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Karakterisering av gråberg samt B-malm

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Innehållsförteckning

Tabellförteckning

Figurförteckning

Bilageförteckning

Inledning

Vanadis Battery Metals (VBM) avser att ansöka om bearbetningskoncession för en del av den så kallade Häggånfyndigheten, belägen nordväst om Myrviken i Bergs kommun, Jämtlands län. Geosyntec Consultants AB (Geosyntec) har på uppdrag av VBM genomfört en karakterisering av gråberg från den planerade verksamheten. Material för tester har erhållits av bolaget.

Den planerade verksamheten utgörs av brytning i dagbrott av alunskiffer och utvinning av vanadin, nickel, zink, molybden och kalium. Brytningen ger upphov till gråberg i form av alunskiffer samt kalksten. Merparten av den brutna kalkstenen kommer att kunna tillgodogöras som tillsatsmedel till processen, samt vid uppbyggnad av utvinningsavfallsanläggningar. En del kalksten bedöms dock behöva deponeras tillsammans med gråberg från alunskiffer. Karakteriseringen och klassificeringen omfattar båda dessa gråbergstyper. Karakterisering har även utförts för B-malm. B-malm utgör inte ett utvinningsavfall men kommer att mellanlagras innan anrikning.

Denna karakterisering avser att utgöra en grundläggande karakterisering med avseende på gråbergets halter av relevanta ämnen samt eventuella potentiellt syrabildande förmåga samt leda fram till en föreslagen klassificering.

Syftet är även att kunna identifiera eventuella skyddsåtgärder som kommer att krävas under drift samt att möjliggöra en miljöriktig efterbehandling av gråberget.

Metodik

Den använda metodiken för urval av prover, analysmetoder samt utvärdering av resultat går i linje med rekommendation i den tekniska vägledningen SIS-CEN/TR 16365:2013[1] samt SIS-CEN/TR 16376:2013[2] samt SIS-CEN/TR 16363:2016[3].

En detaljerad beskrivning av de genomförda prospekteringsarbetena samt mineralresursutvärderingen av fyndigheten redovisas i bolagets scoping studie. Utifrån det erhållna underlaget, erhållna prospekteringsanalyser och utvärdering av dessa samt planerad brytningsmetod så har en metodik för utvärdering av gråberg utarbetats dvs. en provtagningsplan som uppfyller den framtagna vägledningen (Bilaga 1).

Den valda metodiken har gått ut på att alla tillgängliga prospekteringsanalyser (3848 delprov och 48 ämnen) först har utvärderats för geokemiska samband och grupperingar. Därefter har ett urval av prover inifrån dagbrottet på framtida gråberg samt B-malm utvärderats med hjälp av en statistisk programvara, DataDesk®.

[1] Karakterisering av avfall – Provtagning av avfall från utvinningsindustrin
[2] Karakterisering av avfall – Övergripande vägledning för karakterisering av avfall från utvinningsindustrin
[3] Karakterisering av avfall – Kinetiska tester för bedömning av syrabildningspotential i sulfidhaltigt avfall från utvinningsindustrin

Arbetet har sedan fortlöpt som en fördjupad karakterisering genom uttag av kompletterande, representativt, provmaterial baserat på deras svavelhalt för kalksten och gråberg (<540 ppm V) samt B-malm (<1560 ppm V). Detta arbete beskrivs i detalj i bilaga 1. Urvalet har fokuserat på representativitet för de fortsatta analyserna (ABA, Mineralogi, fuktkammarförsök).

De erhållna analyserna från prospekteringsarbetet överskrider d.v.s. uppfyller mer än väl de riktlinjer som finns beskrivna i SIS-CEN/TR 16365:2013 för slumpmässig provtagning från borrkärna. Antalet analyserade prover inom det framtida dagbrottet på vad som motsvarar framtida gråberg från alunskiffer (250 delprover med <540 ppm V) från borrkampanjen 2018–2019 överstiger d.v.s. överskrider mer än väl kravet på slumpmässigt uttagna och analyserade prover för den planerade gråbergsmängden (ca 45–50 Mton, ca 184 prover) vid brytning i dagbrott.

För-B-malm, som inte är ett avfall utan kommer att lagras i väntan på anrikning fanns 21 delprover från borrkampanjen 2018–19 analyserade inom dagbrottet. B-malm är litologiskt samma material som gråberget men med en något högre vanadinhalt. För hela mineraliseringen som undersökts så finns 410 delprover analyserade på B-malm med en V-halt mellan 540 och 1560 ppm. Därutöver har även kalksten tagits ut för fördjupad karakterisering.

Analyspaket

För prospekteringsanalyserna av borrkärna har metoden ME-ICP61 använts där provet först smälts med en fyrsyrametod (perklorsyra, salpetersyra, fluorvätesyra och saltsyra). Metoden Inductively Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES) används för att analysera de närvarande elementen.

Alla särskilt utpekade element i SFS 2013:319 förutom Hg ingår i paketet för totalhalter som användes vid prospekteringsskedet.

Kompletterande analyser som täcker in svavelvariationen för kalksten respektive alunskiffer med en vanadinhalt (<540 och mellan 540 men <1560 ppm V) har utförts med ME-MS61 + Hg vilket innebär att delproverna först smälts med en fyrsyrametod (perklorsyra, salpetersyra, fluorvätesyra och saltsyra). Metoden Inductively Coupled Plasma – Atomic Emission Spectroscopy (ICP-AES) används för att analysera de närvarande elementen. På samma delprover så har även ABA-test utförts. ABA-testerna är paketet ABA-PKG06E vilket innehåller rapporterade resultat för totalsvavel, sulfatsvavel och sulfidsvavel liksom total-C, organiskt C och oorganiskt C. Resultaten rapporteras som AP (Syrabildande förmåga), NP (Neutraliserande förmåga) samt NPR (kvoten mellan NP/AP). ABA-testet följer den europeiska standarden (SS-EN 15875).

För den mineralogiska undersökningen används XRD enligt Rietvelds metod med en rapporteringsgräns på 0,5–1 vikt-%.

Utifrån de använda analyspaketen så kan alla krav för bedömning av bakgrundshalter och om respektive bergart kan bedömas vara inert, nettobuffrande men ej inert eller potentiellt syrabildande utföras.

För att komplettera den statiska bedömningen har tre sammanslagningsprov på kalksten, gråberg respektive B-malm undersökts med kinetiska försök s.k. fuktkammarförsök på laboratorie (ALS Vancouver). Dessa är för närvarande pågående men resultaten som erhållits och nu redovisas har ingått i bedömningen och redovisas i rapporten. De pågående kinetiska försöken följer vägledningen för kinetiska försök (SIS-CEN/TR 16363:2016[4]).

Utvärdering

Alla analyser av gråberg från prospekteringsborrning tillsammans med övrig tillgänglig information som exempelvis litologi har ingått i utvärderingen.

Urval av prover för kompletterande analyser har utförts genom bedömning av resultat från prospekteringsborrning. En utvärdering av resultat från prospekteringsborrning samt en provtagningsplan för uttag av representativa prover för kompletterande analyser (fullanalys, ABA och mineralogi samt fuktkammarförsök) återfinns i bilaga 1.

Ämnen

Utvärdering av elementhalter och samvariationer för att bedöma geokemiska sammanhang har utförts i programvaran DataDesk® som är en statistisk programvara för datautvärdering.

