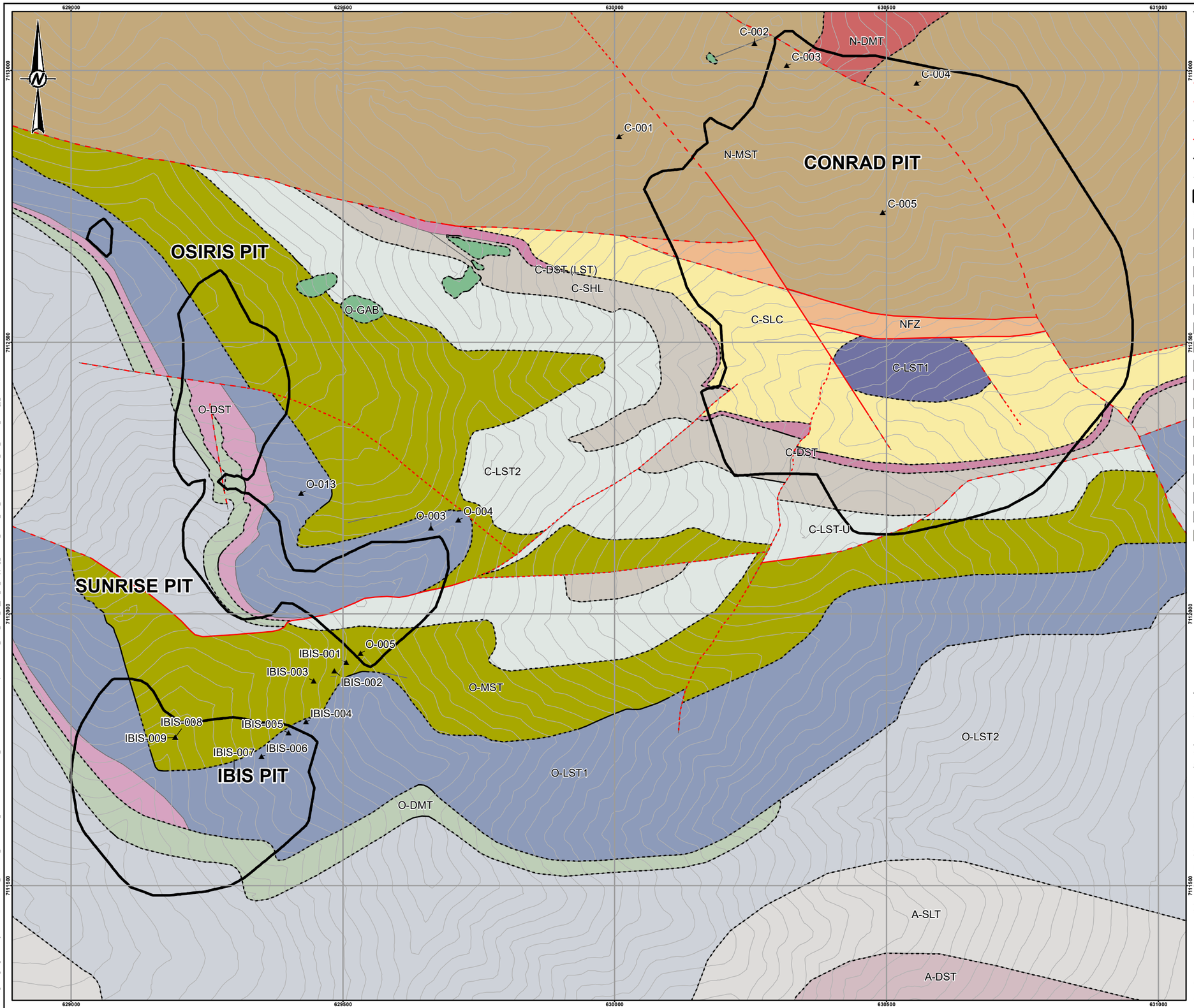
Golder Associates

APPENDIX G

Outcrop Mapping

APPENDIX G1

Discontinuity Survey Data Sheets



LEGEND

- MAPPING LOCATIONS WITH DISCONTINUITY ORIENTATION AND CHARACTERISTIC DATA
- APPROXIMATE FAULTS
- INFERRED FAULTS
- INFERRED CONTACTS
- OBSERVED FAULTS
- OBSERVED CONTACTS
- CONTOUR (20 m)
- PIT OUTLINE

SURFACE GEOLOGY

- A-DST, Atum Dolostone
- A-SLT, Atum Siltstone
- C-DST, Conrad Silica Dolostone
- C-DST (LST), Conrad Silica Dolostone (Limestone)
- C-LST1, Conrad Limestone 1
- C-LST2, Conrad Limestone 2
- C-SHL, Conrad Shale
- C-SLC, Conrad Siliciclastics
- N-DMT, Nonad Diamictite
- N-MST, Unclassified Nonad Mudstone
- NFZ, Nadaleen Fault Zone
- O-DMT, Osiris Diamictite
- O-DST, Osiris Dolostone
- O-GAB, Osiris Gabbro
- O-LST1, Osiris Limestone 1
- O-LST2, Osiris Limestone 2
- O-MST, Osiris Mudstone

0 150 300
1:7,000 METRES

REFERENCE(S)
1. BASE DATA PROVIDED BY CLIENT.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 8N

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
MAPPING LOCATIONS WITH DISCONTINUITY ORIENTATION AND CHARACTERISTIC DATA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-23
DESIGNED	SA
PREPARED	CC
REVIEWED	TGT
APPROVED	AVC

PROJECT NO.	PHASE	REV.	FIGURE
18100420	2000	0	G1-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

PATH: \\golder.gds\gal\burnaby\CAD-GIS\Client\ATAC_Resources_Ltd\Yukon\99_PROJECTS\18100420\2_PRODUCTION\4000\MXD\Report\18100420_4000_4100_Fig_G1_01_Mapping_Location_C-dlars_with_Discontinuity_Data_and_Surface_Geology_Yukon.mxd PRINTED ON: 2019-09-23 AT: 9:29:56 AM

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Project Element	Date	Month	Day	Year
Conrad	C-001	Mapping		6	25	2018

Easting: 630008
Northing: 7112879
Elevation 1744

Inspector: TGT/JKA

Discontinuity data sheet no. 1 of 1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	DDR	Dip	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	Roughness	Shape	Spacing, m	JRC	Comment
	Jt	117	82	2	-	2	2	-	S	C	0.02-0.05		J2 Joint set
	Jt	117	85	2	-	2	2	-	S	C	0.02-0.05		
	Jt	122	83	2	-	2	2	-	S	C	0.02-0.05		
	Jt	111	76	2	-	2	2	-	S	ST	0.02-0.05		
	Jt	229	36	2	-	3	2	-	R	P	0.1-0.5		J1 Joint set
	Jt	304	32	2	-	3	2	-	R	P	0.1-0.5		
	Jt	112	63	2	-	2	2	-	S	C	0.02-0.05		J2 Joint set
	Bd	6	80	3	-	2	1	-	S	-	-		Not so continuous bedding in laminated mudstone, maybe not___
	Jt	108	65	2	-	2	2	-	S	C	0.1		
	Jt	114	45	2	-	2	2	-	S	P	0.3		Shallow J2 Joint set

Type

FZ - Fault Zone
FT -- Fault
JT -- Joint (single)
JS -- Joint Set
BD -- Bedding
SH -- Shear
FO -- Foliation
DY--Dyke
GO--Gouge
SS--Slickensided
VN-Vein
FR--Fracture

Persistence

1.	Very low persistence	<1m
2.	Low persistence	1-3m
3.	Medium persistence	3-10m
4.	High persistence	10-20m
5.	Very high persistence	20-40m
5.	Extremly high persistence	>40m

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite
8. Cal
9. Crushed Rock
10. Gouge
11. Real/Orp

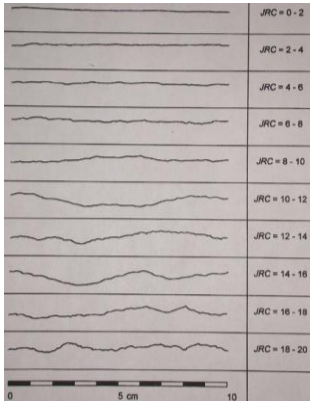
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



Notes: Bedding orentations difficult to obtain
Raw data sheet, structural orientations are relative to magnetic north

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Project Element	Date	Month	Day	Year
Conrad	C-002	Mapping		6	25	2018

Easting: 630257
Northing: 7113050
Elevation: 1808

Inspector: TGT/JKA

Discontinuity data sheet no. 1 of 1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	DDR	Dip	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	Roughness	Shape	Spacing, m	JRC	Comment
	BD	326	39	4	-	1	1	-	R	C	0.005-0.01	-	
	BD	333	39	4	-	1	1	-	R	C	0.005-0.01	-	
	BD	333	29	4	-	1	1	-	R	C	0.005-0.01	-	
	JT	90	82	2	-	3	2	-	R	P	0.002-0.01	-	J2 joint set
	JT	80	76	2	-	3	2	-	R	P	0.002-0.01	-	
	JT	76	70	2	-	3	2	-	R	P	0.002-0.01	-	
	JT	189	89	2	-	2	2	-	R	ST	0.02-0.5	-	J1 joint set
	JT	255	60	2	-	3	2	-	R	P	0.5-1	-	Conjugate set
	JT	247	85	2	-	3	2	-	R	P	0.5-1	-	
	JT	251	80	2	-	3	2	-	R	P	0.005-0.01	-	J2 set likely
	JT	112	65	2	-	2	2	-	R	U	0.5-1	-	Conjugate set

Type

FZ - Fault Zone
FT -- Fault
JT -- Joint (single)
JS -- Joint Set
BD -- Bedding
SH -- Shear
FO -- Foliation
DY--Dyke
GO--Gouge
SS--Slickensided
VN-Vein
FR--Fracture

Persistence

1. Very low persistence <1m
2. Low persistence 1-3m
3. Medium persistence 3-10m
4. High persistence 10-20m
5. Very high persistence 20-40m
5. Extremly high persistence >40m

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite
8. Cal
9. Crushed Rock
10. Gouge
11. Real/Orp

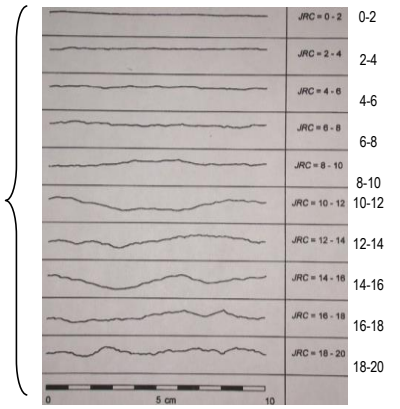
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

	MPa
S1 Very soft clay	<0.025
S2 Soft clay	0.025-0.05
S3 Firm clay	0.05-0.10
S4 Stiff clay	0.10-0.25
S5 Very stiff clay	0.25-0.50
S6 Hard clay	>0.50
R0 Extremely weak rock	0.25-1.0
R1 Very weak rock	1.0-5.0
R2 Weak rock	5.0-25
R3 Medium strong rock	25-50
R4 Strong rock	50-100
R5 Very strong rock	100-250
R6 Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



Notes: Raw data sheet, structural orientations are relative to magnetic north

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Project Element	Date	Month	Day	Year
Conrad	C-003	Mapping		6	25	2018

Easting: 630316
Northing: 7113009
Elevation 1792

Inspector: TGT/JKA

Discontinuity data sheet no. 1 of 1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	DDR	Dip	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	Roughness	Shape	Spacing, m	JRC	Comment
	BD	330	40	4	-	1	2	-	R	C	0.001-0.005	-	
	BD	330	45	4	-	1	2	-	R	C	0.001-0.005	-	
	JT	182	54	1	-	2	2	-	S	U	0.01-0.05	-	J1 joint set
	JT	181	75	1	-	2	2	-	S	U	0.01-0.05	-	
	JT	314	55	2	-	4	2	-	R	U	0.01-0.5	-	Conjugate set
	JT	281	42	2	-	4	2	-	R	U	-	-	
	SH	226	25	2	-	4	2/8	-	K	C	0.5-0.75	-	Slickensided surfaces, trend of slickenlines is 244
	JT	239	39	2	-	4	2	-	R	ST	0.5-0.75	-	
	BD	7	49	4	-	1	2	-	R	C	0.001-0.005	-	

Type

FZ - Fault Zone
FT -- Fault
JT -- Joint (single)
JS -- Joint Set
BD -- Bedding
SH -- Shear
FO -- Foliation
DY--Dyke
GO--Gouge
SS--Slickensided
VN-Vein
FR--Fracture

Persistence

1. Very low persistence <1m
2. Low persistence 1-3m
3. Medium persistence 3-10m
4. High persistence 10-20m
5. Very high persistence 20-40m
5. Extremly high persistence >40m

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite
8. Cal
9. Crushed Rock
10. Gouge
11. Real/Orp

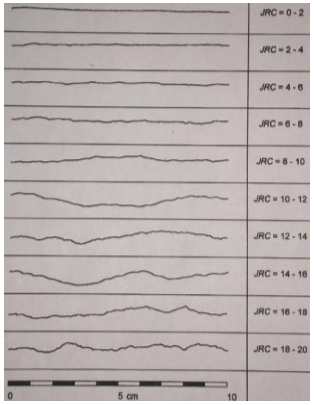
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

	MPa
S1 Very soft clay	<0.025
S2 Soft clay	0.025-0.05
S3 Firm clay	0.05-0.10
S4 Stiff clay	0.10-0.25
S5 Very stiff clay	0.25-0.50
S6 Hard clay	>0.50
R0 Extremely weak rock	0.25-1.0
R1 Very weak rock	1.0-5.0
R2 Weak rock	5.0-25
R3 Medium strong rock	25-50
R4 Strong rock	50-100
R5 Very strong rock	100-250
R6 Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



0-2
2-4
4-6
6-8
8-10
10-12
12-14
14-16
16-18
18-20

Notes: Variable bedding - open folding

Raw data sheet, structural orientations are relative to magnetic north

18100420
Osiris Geotech Data Review

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Project Element	Date	Month	Day	Year
Conrad	C-004	Mapping		6	25	2018

Easting: 630555
Northing: 7112977
Elevation 1711

Inspector: TGT/JKA

Discontinuity data sheet no. 1 of 1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	DDR	Dip	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	Roughness	Shape	Spacing, m	JRC	Comment
Outcrop 1	JT	68	87	2	-	4	2	-	R	ST	0.5-0.75	-	J2 joint set
Outcrop 1	JT	273	83	2	-	4	2	-	R	ST	0.5-0.75	-	J2 joint set
Outcrop 1	JT	280	86	2	-	4	2	-	R	ST	0.5-0.75	-	J2 joint set
Outcrop 1	JT	221	37	1	-	3	2/8	-	S	U	0.005-0.5	-	Conjugate/J1 maybe
Outcrop 1	JT	222	34	1	-	3	2/8	-	S	U	0.005-0.5	-	
Outcrop 1	JT	201	35	1	-	3	2/8	-	S	U	0.005-0.5	-	
Outcrop 1	BD	344	50	4	-	2	C	-	R	U	0.001-0.005	-	Bedding
Outcrop 1	BD	342	55	-	-	-	-	-	-	-	-	-	
Outcrop 1	BD	344	47	-	-	-	-	-	-	-	-	-	
Outcrop 1	BD	355	45	-	-	-	-	-	-	-	-	-	
Outcrop 2	BD	5	38	4	-	2	C	-	R	U	0.001-0.005	-	

Type

FZ - Fault Zone
FT -- Fault
JT -- Joint (single)
JS -- Joint Set
BD -- Bedding
SH -- Shear
FO -- Foliation
DY--Dyke
GO--Gouge
SS--Slickensided
VN-Vein
FR--Fracture

Persistence

1. Very low persistence <1m
2. Low persistence 1-3m
3. Medium persistence 3-10m
4. High persistence 10-20m
5. Very high persistence 20-40m
5. Extremly high persistence >40m

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite
8. Cal
9. Crushed Rock
10. Gouge
11. Real/Orp

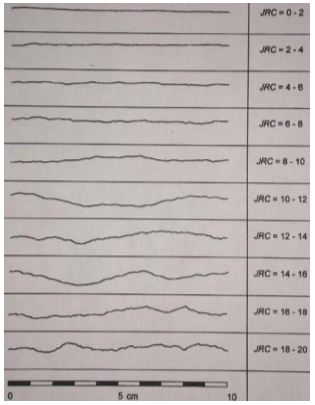
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

	MPa
S1 Very soft clay	<0.025
S2 Soft clay	0.025-0.05
S3 Firm clay	0.05-0.10
S4 Stiff clay	0.10-0.25
S5 Very stiff clay	0.25-0.50
S6 Hard clay	>0.50
R0 Extremely weak rock	0.25-1.0
R1 Very weak rock	1.0-5.0
R2 Weak rock	5.0-25
R3 Medium strong rock	25-50
R4 Strong rock	50-100
R5 Very strong rock	100-250
R6 Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



Notes:
Measurements taken from small outcrop along ridge
Raw data sheet, structural orientations are relative to magnetic north

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Project Element	Date	Month	Day	Year
Conrad	C-005	Mapping		6	25	2018

Easting: 630493
Northing: 7112739
Elevation 1585

Inspector: TGT/JKA

Discontinuity data sheet no. 1 of 1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	DDR	Dip	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	Roughness	Shape	Spacing, m	JRC	Comment
	JT	132	75	2	-	3	2	-	R	U	0.4-0.1		Potentially J1 set
	JT	159	73	2	-	3	2	-	R	U	0.4-0.1		Potentially J1 set
	JT	203	56	2	-	2	2	-	S	U	0.3-0.7		Conjugate set?
	JT	176	58	2	-	2	2	-	S	U	0.3-0.7		
	JT	169	65	2	-	2	2	-	S	U	0.3-0.7		
	JT	156	54	2	-	2	2	-	S	U	0.3-0.7		
	JT	152	66	2	-	2	2	-	S	U	0.3-0.7		

Type

FZ - Fault Zone
FT -- Fault
JT -- Joint (single)
JS -- Joint Set
BD -- Bedding
SH -- Shear
FO -- Foliation
DY--Dyke
GO--Gouge
SS--Slickensided
VN-Vein
FR--Fracture

Persistence

1.	Very low persistence	<1m
2.	Low persistence	1-3m
3.	Medium persistence	3-10m
4.	High persistence	10-20m
5.	Very high persistence	20-40m
5.	Extremly high persistence	>40m

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite
8. Cal
9. Crushed Rock
10. Gouge
11. Real/Orp

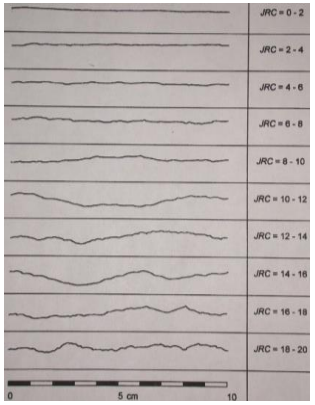
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



0-2
2-4
4-6
6-8
8-10
10-12
12-14
14-16
16-18
18-20

Notes:

Bedding not easily identified in massive and fractured mudstone
Raw data sheet, structural orientations are relative to magnetic north

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Project Element	Date	Month	Day	Year
Osiris	O-003	Mapping		6	27	2018

Easting: 629662
Northing: 7112159
Elevation 1719

Inspector: TGT

Discontinuity data sheet no. 1 of 1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	DDR	Dip	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	Roughness	Shape	Spacing, m	JRC	Comment
	BD	163	23	5	-	4	2	-	S-R	P	0.01-0.1	12-20	
	BD	168	21	5	-	4	2	-	S-R	P	0.01-0.1	12-20	
	J1	342	64	1	-	3	2	-	R	U	0.1	-	
	J1	338	74	1	-	3	2	-	R	U	0.1	-	
	J2	63	78	1	-	3	2	-	R	U	0.1	-	
	J2	244	88	1	-	3	2	-	R	U	0.1	-	

Type

FZ - Fault Zone
FT -- Fault
JT -- Joint (single)
JS -- Joint Set
BD -- Bedding
SH -- Shear
FO -- Foliation
DY--Dyke
GO--Gouge
SS--Slickensided
VN-Vein
FR--Fracture

Persistence

1. Very low persistence <1m
2. Low persistence 1-3m
3. Medium persistence 3-10m
4. High persistence 10-20m
5. Very high persistence 20-40m
5. Extremly high persistence >40m

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite
8. Cal
9. Crushed Rock
10. Gouge
11. Real/Orp

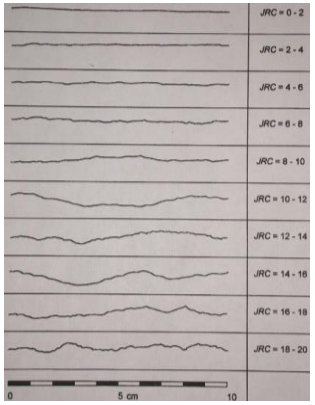
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

	MPa
S1 Very soft clay	<0.025
S2 Soft clay	0.025-0.05
S3 Firm clay	0.05-0.10
S4 Stiff clay	0.10-0.25
S5 Very stiff clay	0.25-0.50
S6 Hard clay	>0.50
R0 Extremely weak rock	0.25-1.0
R1 Very weak rock	1.0-5.0
R2 Weak rock	5.0-25
R3 Medium strong rock	25-50
R4 Strong rock	50-100
R5 Very strong rock	100-250
R6 Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



Notes:

Osiris limestone (O-LST 1), mineralized linestone.

Similar area as O-002 and O-004

Raw data sheet, structural orientations are relative to magnetic north

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Project Element	Date	Month	Day	Year
Osiris	O-004	Mapping		6	27	2018

Easting: 629712
Northing: 7112173
Elevation 1736

Inspector: TGT

Discontinuity data sheet no. 1 of 1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	DDR	Dip	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	Roughness	Shape	Spacing, m	JRC	Comment
	BD	162	37	5	-	4	2	-	R	P	0.01-1	-	
	BD	177	36	5	-	4	2	-	R	P	0.01-1	-	
	BD	178	42	5	-	4	2	-	R	P	0.01-1	-	

Type

FZ - Fault Zone
FT -- Fault
JT -- Joint (single)
JS -- Joint Set
BD -- Bedding
SH -- Shear
FO -- Foliation
DY--Dyke
GO--Gouge
SS--Slickensided
VN-Vein
FR--Fracture

Persistence

1. Very low persistence <1m
2. Low persistence 1-3m
3. Medium persistence 3-10m
4. High persistence 10-20m
5. Very high persistence 20-40m
5. Extremly high persistence >40m

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite
8. Cal
9. Crushed Rock
10. Gouge
11. Real/Orp

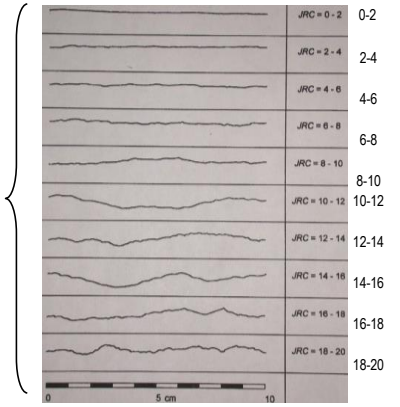
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

	MPa
S1 Very soft clay	<0.025
S2 Soft clay	0.025-0.05
S3 Firm clay	0.05-0.10
S4 Stiff clay	0.10-0.25
S5 Very stiff clay	0.25-0.50
S6 Hard clay	>0.50
R0 Extremely weak rock	0.25-1.0
R1 Very weak rock	1.0-5.0
R2 Weak rock	5.0-25
R3 Medium strong rock	25-50
R4 Strong rock	50-100
R5 Very strong rock	100-250
R6 Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



Notes:

Raw data sheet, structural orientations are relative to magnetic north

DISCONTINUITY SURVEY DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Project Element	Date	Month	Day	Year
Osiris	O-013	Mapping		6	28	2018

Easting: 629423
Northing: 7112223
Elevation 1656

Inspector: TGT

Discontinuity data sheet no. 1 of 1

NATURE AND ORIENTATION OF DISCONTINUITY

Location	Type	DDR	Dip	Persistence	Termination	Aperture/ Width	Nature of Filling	Strength of Filling	Roughness	Shape	Spacing, m	JRC	Comment
	BD	230	89	5	-	3	2	-	S	P	0.03 - 0.01		Planar smooth bedding friction angle estimated to be ~25˚
	BD	230	85	5	-	3	2	-	S	P	0.03 - 0.01		
	BD	74	85	5	-	3	2	-	S	P	0.03 - 0.01		
	BD	72	87	5	-	3	2	-	S	P	-		J2 joint set
	JT	155	85	2	-	4	2	-	R	U	0.1 - 0.7		
	JT	160	82	2	-	4	2	-	R	U	0.1 - 0.7		
	JT	129	82	2	-	4	2	-	R	U	0.1 - 0.7		
	JT	136	71	2	-	4	2	-	R	U	0.1 - 0.7		J1 joint set
	JT	354	15	2	-	2	2	-	R	U	0.2 - 0.6		
	JT	332	21	2	-	2	2	-	R	U	0.2 - 0.6		
	JT	358	5	2	-	2	2	-	R	U	0.2 - 0.6		
	JT	130	10	2	-	2	2	-	R	U	0.2 - 0.6		

Type

FZ - Fault Zone
FT -- Fault
JT -- Joint (single)
JS -- Joint Set
BD -- Bedding
SH -- Shear
FO -- Foliation
DY--Dyke
GO--Gouge
SS--Slickensided
VN-Vein
FR--Fracture

Persistence

1. Very low persistence	<1m
2. Low persistence	1-3m
3. Medium persistence	3-10m
4. High persistence	10-20m
5. Very high persistence	20-40m
5. Extremly high persistence	>40m

Termination

0. Neither end visible
1. One end visible
2. Both ends visible

Aperture/width

1. Very tight (<0.1 mm)
2. Tight (0.1-0.25 mm)
3. Partly open (0.25-0.5 mm)
4. Open (0.5-2.5 mm)
5. Moderately wide (2.5-10 mm)
6. Wide (>10 mm)
7. Very wide (1-10 cm)
8. Extremely wide (10-100 cm)
9. Cavernous (>1 m)

Surface shape

St Stepped
U Undulating
P Planar
C Curved
I Irregular

Nature of filling

1. Clean
2. Surface staining
3. Non-cohesive
4. Inactive clay or clay matrix
5. Swelling clay or clay matrix
6. Cemented
7. Chlorite
8. Cal
9. Crushed Rock
10. Gouge
11. Real/Orp

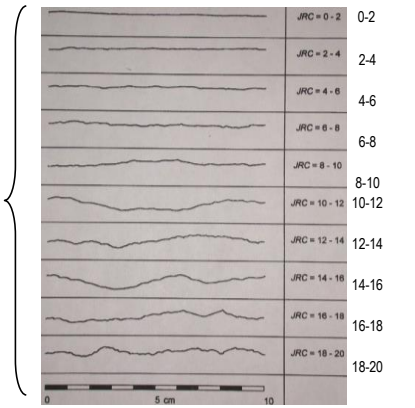
Surface roughness

R Rough
S Smooth
P Polished
K Slickensided
VR Very Rough

Compressive strength of infilling

	MPa
S1 Very soft clay	<0.025
S2 Soft clay	0.025-0.05
S3 Firm clay	0.05-0.10
S4 Stiff clay	0.10-0.25
S5 Very stiff clay	0.25-0.50
S6 Hard clay	>0.50
R0 Extremely weak rock	0.25-1.0
R1 Very weak rock	1.0-5.0
R2 Weak rock	5.0-25
R3 Medium strong rock	25-50
R4 Strong rock	50-100
R5 Very strong rock	100-250
R6 Extremely strong rock	>250

JRC
Refer to Full-Sized Profiles



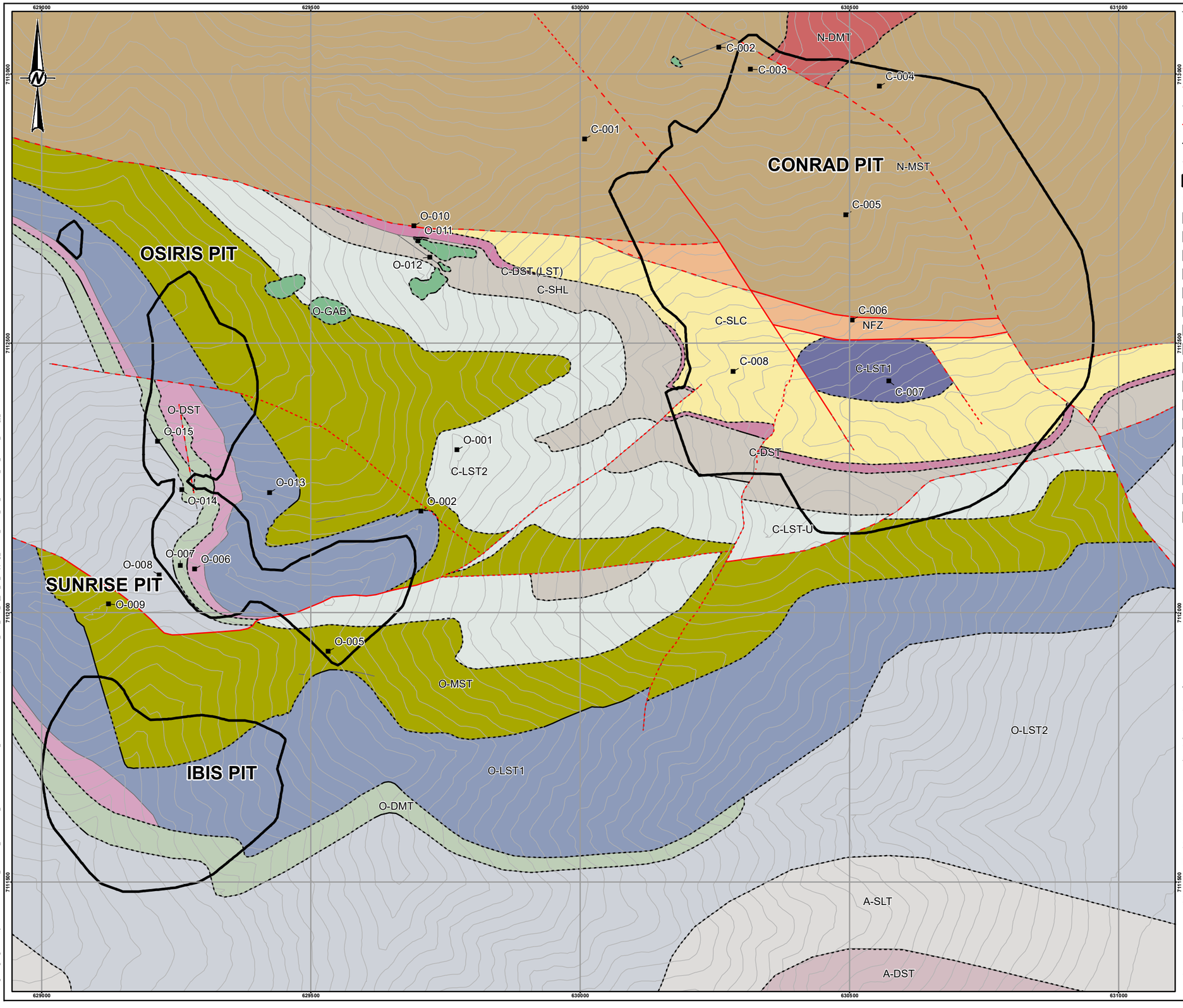
Notes:
Bedding is near verticle
Raw data sheet, structural orientations are relative to magnetic north

Station ID	UTM Zone	Easting	Northing	Elevation	Rock Unit	Rock Unit Description	Type	Dip (degrees)	DDR (raw data, magnetic north)	DDR (True North)	DDR (UTM Grid North)
IBIS-001	8, NAD83	629506	7111911	1784	O-MST	Osiris Mudstone	BD	45	179	199.6	197.36
IBIS-002	8, NAD83	629484	7111895	1775	O-MST	Osiris Mudstone	BD	44	174	194.6	192.36
IBIS-003	8, NAD83	629446	7111877	1758	O-MST	Osiris Mudstone	BD	45	162	182.6	180.36
IBIS-004	8, NAD83	629432	7111802	1747	O-LST1	Osiris Limestone 1	BD	44	158	178.6	176.36
IBIS-005	8, NAD83	629400	7111781	1732	O-LST1	Osiris Limestone 1	BD	64	164	184.6	182.36
IBIS-006	8, NAD83	629350	7111738	1696	O-LST1	Osiris Limestone 1	BD	55	146	166.6	164.36
IBIS-007	8, NAD83	629300	7111709	1660	O-LST1	Osiris Limestone 1	BD	68	176	196.6	194.36
IBIS-008	8, NAD83	629191	7111773	1600	O-MST	Osiris Mudstone	BD	80	217	237.6	235.36
IBIS-009	8, NAD83	629191	7111773	1600	O-MST	Osiris Mudstone	Shear	55	72	92.6	90.36

Note: The structural orientation data collected during discontinuity characterization was collected with a structural compass set to zero magnetic declination. In order to process and plot the structural orientation data, Golder rotated the raw orientation measurements to UTM grid north to be consistent with ATAC's convention. A correction of 20˚ 33.18' East (positive 20.6 decimal degrees) was applied to rotate the measurements to true north (based on site location and the date measurements were collected) and a correction of negative 2.24 decimal degrees was applied to rotate the measurements to UTM grid north (fixed correction value provided by ATAC based site location relative to true north).