Litologier

I samband med borrkärnekartering under prospekteringsarbetet så har en indelning av bergmassan i litologier dvs. bergartsenheter utförts. I samband med utvärderingen av analyserna så har dessa ingått i utvärderingen för att representativa prov skulle tas ut från varje enhet. Kalksten samt alunskiffer är helt dominerande och har valts ut som de representativa litologierna för karakteriseringen.

Haltvariationer liksom skillnader avseende buffrande egenskaper mellan olika bergarter kan därmed också följas upp och utvärderas.

[4] Karakterisering av avfall – Kinetiska tester för bedömning av syrabildningspotential i sulfidhaltigt avfall från utvinningsindustrin

Resultat

Mineralogi

Den mineralogiska undersökningen har utförts på ett representativt sammanslagningsprov vardera av kalksten, framtida gråberg (alunskiffer) samt B-malm (Tabell 1). De huvudsakliga ingående mineralen som identifierats är dock relativt få. Kalkstenprovet består till övervägande del av kalcit (en karbonat) med inslag av kvarts (silikat), muskovit (en skiktsilikat) och klinoklor (en magnesiumrik klorit). Gråberget består till övervägande del av kvarts, muskovit med låga halter av albit (en natriumrik plagioklas), mikroklin (kaliumrik fältspat) samt gips (kalciumsulfat) med relativt hög kalcit- och pyrithalt (järnsulfid) och klinoklor i ungefär samma halt som i kalkstenprovet. B-malm innehåller samma mineral som gråberget förutom klinoklor. Mineralproportionerna är något annorlunda med framförallt en större andel kalcit. De mineralogiska likheterna är inte förvånande då de utgör två olika sammanslagningsprov av samma litologi (alunskiffer med olika vanadinhalt).

Tabell 1 Sammanställning av mineralogisk analys.

Mineral	Sammansättning	vikt-%		
		Kalksten	Gråberg (alunskiffer)	B-malm (alunskiffer)
Kvarts	SiO_2	8,1	44,5	39,3
Albit	$NaAlSi_3O_8$	-	0,8	0,8
Mikroklin	$KAlSi_3O_8$	-	0,6	1,3
Kalcit	$CaCO_3$	83,1	6,5	16
Gips	$Ca(SO_4)(H_2O)_2$	-	0,5	0,9
Pyrit	FeS_2	-	7	7,9
Muskovit	$KAl_2(Si,Al)_4(OH)_2$	4,3	35,2	33,8
Klinoklor	$Mg_{2,8}Fe_{1,75}Al_{2,7}Si_{2,65}O_{10}(OH)_8$	4,5	4,9	-

Fullanalys

För fullanalysen har halter och samvariationer mellan element för alla enskilda litologier (identifierade vid den utförda borrkärnekarteringen) samt halter i framtida gråberg som helhet utvärderats.

Halterna för relevanta element samt element särskilt omnämnda i SFS 2013:319 har utvärderats mot svensk nationell bakgrundshalt i morän (SGU 2014[5]). Upplösningsmetodiken för framtida gråberg (fyrsyraupplösning) och SGU:s moränprover (kungsvatten) skiljer sig dock åt varför bedömningen skall ses som indikativ snarare än absolut. Hade analys av moränprover utförts med fyrsyraupplösning så bedöms halterna ha ökat eftersom fyrsyrametoden ger en effektivare upplösning av svårlösliga mineral som kan innehålla metaller som substituerat (exempelvis zirkon).

Jämförelse med nationell bakgrundshalt

Vid en jämförelse mot de särskilt omnämnda elementen i SFS 2013:319 (6§ 4 p.) samt svavel och uran så visar resultatet att kalkstenproverna överstiger svensk bakgrundshalt för As, Co och Mo upp till 1,5 gånger och för S 40 gånger både för sammanslagningsprov och som medelhalt i de 40 delproverna (Tabell 2).

Det framtida gråbergets (alunskiffer <540 ppm V) analyserade delprover (98) samt sammanslagningsprov från borrkampanjen 2018 och 2019 överskrider svensk bakgrundshalt för As, Cd, Co, Cr, Cu, Mo, Ni, Pb, S, U, V och Zn med mellan 2,8–102 gånger om S undantas som är anrikad 677 gånger (Tabell 2). Anrikningsfaktorn om Mo (102 gånger) och S (677 gånger) undantas är i genomsnitt 8,3.

B-malmen, som dock inte är ett avfall, har liksom gråberget förhöjda halter för alla jämförda element men med generellt högre halter förutom för Pb (Tabell 2).

Resultatet visar dock att framtida gråberg (alunskiffer) inte ska klassas som inert med avseende på halter. För kalksten kan det dock argumenteras för att haltskillnaderna är så marginella (samtidigt som upplösningsmetodik skiljer) att klassningen med avseende på halter borde kunna vara inert.

[5] Geokemisk atlas över Sverige. https://www.sgu.se/mineralnaring/geokemisk-kartlaggning/geokemisk-atlas/

Tabell 2 Medel- och medianhalt för uttagna prover på framtida gråberg (329). Halt över svensk bakgrundshalt (SGU 2014) markerad med senapsfärgad rastrering.

Jämförelse med svensk bakgrundshalt	SGU 2014		Kalksten			Gråberg delprov (98)			B-malm		
	Medel	Median	Halt sammanslagningsprov	Medel delprov (40)	Median delprov (40)	Halt sammanslagningsprov	Medel delprov (98)	Median delprov (98)	Halt sammanslagningsprov	Medel	Median
As (ppm)	**4,4**	**2,3**	6,6	11,3	5,1	70,1	77,6	76	87,3	88,5	87,7
Cd (ppm)	**0,09**	**0,08**	0,04	0,06	0,04	1,15	1,66	1,35	5,25	6,36	5,94
Co (ppm)	**7,6**	**6,3**	7,9	8,4	7,4	21,3	21,9	23	26,5	24,3	24
Cr (ppm)	**24,3**	**20,4**	14	16,7	14	75	67,7	68	72	70,4	71
Cu (ppm)	**18,3**	**13,5**	12,2	12	9,5	77,4	102,3	103,5	129	129,6	132,5
Mo (ppm)	**0,8**	**0,4**	0,94	1,12	0,35	81,4	106	98	168,5	176	172,5
Ni (ppm)	**15,4**	**11,3**	13,6	13,8	13,2	107	123	126	289	272	276
Pb (ppm)	**11,8**	**9,6**	5,7	5,8	3,8	101,5	87,8	86,7	70,8	75,9	54,2
S (%)	**0,007**	**0,004**	0,28	0,52	0,08	4,74	5	5,12	5,11	4,98	4,89
U (ppm)	**2,6**	**2,2**	1,1	1,87	0,8	41	61,5	57	127,5	122	123
V (ppm)	**37,7**	**34,2**	27	37	27	325	364	365	1090	1045	1060
Zn (ppm)	**43,3**	**37,3**	33	24,2	16,5	165	158	111	355	421	350

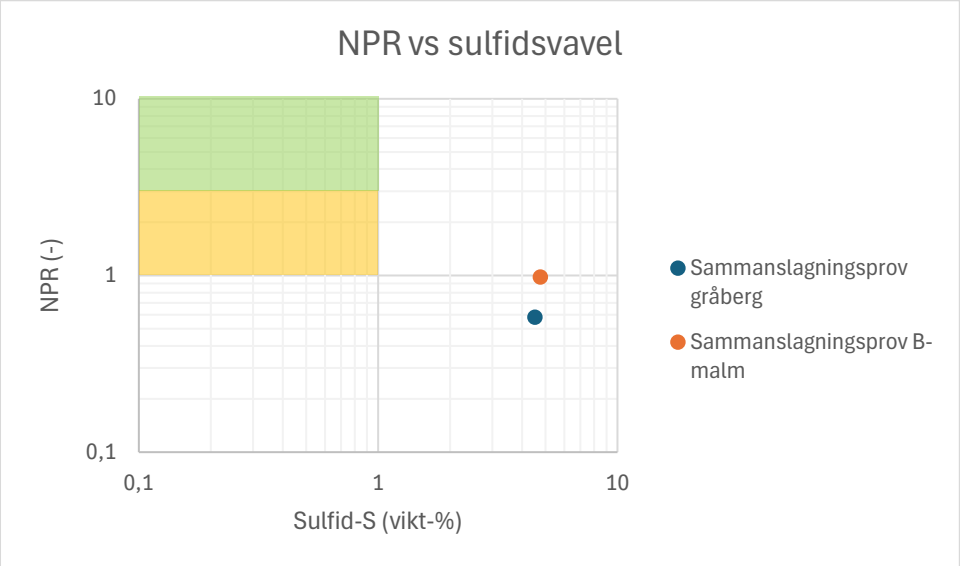
ABA-test

De utförda ABA-testerna redovisas i Figur 1 tillsammans med NPR och sulfidsvavelhalt från de sammanslagningsprov som togs fram. Resultatet visar att sammanslagningsprovet för B-malm har en NPR-kvot nära 1 (0,97) medan sammanslagningsprovet för gråberg har en NPR-kvot på 0,57. Detta innebär att inget av sammanslagningsproverna för gråberg eller B-malm uppfyller kriterier för inert utvinningsavfall enligt 6§ i utvinningsavfallsförordningen (SFS 2013:319) och är därmed klassificerade som potentiellt syrabildande.

Någon signifikant skillnad i mineralogi mellan gråberg och B-malm föreligger inte vilket tidigare redovisats. De har närmast identisk genomsnittlig sulfidsvavelhalt och potentiellt syrabildande förmåga. Att NPR skiljer mellan de två proverna beror enbart på att B-malmsprovet innehåller mer buffrande kalksten.

I princip allt svavel i gråberg liksom B-malmsprovet förekommer som sulfid (Tabell 3Tabell 3) och merparten av kolinnehållet förekommer som organiskt C och därmed inte som karbonat.

Sammanslagningsprovet på kalksten uppvisar en låg sulfidsvavelhalt på 0,25 vikt-% och en mycket hög buffrande förmåga på 784 kg $CaCO_3$ per ton dvs. kalkstenen består av ca 80 % kalcit vilket stämmer väl med den mineralogiska analysen. För kalkstenen består i princip allt kol av oorganiskt C vilket därmed förekommer som karbonat. Med avseende på syrabildande förmåga klassificeras kalkstenen som inert enligt 6§ i utvinningsavfallsförordningen.



Figur 1 Sammanställning av utförda ABA-test på gråberg samt B-malm. Grön rastrering anger inert och beige osäkra buffrande egenskaper (SFS 2013:319 6§)

Tabell 3 Sammanställning av ABA-test.

	S total	S sulfat	S sulfid	C total	C organiskt	C oorganiskt	NP	AP	NPR	NNP
	Vikt-%						tCaCO3/1Kt			

Sammanslagningsprov gråberg	4,63	0,11	4,52	5,03	3,73	1,3	82	141,5	0,58	-60
Sammanslagningsprov B-malm	4,93	0,16	4,77	11,45	9,29	2,16	146	149	0,98	-4
Kalksten sammanslagningsprov	0,26	0,01	0,25	9,63	0,03	9,6	784	7,8	100,35	776

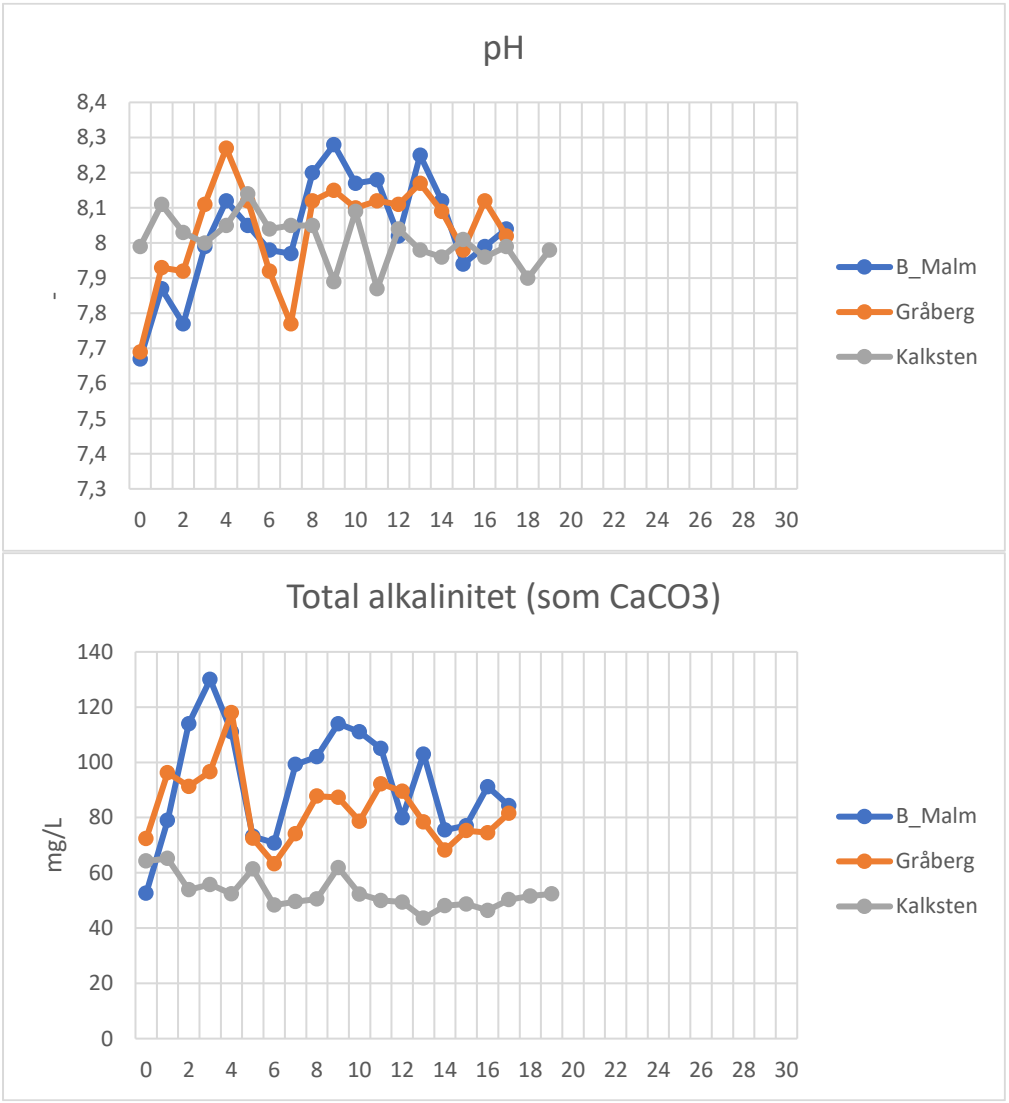
Sammanställda resultat resulterar i bedömningen att surt lakvatten från gråberg och B-malm kan förekomma, särskilt i det fall som lagring sker under längre tidsperiod utan täckning. Framförallt tyder resultaten på att surt lakvatten kan uppkomma från gråbergsfraktionen.