APPENDIX G2

Rock Mass Description Data Sheets



LEGEND

- MAPPING LOCATIONS WITH ROCKMASS CLASSIFICATION DATA
- APPROXIMATE FAULTS
- INFERRED FAULTS
- INFERRED CONTACTS
- OBSERVED FAULTS
- OBSERVED CONTACTS
- CONTOUR (20 m)
- PIT OUTLINE

SURFACE GEOLOGY

- A-DST, Atum Dolostone
- A-SLT, Atum Siltstone
- C-DST, Conrad Silica Dolostone
- C-DST (LST), Conrad Silica Dolostone (Limestone)
- C-LST1, Conrad Limestone 1
- C-LST2, Conrad Limestone 2
- C-SHL, Conrad Shale
- C-SLC, Conrad Siliciclastics
- N-DMT, Nonad Diamictite
- N-MST, Unclassified Nonad Mudstone
- NFZ, Nadaleen Fault Zone
- O-DMT, Osiris Diamictite
- O-DST, Osiris Dolostone
- O-GAB, Osiris Gabbro
- O-LST1, Osiris Limestone 1
- O-LST2, Osiris Limestone 2
- O-MST, Osiris Mudstone

0 150 300
1:7,000 METRES

REFERENCE(S)
1. BASE DATA PROVIDED BY CLIENT.
COORDINATE SYSTEM: NAD 1983 UTM ZONE 8N

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
MAPPING LOCATION WITH ROCKMASS CLASSIFICATION DATA

CONSULTANT
GOLDER

YYYY-MM-DD	2019-09-23
DESIGNED	SA
PREPARED	CC
REVIEWED	TGT
APPROVED	AVC

PROJECT NO.	PHASE	REV.	FIGURE
18100420	4000	0	G2-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

PATH: \\golder.gds\gal\burnaby\CAD-GIS\Client\ATAC_Resources_Ltd\Yukon\99_PROJECTS\18100420\2_PRODUCTION\4000\MXD\Report\18100420_4000_4100_Fig_G2_01_Mapping_Location_C-dlars_with_Rockmass_and_Surface_Geology_Yukon.mxd PRINTED ON: 2019-09-23 AT: 9:25:37 AM

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	C-001		6	25	2018	TGT/JKA

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	15	1

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
20	SE	70°

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	2	4	3-4	R2-R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1-4	2-4	3	3

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	3
J1 - 2	4
J2 - 3	3
4	
5	

GSI: 50-60

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength: 2
Rock Type: C-NONAD

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

-GPS X: 630008
Y: 7112879
Z: 1744

- Ridge top exposure

- Weathering on fracture surface (Fe Ox)

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	C-002		6	25	2018	TGT/JKA

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	10	1

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
15		70

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	2	4	4	R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	4	3	3

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	3
J2 - 2	3
J1 - 3	4
4	
5	

GSI: 40-50

Discontinuity spacing
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength: 2
Rock Type: C-NONAD

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

-GPS X: 630257
Y: 7113050
Z: 1808

- Weathering is Fe Ox on joint surfaces

- Exposure is ~40m below ridge

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	C-003		6	25	2018	TGT/JKA

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	10	1

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
15	5	80

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	2	4	3	R3-R4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	3	2-3	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	2
2	
3	
4	
5	

GSI: 40-50

Discontinuity spacing
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
1	C-NONAD

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

-GPS X: 630316
Y: 7113009
Z: 1792

- Weathering on joint surfaces

- Steep natural exposure

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location: Station ID: C-004 | Date: Month 6, Day 25, Year 2018 | Inspector: TGT/JKA

Locality Type: 1

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Length: 10

Slope Height: 5

Azimuth: SE

Slope Angle: 70

No. of supplementary sheets of discontinuity data sheets: 1

ROCK MATERIAL INFORMATION

Color: 2 | 2 | 4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

Grain size: 4

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

Compressive strength: R3

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric: 1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

Block size: 3

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

State of weathering: 2

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

No. of major discontinuity sets: 3

Set #	Spacing Rating
BD - 1	
J1 - 2	
J2 - 3	
4	
5	

GSI: 60-70

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength: 1

1. Measured
2. Assessed

Rock Type: C-NONAD

REMARKS (exposure type/age, stability condition, design issues etc.)

-GPS X: 630555
Y: 7112977
Z: 1711

- Laminated bedding

- Variable weathering based on grain size

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	C-005		6	25	2018	TGT/JKA

Locality Type: 1

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Length: 5

Slope Height: 5

Azimuth: 5

Slope Angle: 80

No. of supplementary sheets of discontinuity data sheets: 1

ROCK MATERIAL INFORMATION

Color: 2 | 2 | 4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

Grain size: 4

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

Compressive strength: R3

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric: 4

1. Blocky
2. Tabular
3. Columnar
4. Shattered

Block size: 3

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

State of weathering: 3

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

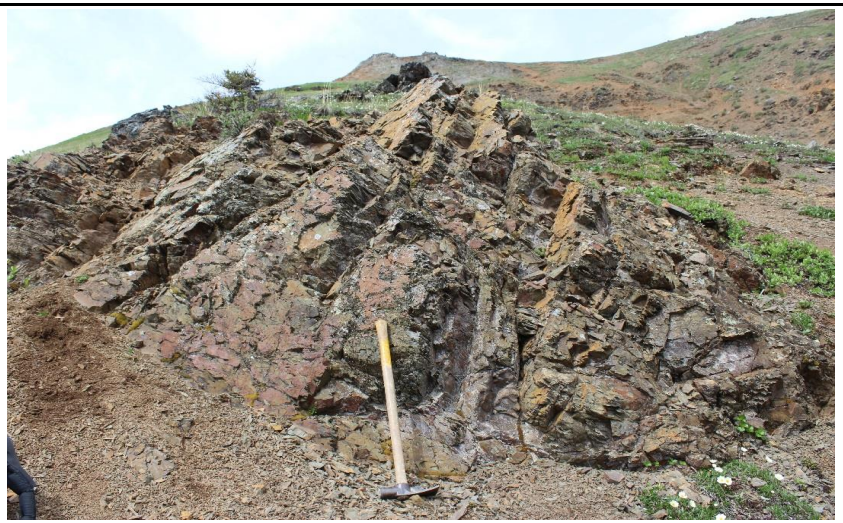
No. of major discontinuity sets: 2

Set #	Spacing Rating
J1 - 1	4
J2 - 2	4
3	
4	
5	

GSI: 50-60

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength: 1

1. Measured
2. Assessed

Rock Type: C-NONAD

REMARKS (exposure type/age, stability condition, design issues etc.)

-GPS X: 630493
Y: 7112739
Z: 1585

-Joint sets form medium sized blocks, however, rock mass between joint sets is heavily fractured

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	C-006		6	25	2018	TGT/JKA

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	30	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
45	5	42

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
1	8	4	4	R2-R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
4	5	3	3

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
All - 1	1
2	
3	
4	
5	

GSI: 25-35

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
2	NFZ

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0630505
  Y: 7112543
  Z: 1427

- Rock mass is likely within NFZ, rock type is still C-NONAD mudstone, rock is heavily sheared and forms very small blocks

- Joint surfaces are stained, rough to smooth, and undulating

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	C-007		6	25	2018	TGT/JKA

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	30	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
15	West	70

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	8	9	2-3	R4 to R5

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	3	2	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	4
2	
3	
4	
5	

GSI: 70-80

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
1	C-LST 1

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0630573
  Y: 7112430
  Z: 1340

- Conrad limestone 1, tight and complicated folding observed on small scale

- No structural measurements taken due to observed folding

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	C-008		6	25	2018	TGT/JKA

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	100	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
40	90	45

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
1	8	4	1-4	R2-R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	3-4	3	N/A

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
1	
2	
3	
4	
5	

GSI
35-45

Discontinuity spacing
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
2	C-SLC

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0630284
  Y: 7112448
  Z: 1433

- Exposure of Conrad Siliclastic along ridge between two creeks

- Exposure observed at end of field day, no time for structural mapping. Additionally, tight folding was observed, andtherefore, this outcrop is not ideal for general mapping

Geology Notes: Siliclastic unit (C-SLC) is most obviously identified by quartz pebbles, and is sometimes refered to as "stary night" conglomerate. The unit contains a range of grain sizes, and was observed to be tightly folded on a small scale. Unit rock types range from mudstione to conglomerate, therefore, bedding spacing is variable.

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-001		6	27	2018	TGT/AS/MSK

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	10	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
3	West	80

Photograph



ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
1	3	9	1	R4-R5

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

Methods to determine compressive strength	Rock Type
2	C-DMT (within C-LST2)

1. Measured
2. Assessed

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	1	2	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
1	
2	
3	
4	
5	

GSI: 75-80

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629771
  Y: 7112302
  Z: 1748

- Bedding not easily identified

- Outcrop at ridge top

- Fractures are rough to very rough

Note: The Conrad diamictite unit (C-DMT) occus as debris flows within the Conrad limestone 2 unit (C-LST 2). C-DMT is not mapped as a separate unit because of its spatial variability within C-LST 2.

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-002		6	27	2018	TGT/AS/MSK

Locality Type	1	Slope Length	15	No. of supplementary sheets of discontinuity data sheets	0
		Slope Height	40	Azimuth	West
		Slope Angle	80		

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
1	8	4	3	R3-R4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	4	3	3

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	2
J1 - 2	2
J2 - 3	3
4	
5	

GSI: 40-50

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength: 2 (1. Measured, 2. Assessed)

Rock Type: O-LST1

REMARKS (exposure type/age, stability condition, design issues etc.)

-GPS X: 0629704
Y: 7112188
Z: 1734

- Exposure below ridge, along fold hinge of in osiris limestone.

- Bedding and cross-joints are well defined in fold hinge.

- Bedding surfaces are planar, smooth to rough, and clean or stained.

- Kink folding observed.

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-005		6	27	2018	TGT

Locality Type	1	Slope Length	20	No. of supplementary sheets of discontinuity data sheets	0
		Slope Height	30	Azimuth	330
		Slope Angle	70		

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	4	10	4-5	R2-R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	5	3	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

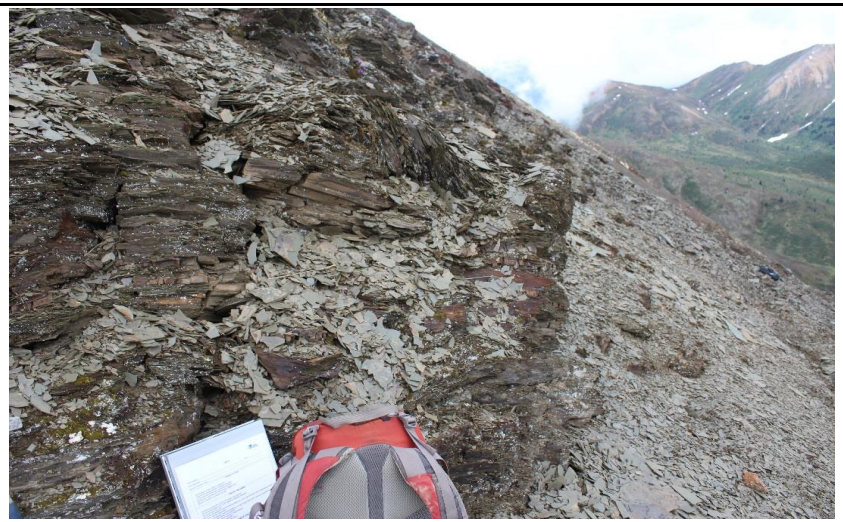
1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	2
2	
3	
4	
5	

GSI: 35-45

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength: 2 (1. Measured, 2. Assessed)

Rock Type: O-MST1

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629532
  Y: 7111928
  Z: 1798
- Exposure at end of ridge, top of natural slope above proposed IBIS Pit
- Bedding confirmed to be shallow dipping in this area

- Bedding (Dip/DDR, magnetic declination):
(25/168)
(25/162)
(31/171)

- Planar smooth bedding surfaces, minor Fe Ox and weathering

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-006		6	27	2018	TGT

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	30	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
50		

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
1	3	4	3-4	R3-R4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

Photograph



Methods to determine compressive strength	Rock Type
1	O-DST

1. Measured
2. Assessed

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	3	3	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	0.02 - 1 m
2	
3	
4	
5	

GSI: 45-55

Discontinuity spacing
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629284
  Y: 7112081
  Z: 1771

- Dolostone unit exposed along ridge
- Unit is 5 to 10 m thick

- Bedding (dip/DDR, magnetic declination)
(84/242)

- Undulating rough bedding planes

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-007		6	27	2018	TGT

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	10	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
50	015	70

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
1	8	3	1-4	R2-R4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	2-4	3	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^3m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^3m)
5. Very small (<0.0002 m3 or <0.058^3m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	Variable
2	
3	
4	
5	

GSI: 40-60

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
2	O-DMT

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629257
  Y: 7112088
  Z: 1760

- O-DMT contains variable rock types: limestone, dolostone, and siltstone

- O-DMT is recessive compared to adjacent dolostone unit

- Due to variability of rock types within this unit it has been assigned a wide range of rock material and rock mass properties.

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-008		6	27	2018	TGT

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
2	10	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
2	190	60

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
			1-4	R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

Photograph



Methods to determine compressive strength	Rock Type
2	O-LST 2

1. Measured
2. Assessed

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	2-3	2	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	1-2
2	
3	
4	
5	

GSI: 40-50

Discontinuity spacing
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629218
  Y: 7112070
  Z: 1783

- Road cut exposure of Osiris limestone 2

- This linestone unit is identified by thinly bedded "flaggy" limestone, however, also includes beds of silstone, sandstone, and conglomerate

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-009		6	27	2018	TGT

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1-2	40	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
20	45	45

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	6	2	4-5	R2-R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	5	3	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	2
2	
3	
4	
5	

GSI: 25-35

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
1	O-MST1

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629124
  Y: 7112016
  Z: 1748

- Outcrop along ridge adjacent to Sunshine Fault

- O-MST is heavily fractured and forms "pencil" cleavage

- Heavy fracturing and low GSI could be due to proximity to Sunshine Fault

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-010		6	28	2018	TGT

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	10	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth
15	West

Slope Angle
60

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	8	4	4	R3-R4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	3	3	

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
1	
2	
3	
4	
5	

GSI
65-75

Discontinuity spacing
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
2	C-DST

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629691
  Y: 7112718
  Z: 1757

- Exposure below ridge, adjacent to Nadaleen Fault Zone.

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-011		6	28	2018	TGT

Locality Type	1	Slope Length	15	No. of supplementary sheets of discontinuity data sheets	0
		Slope Height	15	Azimuth	West
		Slope Angle	65		

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	8	4	3	R3-R4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	2-4	3	0

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

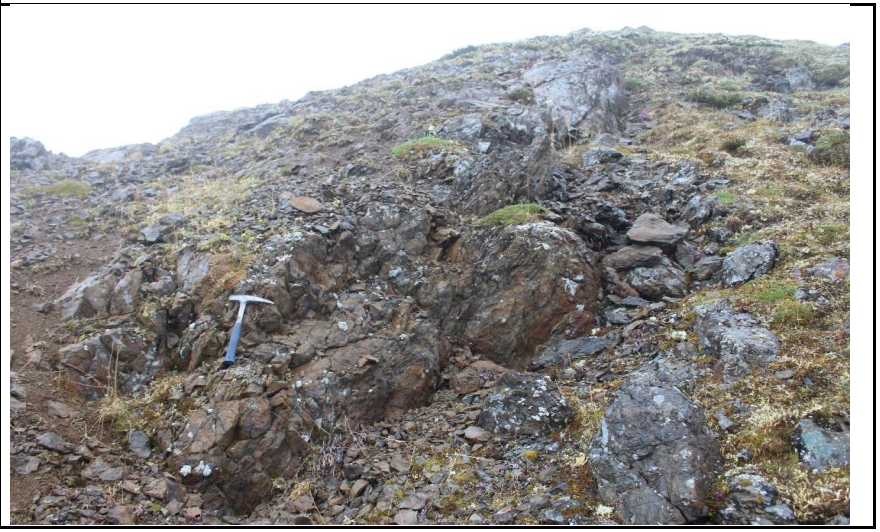
1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
1	
2	
3	
4	
5	

GSI: 70-80

Discontinuity spacing
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength: 2 (1. Measured, 2. Assessed)

Rock Type: O-GAB

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629699
  Y: 7112691
  Z: 1766

- Outcrop along ridge

- Strength likely degraded due to weathering, rock assessed to be stronger in core

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-012		6	28	2018	TGT

Locality Type	1	Slope Length	35	No. of supplementary sheets of discontinuity data sheets	0
		Slope Height	15	Azimuth	East
		Slope Angle	35		

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	8	10	4	R2-R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	4	3	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD-1	2
2	
3	
4	
5	

GSI: 25-35

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
2	C-SHL

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629721
  Y: 7112660
  Z: 1763

- Outcrop of shale unit (C-SHL) are infrequent in the project area. This unit is recessive compared to adjacent gabbro and limestone outcrops.

- Bedding is distinguishable, but not measured due to observed small scale folding

- Bedding is steep
- J2 observed
- Bedding is smoth to rough and planar

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-013		6	28	2018	TGT

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	40	1

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
100	150	90

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
1	4	9	4	R3-R4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	3	2	3

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
1	
2	
3	
4	
5	

GSI: 55-65

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
2	O-LST 1

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

-GPS X: 629423
Y: 7112223
Z: 1656

- Steep exposure of Osiris limestone (O-LST 1) that is overhanging in some locations

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date (Month)	Day	Year	Inspector
	O-014	6	28	2018	TGT

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	10	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
50	020	70

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	2	4	1-4	R3-R4

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
1	2-3	3	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	3-4
2	
3	
4	
5	

GSI: 60-70

Discontinuity spacing:
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength	Rock Type
1	O-DMT

1. Measured
2. Assessed

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629260
  Y: 7112228
  Z: 1661

- Bedding is observed, however, cross joints are not well defined

- Bedding dips 80˚ towards 282˚ (magenetic declination)

Note: The Osiris diamitite unit (O-DMT) forms a resistive ridge along the bottom of the valley wall where it is adjacent to the O-DST and O-LST 2

18100420
Osiris Geotech Data Review

ROCK MASS DESCRIPTION DATA SHEET

GENERAL INFORMATION

Area/Location	Station ID	Date	Month	Day	Year	Inspector
	O-015		6	28	2018	TGT

Locality Type	Slope Length	No. of supplementary sheets of discontinuity data sheets
1	10	0

1. Natural exposure
2. Road cut
3. Mine Bench
4. Test Pit
5. Adit
6. Tunnel
7. Drill hole

Slope Height	Azimuth	Slope Angle
10	025	60

ROCK MATERIAL INFORMATION

Color			Grain size	Compressive strength
2	4	9	4	R3

1. Light
2. Dark

1. Pinkish
2. Reddish
3. Yellowish
4. Brownish
5. Olive
6. Greenish
7. Bluish
8. Greyish

1. Pink
2. Red
3. Yellow
4. Brown
5. Olive
6. Green
7. Blue
8. White
9. Grey
10. Black

1. Very coarse (>60 mm)
2. Coarse (2-60 mm)
3. Medium (60 μ - 2 mm)
4. Fine (2-60 μ)
5. Very fine (<2 μ)

		MPa
S1	Very soft clay	<0.025
S2	Soft clay	0.025-0.05
S3	Firm clay	0.05-0.10
S4	Stiff clay	0.10-0.25
S5	Very stiff clay	0.25-0.50
S6	Hard clay	>0.50
R0	Extremely weak rock	0.25-1.0
R1	Very weak rock	1.0-5.0
R2	Weak rock	5.0-25
R3	Medium strong rock	25-50
R4	Strong rock	50-100
R5	Very strong rock	100-250
R6	Extremely strong rock	>250

ROCK MASS INFORMATION

Fabric	Block size	State of weathering	No. of major discontinuity sets
2	5	3	1

1. Blocky
2. Tabular
3. Columnar
4. Shattered

1. Very large (>8 m^3 or 2^3m)
2. Large (0.2-8 m^3 or 0.58-2^3m)
3. Medium (0.008-0.2 m^3 or 0.2-0.58^{3}m)
4. Small (0.0002 - 0.008 m^3 or 0.058-0.2^{3}m)
5. Very small (<0.0002 m3 or <0.058^{3}m)

1. Fresh
2. Slightly
3. Moderately
4. Highly
5. Completely
6. Residual soil

Set #	Spacing Rating
BD - 1	2
2	
3	
4	
5	

GSI: 30-40

Discontinuity spacing
1. Extremely close (<20 mm)
2. Very close (20-60 mm)]
3. Close (60 - 200 mm)
4. Moderately (200-600 mm)
5. Wide (600-2000 mm)
6. Very wide (2000-6000 mm)
7. Ext. wide (>6000 m)

Photograph



Methods to determine compressive strength: 2 (1. Measured, 2. Assessed)

Rock Type: O-LST 2

REMARKS (exposure type/age, stability condition, design issues etc.)

- GPS X: 0629215
  Y: 7112318
  Z: 1624

- Thinnly bedded limestone has well formed cross-joints that form well defined thin squares and rectangles.

- Bedding is planar, rough to smooth , stained Fe Ox surfaces

APPENDIX H

Rock Exposure and Core Photographs of Osiris Rock Units

OSIRIS LIMESTONE (O-LST 2) OUTCROP



PHOTOGRAPH TAKEN 28 JUNE 2018
MAPPING STATION ID: O-015
X: 629215
Y: 7112318
Z: 1624
GSI = 30-40

OSIRIS LIMESTONE (O-LST 2) DRILLCORE



OS-18-280
DEPTH: 62.48 TO 68.58 m
RMR = 47-61

NOTES:

- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

TITLE
OSIRIS LIMESTONE 2
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-1

Path: \\golder.gds\gal\Vancouver\Complete\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\ | File Name: Osiris_Outcrop and Core Photos.pptx

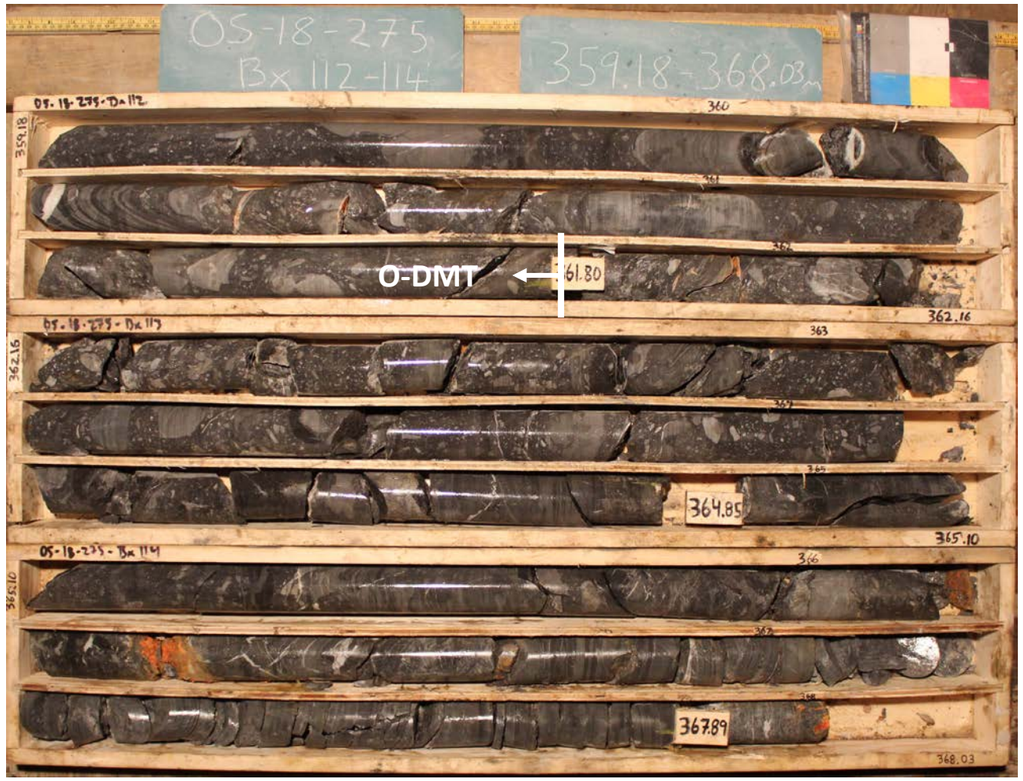
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

OSIRIS DIAMICTITE (O-DMT) OUTCROP



PHOTOGRAPH TAKEN 28 JUNE 2018
MAPPING STATION ID: O-014
X: 629260
Y: 7112228
Z: 1661
GSI = 60-70

OSIRIS DIAMICTITE (O-DMT) DRILLCORE



OS-18-275
DEPTH: 359.18 TO 361.8 m
RMR = 47

NOTES:

- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS DIAMICTITE
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-2

Path: \\golder.gds\gal\vancouver\Complete\Data\ATAC\Osiris\18100420 Osiris Geotech\5. Technical Work\5D Analysis \ File Name: Osiris_Outcrop and Core Photos.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

OSIRIS DOLOSTONE (O-DST) OUTCROP



PHOTOGRAPH TAKEN 27 JUNE 2018
MAPPING STATION ID: O-006
X: 629284
Y: 7112081
Z: 1771
GSI = 45-55

OSIRIS DOLOSTONE (O-DST) DRILLCORE



OS-17-251
DEPTH: 96.10 TO 104.69 m
RMR = 53-66

NOTES:
- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS DOLOSTONE
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-3

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris_Outcrop and Core Photos.pptx

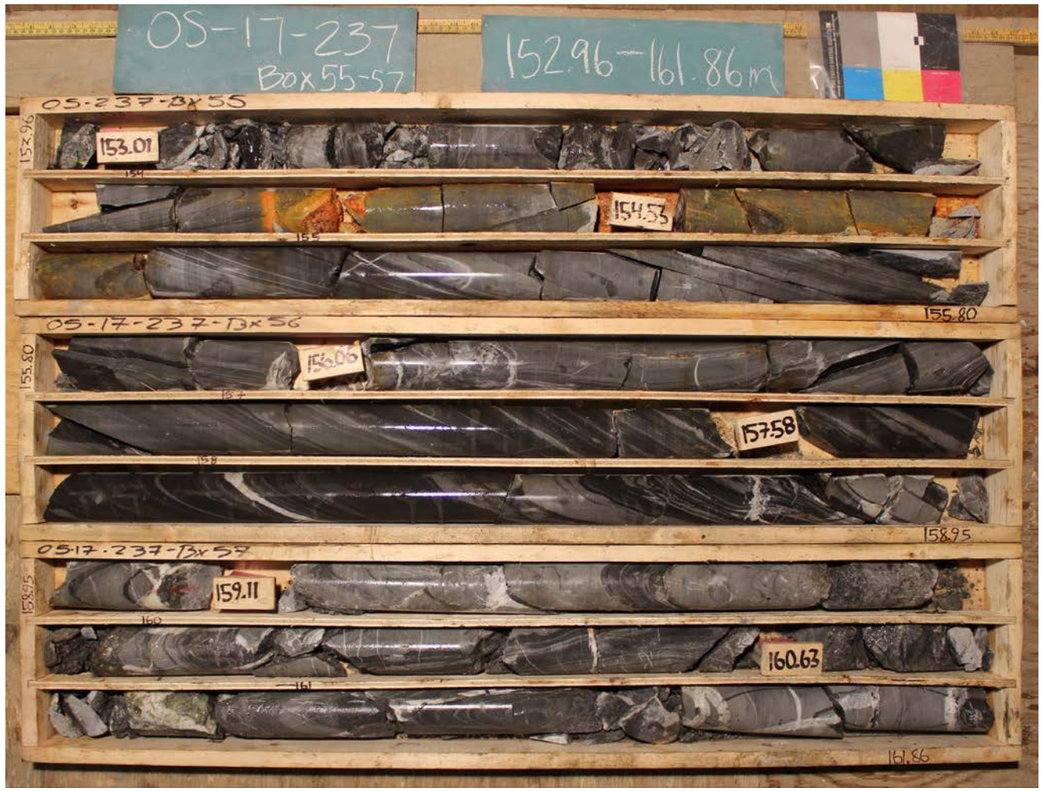
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm

OSIRIS LIMESTONE (O-LST 1) OUTCROP



PHOTOGRAPH TAKEN 27 JUNE 2018
MAPPING STATION ID: O-002
X: 629704
Y: 7112188
Z: 1734
GSI = 40-50

OSIRIS LIMESTONE (O-LST 1) DRILLCORE



OS-17-237
DEPTH: 152.96 TO 161.86 m
RMR = 39-59

NOTES:

- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS LIMESTONE 1
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-4

Path: \golder.gds\gal\Vancouver\Compile\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris_Outcrop and Core Photos.pptx
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

OSIRIS LIMESTONE (O-LST 1) OUTCROP



PHOTOGRAPH TAKEN 28 JUNE 2018
MAPPING STATION ID: O-013
X: 629423
Y: 7112223
Z: 1656
GSI = 55-65

OSIRIS LIMESTONE (O-LST 1) DRILLCORE



OS-18-280
DEPTH: 225 TO 233.54 m
RMR = 57

NOTES:

- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS LIMESTONE 1
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-5

Path: \\golder.gds\gal\vancouver\Complete\Data\ATAC\Osiris\18100420 Osiris Geotech\5. Technical Work\5D Analysis | File Name: Osiris_Outcrop and Core Photos.pptx
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm

OSIRIS GABBRO (O-GAB) OUTCROP



PHOTOGRAPH TAKEN 28 JUNE 2018
MAPPING STATION ID: O-011
X: 629699
Y: 7112691
Z: 1766
GSI = 70-80

OSIRIS GABBRO (O-GAB) DRILLCORE



OS-11-090
DEPTH: 187.74 TO 205.80 m
INSUFFICIENT GEOTECHNICAL INTERVAL DATA TO CALCULATE RMR
ROCK APPEARS TO BE GOOD QUALITY IN CORE

NOTES:

- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

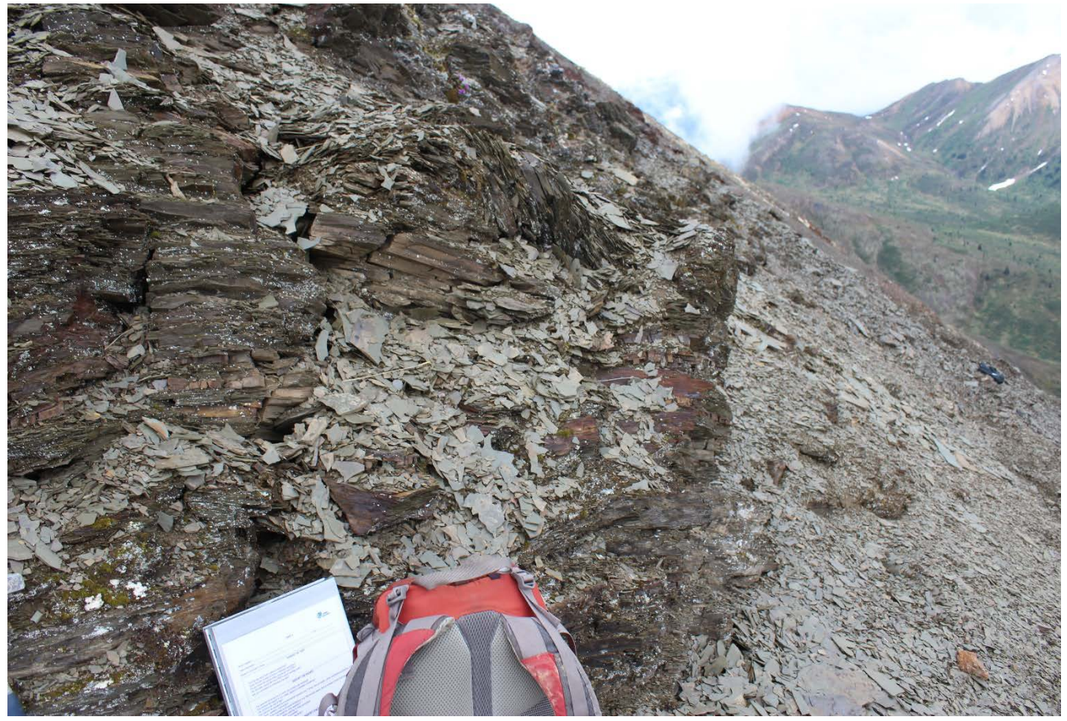
TITLE
OSIRIS GABBRO
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-6

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris_Outcrop and Core Photos.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

OSIRIS MUDSTONE (O-MST 1) OUTCROP



PHOTOGRAPH TAKEN 27 JUNE 2018
MAPPING STATION ID: O-005
X: 629532
Y: 7111928
Z: 1798
GSI = 35-45

OSIRIS MUDSTONE (O-MST 1) DRILLCORE



OS-18-274
DEPTH: 73.33 TO 82.30 m
RMR = 37-53

NOTES:
- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS MUDSTONE
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm

Path: \\golder.gds\gal\vancouver\Complete\Data\ATAC\Osiris\18100420 Osiris Geotech\5. Technical Work\5D Analysis | File Name: Osiris_Outcrop and Core Photos.pptx

CONRAD DIAMICTITE (C-DMT) OUTCROP



PHOTOGRAPH TAKEN 27 JUNE 2018
MAPPING STATION ID: O-001
X: 629771
Y: 7112302
Z: 1748
GSI = 75-80

GEOLOGY NOTE: C-DMT is a poorly defined debris flow unit that occurs within the well defined C-LST2 limestone unit.

CONRAD DIAMICTITE (C-DMT) DRILLCORE



OS-17-253
DEPTH: 94.70 TO 103.38 m
RMR = 49-71

NOTES:
- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD DIAMICTITE
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-8

Path: \golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis \ File Name: Osiris_Outcrop and Core Photos.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

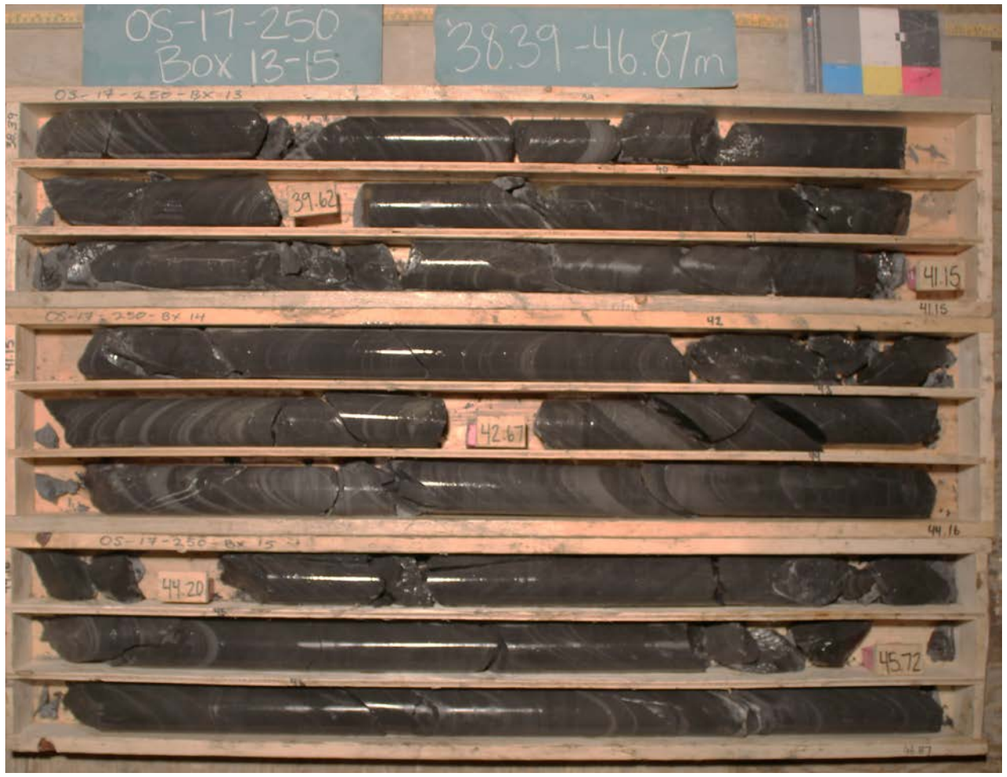
0 25 mm

CONRAD SHALE (C-SHL) OUTCROP



PHOTOGRAPH TAKEN 28 JUNE 2018
MAPPING STATION ID: O-012
X: 629721
Y: 7112660
Z: 1763
GSI = 25-35

CONRAD SHALE (C-SHL) DRILLCORE



OS-17-250
DEPTH: 38.39 TO 46.87 m
RMR = 57-59

NOTES:
- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD SHALE
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-9

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\ | File Name: Osiris_Outcrop and Core Photos.pptx
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
0

CONRAD DOLOSTONE (C-DST) OUTCROP



PHOTOGRAPH TAKEN 28 JUNE 2018
MAPPING STATION ID: O-010
X: 629691
Y: 7112718
Z: 1757
GSI = 65-75

CONRAD DOLOSTONE (C-DST) DRILLCORE



OS-17-253
DEPTH: 214.59 TO 222.50 m
RMR = 43-72

NOTES:
- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD DOLOSTONE
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-10

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris_Outcrop and Core Photos.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

CONRAD SILICLASTIC (C-SLC) OUTCROP



PHOTOGRAPH TAKEN 25 JUNE 2018
MAPPING STATION ID: C-008
X: 630284
Y: 7112448
Z: 1433
GSI = 35-45

CONRAD SILICLASTIC (C-SLC) DRILLCORE



OS-17-232
DEPTH: 158.07 TO 167.03 m
RMR = 53-61

NOTES:

- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD SILICLASTIC
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-11

Path: \\golder.gds\gal\vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\3D Analysis | File Name: Osiris_Outcrop and Core Photos.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm

CONRAD LIMESTONE (C-LST 1) OUTCROP



PHOTOGRAPH TAKEN 25 JUNE 2018
MAPPING STATION ID: C-007
X: 630573
Y: 7112430
Z: 1340
GSI = 70-80

CONRAD LIMESTONE 1 (C-LST 1) DRILLCORE



OS-18-272
DEPTH: 301.14 TO 308.17 m
RMR = 61-74

NOTES:

- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD LIMESTONE 1
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-12

Path: \\golder.gds\gal\vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris_Outcrop and Core Photos.pptx

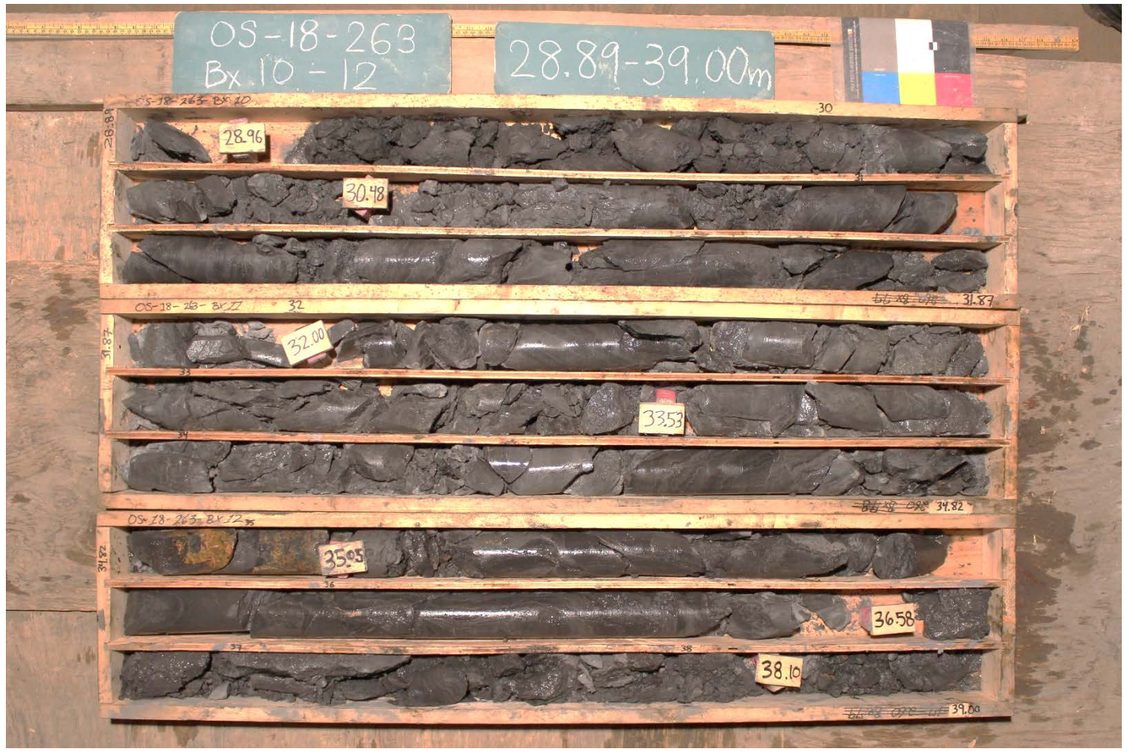
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

NADALEEN FAULT ZONE (C-NFZ) OUTCROP



PHOTOGRAPH TAKEN 25 JUNE 2018
MAPPING STATION ID: C-006
X: 630505
Y: 7112543
Z: 1427
GSI = 25-35

NADALEEN FAULT ZONE (C-NFZ) DRILLCORE



OS-18-263
DEPTH: 30.48 TO 36.58 m
RMR = 34-44

NOTES:

- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
NADALEEN FAULT ZONE
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-13

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\ | File Name: Osiris_Outcrop and Core Photos.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

CONRAD MUDSTONE (C-NONAD) OUTCROP



PHOTOGRAPH TAKEN 25 JUNE 2018
MAPPING STATION ID: C-002
X: 630257
Y: 7113050
Z: 1808
GSI = 40-50

CONRAD MUDSTONE (C-NONAD) DRILLCORE



OS-12-119
DEPTH: 105.46 TO 115.31 m
INSUFFICIENT GEOTECHNICAL INTERVAL DATA TO CALCULATE RMR
ROCK APPEARS TO BE FAIR QUALITY IN CORE

NOTES:
- OUTCROP PHOTOGRAPHS TAKEN BY GOLDER DURING JUNE 2018 SITE VISIT
- CORE PHOTOGRAPHS TAKEN BY ATAC DURING SUMMER DRILLING PROGRAMS
- ROCK MASS RATINGS CALCULATED BY GOLDER

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-11-19
PREPARED	SHA
DESIGNED	TGT
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CONRAD MUDSTONE
REPRESENTATIVE OUTCROP AND CORE PHOTOGRAPHS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	H-14

Path: \golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis | File Name: Osiris_Outcrop_and_Core Photos.pptx
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

APPENDIX I

Core Photographs of Weathered Zone Rocks



OS-17-233 GEOTECH LOG
DEPTH: 2.6 TO 11.6 m
RMR = 18 to 42
RQD = 0 to 47%
ROCK STRENGTH = 2 to 4
ROCK UNIT = C-LST1

AVERAGES
RMR = 26
RQD = 16%
ROCK STRENGTH = 3

NOTES:
-CONRAD LIMESTONE 1
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
CONRAD PIT
OS-17-233

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.cptx



OS-17-233 GEOTECH LOG
DEPTH: 11.6 TO 22.5 m
RMR = 18 to 42
RQD = 0 to 43%
ROCK STRENGTH = 0 to 4
ROCK UNIT = C-LST1

AVERAGES
RMR = 31
RQD = 14%
ROCK STRENGTH = 2

THIS INTERVAL OF WEATHERED ROCK IS POTENTIALLY EFFECTED BY FAULTING WHICH HAS SIGNIFICANTLY DECREASED THE AVERAGES FOR THESE INTERVALS. THIS INTERVAL IS NOT TYPICALY FOR WEATHERED ROCK IN THIS AREA. HOWEVER, THIS CAN BE CONSIDERED TO REPRESENT THE A WORST CASE SCENARIO FOR CONRAD LIMESTONE WEATHERED ROCK.

NOTES:
-CONRAD LIMESTONE 1
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

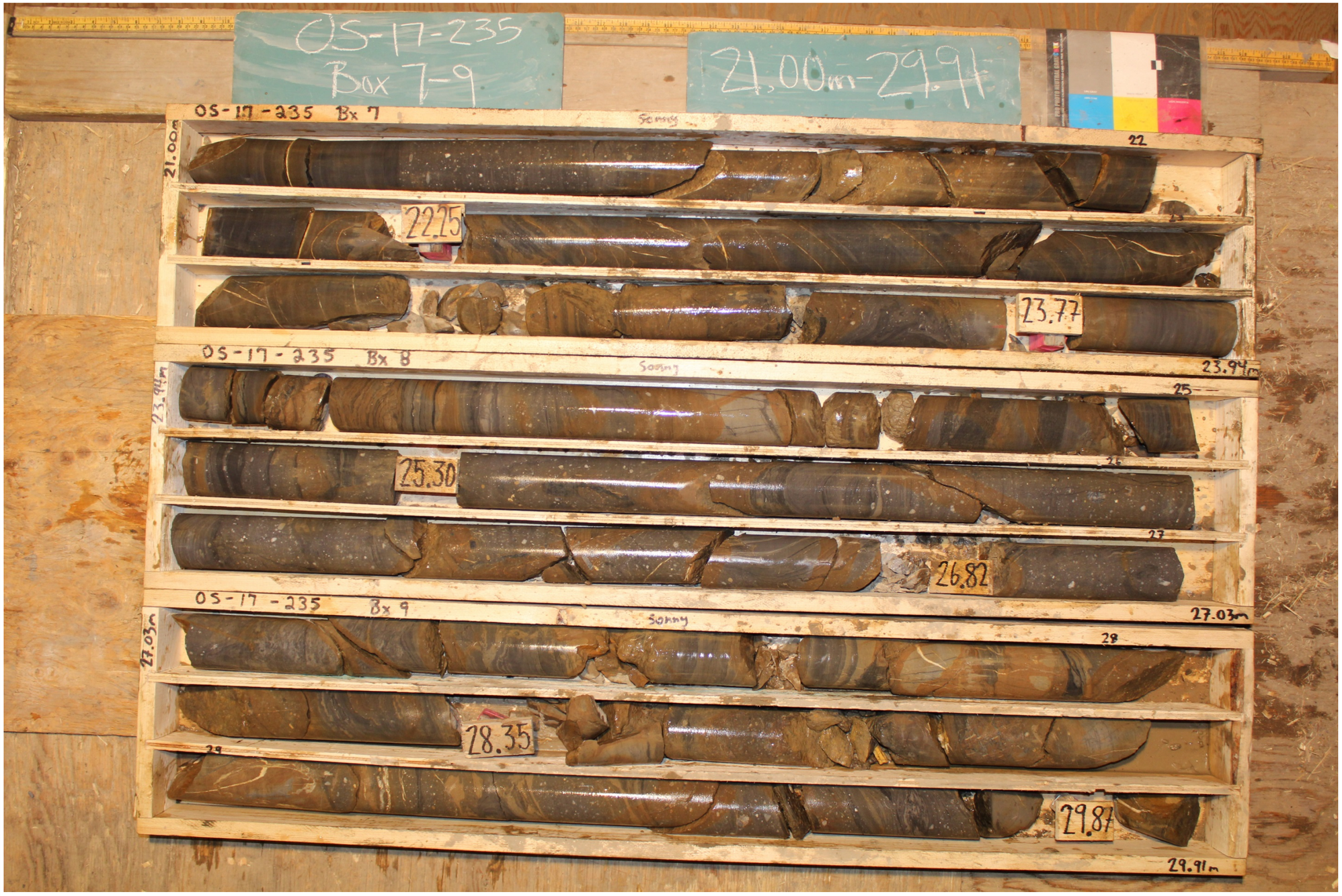
YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
CONRAD PIT
OS-17-233

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-2

Path: tgolder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Bomhold\Core Photo Review\ File Name: Osiris_Core Photos_ Weathered Rock Review.pptx
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
0



OS-17-235 GEOTECH LOG
DEPTH: 21.0 TO 29.9 m
RMR = 49 to 64
RQD = 61 to 97%
ROCK STRENGTH = 3
ROCK UNIT = C-SLC

AVERAGES
RMR = 55
RQD = 81%
ROCK STRENGTH = 3

NOTES:
-CONRAD SILISICLASTIC
-WEATHERING OBSERVED FROM ROCK DISCOLOURATION
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
CONRAD PIT
OS-17-235

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

Path: \golder.gds\gal\Vancouver\Complex\Data\ATAC\Data\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Core Photo Review\ File Name Osiris_Core Photos_ Weathered Rock Review.pptx



OS-17-250 GEOTECH LOG
DEPTH: 12.0 TO 21.3 m
RMR = 36 to 37
RQD = 42 to 58%
ROCK STRENGTH = 2
ROCK UNIT = C-SHL

AVERAGES
RMR = 36
RQD = 48%
ROCK STRENGTH = 2

NOTES:
-CONRAD BLACK SHALE
-VISIBIEL DISCOLOURATION FROM WEATHERING IN THIS ROCK TYPE NOT OBSERVABLE
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
CONRAD PIT
OS-17-250

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-4

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_BoreholeCore Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
0 1 2



OS-12-093 GEOTECH LOG
DEPTH: 17.5 TO 29.4 m
RMR = NA
RQD = 7 TO 32%
ROCK STRENGTH = 3
ROCK UNIT = C-NONAD

AVERAGES
RQD = 21%
ROCK STRENGTH = 3

NOTES:
-CONRAD NONAD MUDSTONE
-BASED ON VISUAL OBSERVATIONS OF THE CORE, IT APPEARS THE ROCK STRENGTH WAS LOGGED HIGHER THAN THE ACTUAL ROCK STRENGTH
-LOGGED RQD APPEARS APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
CONRAD PIT
OS-12-093

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
0

Path: \\golder.gds\gal\vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Boreholes\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx



OS-12-197 GEOTECH LOG
DEPTH: 28.1 TO 38.4 m
RMR = NA
RQD = 7 TO 36%
ROCK STRENGTH = 2 TO 3
ROCK UNIT = C-NONAD

AVERAGES
RQD = 20%
ROCK STRENGTH = 2

NOTES:
-CONRAD NONAD MUDSTONE
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
CONRAD PIT
OS-12-197

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm
0

Path: \\golder.gds\gal\Vancouver\Complete\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx

ONLY FIRST BOX OF CORE APPEARS VISUALLY EFFECTED BY WEATHERING

OS-17-240 GEOTECH LOG
DEPTH: 7.8 TO 22.9 m
RMR = 18 TO 52
RQD = 0 TO 85%
ROCK STRENGTH = 0 TO 4
ROCK UNIT = O-DST

AVERAGES
RMR = 34
RQD = 52%
ROCK STRENGTH = 3

NOTES:
-OSIRIS DOLOSTONE
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
OSIRIS PIT
OS-17-240

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET IS NOT MODIFIED FROM ANSI B

0 25mm

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx



OS-17-249 GEOTECH LOG
DEPTH: 3.6 TO 12.5 m
RMR = NA
RQD = 18 TO 50%
ROCK STRENGTH = 3
ROCK UNIT = O-LST1

AVERAGES
RQD = 30%
ROCK STRENGTH = 3

NOTES:
-OSIRIS LIMESTONE 1
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
SUNRISE PIT
OS-17-249

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25mm

Path: \golder.gds\gal\Vancouver\Complex\Data\ATAC\Data\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analyses_Boreholes\Core Photo Review\ File Name: Osiris_Core Photos_ Weathered Rock Review.pptx



OS-17-258 GEOTECH LOG
DEPTH: 20.9 TO 30.4 m
RMR = 25 TO 35
RQD = 6 TO 12%
ROCK STRENGTH = 3
ROCK UNIT = O-MST1

AVERAGES
RMR = 30
RQD = 8%
ROCK STRENGTH = 3

NOTES:
-OSIRIS MUDSTONE 1
-LOGGED RQD APPEARS APPROPRIATE
-BASED ON VISUAL OBSERVATIONS OF THE CORE, IT APPEARS THE ROCK STRENGTH WAS LOGGED HIGHER THAN THE ACTUAL ROCK STRENGTH

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
OSIRIS PIT
OS-17-258

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx



OS-17-246 GEOTECH LOG
DEPTH: 7.3 TO 19.8 m
RMR = 32
RQD = 14 TO 24%
ROCK STRENGTH = 2
ROCK UNIT = O-MST1

AVERAGES
RMR = 32
RQD = 20%
ROCK STRENGTH = 2

NOTES:
-OSIRIS MUDSTONE 1
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
SUNRISE PIT
OS-17-246

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm

Path: \golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx



OS-12-125 GEOTECH LOG
DEPTH: 2.1 TO 13.9 m
RMR = NA
RQD = 7 TO 58%
ROCK STRENGTH = 3 TO 5
ROCK UNIT = O-LST 2

AVERAGES
RQD = 32%
ROCK STRENGTH = 4

NOTES:
-OSIRIS LIMESTONE 2
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
IBIS PIT
OS-12-125

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-11

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_BoreholeCore Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm



OS-13-212 GEOTECH LOG
DEPTH: 1.0 TO 12.5 m
RMR = NA
RQD = 0 TO 47%
ROCK STRENGTH = 3 TO 5
ROCK UNIT = 0-LST 2

AVERAGES
RMR = NA
RQD = 17%
ROCK STRENGTH = 4

NOTES:
-OSIRIS LIMESTONE 2
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

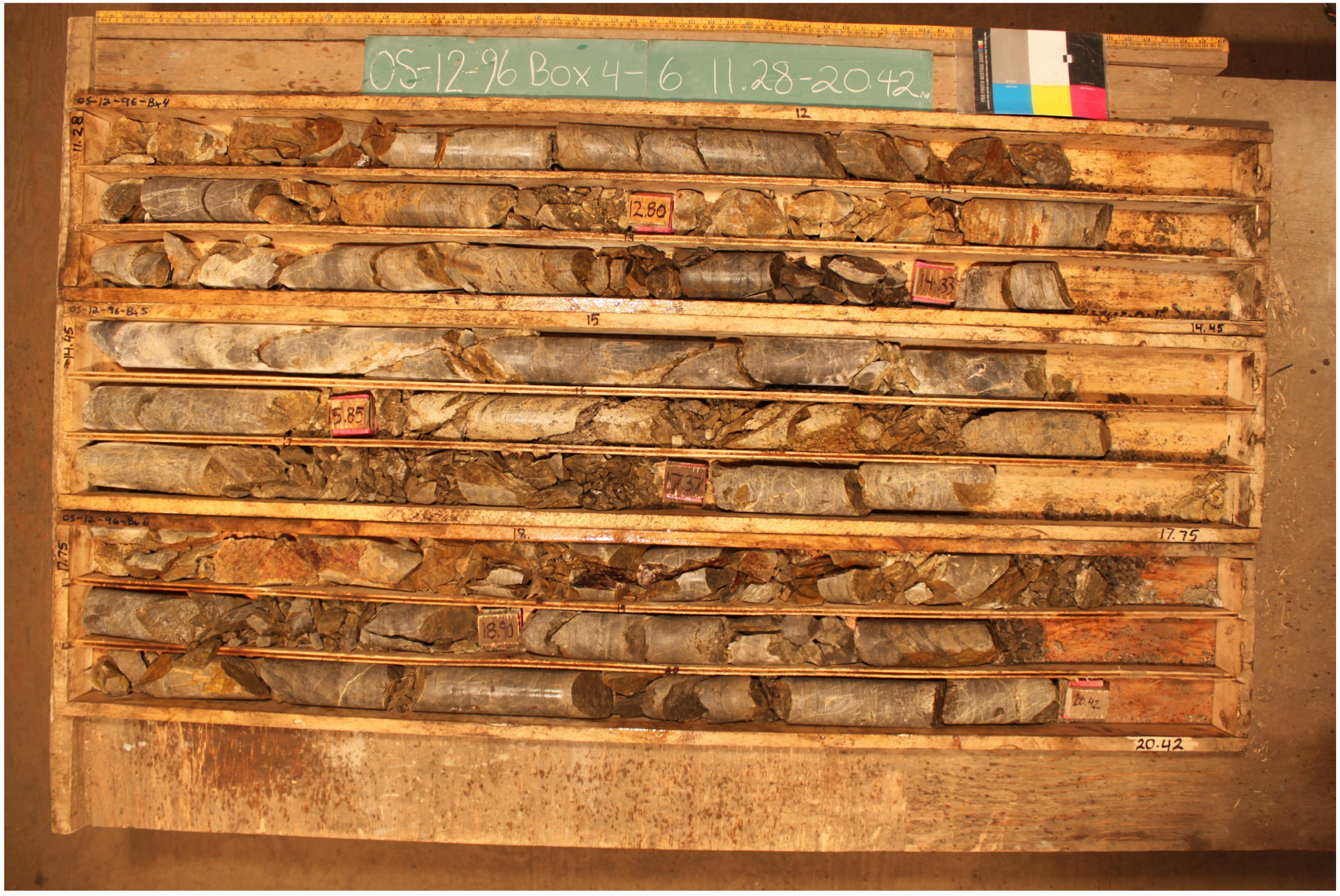
PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
IBIS PIT
OS-13-212

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-12

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

Path: \golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis\Boreholes\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx



OS-12-096 GEOTECH LOG
DEPTH: 11.3 TO 20.4 m
RMR = NA
RQD = 0 TO 54%
ROCK STRENGTH = 3 TO 4
ROCK UNIT = O-DST

AVERAGES
RMR = NA
RQD = 22%
ROCK STRENGTH = 3

NOTES:
-OSIRIS DOLOSTONE
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
IBIS PIT
OS-12-096