Kinetiska försök vilka genomförs för att fastställa provernas slutgiltiga egenskaper utförs för närvarande.

Inblandning av eller undergrund av kalksten kommer att kunna motverka uppkomsten av surt lakvatten eftersom kalkstenen har utmärkta buffrande egenskaper och innehåller låga halter av ämnen.

Kinetiska försök

Kinetiska försök utförs på representativa sammanslagningsprov för kalksten, gråberg och B-malm. Uppmätt pH för alla tre sammanslagningsproverna är omkring 8 vilket visar på att karbonatbuffring sker. Den total alkaliniteten varierar mellan 40–60 mg/L för kalkstenen och omkring 80–120 mg/L för gråberg och B-malm. Skillnaden i alkalinitet beror på skillnaden i produktion av aciditet mellan proverna.

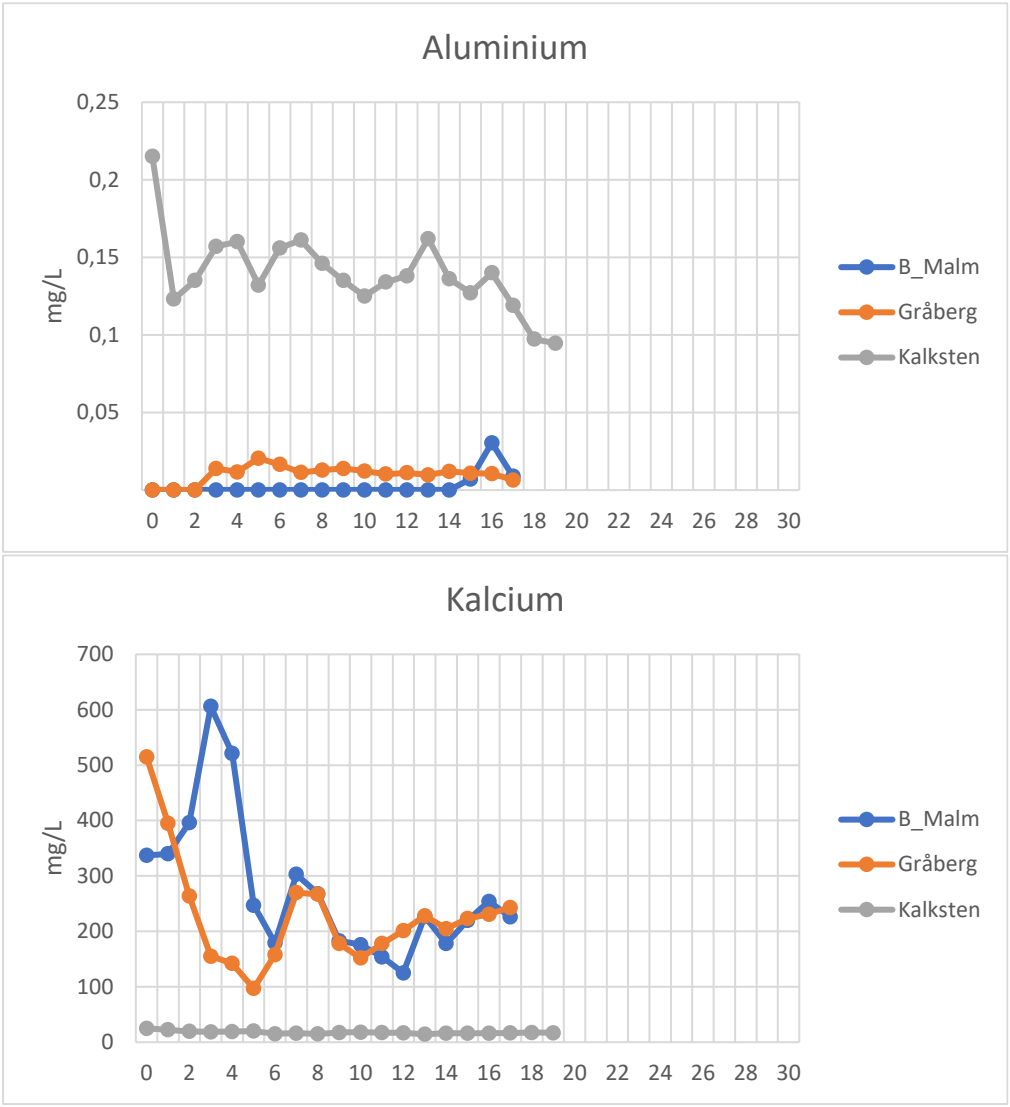


Figur 2 Uppmätt pH samt alkalinitet i för de tre sammanslagningsproverna i fuktkammarförsök.

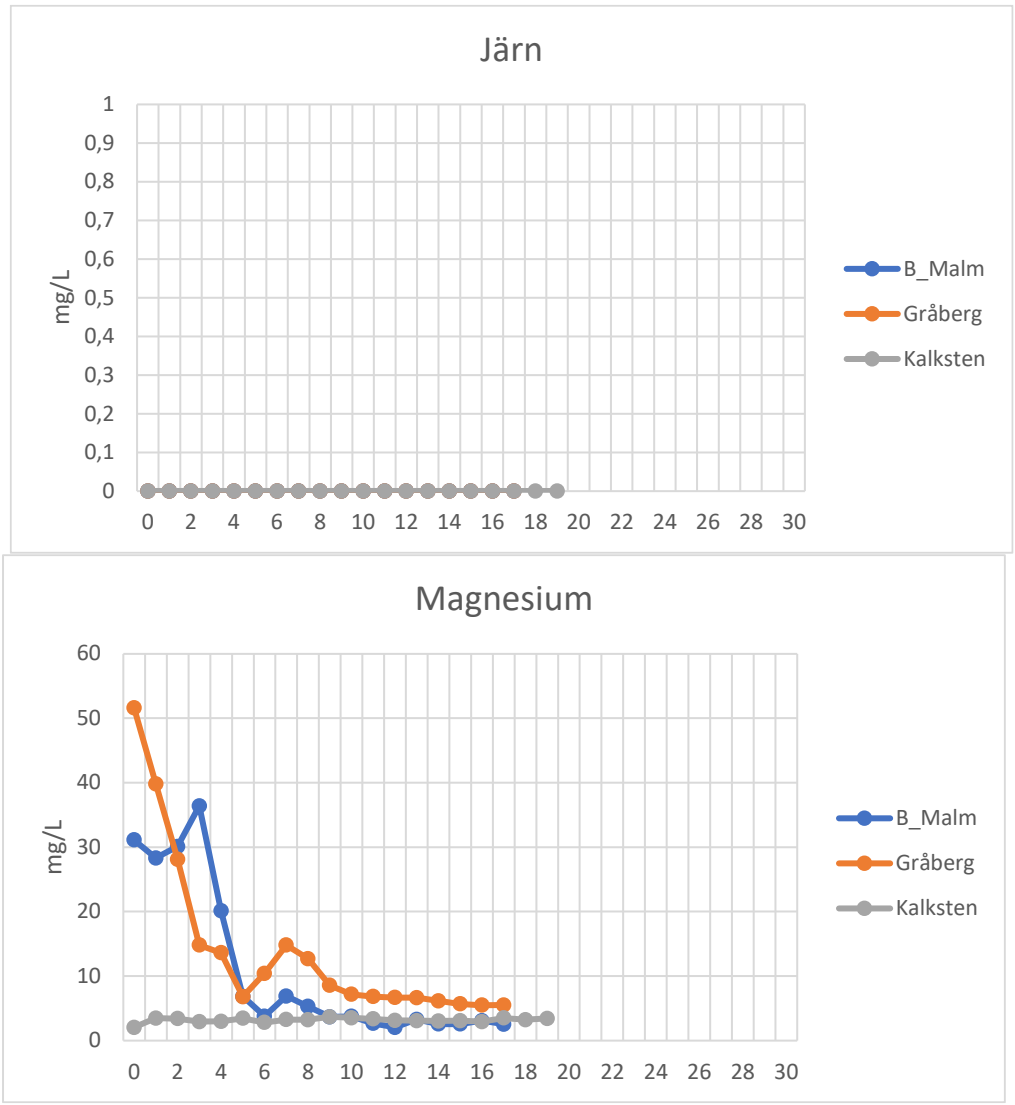
Huvudelementen redovisas i Figur 6. Aluminium uppträder i de högsta halterna i kalkstensprovet med lägre halter i gråberg samt B-malm medan förhållandet är det motsatta för kalcium, magnesium, kalium, kisel och natrium. Detta beror enbart på förekomsten av merparten av huvudelementen är högre i gråbergs- och B-malmslitologin (alunskiffer) än i kalkstenen. Anledningen till att aluminium lakar från kalkstenen är att den innehåller muskovit samt klinoklor, båda är relativt rika på aluminium och relativt lättvittrade.

Kalcium och magnesium bedöms i huvudsak komma från kalcit, kalcithalten är högre i kalkstenen men i kalkstenen utbildas betydligt mindre syra från sulfidvittring varför reaktionen i kalkstensprovet är mindre för att nå jämvikts-pH. Järn faller ut efter mobiliseringen eftersom pH är 8 då lösligheten (samt reaktionstiden för oxidation och utfällning av järnhydroxid är snabb) är mycket låg. Kalium och natrium kommer från albit, mikroklin samt muskovit i gråberg och B-malmsprovet samt från muskovit i kalkstenen. Den initiala utsköljningen s.k. ”first flush” i framförallt gråbergsprovet kan bero på upplösning av lättlösliga salter (Na- och KCl) eller på utsköljning av tidigare vittrade silikatmineral. Halterna sjunker snabbt till en låg nivå som är

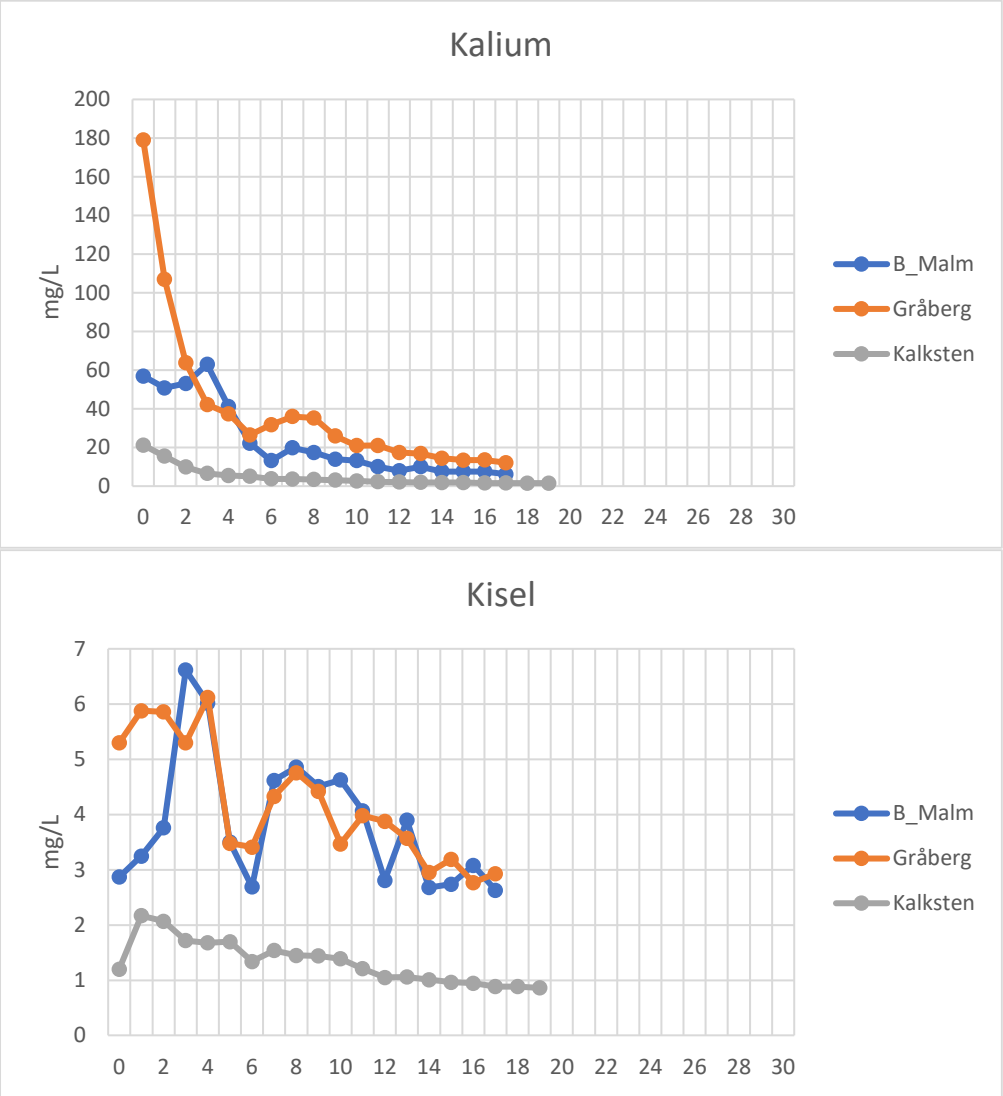
likvärdig för alla tre proverna. Kisel är högre i gråbergs- och B-malmsproverna än i kalkstenen vilket beror på att kisel förekommer i större andel i de silikatmineral som vittrar i de förstnämnda.