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\3D Analysis\3D Analysis_Borehole\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx



OS-12-097 GEOTECH LOG
DEPTH: 3.6 TO 17.7 m
RMR = NA
RQD = 7 TO 62%
ROCK STRENGTH = 3 TO 5
ROCK UNIT = O-DST/LST1

AVERAGES
RMR = NA
RQD = 36%
ROCK STRENGTH = 4

NOTES:
-OSIRIS DOLOSTONE AND OSIRIS LIMESTONE
-LOGGED ROCK STRENGTH AND RQD APPEAR APPROPRIATE

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-06-20
PREPARED	TGT
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

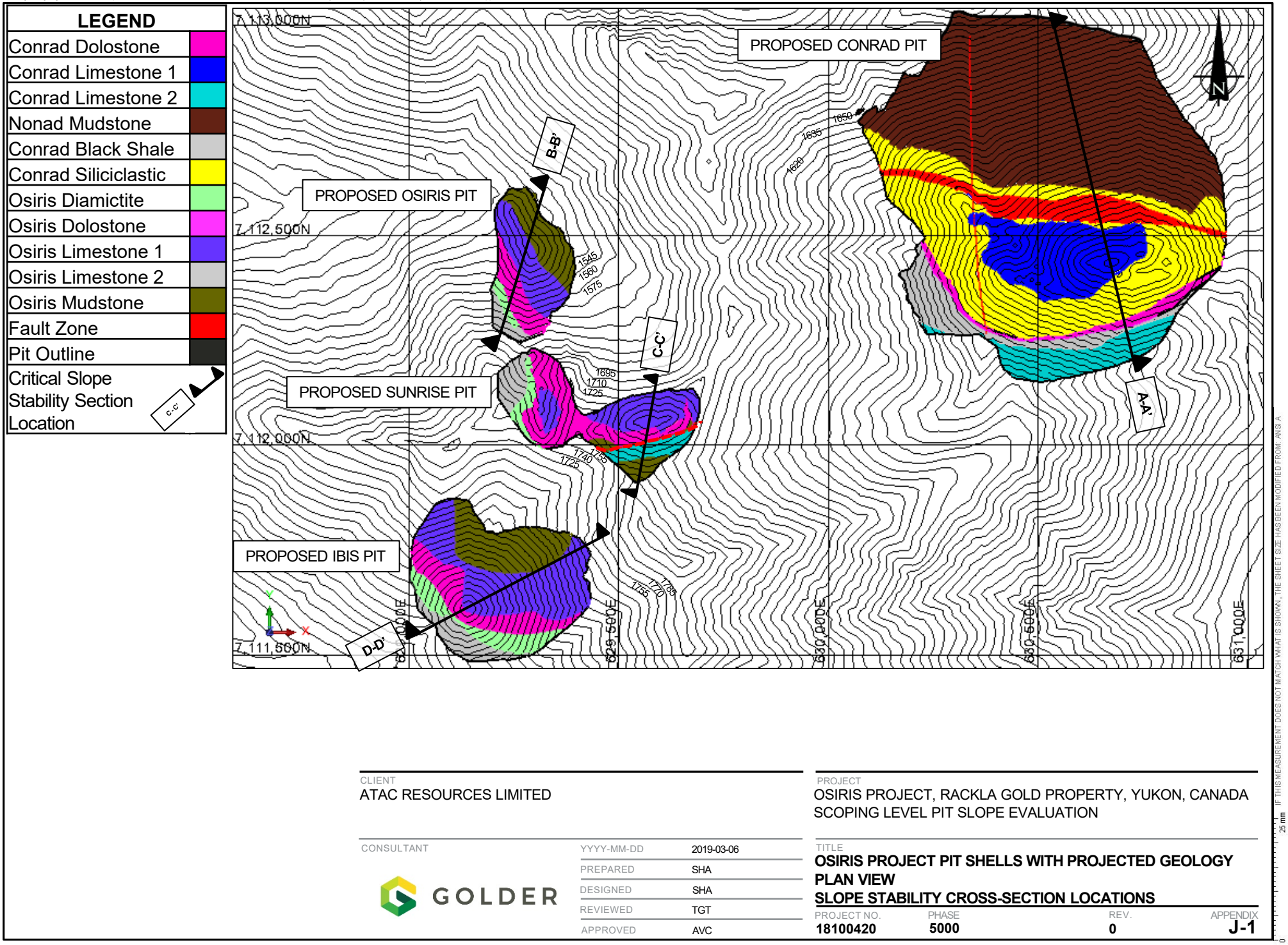
TITLE
CORE PHOTOGRAPH REVIEW OF WEATHERED ROCK
IBIS PIT
OS-12-097

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	4000	0	I-14

Path: \\golder.gds\gal\Vancouver\Complex\Data\ATAC\Osiris\18100420 Osiris Geotech\5 Technical Work\5D Analysis\Data Analysis_Borehole\Core Photo Review\ File Name: Osiris_Core Photos_Weathered Rock Review.pptx
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm
0

APPENDIX J

Scoping-level Pit Slope Stability Analyses



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
OSIRIS PROJECT PIT SHELLS WITH PROJECTED GEOLOGY PLAN VIEW
SLOPE STABILITY CROSS-SECTION LOCATIONS

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

Conrad Pit Material Properties

Material Name	Color	Unit Weight (kN/m3)	Strength Type	UCS (kPa)	GSI	mi	D	PC a	PC b	PC c	PC d	Water Surface
C-DST		25	Generalized Hoek-Brown	60000	44	9	0					Water Surface
C-DST blast damage		25	Generalized Hoek-Brown	60000	44	9	0.7					Water Surface
C-LST 1		25	Generalized Hoek-Brown	78000	58	10	0					Water Surface
C-LST 1 blast damage		25	Generalized Hoek-Brown	78000	58	10	0.7					Water Surface
C-LST 2		25	Generalized Hoek-Brown	80000	52	10	0					Water Surface
C-LST 2 blast damage		25	Generalized Hoek-Brown	80000	52	10	0.7					Water Surface
C-NFZ		25	Generalized Hoek-Brown	35000	46	4	0					Water Surface
C-NFZ blast damage		25	Generalized Hoek-Brown	35000	46	4	0.7					Water Surface
C-NONAD		25	Generalized Hoek-Brown	45000	53	4	0					Water Surface
C-NONAD blast damage		25	Generalized Hoek-Brown	45000	53	4	0.7					Water Surface
C-SHL		25	Generalized Hoek-Brown	25000	59	6	0					Water Surface
C-SHL blast damage		25	Generalized Hoek-Brown	25000	59	6	0.7					Water Surface
C-SLC		25	Generalized Hoek-Brown	66000	53	7	0					Water Surface
C-SLC blast damage		25	Generalized Hoek-Brown	66000	53	7	0.7					Water Surface
Weathered Zone		22	Power Curve					1.57	0.889	0	0	Water Surface

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
CONRAD PIT
SLIDE MODEL MATERIAL PROPERTIES

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-2**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Osiris Pit Material Properties

Material Name	Color	Unit Weight (kN/m3)	Strength Type	UCS (kPa)	GSI	mi	D	PC a	PC b	PC c	PC d	Water Surface
O-MST		25	Generalized Hoek-Brown	54000	49	4	0					Water Surface
O-MST blast damage		25	Generalized Hoek-Brown	54000	49	4	0.7					Water Surface
O-LST1		25	Generalized Hoek-Brown	76000	55	10	0					Water Surface
O-LST1 Blast Damage		25	Generalized Hoek-Brown	76000	55	10	0.7					Water Surface
O-LST2		25	Generalized Hoek-Brown	44000	46	10	0					Water Surface
O-LST2 blast damage		25	Generalized Hoek-Brown	44000	46	10	0.7					Water Surface
O-DST		25	Generalized Hoek-Brown	62000	51	10	0					Water Surface
O-DST blast damage		25	Generalized Hoek-Brown	62000	51	10	0.7					Water Surface
O-DMT		25	Generalized Hoek-Brown	75000	49	7	0					Water Surface
O-DMT blast damage		25	Generalized Hoek-Brown	75000	49	7	0.7					Water Surface
Weathered Zone		22	Power Curve					1.576	0.889	0	0	Water Surface

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
OSIRIS PIT
SLIDE MODEL MATERIAL PROPERTIES

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-3**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Sunrise Pit Material Properties

Material Name	Color	Unit Weight (kN/m3)	Strength Type	UCS (kPa)	GSI	mi	D	PC a	PC b	PC c	PC d	Water Surface
O-MST		25	Generalized Hoek-Brown	35000	48	4	0					Water Surface
O-MST blast damge		25	Generalized Hoek-Brown	35000	48	4	0.7					Water Surface
O-LST1		25	Generalized Hoek-Brown	66000	52	10	0					Water Surface
O-LST1 blast damage		25	Generalized Hoek-Brown	66000	52	10	0.7					Water Surface
C-LST2		25	Generalized Hoek-Brown	80000	48	10	0					Water Surface
C-LST2 blast damge		25	Generalized Hoek-Brown	80000	48	10	0.7					Water Surface
O-DST		25	Generalized Hoek-Brown	82000	56	10	0					Water Surface
O-DST blast damage		25	Generalized Hoek-Brown	82000	56	10	0.7					Water Surface
Weathered Zone		22	Power Curve					1.576	0.889	0	0	Water Surface
Fault Zone		25	Generalized Hoek-Brown	35000	46	4	0					Water Surface

CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

TITLE
SUNRISE PIT
SLIDE MODEL MATERIAL PROPERTIES

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-4**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

Ibis Pit Material Properties

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	GSI	mi	D	PC a	PC b	PC c	PC d	Water Surface
O-LST1		25	Generalized Hoek-Brown			76000	55	10	0					Water Surface
O-LST1 blast damage		25	Generalized Hoek-Brown			76000	55	10	0.7					Water Surface
O-DST		25	Generalized Hoek-Brown			62000	51	10	0					Water Surface
O-DST blast damage		25	Generalized Hoek-Brown			62000	51	10	0.7					Water Surface
O-DMT		25	Generalized Hoek-Brown			75000	49	7	0					Water Surface
O-DMT blast damage		25	Generalized Hoek-Brown			75000	49	7	0.7					Water Surface
O-LST2		25	Generalized Hoek-Brown			44000	46	10	0					Water Surface
O-LST2 blast damge		25	Generalized Hoek-Brown			44000	46	10	0.7					Water Surface
O-MST		25	Generalized Hoek-Brown			43000	49	4	0					Water Surface
O-MST blast damage		25	Generalized Hoek-Brown			43000	49	4	0.7					Water Surface
Weathered Zone		22	Power Curve							1.576	0.889	0	0	Water Surface
Bedding		25	Mohr-Coulomb	0	25									Water Surface

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

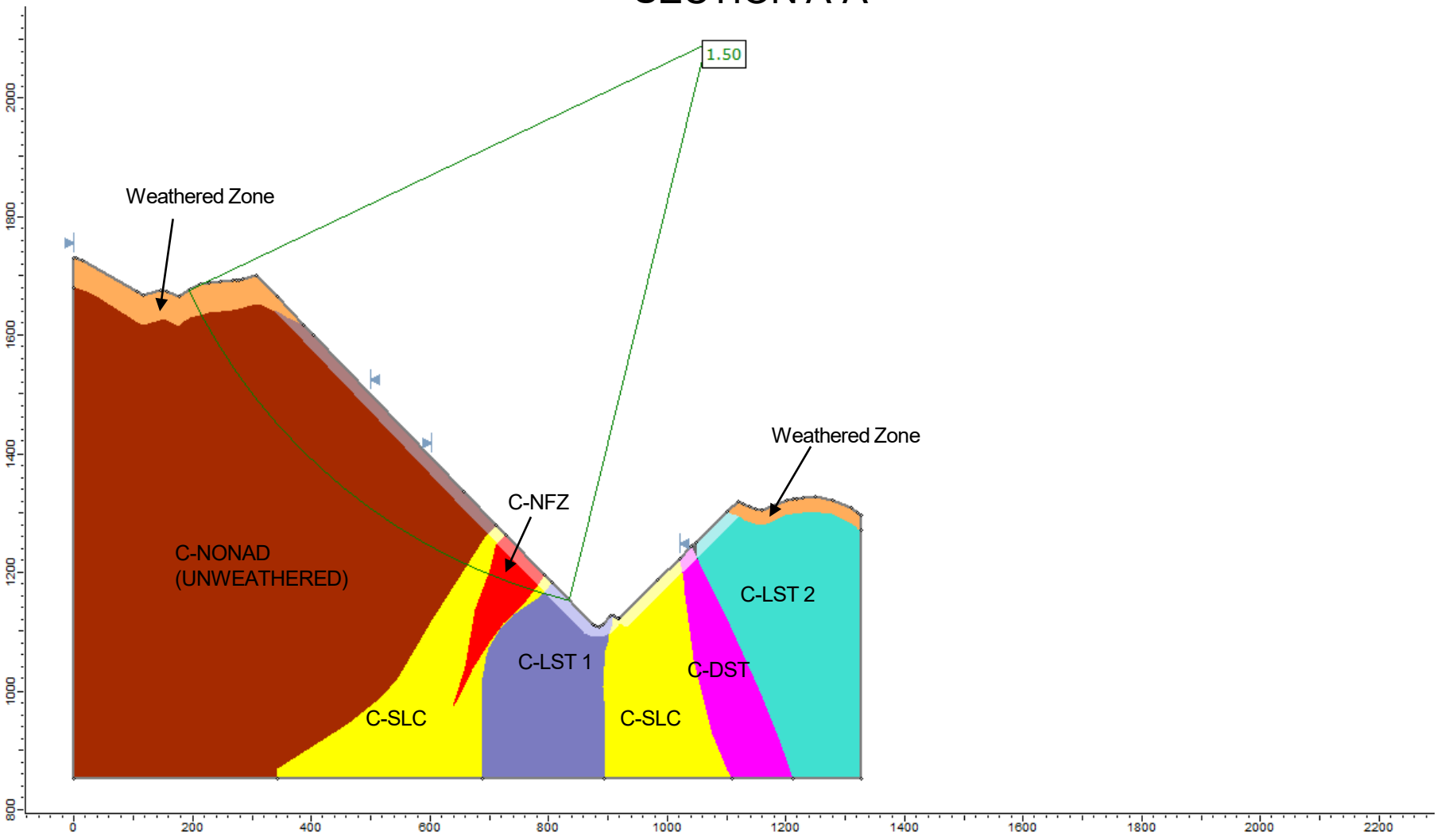
TITLE
IBIS PIT
SLIDE MODEL MATERIAL PROPERTIES

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-5**

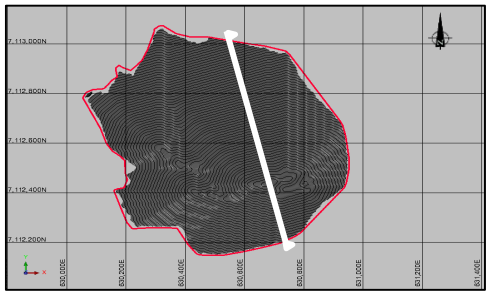
0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

SECTION A-A'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

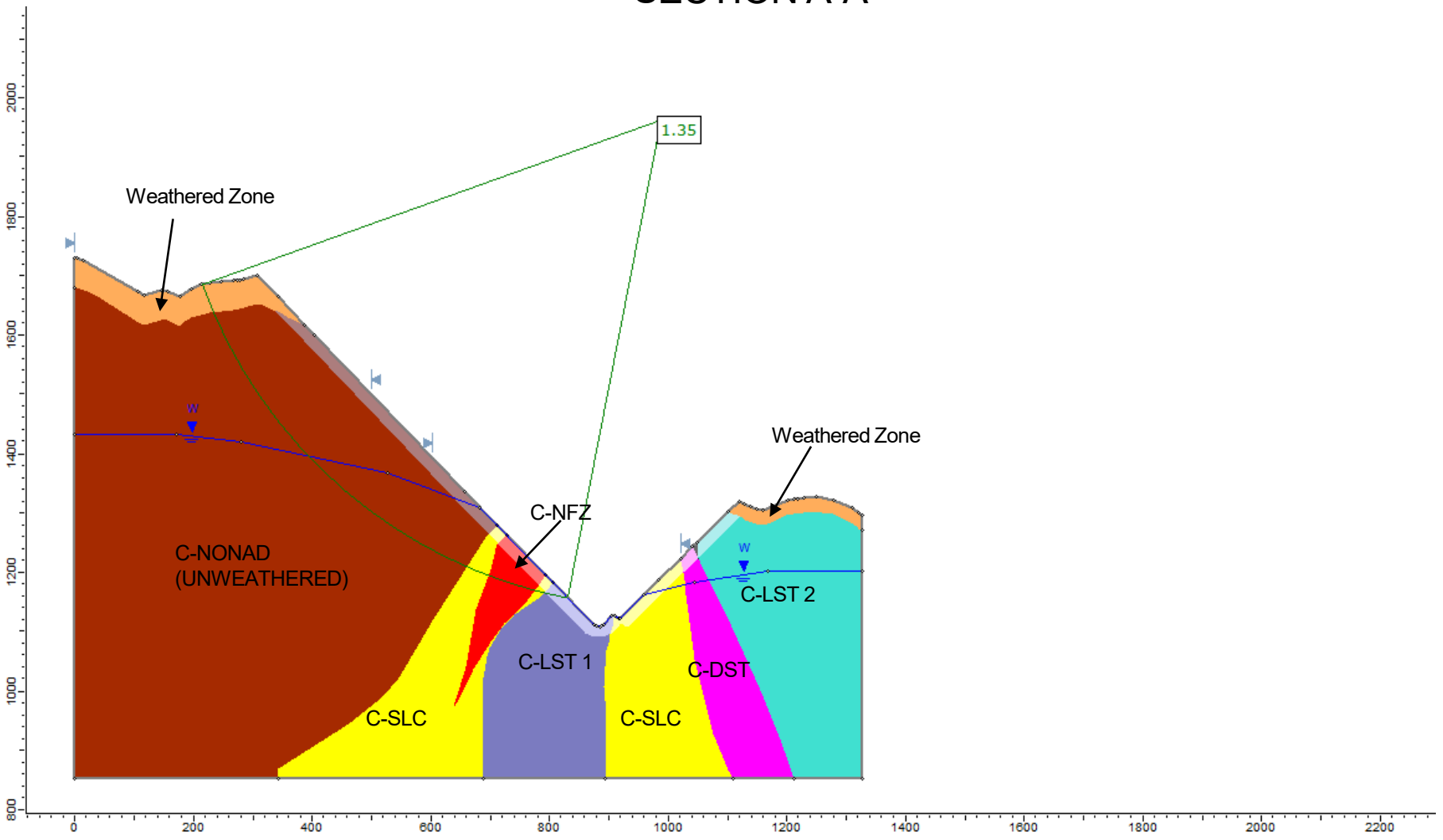
TITLE
CONRAD PIT
OVERALL SLOPE STABILITY ASSESSMENT
DRY SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-6**

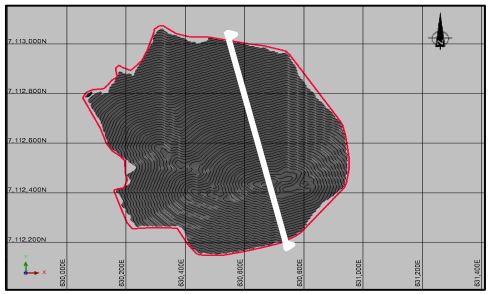
0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

SECTION A-A'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

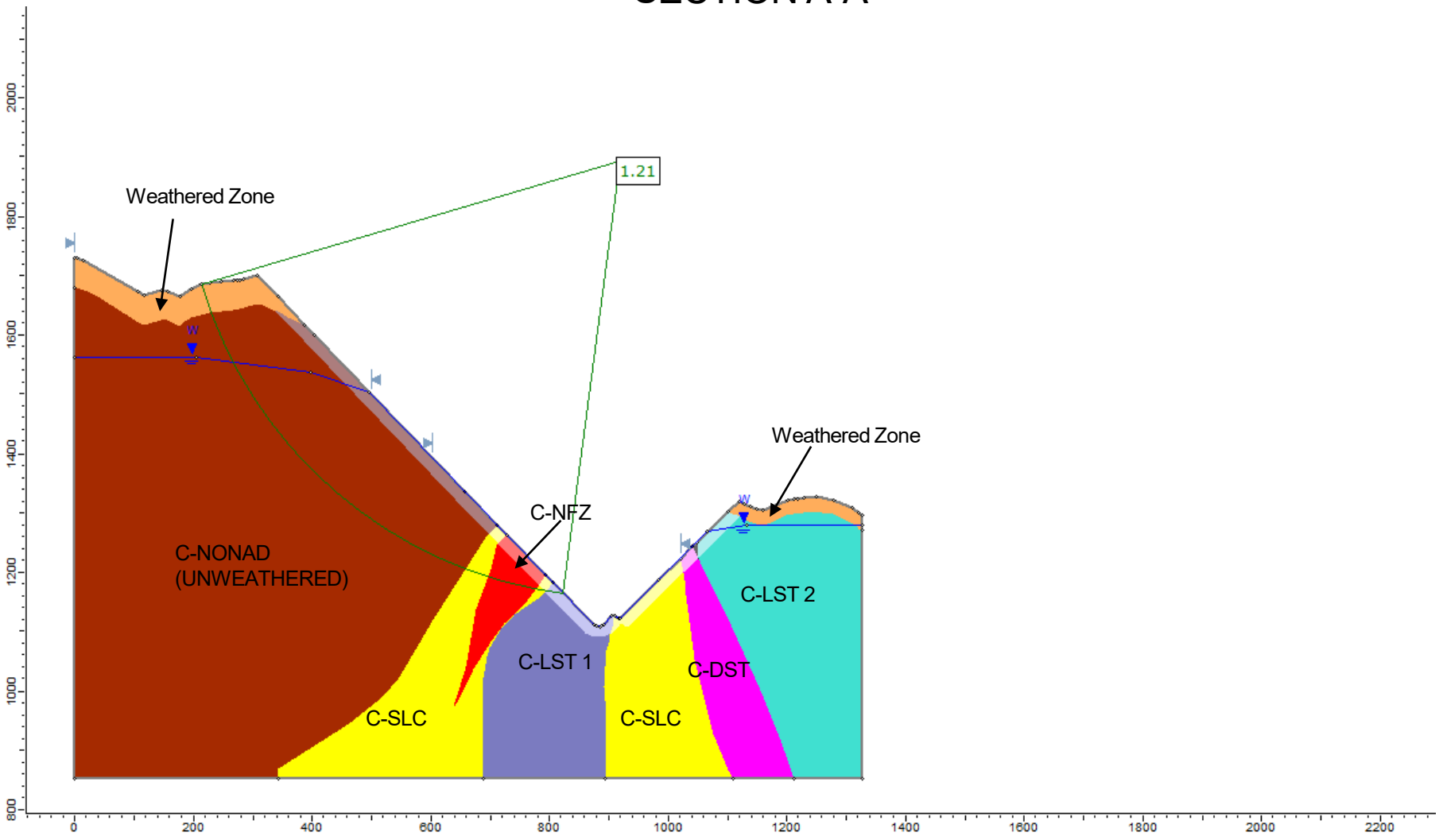
TITLE
CONRAD PIT
OVERALL SLOPE STABILITY ASSESSMENT
1/3rd SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-7**

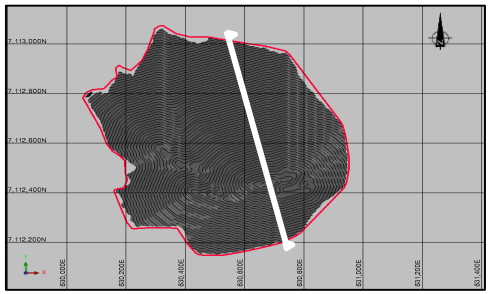
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION A-A'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

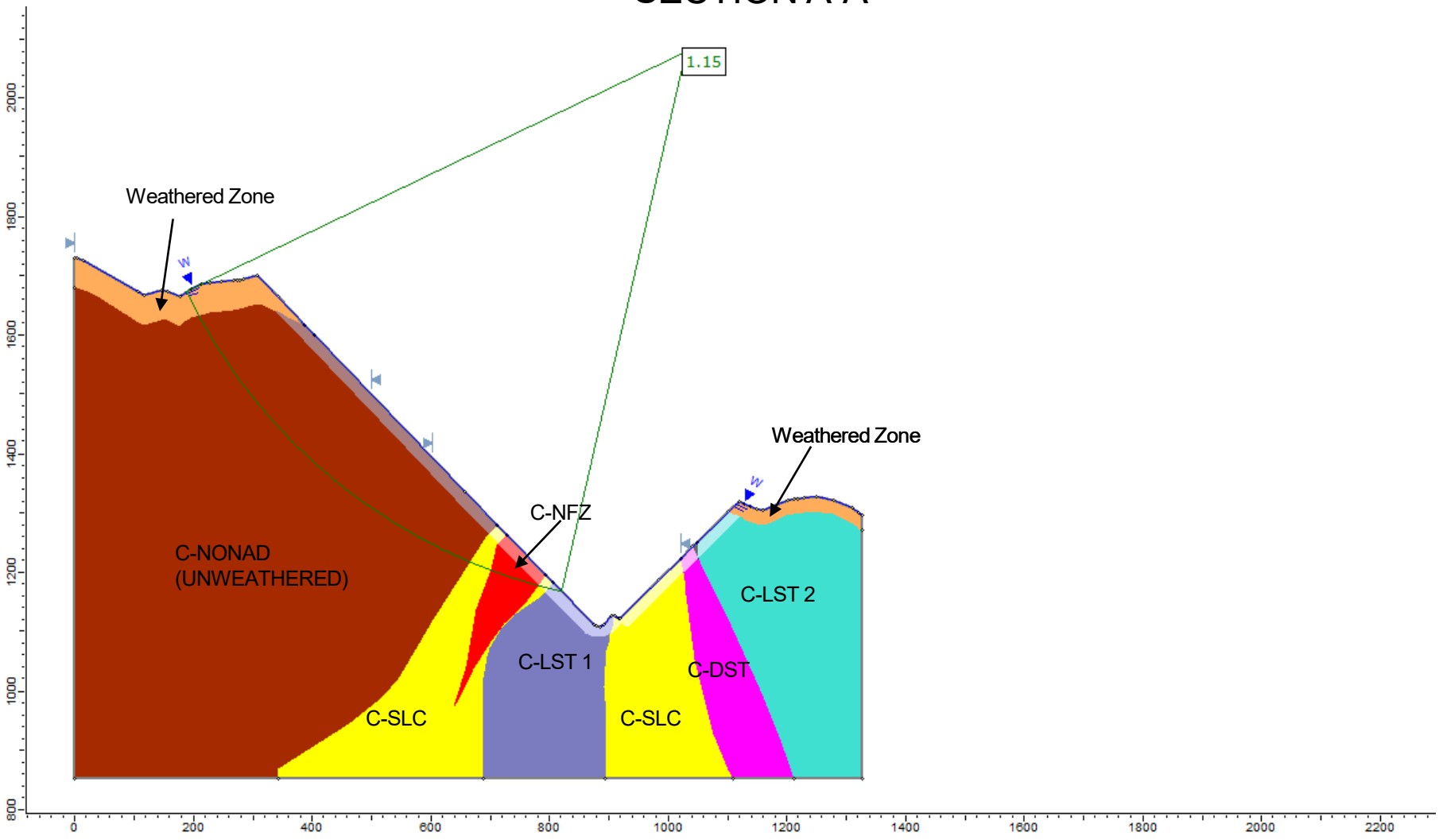
TITLE
CONRAD PIT
OVERALL SLOPE STABILITY ASSESSMENT
2/3rd SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-8**

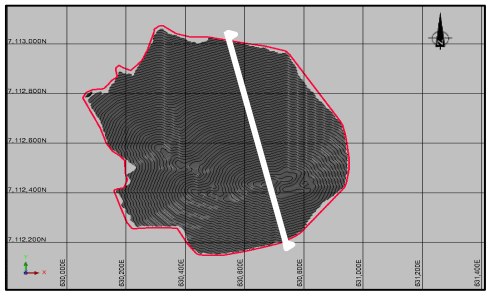
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION A-A'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

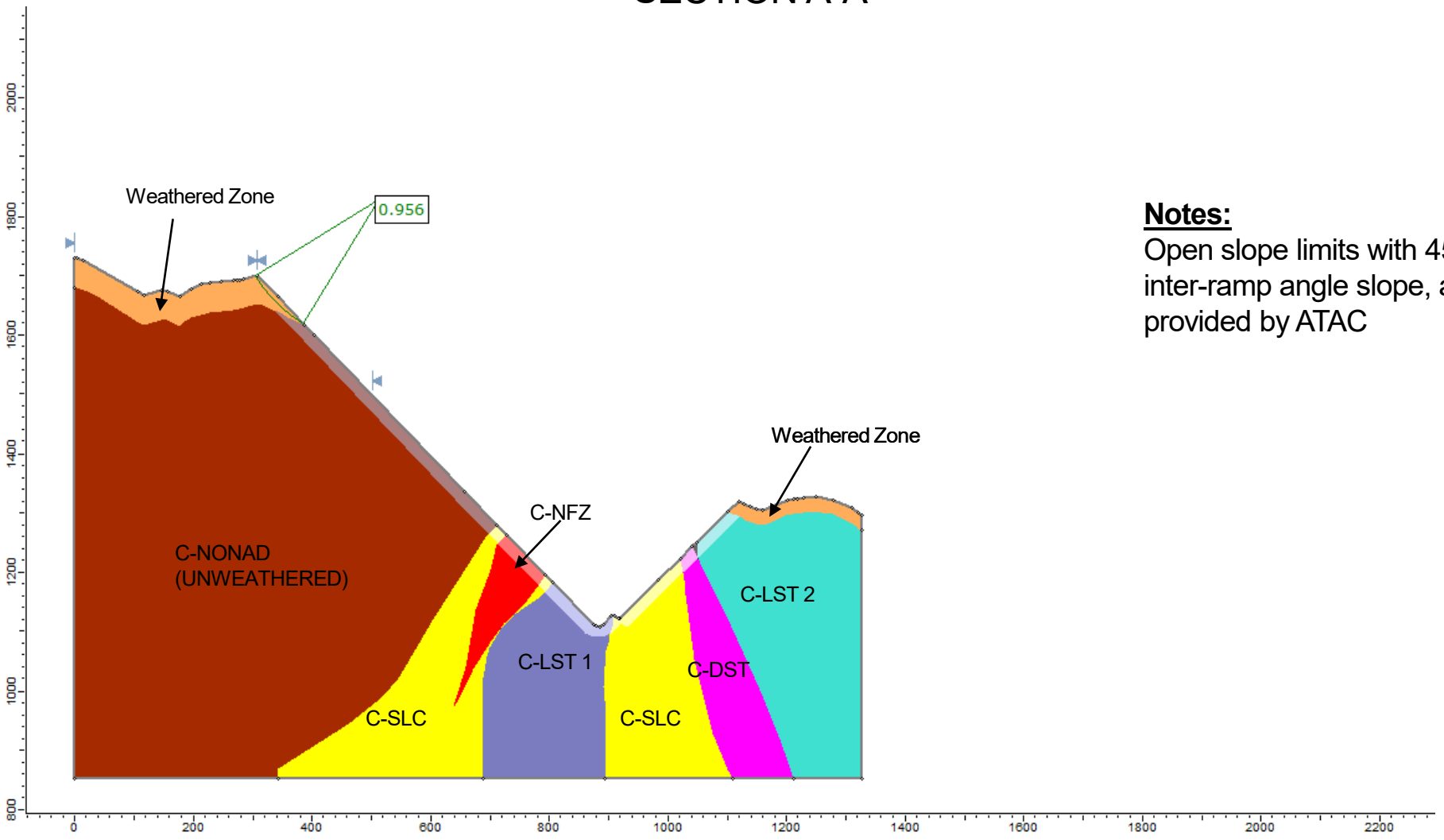
TITLE
CONRAD PIT
OVERALL SLOPE STABILITY ASSESSMENT
FULLY SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-9**