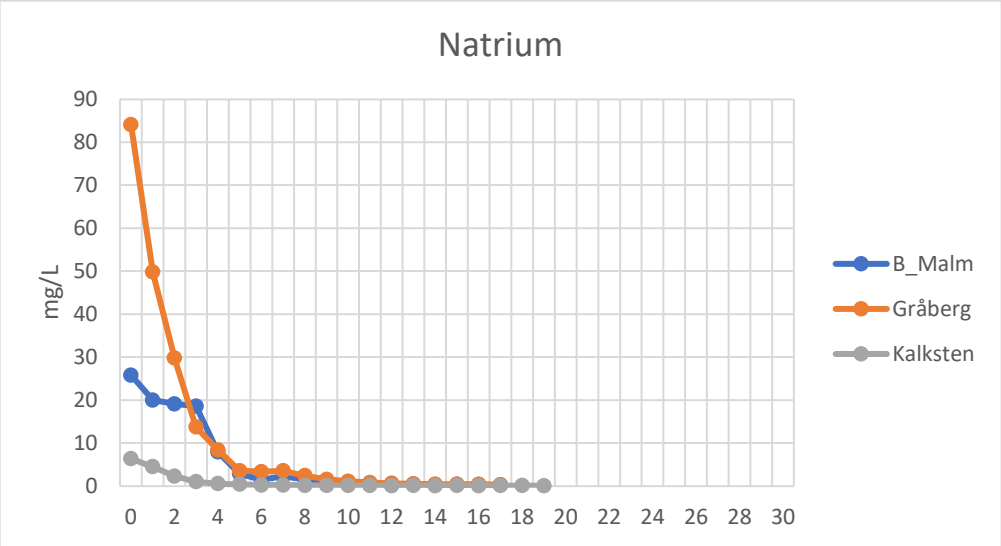
Figur 3 Aluminium och Kalcium för de tre sammanslagningsproverna i fuktkammarförsök.



Figur 4 Järn och Magnesium för de tre sammanslagningsproverna i fuktkammarförsök.

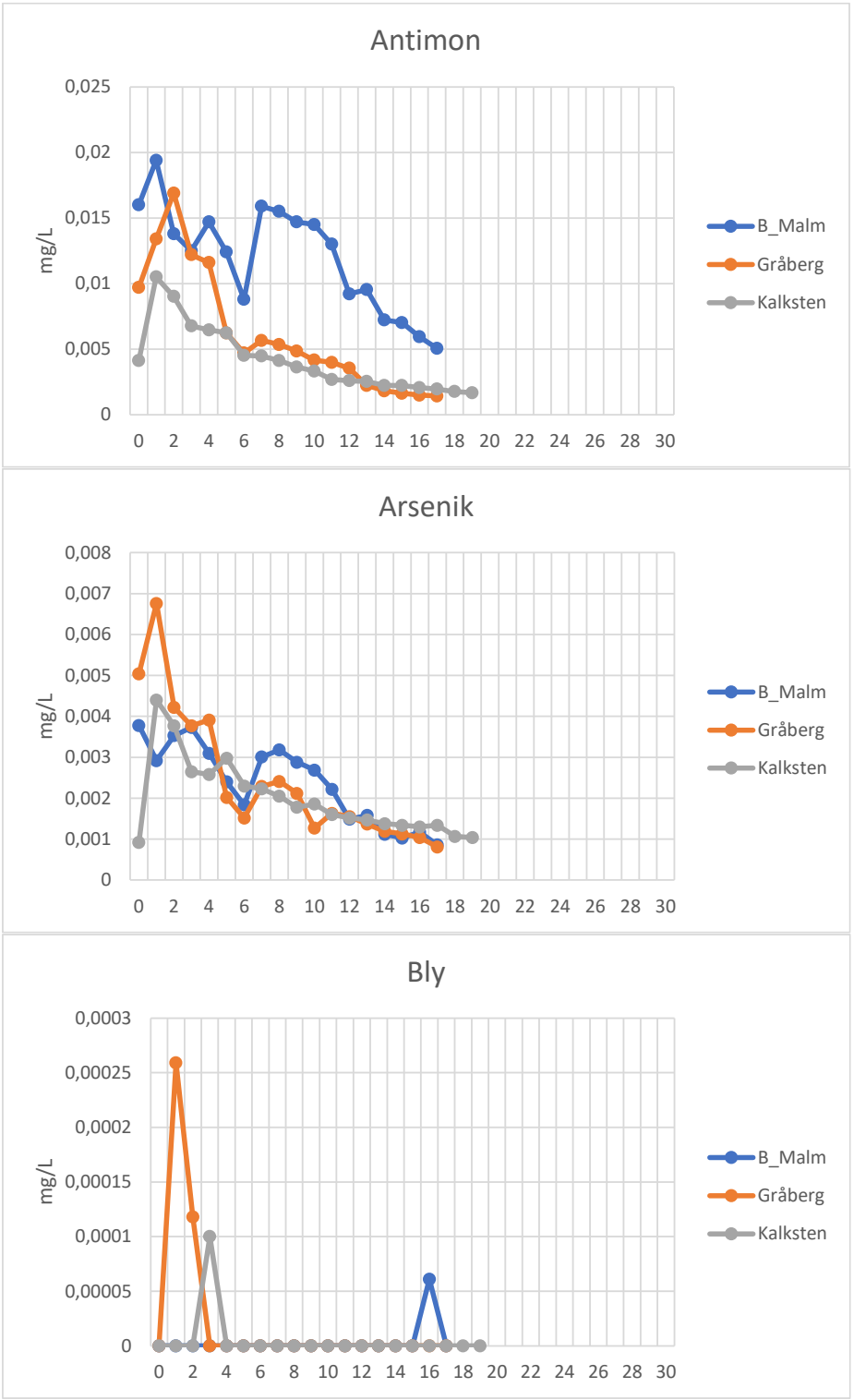


Figur 5 Kalium och Kisel för de tre sammanslagningsproverna i fuktkammarförsök.