0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

SECTION A-A'

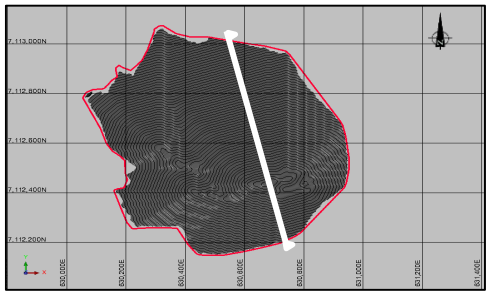
GLE Factor of Safety



Notes:

Open slope limits with 45˚ inter-ramp angle slope, as provided by ATAC

PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

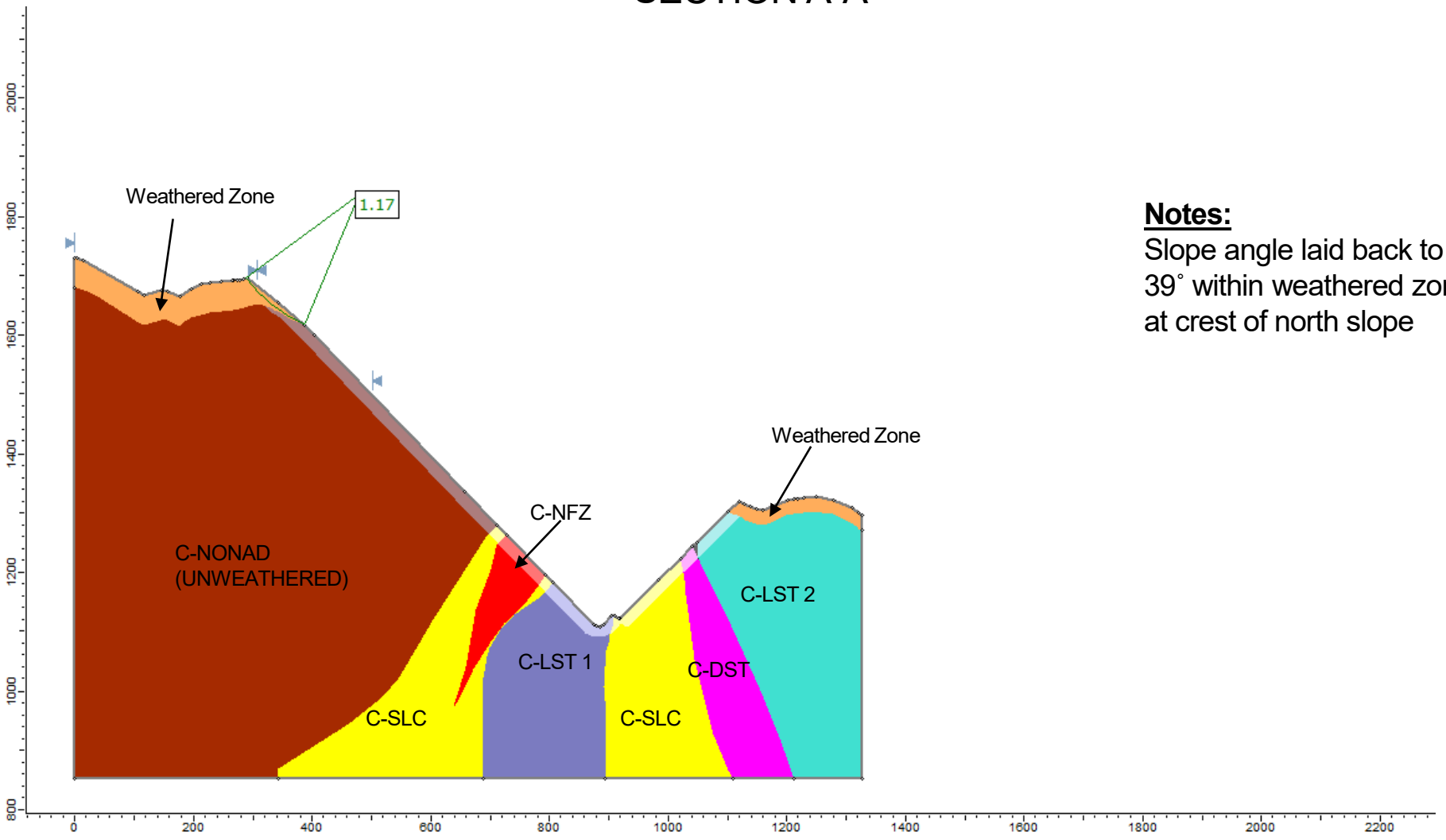
TITLE
CONRAD PIT
WEATHERED ZONE SLOPE STABILITY ASSESSMENT
DRY SLOPE AT 45 DEGREES

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION A-A'

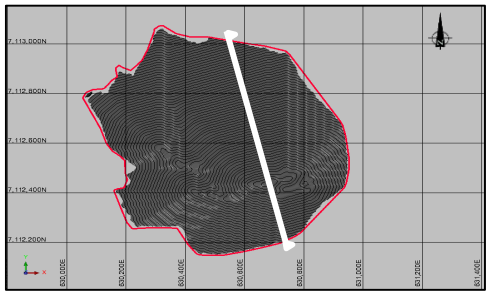
GLE Factor of Safety



Notes:

Slope angle laid back to 39˚ within weathered zone at crest of north slope

PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

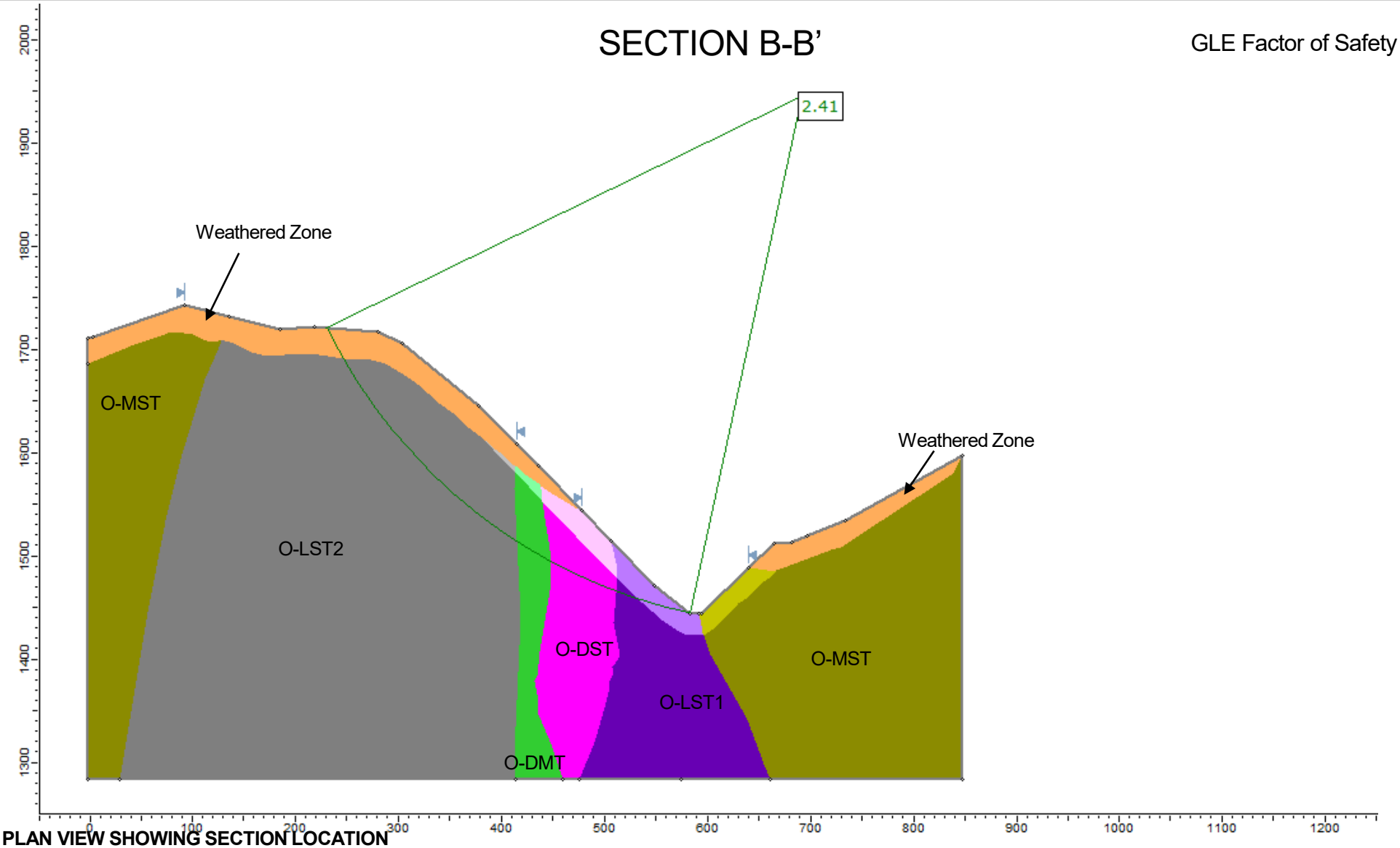
TITLE
CONRAD PIT
WEATHERED ZONE SLOPE STABILITY ASSESSMENT
DRY SLOPE AT 39 DEGREES

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-11**

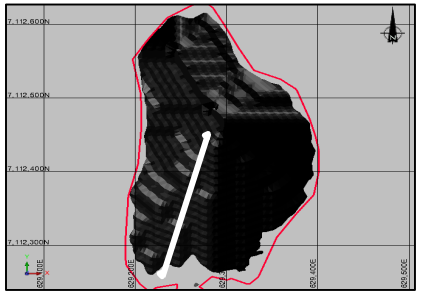
0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

SECTION B-B'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

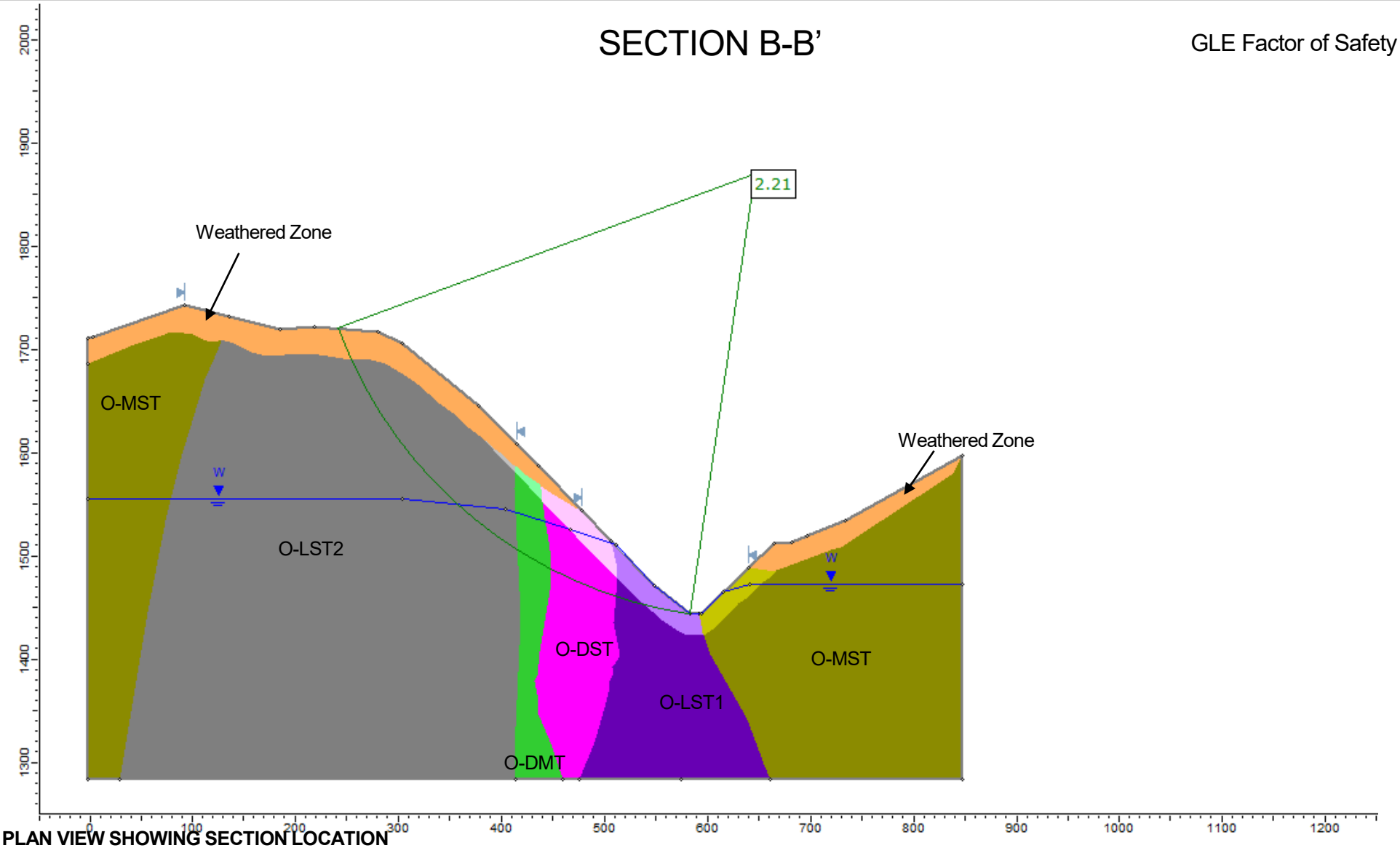
TITLE
OSIRIS PIT
OVERALL SLOPE STABILITY ASSESSMENT
DRY SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-12**

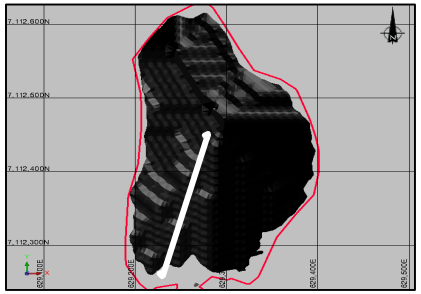
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION B-B'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

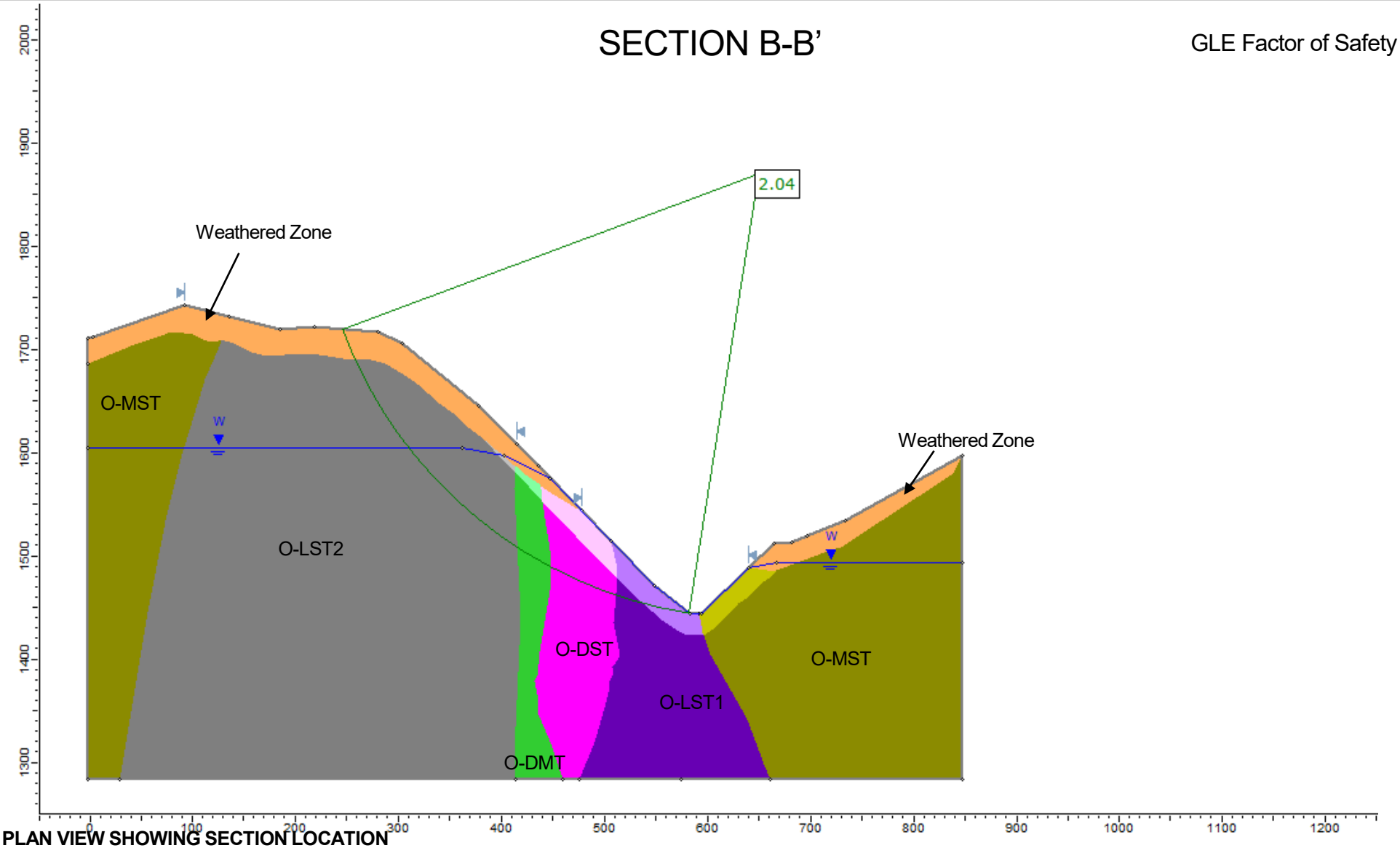
TITLE
OSIRIS PIT
OVERALL SLOPE STABILITY ASSESSMENT
1/3rd SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-13**

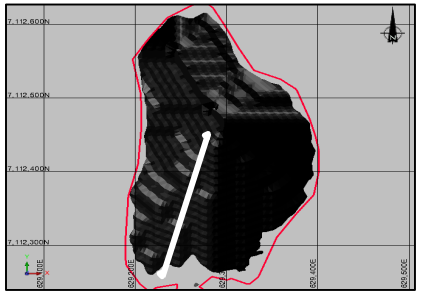
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION B-B'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

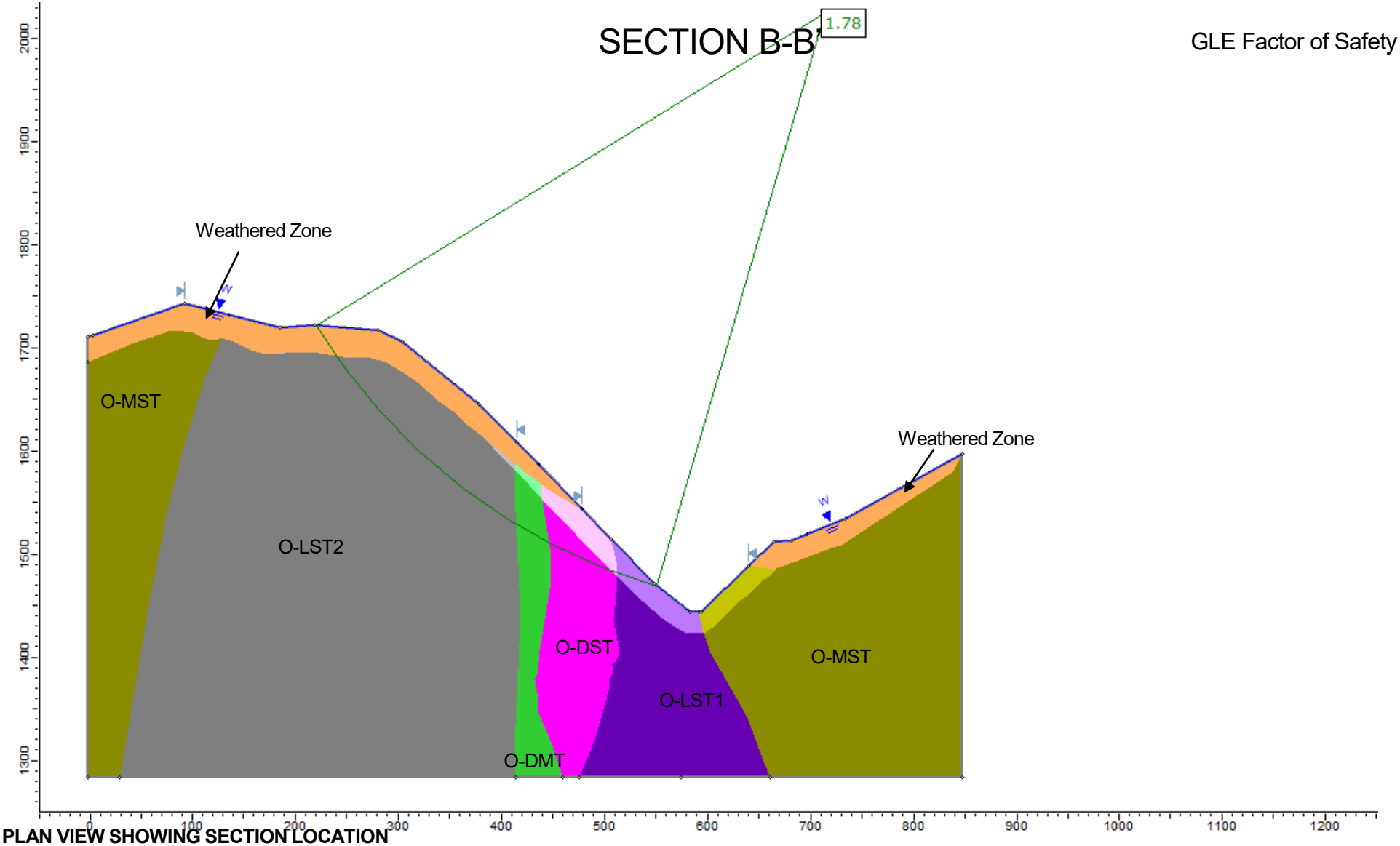
TITLE
OSIRIS PIT
OVERALL SLOPE STABILITY ASSESSMENT
2/3rd SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-14**

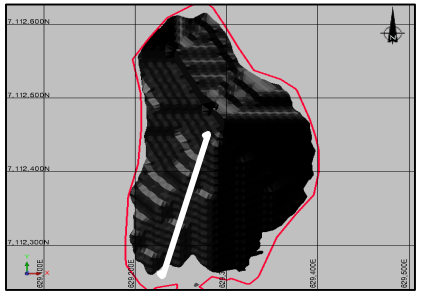
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION B-B'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

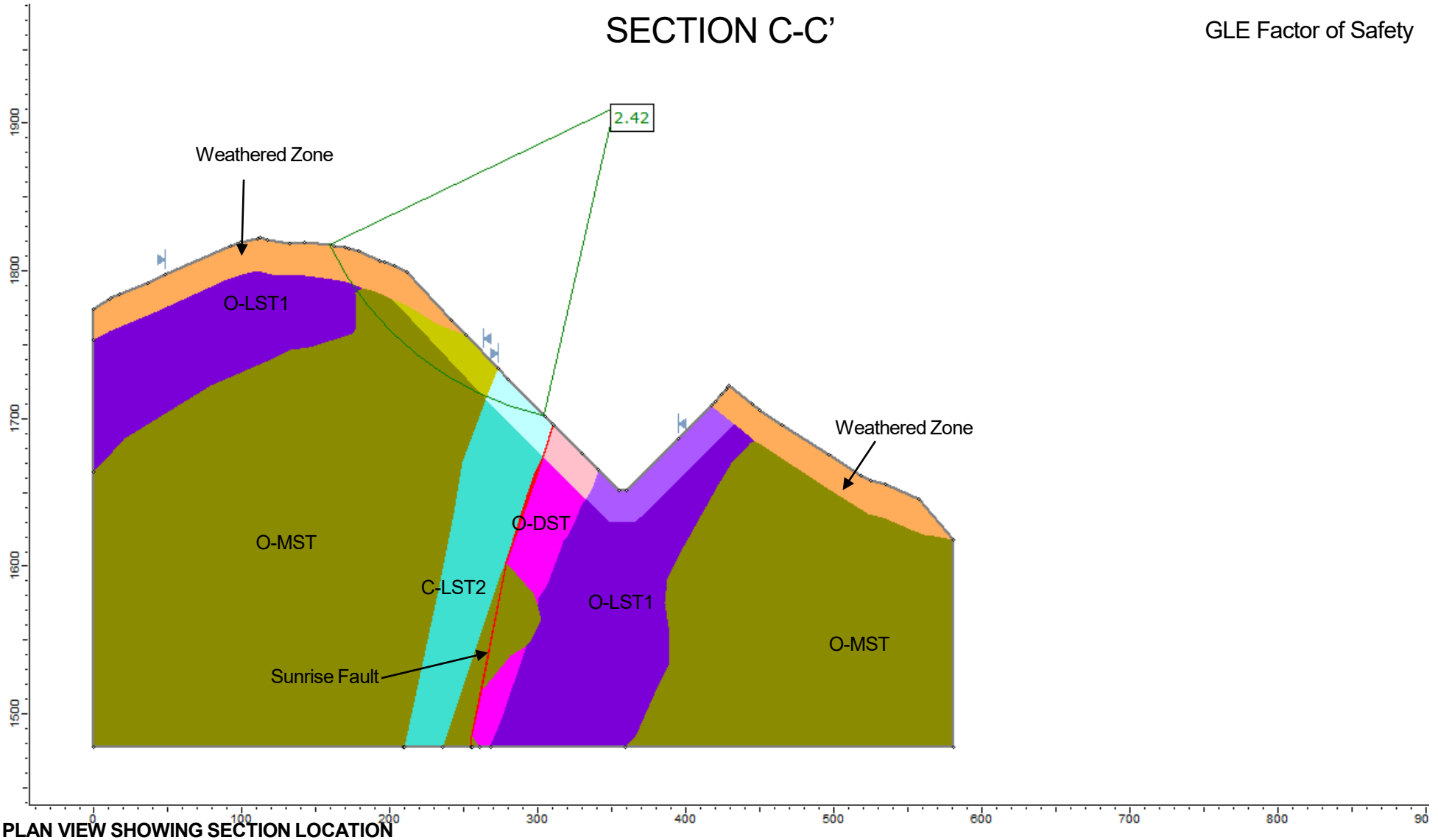
TITLE
OSIRIS PIT
OVERALL SLOPE STABILITY ASSESSMENT
FULLY SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-15**

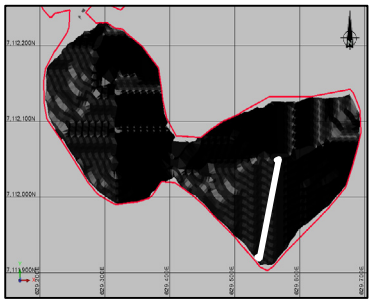
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION C-C'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