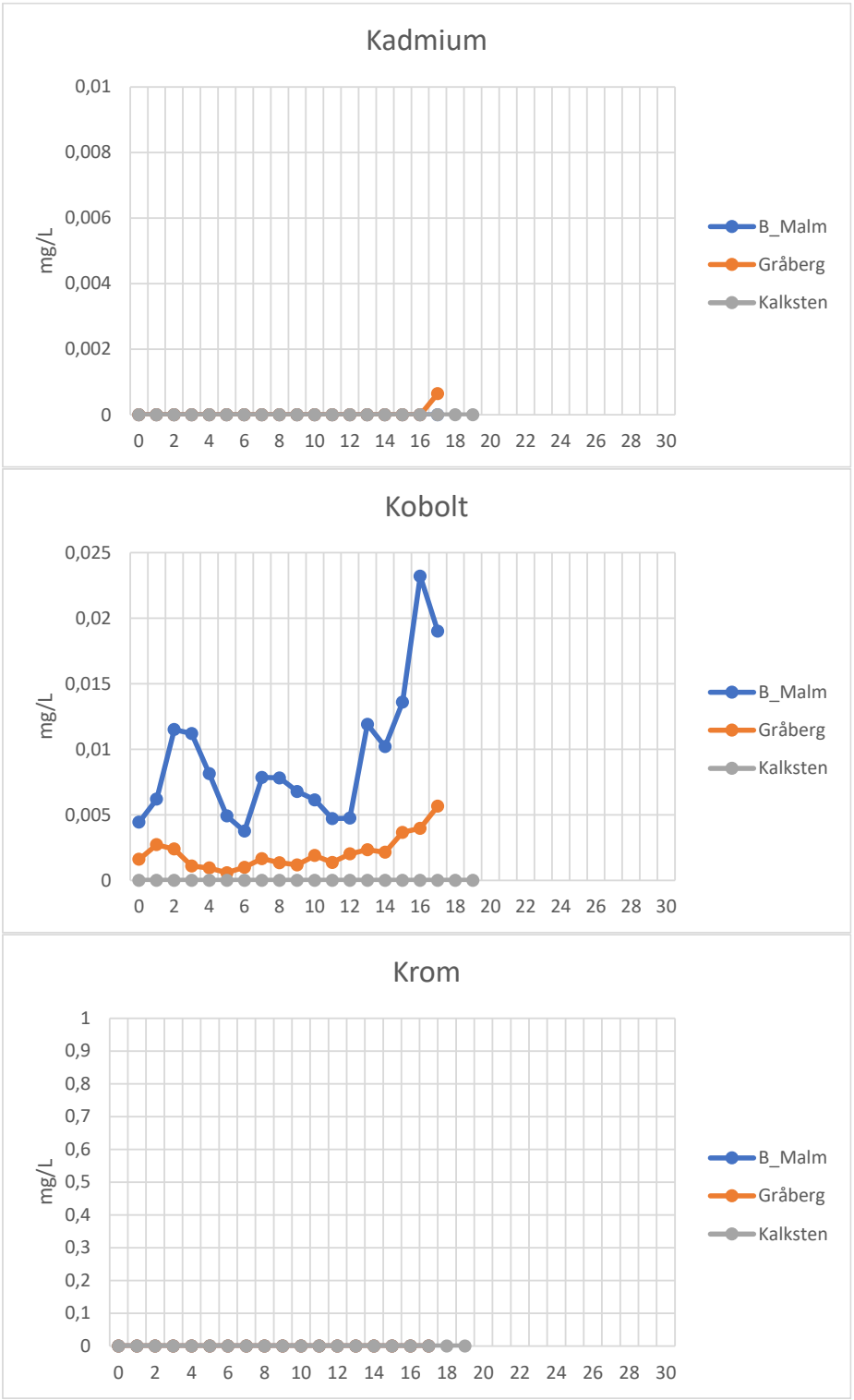


Figur 6 Natrium för de tre sammanslagningsproverna.

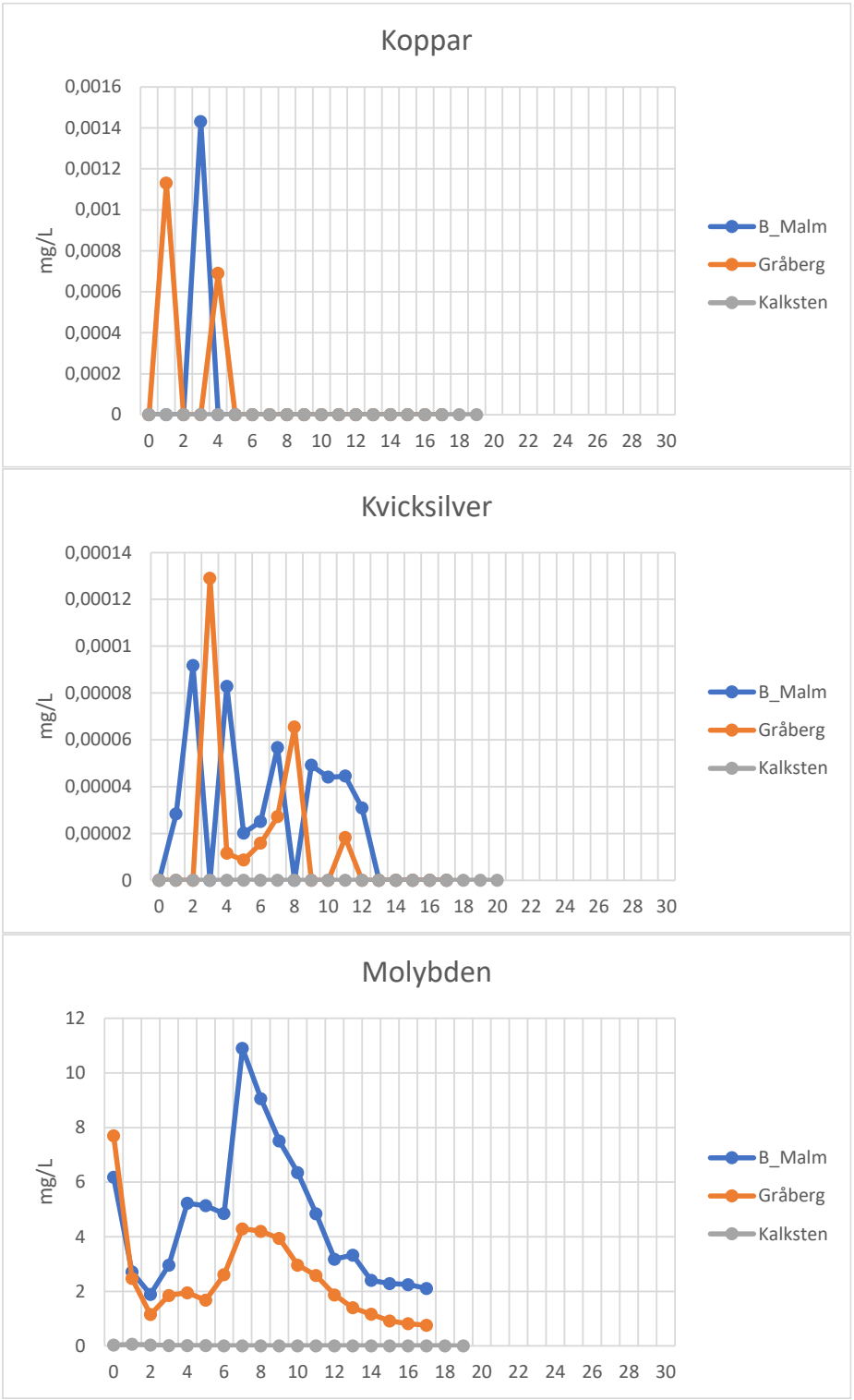
Utvalda spårelement, särskilt utpekade i SFS 2013:319 samt uran och svavel, redovisas i Figur 7-11. Halterna av kadmium, koppar, bly, vanadin och kvicksilver är under eller strax omkring rapporteringsgränsen vilket visar på en låg utlakningstakt för gråberg och B-malm. Krom ligger under rapporteringsgräns för alla tre sammanslagningsproverna. Halterna av arsenik, kobolt och zink är generellt låga medan halten av oxyanjonerna molybden och uran är att betrakta som höga för gråberg och B-malm. Utlakningen av dessa beror på det neutrala-svagt basiska pH-värdet vilket innebär att dessa ämnen har som högst mobilitet. Svavel har en relativt hög halt i gråberg- samt B-malmsproverna vilket visar att sulfidoxidation sker men det neutrala-svagt basiska pH-värdet visar att karbonatbuffring, i en omfattning som klarar av att buffra den bildade syran, sker i båda proverna. Svavelhalten, liksom övriga spårmetaller, i kalkstensprovets lakvatten är försumbar.