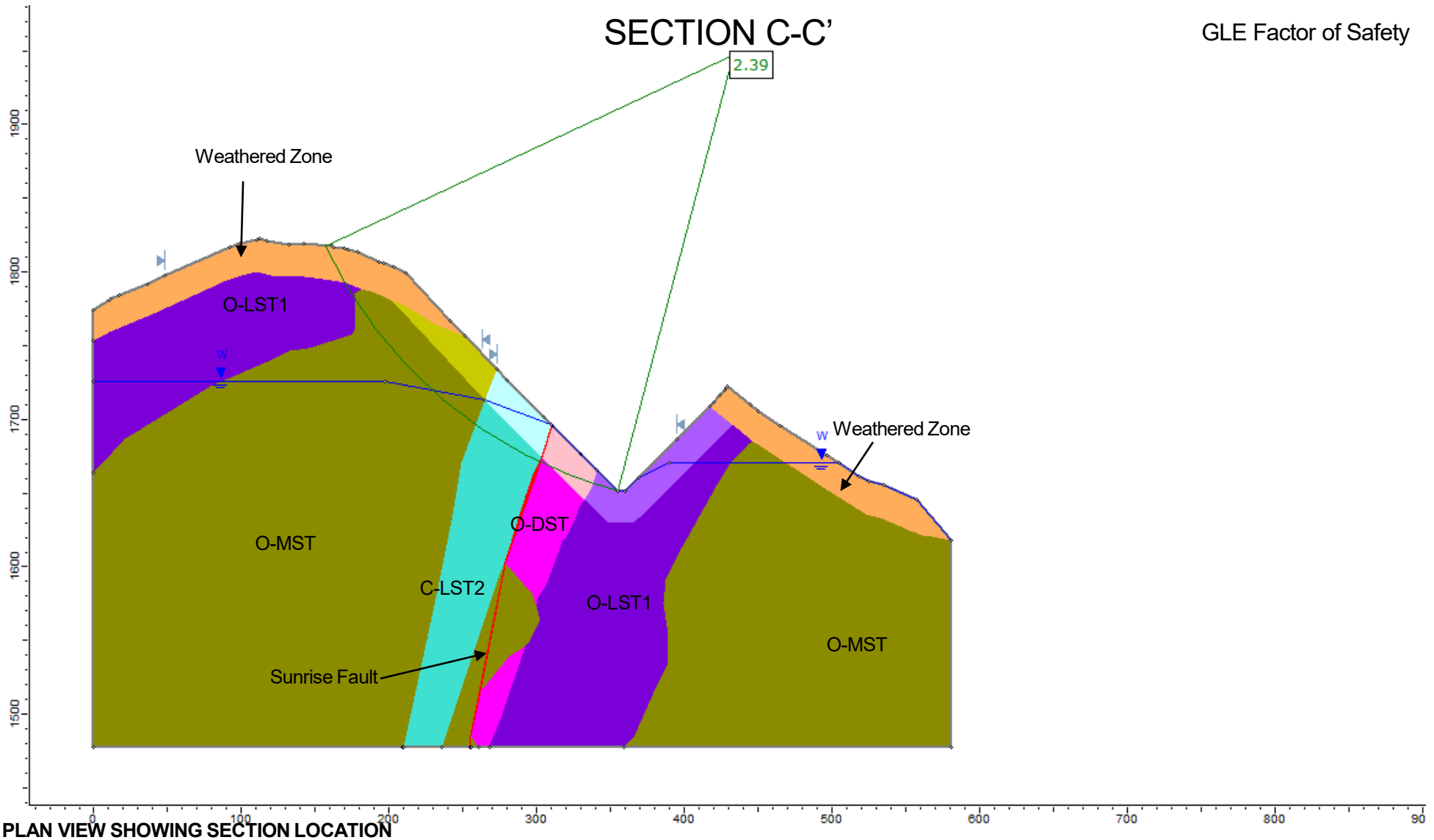
TITLE
SUNRISE PIT
OVERALL SLOPE STABILITY ASSESSMENT
DRY SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-16**

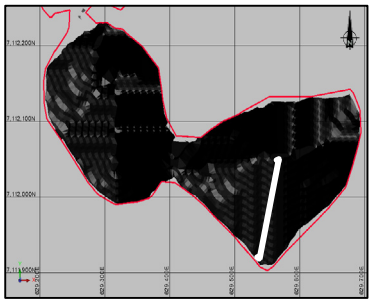
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION C-C'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

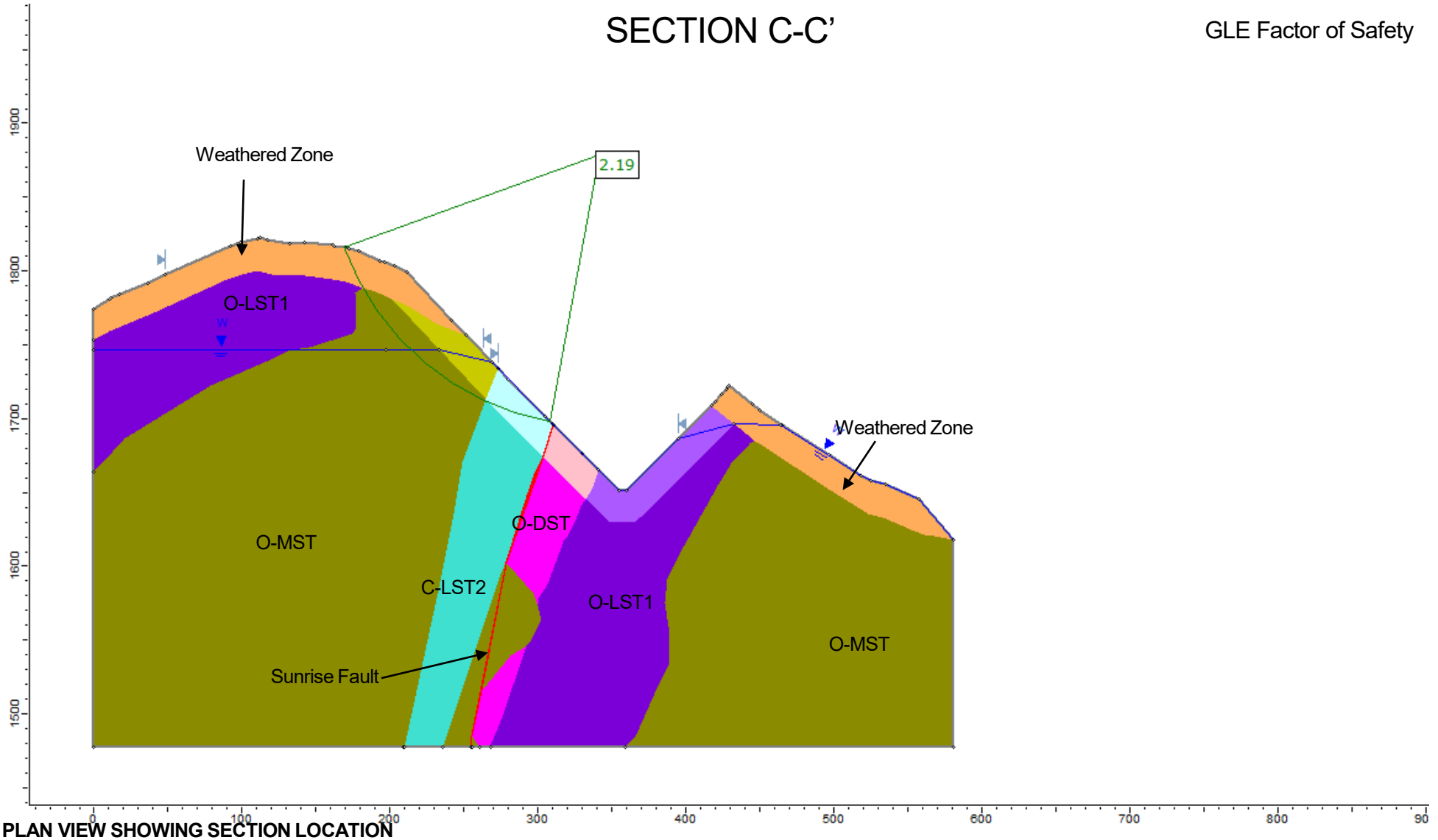
TITLE
SUNRISE PIT
OVERALL SLOPE STABILITY ASSESSMENT
1/3rd SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-17**

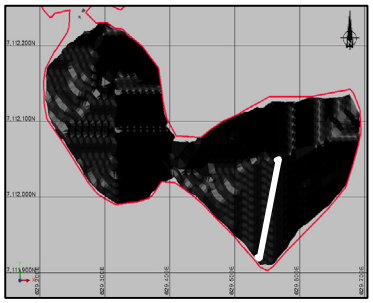
0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

SECTION C-C'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

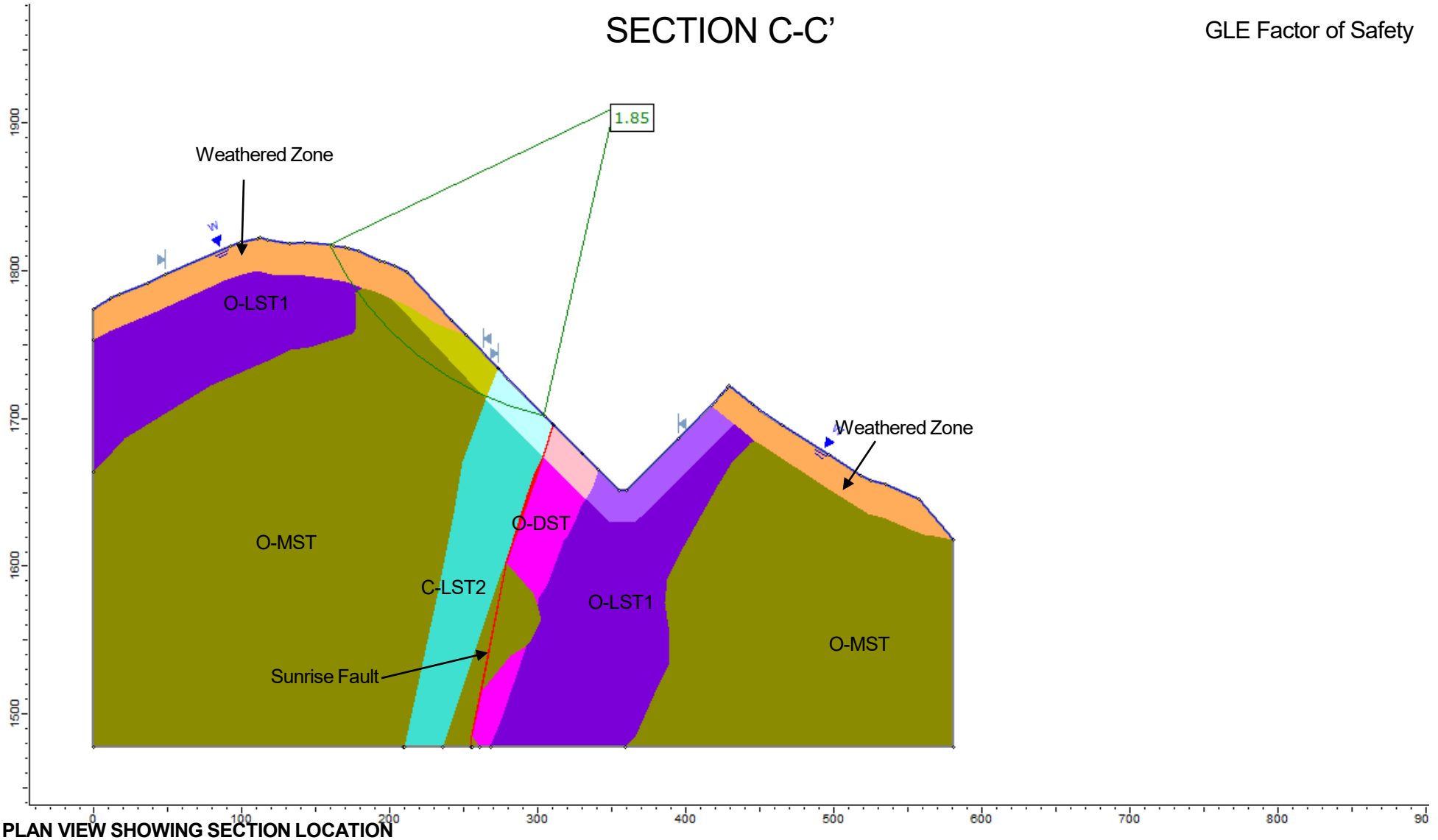
TITLE
SUNRISE PIT
OVERALL SLOPE STABILITY ASSESSMENT
2/3rd SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-18**

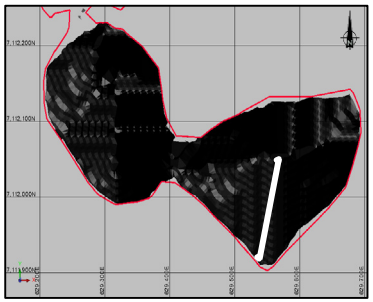
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION C-C'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

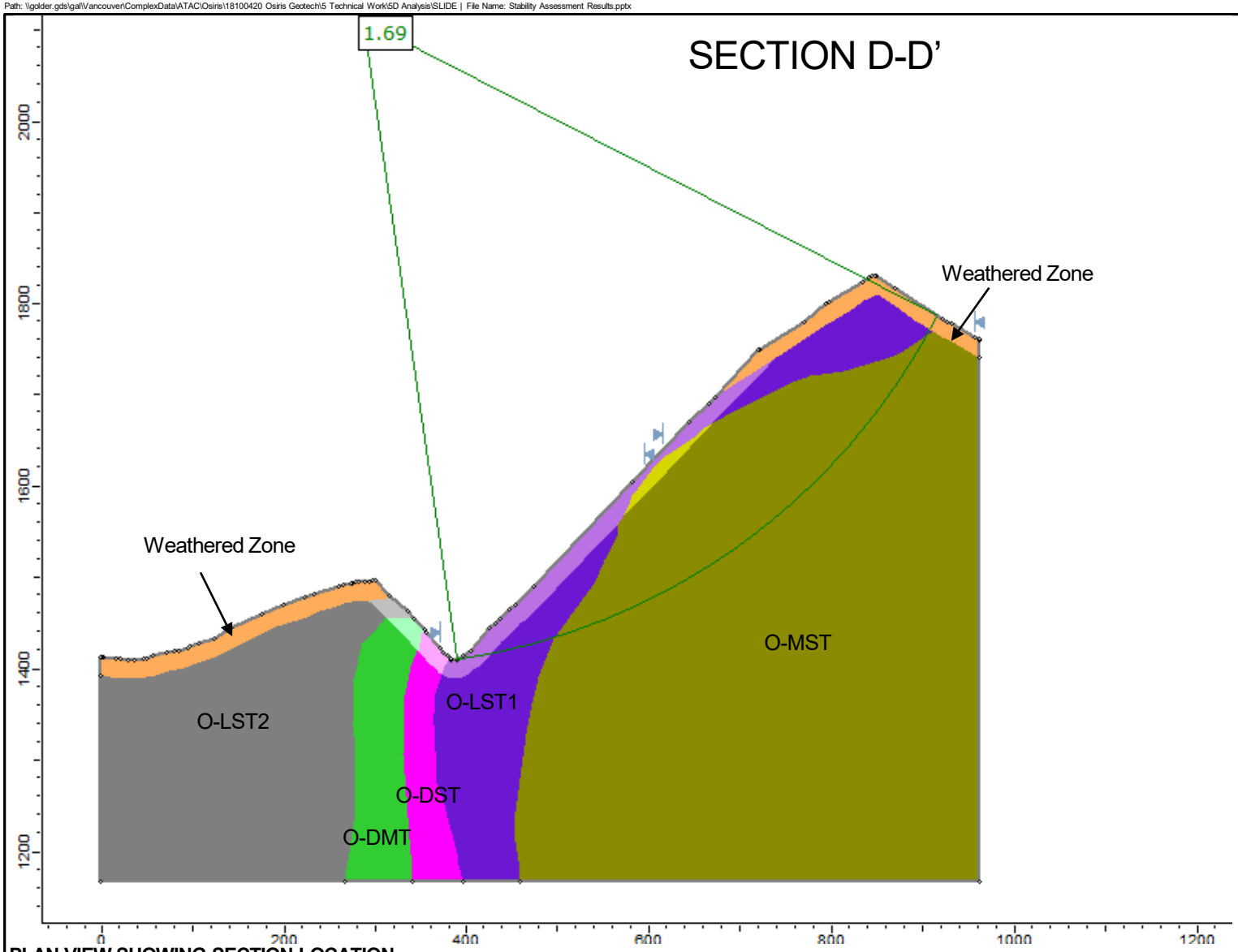
TITLE
SUNRISE PIT
OVERALL SLOPE STABILITY ASSESSMENT
FULLY SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-19**

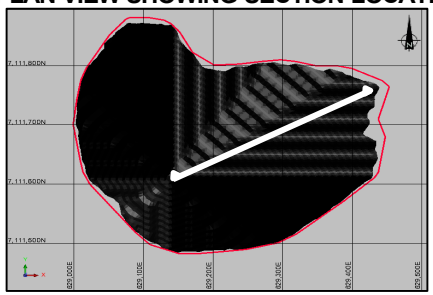
0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

SECTION D-D'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

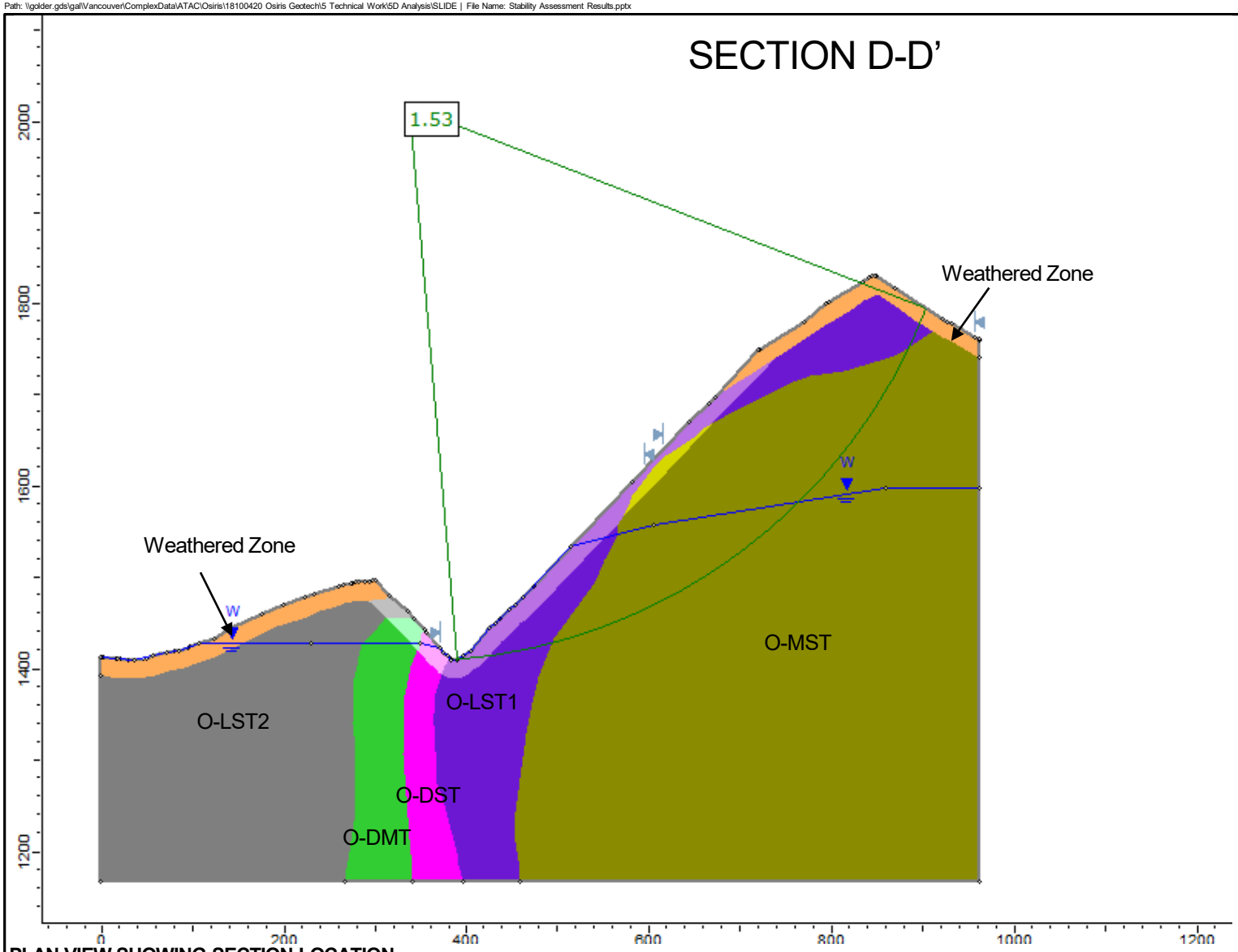
TITLE
IBIS PIT
OVERALL SLOPE STABILITY ASSESSMENT
DRY SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-20**

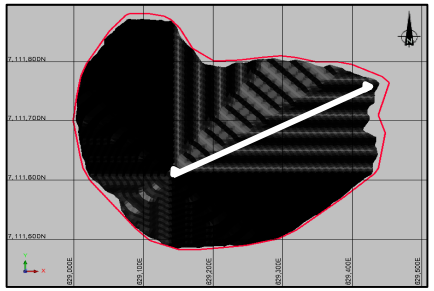
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION D-D'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

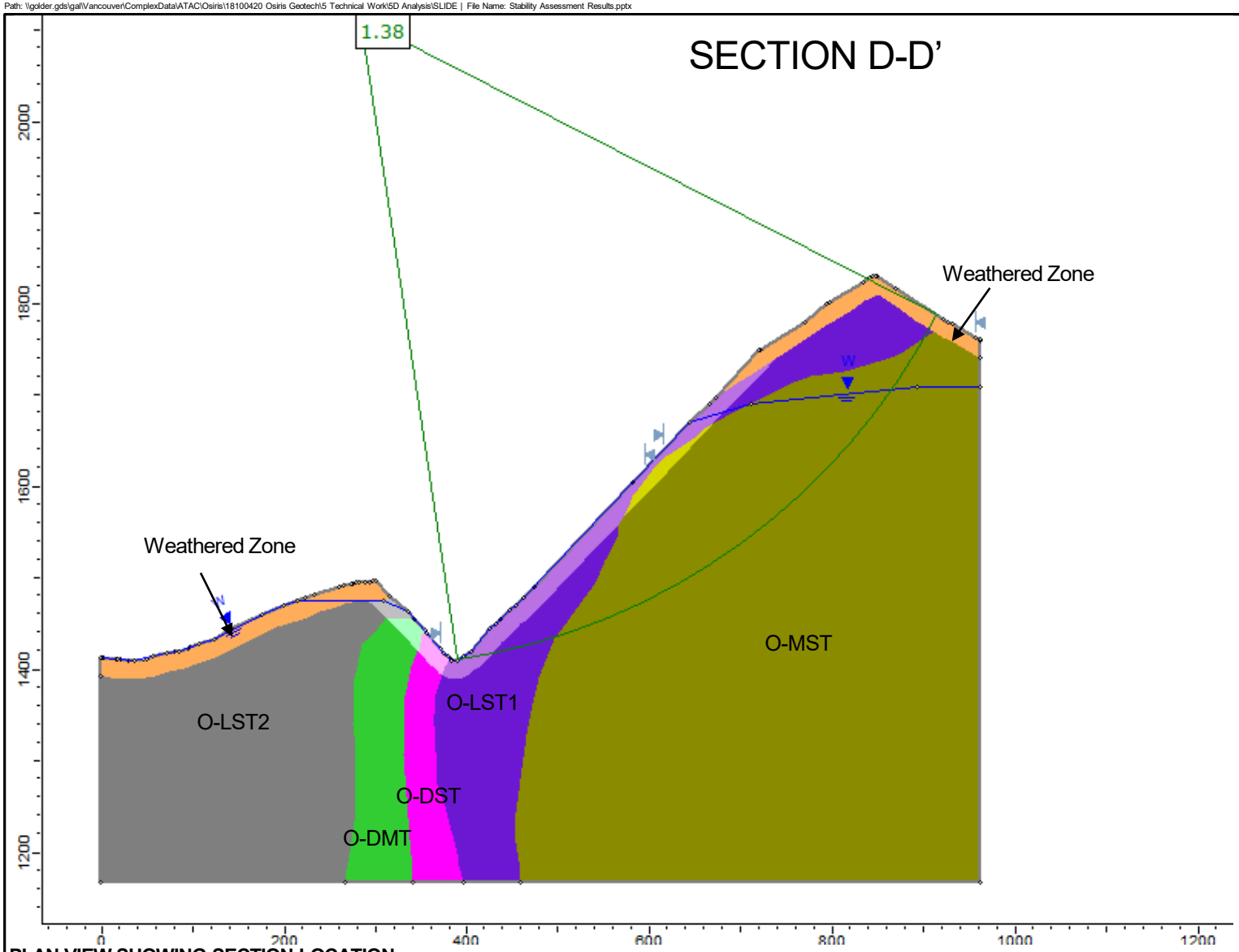
TITLE
IBIS PIT
OVERALL SLOPE STABILITY ASSESSMENT
1/3rd SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-21**

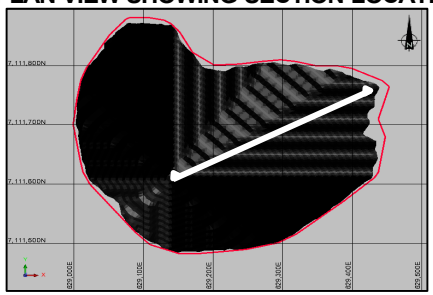
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION D-D'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

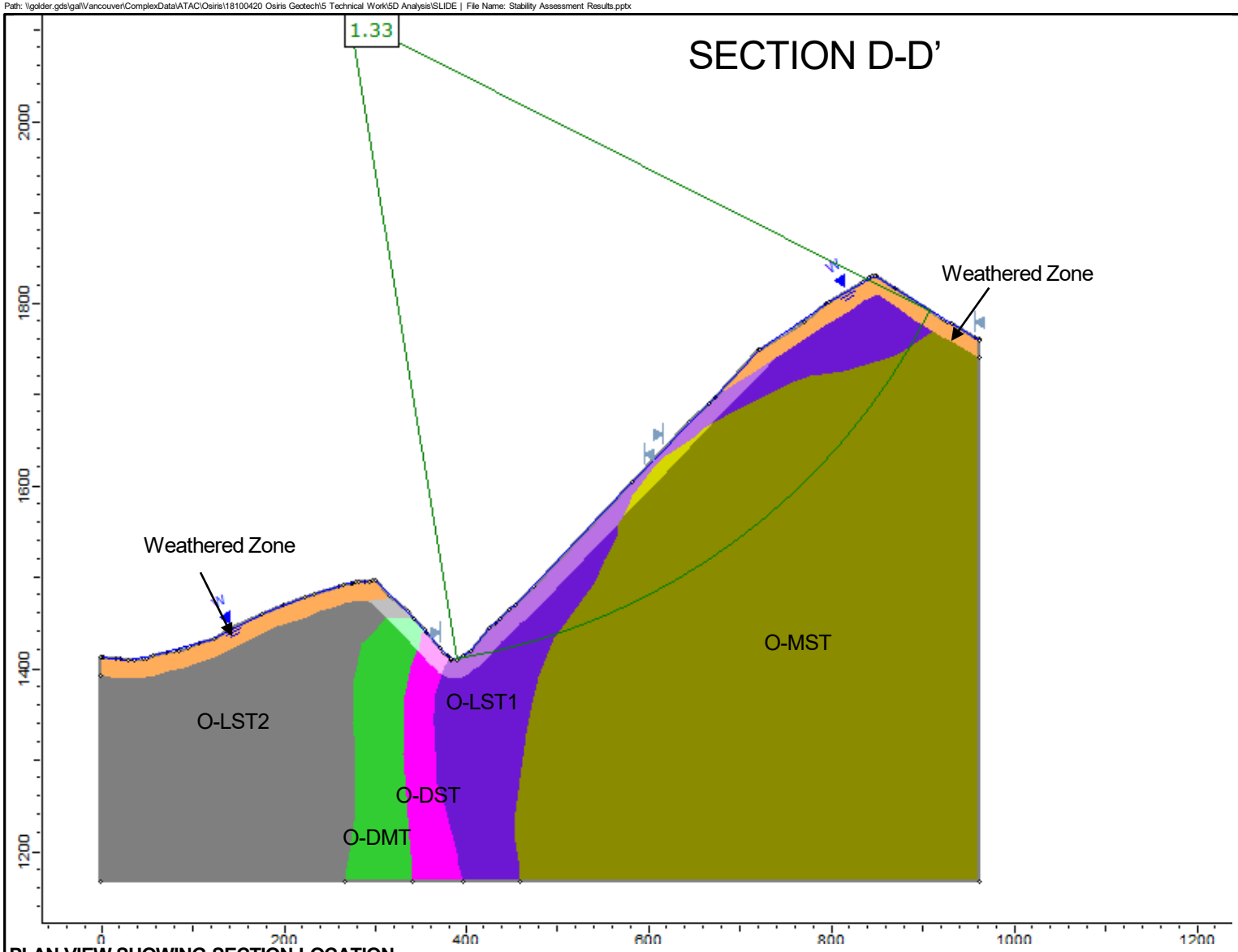
TITLE
IBIS PIT
OVERALL SLOPE STABILITY ASSESSMENT
2/3rd SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-22**

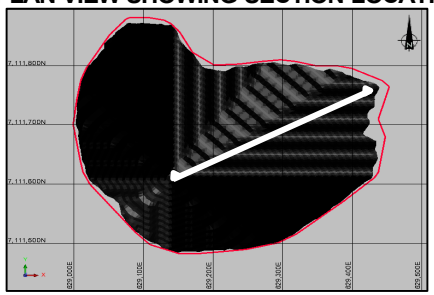
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION D-D'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

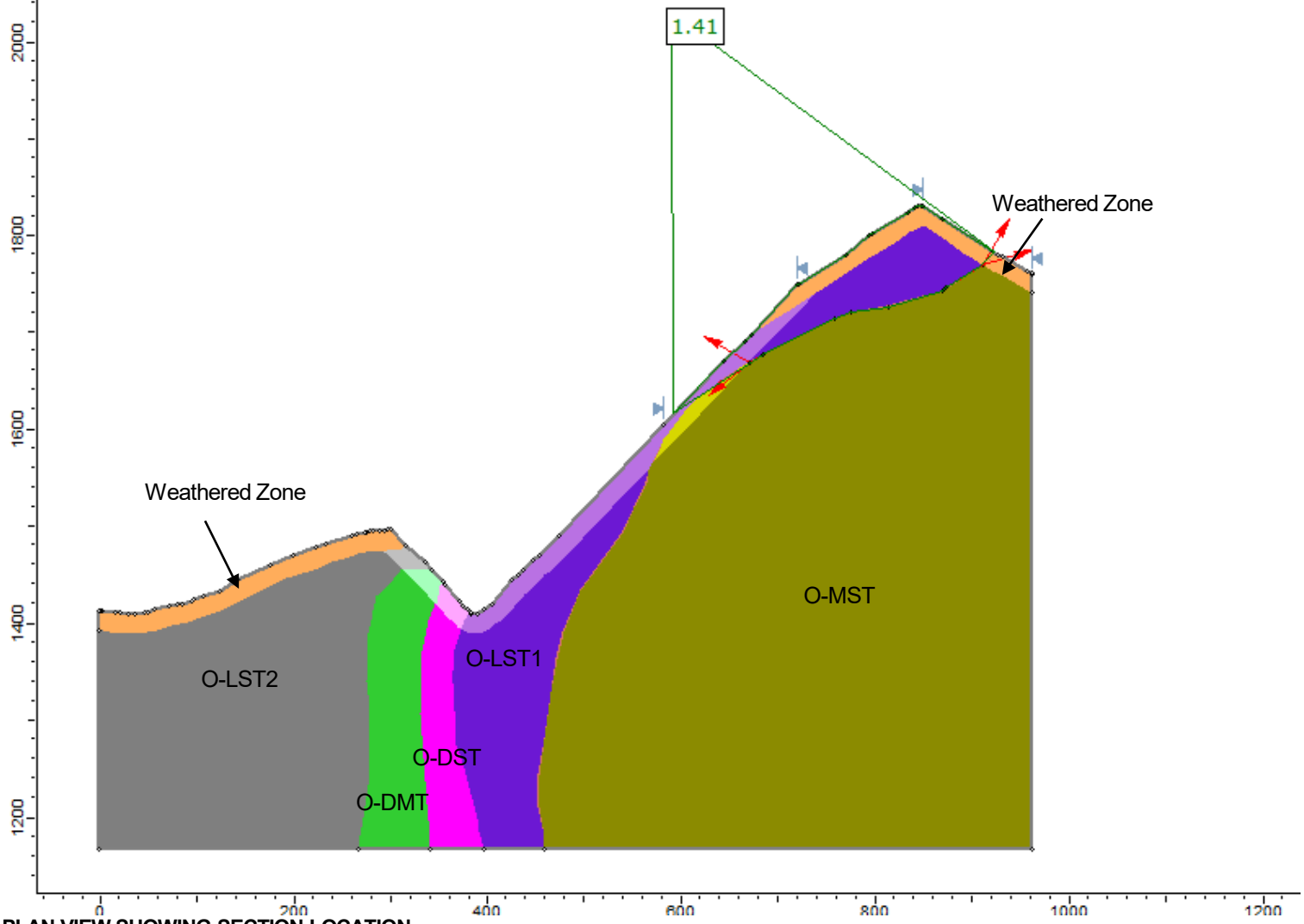
TITLE
IBIS PIT
OVERALL SLOPE STABILITY ASSESSMENT
FULLY SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-23**

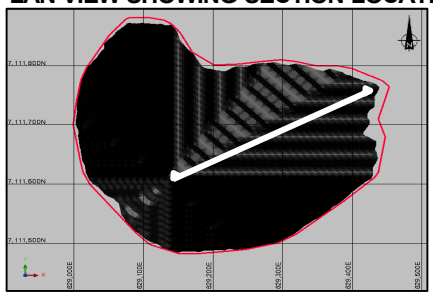
0 25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

SECTION D-D'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

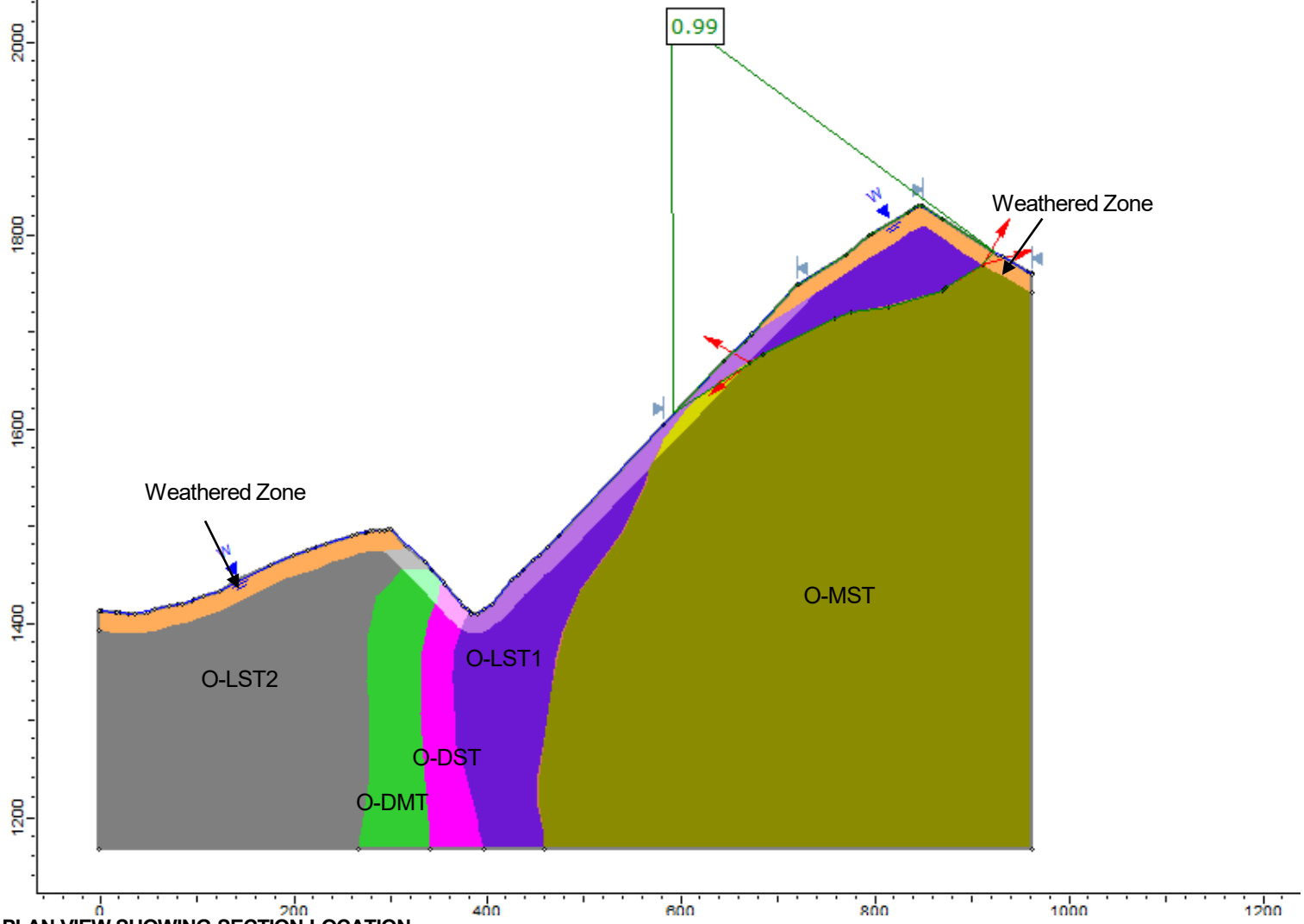
TITLE
IBIS PIT
FAILURE ALONG GEOLOGICAL CONTACT ASSESSMENT
DRY SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-24**

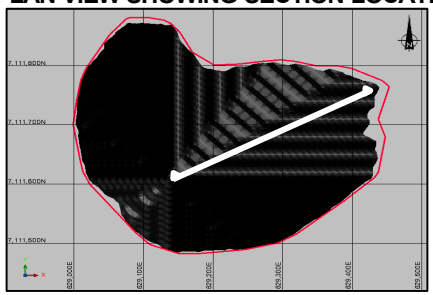
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

SECTION D-D'

GLE Factor of Safety



PLAN VIEW SHOWING SECTION LOCATION



CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

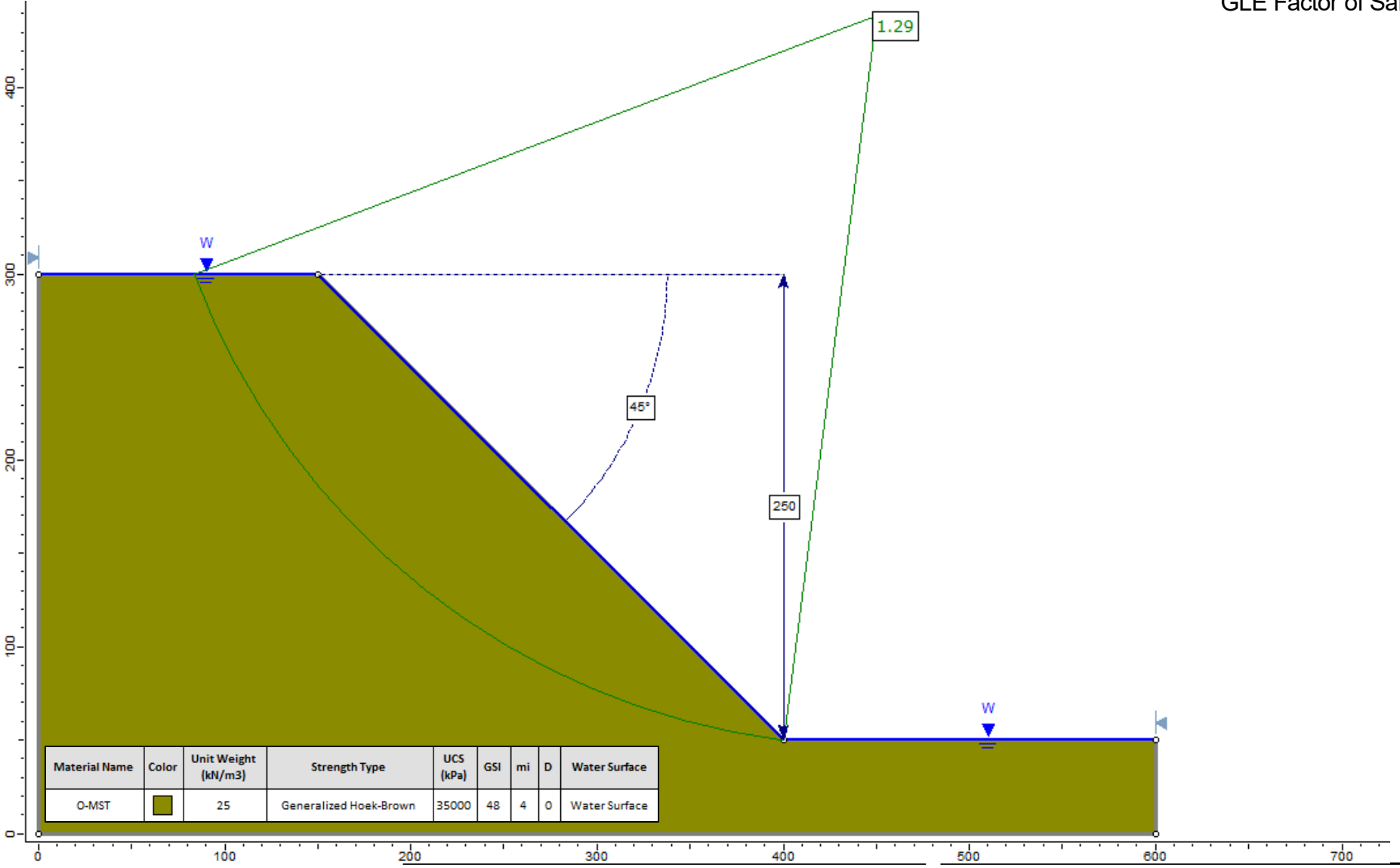
TITLE
IBIS PIT
FAILURE ALONG GEOLOGICAL CONTACT ASSESSMENT
FULLY SATURATED SLOPE

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-25**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

GENERAL SECTION

GLE Factor of Safety



Material Name	Color	Unit Weight (kN/m3)	Strength Type	UCS (kPa)	GSI	mi	D	Water Surface
O-MST		25	Generalized Hoek-Brown	35000	48	4	0	Water Surface

Results:
FOS = ~1.3 with a 250 metre high slope height at 45˚ excavated in the Osiris Mudstone

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

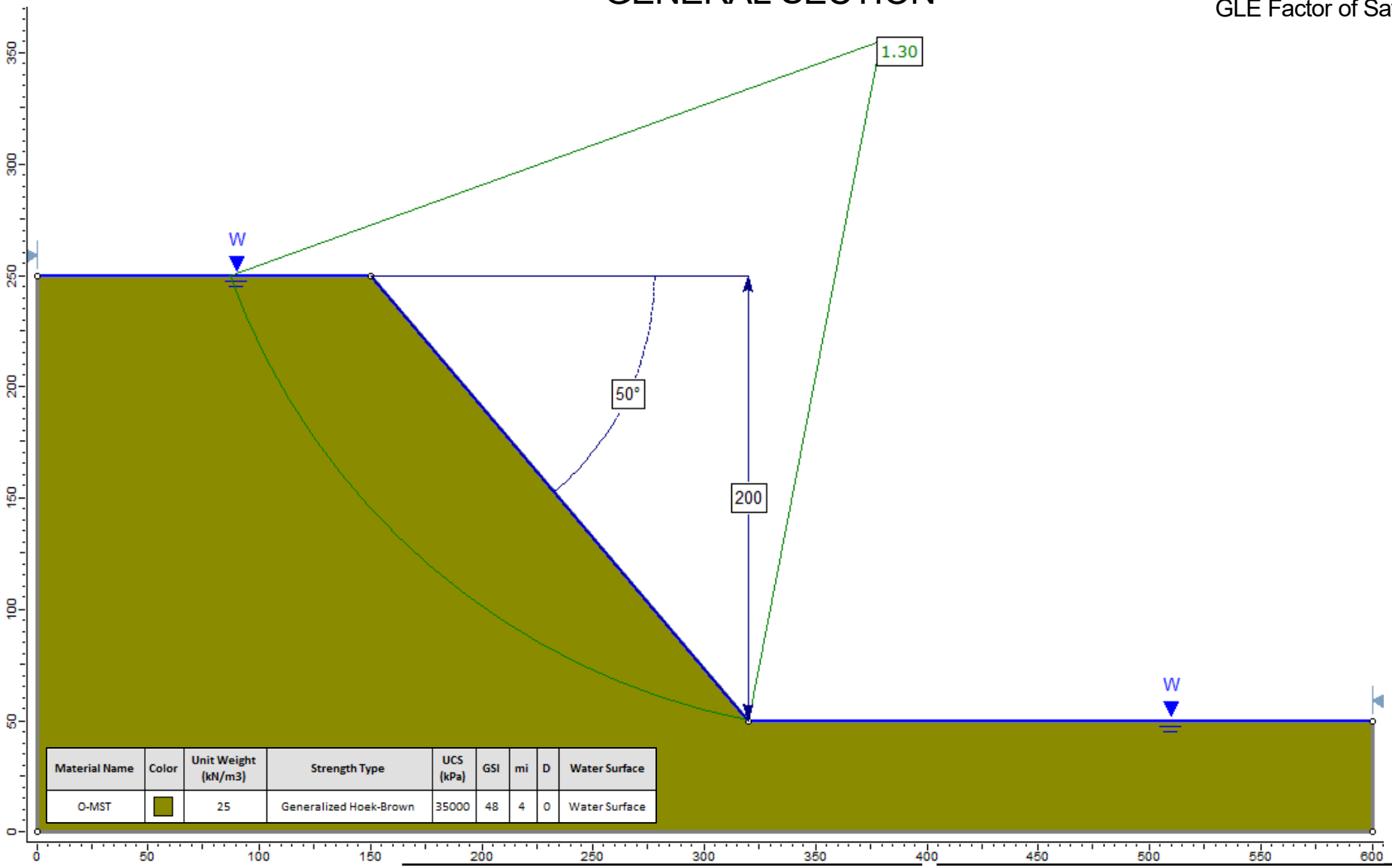
TITLE
GENERAL SLOPE IN OSIRIS MUDSTONE
OVERALL SLOPE STABILITY ASSESSMENT
FULLY SATURATED SLOPE AT 45˚

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-26**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm

GENERAL SECTION

GLE Factor of Safety



Material Name	Color	Unit Weight (kN/m3)	Strength Type	UCS (kPa)	GSI	mi	D	Water Surface
O-MST		25	Generalized Hoek-Brown	35000	48	4	0	Water Surface

Results:
FOS = ~1.3 with a 200 metre high slope height at 55˚ excavated in the Osiris Mudstone

CLIENT
ATAC RESOURCES LIMITED

PROJECT
OSIRIS PROJECT, RACKLA GOLD PROPERTY, YUKON, CANADA
SCOPING LEVEL PIT SLOPE EVALUATION

CONSULTANT
GOLDER

YYYY-MM-DD	2019-03-06
PREPARED	SHA
DESIGNED	SHA
REVIEWED	TGT
APPROVED	AVC

TITLE
GENERAL SLOPE IN OSIRIS MUDSTONE
OVERALL SLOPE STABILITY ASSESSMENT
FULLY SATURATED SLOPE AT 50˚

PROJECT NO.	PHASE	REV.	APPENDIX
18100420	**5000**	**0**	**J-27**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
0 25 mm



golder.com

APPENDIX VI

GEOCHEMICAL SAMPLING – CERTIFICATES OF ANALYSIS

ALS Canada Ltd.

2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 18-AUG-2019
Account: RCM

CERTIFICATE WH19200222

Project: Rau

P.O. No.: R19-R12

This report is for 4 Rock samples submitted to our lab in Whitehorse, YT, Canada on 13-AUG-2019.

The following have access to data associated with this certificate:

ANDREW CARNE	ADAM COULTER	JULIA LANE

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-21	Sample logging - ClientBarCode
CRU-31	Fine crushing - 70% <2mm
CRU-QC	Crushing QC Test
PUL-QC	Pulverizing QC Test
SPL-21	Split sample - riffle splitter
PUL-31	Pulverize split to 85% <75 um

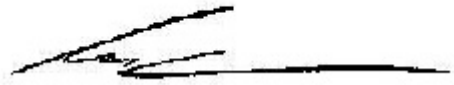
ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
Au-AA25	Ore Grade Au 30g FA AA finish	AAS
ME-MS61	48 element four acid ICP-MS	

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:



Colin Ramshaw, Vancouver Laboratory Manager

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Project: Rau

Finalized Date: 18-AUG-2019
Account: RCM

CERTIFICATE OF ANALYSIS WH19200222

Sample Description	Method	WEI-21	Au-AA25	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Recvd Wt.	Au	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu
	Units	kg	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
	LOD	0.02	0.01	0.01	0.01	0.2	10	0.05	0.01	0.01	0.02	0.01	0.1	1	0.05	0.2
Q013418		0.37	0.01	0.05	0.80	20.9	210	0.68	0.34	18.15	0.43	8.47	0.8	16	1.31	4.4
Q013419		1.55	0.02	0.07	7.34	165.0	220	8.69	6.08	0.07	<0.02	7.23	0.3	9	6.25	4.5
Q013420		1.23	0.01	0.07	6.69	8.0	550	4.56	1.12	0.56	0.06	28.4	0.5	10	4.86	3.3
W842200		1.17	0.04	0.30	6.27	103.5	360	6.80	26.7	0.14	<0.02	7.46	0.8	9	7.16	77.8

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 18-AUG-2019
Account: RCM

Project: Rau

CERTIFICATE OF ANALYSIS WH19200222

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Fe	Ga	Ge	Hf	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P
	Units	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm
	LOD	0.01	0.05	0.05	0.1	0.005	0.01	0.5	0.2	0.01	5	0.05	0.01	0.1	0.2	10
Q013418		0.49	2.58	0.09	0.4	0.044	0.22	4.4	5.3	10.15	560	2.00	0.03	1.9	7.8	80
Q013419		1.88	40.5	0.13	2.6	0.201	4.55	3.6	70.0	0.70	143	28.9	0.05	43.1	1.2	20
Q013420		0.47	28.4	0.11	3.1	0.061	4.26	13.2	6.8	0.09	194	0.73	0.80	120.0	1.4	10
W842200		1.90	32.5	0.09	3.0	0.220	4.33	3.5	124.0	0.90	260	15.60	0.42	92.6	1.8	20

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 18-AUG-2019
Account: RCM

Project: Rau

CERTIFICATE OF ANALYSIS WH19200222

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U
	Units	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
	LOD	0.5	0.1	0.002	0.01	0.05	0.1	1	0.2	0.2	0.05	0.05	0.01	0.005	0.02	0.1
Q013418		2.3	27.1	<0.002	0.02	0.67	1.5	1	5.4	82.1	0.11	<0.05	1.25	0.047	0.51	1.8
Q013419		2.9	560	<0.002	0.19	0.71	3.3	<1	383	5.5	21.7	<0.05	6.73	<0.005	1.81	2.2
Q013420		43.6	370	<0.002	0.03	0.32	1.6	1	38.1	37.8	22.6	<0.05	19.10	<0.005	3.33	9.5
W842200		13.8	600	<0.002	0.91	1.08	2.4	1	247	10.1	22.1	<0.05	9.03	0.005	2.27	6.7

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 18-AUG-2019
Account: RCM

Project: Rau

CERTIFICATE OF ANALYSIS WH19200222

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	V	W	Y	Zn	Zr
	Units	ppm	ppm	ppm	ppm	ppm
	LOD	1	0.1	0.1	2	0.5
Q013418		47	2.2	4.4	31	10.2
Q013419		1	10.1	6.5	6	19.2
Q013420		1	7.7	24.3	15	31.7
W842200		2	170.0	18.2	18	26.7

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Project: Rau

Finalized Date: 18-AUG-2019
Account: RCM

CERTIFICATE OF ANALYSIS WH19200222

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

Applies to Method: REE's may not be totally soluble in this method.
ME-MS61

LABORATORY ADDRESSES

Applies to Method: Processed at ALS Whitehorse located at 78 Mt. Sima Rd, Whitehorse, YT, Canada.

CRU-31	CRU-QC	LOG-21	PUL-31
PUL-QC	SPL-21	WEI-21	

Applies to Method: Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada.

Au-AA25	ME-MS61

ALS Canada Ltd.

2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 10-SEP-2019
Account: RCM

CERTIFICATE WH19197011

Project: Rau

P.O. No.: R19-R12

This report is for 28 Rock samples submitted to our lab in Whitehorse, YT, Canada on 9-AUG-2019.

The following have access to data associated with this certificate:

ANDREW CARNE	ADAM COULTER	JULIA LANE

SAMPLE PREPARATION

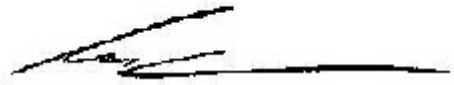
ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-21	Sample logging - ClientBarCode
CRU-31	Fine crushing - 70% <2mm
CRU-QC	Crushing QC Test
PUL-QC	Pulverizing QC Test
SPL-21	Split sample - riffle splitter
PUL-31	Pulverize split to 85% <75 um

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
Au-AA25	Ore Grade Au 30g FA AA finish	AAS
ME-MS61	48 element four acid ICP-MS	

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature: 

Colin Ramshaw, Vancouver Laboratory Manager

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 10-SEP-2019
Account: RCM

Project: Rau

CERTIFICATE OF ANALYSIS WH19197011

Sample Description	Method	WEI-21	Au-AA25	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Recvd Wt.	Au	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu
	Units	kg	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
	LOD	0.02	0.01	0.01	0.01	0.2	10	0.05	0.01	0.01	0.02	0.01	0.1	1	0.05	0.2
Q013421		0.15	<0.01	0.13	0.55	2.2	80	0.11	0.03	0.08	0.24	1.48	1.0	13	0.46	5.4
Q013422		0.11	1.63	10.05	1.51	169.5	310	0.34	11.10	0.02	0.16	15.95	1.7	16	0.65	5.9
Q013423		0.10	0.03	0.04	0.67	410	290	0.27	0.31	0.06	0.15	23.5	17.8	24	0.41	52.4
Q013424		1.54	<0.01	0.19	1.45	15.0	520	0.49	0.07	0.30	0.40	15.65	5.8	34	0.59	56.1
Q013425		0.47	0.08	0.01	0.48	151.0	90	0.20	3.78	0.08	0.10	5.23	3.6	26	0.41	27.6
Q013426		0.81	<0.01	0.03	0.09	199.5	30	0.06	0.74	0.51	0.13	1.55	3.1	23	0.30	16.3
Q013427		0.10	0.03	<0.01	1.49	55.7	350	0.67	4.54	0.09	0.07	17.20	11.0	36	0.95	8.4
Q013428		0.60	<0.01	<0.01	0.05	0.6	30	0.09	0.04	24.2	0.04	4.45	0.4	4	0.72	0.8
Q013429		0.66	0.31	0.35	4.53	1.8	180	3.25	248	4.24	0.05	24.3	29.2	170	10.60	543
Q013430		1.02	0.04	0.15	1.03	1.7	100	0.75	52.2	1.09	<0.02	119.0	0.7	63	1.90	58.4
Q013431		0.42	<0.01	0.49	3.32	2.5	20	2.20	7.09	6.56	0.04	169.5	143.0	178	0.80	1160
Q013432		1.02	0.32	27.0	0.14	815	<10	0.11	5860	0.03	8.19	3.29	171.0	10	0.74	2430
Q013433		0.66	0.05	0.15	0.34	1.5	20	19.15	48.9	12.65	0.09	2.79	5.5	9	0.65	220
Q013434		0.92	<0.01	0.04	0.35	0.5	20	12.05	8.88	13.25	0.17	1.69	2.1	8	0.17	15.6
Q013435		0.28	0.01	0.23	1.53	7.3	240	0.91	13.25	1.14	<0.02	22.5	7.3	90	2.87	498
Q013436		0.32	0.03	0.75	0.11	10.9	10	0.18	28.3	0.12	0.03	0.93	18.5	25	0.44	384
Q013437		0.55	<0.01	0.37	3.51	12.0	260	0.92	3.04	0.62	<0.02	40.7	2.5	88	7.41	42.5
Q013438		0.35	<0.01	1.16	3.17	3.0	20	1.34	17.25	3.63	0.06	22.3	132.5	43	0.58	3440
Q013439		0.10	0.94	0.06	0.56	613	120	0.24	3.62	0.04	0.07	6.53	20.1	26	0.42	42.7
Q013440		0.40	<0.01	0.59	0.76	2.8	30	107.0	0.99	14.25	0.12	17.10	11.6	8	0.27	1210
Q013441		0.35	<0.01	1.41	1.11	47.7	130	0.73	0.17	15.25	0.12	11.40	11.7	7	1.57	10.4
Q013442		0.53	<0.01	0.82	0.59	23.7	60	0.44	0.10	19.05	1.26	6.79	6.0	4	0.78	6.2
Q013443		0.41	<0.01	2.84	0.03	10.3	<10	0.07	0.09	20.8	19.50	0.47	1.0	1	<0.05	2.9
Q013444		0.61	<0.01	0.06	0.02	5.8	10	0.05	0.07	20.9	0.19	0.38	1.0	1	<0.05	2.2
Q013445		0.64	<0.01	0.20	0.04	5.9	10	<0.05	0.06	21.6	1.48	0.68	1.0	1	<0.05	1.9
Q013446		0.41	<0.01	0.04	0.02	3.6	10	0.06	0.04	21.4	0.12	0.65	0.8	1	<0.05	1.5
Q013447		0.81	<0.01	0.41	0.02	17.7	<10	0.05	0.03	20.8	0.08	0.57	1.5	1	<0.05	2.1
Q013448		0.70	<0.01	0.34	0.04	20.0	10	0.05	0.05	20.4	1.62	0.77	1.2	1	<0.05	4.7

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 10-SEP-2019
Account: RCM

Project: Rau

CERTIFICATE OF ANALYSIS WH19197011

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Fe	Ga	Ge	Hf	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P
	Units	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm
	LOD	0.01	0.05	0.05	0.1	0.005	0.01	0.5	0.2	0.01	5	0.05	0.01	0.1	0.2	10
Q013421		0.91	0.83	<0.05	<0.1	0.007	0.11	0.7	4.1	0.07	128	0.65	0.05	0.7	3.3	220
Q013422		2.29	4.29	<0.05	0.3	0.030	0.69	8.3	0.9	0.06	113	0.69	0.03	5.3	3.9	130
Q013423		4.52	1.92	<0.05	0.3	0.032	0.30	10.4	1.3	0.05	970	2.29	0.01	1.9	51.3	370
Q013424		1.86	3.28	<0.05	0.6	0.010	0.53	8.5	4.7	0.13	373	0.70	0.04	3.5	18.0	540
Q013425		1.36	1.19	<0.05	0.2	0.010	0.19	2.8	0.8	0.06	215	1.00	0.02	1.9	9.7	310
Q013426		1.11	0.30	<0.05	<0.1	0.015	0.01	0.7	0.5	0.24	336	0.51	0.01	0.2	5.7	120
Q013427		2.24	4.06	<0.05	0.9	0.020	0.72	8.2	3.0	0.10	423	1.65	0.01	6.0	27.8	610
Q013428		0.06	0.22	0.08	<0.1	0.007	0.03	9.6	1.6	10.30	85	0.10	0.01	0.1	3.7	160
Q013429		8.87	19.55	0.09	1.1	0.074	0.74	14.9	27.8	0.93	461	110.5	0.65	8.0	55.1	2970
Q013430		2.67	7.87	0.06	0.2	0.078	0.60	83.5	7.2	0.11	78	26.5	0.02	1.2	3.1	5880
Q013431		24.6	13.05	0.48	0.8	0.201	0.04	125.0	3.7	1.02	861	77.2	0.49	6.5	272	9380
Q013432		30.8	0.30	0.20	<0.1	1.155	0.01	2.1	1.0	0.05	1910	2.72	<0.01	0.1	351	20
Q013433		7.08	5.75	<0.05	0.2	0.732	0.08	2.2	8.4	9.81	3360	2.88	0.10	0.4	57.5	510
Q013434		4.83	5.52	<0.05	0.1	0.899	0.07	1.2	6.9	10.65	2800	14.80	0.11	0.5	23.9	380
Q013435		34.3	8.81	0.19	0.5	0.115	0.35	12.9	5.8	0.48	328	80.7	0.15	3.2	14.5	8600
Q013436		8.92	0.47	0.05	<0.1	0.362	0.04	0.5	2.3	0.08	1140	2.81	0.01	0.1	38.3	80
Q013437		21.8	8.99	0.11	0.9	0.047	1.36	20.4	14.5	0.53	98	3.68	0.16	1.6	15.7	2470
Q013438		35.4	11.10	0.26	0.8	0.079	0.03	10.3	2.4	0.73	184	29.2	0.31	5.1	202	1350
Q013439		4.49	1.70	<0.05	0.3	0.019	0.23	3.2	1.2	0.06	574	4.18	0.01	1.7	52.1	500
Q013440		14.60	13.35	0.06	0.4	3.74	0.11	6.4	5.6	4.41	7400	2.75	0.17	21.5	5.8	80
Q013441		3.99	2.96	<0.05	0.4	0.056	0.49	4.8	1.5	6.29	6910	0.33	0.01	1.2	10.1	270
Q013442		2.09	1.61	0.06	0.2	0.023	0.26	2.9	1.4	10.95	3610	0.28	0.01	0.8	5.7	270
Q013443		0.74	0.11	<0.05	<0.1	0.005	0.01	<0.5	0.7	13.10	876	0.09	0.01	<0.1	0.9	50
Q013444		0.94	0.06	<0.05	<0.1	0.008	0.01	<0.5	0.7	13.00	996	0.12	0.01	<0.1	1.1	60
Q013445		1.36	0.10	0.05	<0.1	0.012	0.01	<0.5	0.6	13.25	1480	0.13	0.01	<0.1	1.2	280
Q013446		1.03	0.06	0.07	<0.1	0.006	0.01	<0.5	0.8	13.35	877	0.09	0.01	<0.1	1.1	70
Q013447		2.11	0.06	<0.05	<0.1	<0.005	<0.01	<0.5	0.7	12.75	1150	0.17	0.01	<0.1	2.0	110
Q013448		1.56	0.11	0.08	<0.1	0.010	0.01	<0.5	0.8	12.55	1240	0.67	0.01	<0.1	4.1	200

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 10-SEP-2019
Account: RCM

Project: Rau

CERTIFICATE OF ANALYSIS WH19197011

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U
	Units	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
	LOD	0.5	0.1	0.002	0.01	0.05	0.1	1	0.2	0.2	0.05	0.05	0.01	0.005	0.02	0.1
Q013421		17.8	5.2	<0.002	<0.01	0.44	0.3	<1	0.2	10.8	<0.05	<0.05	0.13	0.006	0.04	0.1
Q013422		150.5	28.9	<0.002	0.03	4.15	1.7	1	2.8	7.6	0.29	<0.05	1.16	0.071	0.13	0.4
Q013423		6.2	12.6	0.002	0.01	0.39	1.9	2	1.1	5.9	0.10	<0.05	0.70	0.037	0.08	1.5
Q013424		10.5	20.1	<0.002	0.02	0.96	2.2	1	0.4	17.6	0.17	<0.05	1.46	0.072	0.15	0.9
Q013425		4.2	8.1	<0.002	0.01	0.27	1.1	1	2.7	5.7	0.08	<0.05	0.48	0.037	0.08	0.8
Q013426		5.3	0.7	<0.002	0.06	0.34	0.8	1	0.3	5.7	<0.05	<0.05	0.15	<0.005	0.03	0.3
Q013427		2.3	28.4	<0.002	0.01	0.60	3.5	1	4.6	9.6	0.33	<0.05	2.07	0.117	0.16	1.5
Q013428		0.7	4.9	<0.002	<0.01	0.18	0.4	<1	0.3	81.2	<0.05	<0.05	0.11	<0.005	0.08	1.0
Q013429		3.7	173.5	0.203	4.47	0.13	6.2	19	9.1	246	0.50	6.49	4.44	0.309	0.92	7.9
Q013430		1.9	84.8	0.025	0.24	0.11	2.5	8	6.4	10.8	0.05	1.69	6.00	0.045	0.51	4.6
Q013431		3.6	3.4	0.204	>10.0	0.07	7.4	115	8.1	201	0.40	0.32	5.66	0.214	0.21	20.4
Q013432		1090	2.6	0.003	>10.0	43.1	0.2	68	11.6	0.5	<0.05	87.7	0.04	<0.005	0.23	0.3
Q013433		2.4	7.5	0.009	0.10	0.22	0.9	3	4.5	4.6	<0.05	1.91	0.82	0.016	0.13	7.3
Q013434		2.7	2.3	0.042	0.02	0.22	0.8	1	5.1	5.4	<0.05	0.18	0.38	0.012	0.04	2.5
Q013435		4.5	34.9	0.024	1.62	0.36	4.0	61	3.5	30.7	0.22	0.61	4.47	0.127	0.28	7.6
Q013436		14.2	5.0	0.003	5.10	2.79	0.3	15	1.7	0.9	<0.05	1.05	0.08	<0.005	0.18	0.3
Q013437		3.2	128.5	0.017	2.61	0.21	7.0	5	5.9	54.3	0.10	0.26	5.18	0.084	1.17	2.1
Q013438		6.0	2.2	0.043	>10.0	0.13	6.3	83	6.4	165.0	0.34	1.50	4.17	0.239	0.61	7.7
Q013439		4.6	9.6	<0.002	0.16	0.68	1.5	2	3.2	5.1	0.09	0.05	0.81	0.035	0.08	1.4
Q013440		12.7	2.4	0.006	1.59	0.13	1.7	2	30.8	8.7	0.86	<0.05	1.12	0.051	0.22	1.0
Q013441		16.3	25.4	<0.002	0.03	9.26	4.2	<1	0.5	101.0	0.08	<0.05	1.39	0.050	0.26	0.9
Q013442		62.8	12.1	<0.002	0.03	7.32	2.3	<1	0.3	61.6	0.05	<0.05	0.71	0.028	0.16	0.7
Q013443		1060	0.4	<0.002	0.28	6.00	0.1	<1	<0.2	28.6	<0.05	<0.05	0.03	<0.005	<0.02	0.2
Q013444		15.1	0.2	<0.002	0.28	0.56	0.1	<1	<0.2	25.7	<0.05	<0.05	0.02	<0.005	<0.02	0.2
Q013445		52.2	0.4	<0.002	0.32	1.00	0.1	<1	<0.2	30.1	<0.05	<0.05	0.03	<0.005	<0.02	0.2
Q013446		17.8	0.2	<0.002	0.12	2.08	0.1	<1	<0.2	26.0	<0.05	<0.05	0.01	<0.005	<0.02	0.2
Q013447		150.5	0.1	<0.002	1.02	2.31	0.2	1	<0.2	30.5	<0.05	<0.05	0.02	<0.005	<0.02	0.2
Q013448		129.0	0.3	<0.002	0.85	5.28	0.1	1	<0.2	30.7	<0.05	<0.05	0.03	<0.005	0.02	0.3

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 10-SEP-2019
Account: RCM

Project: Rau

CERTIFICATE OF ANALYSIS WH19197011

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	V	W	Y	Zn	Zr
	Units	ppm	ppm	ppm	ppm	ppm
	LOD	1	0.1	0.1	2	0.5
Q013421		2	<0.1	0.9	53	1.2
Q013422		18	1.0	2.0	366	14.0
Q013423		18	0.3	6.8	22	11.3
Q013424		42	0.4	4.7	53	23.3
Q013425		12	0.6	2.6	13	10.7
Q013426		2	<0.1	4.5	12	1.3
Q013427		48	1.1	7.6	12	42.1
Q013428		12	<0.1	9.3	7	0.8
Q013429		651	8.3	31.1	36	39.8
Q013430		178	1450	14.2	4	7.7
Q013431		1720	386	48.1	41	31.6
Q013432		2	6.1	3.6	1800	<0.5
Q013433		95	210	12.5	187	6.8
Q013434		40	57.8	13.8	175	4.6
Q013435		770	1410	9.8	24	18.8
Q013436		7	8.4	1.8	11	<0.5
Q013437		130	13.0	11.6	14	37.2
Q013438		136	4.8	24.4	22	29.6
Q013439		19	1.1	4.0	20	13.6
Q013440		11	950	21.7	311	12.1
Q013441		20	6.2	12.3	389	12.9
Q013442		11	3.6	6.9	396	8.4
Q013443		2	0.3	0.8	3350	<0.5
Q013444		2	0.3	1.0	121	<0.5
Q013445		1	0.3	2.1	261	<0.5
Q013446		2	0.2	1.3	51	<0.5
Q013447		2	0.1	1.6	46	<0.5
Q013448		2	0.1	1.4	307	<0.5

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Project: Rau

Finalized Date: 10-SEP-2019
Account: RCM

CERTIFICATE OF ANALYSIS WH19197011

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

Applies to Method: REE's may not be totally soluble in this method.
ME-MS61

LABORATORY ADDRESSES

Applies to Method: Processed at ALS Whitehorse located at 78 Mt. Sima Rd, Whitehorse, YT, Canada.

CRU-31	CRU-QC	LOG-21	PUL-31
PUL-QC	SPL-21	WEI-21	

Applies to Method: Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada.

Au-AA25	ME-MS61

ALS Canada Ltd.

2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 2-NOV-2019
Account: RCM

CERTIFICATE WH19235954

Project: RM

P.O. No.: R19-R19

This report is for 35 Rock samples submitted to our lab in Whitehorse, YT, Canada on 20-SEP-2019.

The following have access to data associated with this certificate:

ANDREW CARNE	ADAM COULTER	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-21	Sample logging - ClientBarCode
CRU-31	Fine crushing - 70% <2mm
CRU-QC	Crushing QC Test
PUL-QC	Pulverizing QC Test
SPL-21	Split sample - riffle splitter
PUL-31	Pulverize up to 250g 85% <75 um

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
Au-AA25	Ore Grade Au 30g FA AA finish	AAS
ME-MS61	48 element four acid ICP-MS	
Ag-OG62	Ore Grade Ag - Four Acid	
ME-OG62	Ore Grade Elements - Four Acid	ICP-AES
Pb-OG62	Ore Grade Pb - Four Acid	
Ag-GRA21	Ag 30g FA-GRAV finish	WST-SIM
Ag-CON01	Ag Concentrate	
Pb-VOL70	Pb by Titration	
Cu-OG62	Ore Grade Cu - Four Acid	
Zn-OG62	Ore Grade Zn - Four Acid	
Zn-VOL50	Zn by titration	

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:

Saa Traxler, General Manager, North Vancouver

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 2-NOV-2019
Account: RCM

Project: RM

CERTIFICATE OF ANALYSIS WH19235954

Sample Description	Method	WEI-21	Au-AA25	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Recvd Wt.	Au	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu
	Units	kg	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
	LOD	0.02	0.01	0.01	0.01	0.2	10	0.05	0.01	0.01	0.02	0.01	0.1	1	0.05	0.2
W845301		0.45	0.05	>100	0.18	258	10	0.08	1.53	0.30	>1000	1.40	3.1	1	0.28	>10000
W845302		1.35	0.02	>100	0.03	439	<10	<0.05	0.16	0.05	613	0.26	0.1	1	<0.05	>10000
W845303		0.91	0.01	>100	0.03	258	<10	<0.05	0.04	0.04	683	0.24	0.1	<1	0.05	9030
W845304		0.43	0.03	>100	0.05	477	10	0.05	0.78	1.13	>1000	0.81	0.5	<1	<0.05	1040
W845305		0.33	0.02	>100	0.06	428	<10	0.09	6.02	0.20	>1000	0.86	0.9	1	0.06	1070
W845306		0.53	0.03	>100	0.10	707	10	0.05	0.12	0.22	>1000	0.88	1.0	<1	0.12	1130
W845307		0.28	<0.01	23.3	0.19	736	30	0.06	0.06	7.15	>1000	3.05	1.4	<1	0.11	110.5
W845308		0.90	0.02	>100	0.03	56.7	<10	<0.05	0.03	0.44	62.6	0.08	<0.1	<1	0.07	1840
W845309		0.93	0.02	>100	0.24	317	10	0.06	0.04	0.12	173.0	0.45	0.1	<1	0.17	7920
W845310		0.45	0.17	>100	0.21	13.1	10	0.08	0.26	0.18	978	1.59	2.2	1	0.28	1260
W845311		0.80	0.07	>100	0.01	829	10	<0.05	0.14	0.01	57.0	0.12	0.1	<1	<0.05	>10000
W845312		0.52	0.08	>100	0.05	1155	10	<0.05	0.34	0.07	152.5	0.42	0.2	1	0.07	>10000
W845313		0.28	0.03	>100	0.02	701	10	<0.05	0.06	0.02	25.6	0.23	<0.1	2	<0.05	>10000
W845314		0.34	0.01	>100	0.01	891	10	<0.05	0.02	0.38	473	0.09	<0.1	<1	<0.05	>10000
W845315		0.20	0.07	>100	0.06	>10000	30	<0.05	0.04	0.04	513	0.73	0.3	<1	0.07	1270
W845316		0.27	<0.01	70.7	0.34	56.2	150	1.31	7.51	0.05	239	4.82	41.1	7	0.35	941
W845317		0.23	<0.01	14.15	0.32	10.6	40	0.25	0.30	7.36	698	1.65	63.2	8	0.22	295
W845318		0.21	0.02	13.35	0.63	15.7	20	0.31	0.05	10.40	>1000	0.96	36.9	39	0.65	118.0
W845319		0.25	3.20	93.0	5.32	21.4	230	<0.05	0.42	7.26	115.0	0.86	107.5	32	2.03	>10000
W845320		0.38	<0.01	8.13	0.47	5.3	20	0.15	0.03	0.44	3.70	1.58	1.2	18	0.47	66.5
W845321		0.77	<0.01	5.35	3.41	9.2	440	<0.05	0.03	2.88	2.02	1.25	12.8	22	1.23	97.7
W845322		0.29	<0.01	3.68	0.20	3.2	10	0.11	0.01	10.10	15.25	0.85	7.0	13	0.18	49.7
W845323		0.18	0.03	>100	0.14	2580	30	0.14	0.02	0.82	254	1.45	0.3	<1	0.46	168.5
W845324		0.29	0.02	>100	0.15	3750	20	0.13	0.01	1.16	237	1.66	0.2	<1	0.22	157.0
W845325		0.35	0.08	>100	0.32	>10000	20	0.20	0.02	0.55	357	4.22	0.7	2	0.42	124.0
W845326		0.17	0.01	>100	0.30	5240	10	0.11	0.04	0.63	49.9	0.67	0.4	4	0.22	126.0
W845327		0.28	0.02	49.3	0.72	876	30	0.23	0.02	10.35	266	1.32	0.7	1	0.40	210
W845328		0.18	0.01	>100	0.10	1860	10	0.13	0.02	0.39	297	0.96	0.6	1	0.13	415
W845260		0.72	0.66	>100	0.16	3170	10	0.08	0.03	0.10	316	1.26	0.5	4	0.20	349
W845261		0.42	0.01	>100	0.11	1915	10	0.08	0.01	0.40	215	0.51	0.2	3	0.16	123.5
W845262		0.42	0.02	88.0	0.14	1025	140	0.11	0.01	0.23	602	0.77	0.7	<1	0.12	318
W845263		0.39	<0.01	24.2	0.18	452	80	0.06	<0.01	17.55	211	3.65	1.2	1	0.07	81.4
W845264		0.48	0.03	30.2	0.16	120.5	10	0.08	0.01	2.28	>1000	1.10	0.9	<1	0.17	160.0
W845265		0.58	0.53	>100	0.17	>10000	10	0.07	0.03	0.09	341	1.64	0.6	5	0.14	141.5
W845266		0.41	0.04	>100	0.06	>10000	10	<0.05	0.03	0.03	>1000	0.36	0.1	2	0.05	366

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 2-NOV-2019
Account: RCM

Project: RM

CERTIFICATE OF ANALYSIS WH19235954

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Fe	Ga	Ge	Hf	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P
	Units	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm
	LOD	0.01	0.05	0.05	0.1	0.005	0.01	0.5	0.2	0.01	5	0.05	0.01	0.1	0.2	10
W845301		1.29	14.90	0.05	0.1	0.098	0.05	0.8	0.9	0.21	1690	0.34	0.01	0.2	5.1	490
W845302		0.81	1.53	0.05	<0.1	0.015	0.01	1.0	0.2	0.03	616	0.15	<0.01	<0.1	0.3	20
W845303		0.36	1.72	0.06	<0.1	<0.005	0.01	0.6	0.3	0.01	224	0.13	<0.01	<0.1	0.2	10
W845304		5.58	7.45	<0.05	<0.1	0.197	0.01	<0.5	0.6	0.61	9340	0.24	<0.01	<0.1	2.8	40
W845305		4.63	3.43	<0.05	<0.1	0.035	0.01	<0.5	0.5	0.20	5920	0.35	0.01	0.1	3.8	60
W845306		4.88	6.05	<0.05	<0.1	<0.005	0.03	<0.5	0.9	0.26	6290	0.29	<0.01	0.1	3.9	30
W845307		7.18	3.24	<0.05	0.1	0.030	0.04	1.3	1.0	2.83	15650	0.28	0.01	0.3	3.1	220
W845308		0.13	0.28	<0.05	<0.1	<0.005	0.01	<0.5	0.2	0.20	142	0.05	<0.01	<0.1	<0.2	<10
W845309		0.30	0.86	<0.05	<0.1	0.014	0.09	0.5	0.4	0.07	357	0.07	<0.01	<0.1	0.3	10
W845310		0.18	3.39	<0.05	0.1	0.081	0.08	0.9	0.9	0.10	246	0.14	<0.01	0.2	7.9	20
W845311		0.05	0.08	<0.05	<0.1	<0.005	<0.01	0.6	0.2	0.01	9	0.07	<0.01	<0.1	<0.2	<10
W845312		0.09	0.25	<0.05	<0.1	0.005	0.02	0.9	0.2	0.03	34	0.23	<0.01	<0.1	0.2	10
W845313		0.04	0.06	<0.05	<0.1	<0.005	0.01	1.2	<0.2	0.01	20	0.09	<0.01	<0.1	0.2	10
W845314		0.43	1.50	<0.05	<0.1	0.006	<0.01	0.9	<0.2	0.13	543	0.06	<0.01	<0.1	<0.2	10
W845315		29.8	2.12	0.10	<0.1	0.023	0.03	0.7	1.4	0.01	332	0.74	<0.01	0.1	0.5	110
W845316		42.6	2.36	0.36	0.1	1.270	0.11	1.9	1.2	0.11	44800	1.74	0.01	0.1	120.5	30
W845317		17.15	1.63	0.06	<0.1	0.974	0.13	0.8	0.5	2.56	33300	0.28	<0.01	0.1	150.5	20
W845318		8.93	3.16	<0.05	0.1	0.125	0.27	<0.5	0.6	4.54	13800	0.31	<0.01	0.2	100.0	30
W845319		11.40	11.50	0.09	<0.1	0.569	2.72	<0.5	73.6	2.26	1230	0.15	0.82	0.1	184.0	100
W845320		0.76	1.75	<0.05	0.2	0.016	0.21	0.7	2.9	0.18	284	0.28	0.01	0.6	6.6	80
W845321		2.56	12.90	0.05	0.1	0.056	1.46	0.6	4.5	0.06	174	0.22	0.20	<0.1	402	20
W845322		3.83	1.08	<0.05	<0.1	0.025	0.08	0.6	1.1	4.22	3520	0.14	0.01	<0.1	29.1	<10
W845323		8.91	8.22	<0.05	<0.1	0.059	0.06	0.9	2.8	0.26	>100000	0.27	<0.01	<0.1	2.3	40
W845324		9.67	6.44	<0.05	<0.1	0.036	0.06	0.8	2.8	0.23	>100000	0.26	<0.01	<0.1	0.8	30
W845325		12.20	7.62	0.06	0.1	0.028	0.12	2.4	3.0	0.12	70800	0.38	<0.01	0.4	2.3	80
W845326		1.67	1.16	<0.05	<0.1	0.008	0.03	<0.5	4.6	0.19	5140	0.29	0.01	0.1	1.4	40
W845327		6.58	2.61	<0.05	<0.1	0.039	0.26	0.6	2.6	3.57	25900	0.16	<0.01	0.3	2.5	10
W845328		7.81	3.71	0.07	<0.1	0.024	0.02	0.8	2.1	0.14	50600	0.24	<0.01	0.2	1.8	30
W845260		1.64	1.25	<0.05	<0.1	0.011	0.04	0.7	3.1	0.04	3620	0.22	<0.01	0.3	1.2	20
W845261		8.80	4.15	0.08	<0.1	0.021	0.03	<0.5	2.3	0.11	53300	0.12	<0.01	0.1	0.5	30
W845262		23.6	4.78	0.07	<0.1	0.023	0.03	0.5	1.8	0.42	67500	0.36	<0.01	0.1	2.5	60
W845263		2.42	2.42	<0.05	0.1	0.027	0.04	2.0	0.8	10.00	4440	0.18	<0.01	0.3	3.2	240
W845264		2.75	4.58	<0.05	<0.1	0.050	0.03	0.6	1.0	1.36	3890	0.26	<0.01	0.1	2.4	70
W845265		3.09	2.09	<0.05	<0.1	0.031	0.05	0.9	3.1	0.04	397	0.16	<0.01	0.1	1.4	30
W845266		1.60	7.77	0.06	<0.1	0.022	0.01	1.4	2.3	0.01	335	0.26	<0.01	0.2	0.5	10

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Finalized Date: 2-NOV-2019
Account: RCM

Project: RM

CERTIFICATE OF ANALYSIS WH19235954

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U
	Units	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
	LOD	0.5	0.1	0.002	0.01	0.05	0.1	1	0.2	0.2	0.05	0.05	0.01	0.005	0.02	0.1
W845301		>10000	2.3	<0.002	0.67	5650	0.2	2	152.5	4.3	<0.05	<0.05	0.22	0.006	0.42	6.6
W845302		>10000	0.4	<0.002	9.69	>10000	0.1	2	15.1	4.3	<0.05	<0.05	0.04	<0.005	0.58	2.9
W845303		>10000	0.5	<0.002	>10.0	>10000	0.1	1	17.8	4.1	<0.05	<0.05	0.04	<0.005	0.70	3.8
W845304		>10000	0.5	<0.002	1.08	1310	0.2	3	141.5	2.2	<0.05	<0.05	0.04	<0.005	0.02	0.7
W845305		>10000	0.8	<0.002	2.15	1500	0.2	2	35.3	8.7	<0.05	<0.05	0.07	<0.005	0.12	1.4
W845306		>10000	1.6	<0.002	0.13	697	0.3	2	92.4	1.3	<0.05	<0.05	0.12	<0.005	0.09	0.6
W845307		3470	1.9	<0.002	1.76	81.9	0.7	3	26.7	10.9	<0.05	<0.05	0.27	0.008	0.02	0.5
W845308		>10000	0.6	<0.002	>10.0	3410	0.1	<1	5.5	1.7	<0.05	<0.05	0.01	<0.005	0.67	0.1
W845309		>10000	3.5	<0.002	>10.0	8110	0.1	1	12.5	3.8	<0.05	<0.05	0.04	<0.005	0.61	0.3
W845310		>10000	3.3	<0.002	7.59	1885	0.4	3	66.5	9.8	<0.05	<0.05	0.26	0.010	0.31	4.8
W845311		>10000	0.2	<0.002	>10.0	>10000	<0.1	<1	0.7	1.5	<0.05	<0.05	0.02	<0.005	0.61	0.8
W845312		>10000	0.7	<0.002	>10.0	>10000	0.1	<1	4.8	3.8	<0.05	<0.05	0.06	<0.005	0.43	2.5
W845313		>10000	0.2	<0.002	>10.0	>10000	<0.1	<1	0.3	2.9	<0.05	<0.05	0.03	<0.005	0.63	0.6
W845314		>10000	0.1	<0.002	>10.0	>10000	<0.1	2	12.1	2.5	<0.05	<0.05	0.01	<0.005	0.86	0.2
W845315		>10000	0.8	<0.002	2.48	>10000	0.3	3	33.3	1.8	<0.05	<0.05	0.10	<0.005	0.27	0.5
W845316		3140	6.2	<0.002	0.10	361	27.6	5	11.4	28.4	<0.05	<0.05	0.15	0.010	0.14	3.1
W845317		808	8.3	<0.002	2.57	55.2	8.9	3	40.7	9.6	<0.05	<0.05	0.03	0.009	0.12	0.5
W845318		1655	15.4	<0.002	7.74	63.6	4.5	<1	5.6	27.6	<0.05	<0.05	0.05	0.035	0.13	0.4
W845319		1270	74.3	<0.002	8.17	19.20	2.3	9	0.5	40.1	<0.05	0.27	0.02	0.030	0.84	<0.1
W845320		984	10.6	<0.002	0.04	31.7	1.1	<1	0.7	1.5	<0.05	<0.05	0.56	0.012	0.09	0.4
W845321		662	44.3	<0.002	0.05	15.65	3.1	1	0.6	139.0	<0.05	<0.05	0.02	0.008	0.48	0.2
W845322		1730	4.2	<0.002	0.11	15.30	1.2	<1	<0.2	14.6	<0.05	<0.05	0.01	<0.005	0.06	<0.1
W845323		>10000	2.1	<0.002	0.04	7800	1.8	<1	14.5	25.9	<0.05	<0.05	0.06	<0.005	0.08	3.5
W845324		>10000	1.9	<0.002	0.05	7110	1.3	<1	10.6	9.3	<0.05	<0.05	0.06	<0.005	0.08	3.8
W845325		>10000	4.5	0.002	0.21	3910	1.1	1	9.3	25.6	<0.05	<0.05	0.23	0.006	0.19	1.5
W845326		>10000	1.4	<0.002	0.52	887	0.8	1	2.0	4.0	<0.05	<0.05	0.08	<0.005	0.05	2.5
W845327		>10000	9.9	<0.002	1.08	1385	2.5	1	2.1	18.1	<0.05	<0.05	0.03	<0.005	0.10	0.4
W845328		>10000	1.1	0.009	0.19	9270	1.2	2	11.2	8.5	<0.05	<0.05	0.07	<0.005	0.16	1.3
W845260		>10000	1.7	<0.002	0.34	1110	0.4	3	3.9	2.3	<0.05	<0.05	0.10	<0.005	0.05	1.4
W845261		>10000	1.3	0.006	0.07	5630	0.9	1	7.2	7.3	<0.05	<0.05	0.03	<0.005	0.10	0.3
W845262		6370	1.5	<0.002	0.14	2130	0.4	2	8.5	23.2	<0.05	<0.05	0.08	<0.005	0.07	0.9
W845263		981	1.8	<0.002	0.85	99.0	1.8	3	8.1	12.2	<0.05	<0.05	0.20	0.006	0.13	0.5
W845264		5090	1.6	<0.002	0.86	88.8	0.3	2	108.5	5.6	<0.05	<0.05	0.06	<0.005	0.03	0.6
W845265		>10000	2.0	<0.002	5.43	761	0.1	1	8.8	1.7	<0.05	<0.05	0.10	<0.005	0.09	0.4
W845266		>10000	0.4	0.014	>10.0	>10000	0.2	1	64.9	1.7	<0.05	<0.05	0.08	<0.005	0.44	0.4

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Project: RM

Finalized Date: 2-NOV-2019
Account: RCM

CERTIFICATE OF ANALYSIS WH19235954

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	Ag-OG62	Ag-GRA21	Pb-OG62	Ag-CON01	Pb-VOL70	Cu-OG62	Zn-OG62	Zn-VOL50
	Analyte	V	W	Y	Zn	Zr	Ag	Ag	Pb	Ag	Pb	Cu	Zn	Zn
	Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	%	%	%	%
	LOD	1	0.1	0.1	2	0.5	1	5	0.001	0.7	0.01	0.001	0.001	0.01
W845301		1	0.3	0.9	>10000	2.6	>1500	1805	16.15			1.430	>30.0	35.84
W845302		<1	0.1	0.2	>10000	<0.5	>1500	2650	>20.0		68.55	1.760	4.84	
W845303		<1	0.1	0.1	>10000	<0.5	>1500	3660	>20.0		73.96		4.04	
W845304		<1	0.2	1.8	>10000	<0.5	179		2.32				>30.0	42.03
W845305		1	0.6	1.0	>10000	1.1	351		>20.0		25.30		>30.0	30.64
W845306		1	8.1	1.2	>10000	1.4	165		1.795				>30.0	44.29
W845307		6	1.8	2.8	>10000	2.4							>30.0	30.78
W845308		<1	<0.1	0.2	>10000	<0.5	>1500	2490	>20.0		81.76		1.285	
W845309		2	<0.1	0.4	>10000	2.0	>1500	4010	>20.0		73.27		3.39	
W845310		3	0.1	0.8	>10000	2.6	>1500	1465	>20.0		57.68		15.40	
W845311		<1	<0.1	0.1	2710	<0.5	>1500	6300	>20.0		80.83	1.555		
W845312		<1	<0.1	0.2	8510	0.7	>1500	>10000	>20.0	11663.0	76.43	2.59		
W845313		<1	<0.1	0.1	583	<0.5	>1500	2700	>20.0		78.59	1.560		
W845314		<1	<0.1	0.1	>10000	<0.5	>1500	3470	>20.0		68.13	1.190	7.46	
W845315		2	30.0	0.9	>10000	0.7	876		9.92				9.48	
W845316		44	0.6	41.4	>10000	2.4							8.06	
W845317		25	0.7	12.4	>10000	0.8							18.25	
W845318		26	2.2	3.9	>10000	1.9							19.60	
W845319		71	0.1	3.8	>10000	1.1						7.67	2.30	
W845320		25	0.2	6.2	640	6.4								
W845321		97	<0.1	6.4	411	1.1								
W845322		4	<0.1	2.5	2750	<0.5								
W845323		4	77.4	7.1	>10000	0.7	965		1.640				1.540	
W845324		3	97.4	6.6	>10000	0.8	1175		1.635				1.455	
W845325		4	438	5.8	>10000	3.3	671		1.745				5.34	
W845326		4	3.2	1.0	>10000	1.0	406		6.46				1.400	
W845327		9	1.0	6.7	>10000	1.8			1.600				8.70	
W845328		3	1170	3.7	>10000	0.8	904		3.02				8.19	
W845260		2	40.1	1.0	>10000	1.7	613		5.85				8.33	
W845261		2	760	2.7	>10000	<0.5	777		1.230				1.405	
W845262		2	6.8	3.3	>10000	0.9							9.93	
W845263		6	1.4	1.0	>10000	2.9							6.46	
W845264		<1	0.6	1.7	>10000	1.0							>30.0	43.48
W845265		1	1.1	0.2	>10000	1.6	321		5.98				7.25	
W845266		<1	1720	0.1	>10000	<0.5	>1500	1630	16.05				26.0	

***** See Appendix Page for comments regarding this certificate *****

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone: +1 (604) 984 0221 Fax: +1 (604) 984 0218
www.alsglobal.com/geochemistry

To: **ATAC RESOURCES LTD.**
C/O ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
1016-510 W HASTINGS ST
VANCOUVER BC V6B 1L8

Project: RM

Finalized Date: 2-NOV-2019
Account: RCM

CERTIFICATE OF ANALYSIS WH19235954

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

Applies to Method: REE's may not be totally soluble in this method.
ME-MS61

LABORATORY ADDRESSES

Applies to Method: Processed at ALS Whitehorse located at 78 Mt. Sima Rd, Whitehorse, YT, Canada.

CRU-31	CRU-QC	LOG-21	PUL-31
PUL-QC	SPL-21	WEI-21	

Applies to Method: Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada.

Ag-CON01	Ag-GRA21	Ag-OG62	Au-AA25
Cu-OG62	ME-MS61	ME-OG62	Pb-OG62
Pb-VOL70	Zn-OG62	Zn-VOL50	