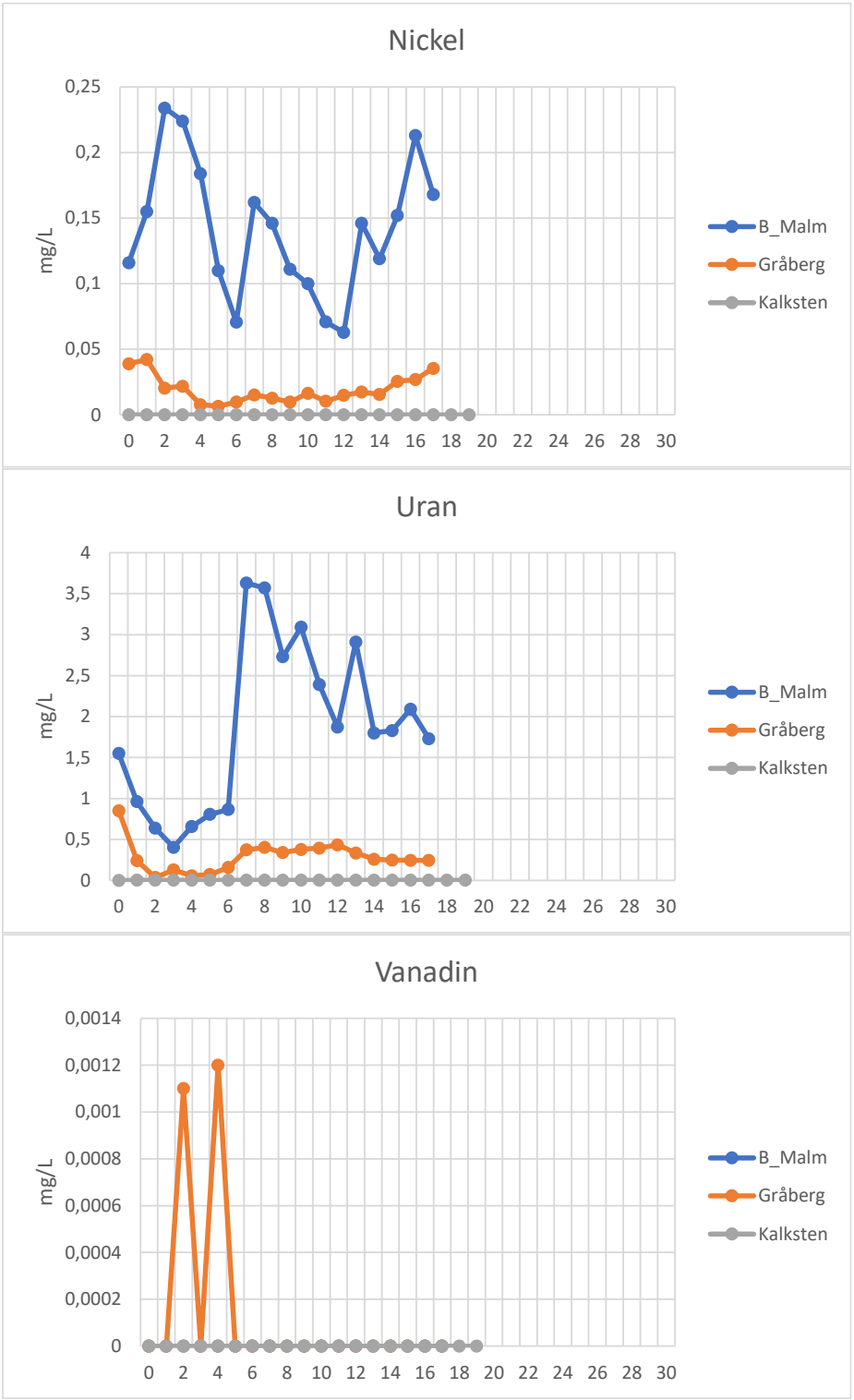
Figur 7 Antimon, arsenik och bly, för de tre sammanslagningsproverna i fuktkammarförsök.



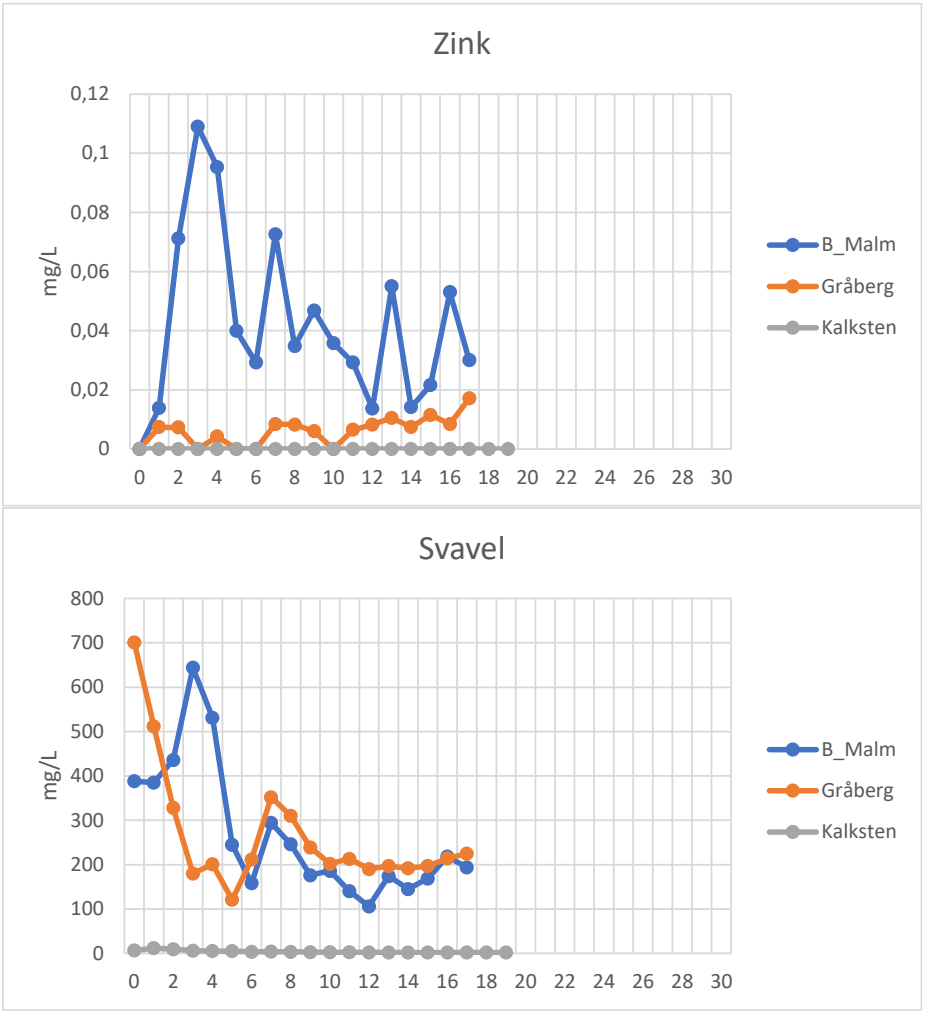
Figur 8 Kadmium, kobolt och krom för de tre sammanslagningsproverna i fuktkammarförsök.



Figur 9 Koppar, kvicksilver och molybden för de tre sammanslagningsproverna i fuktkammarförsök.

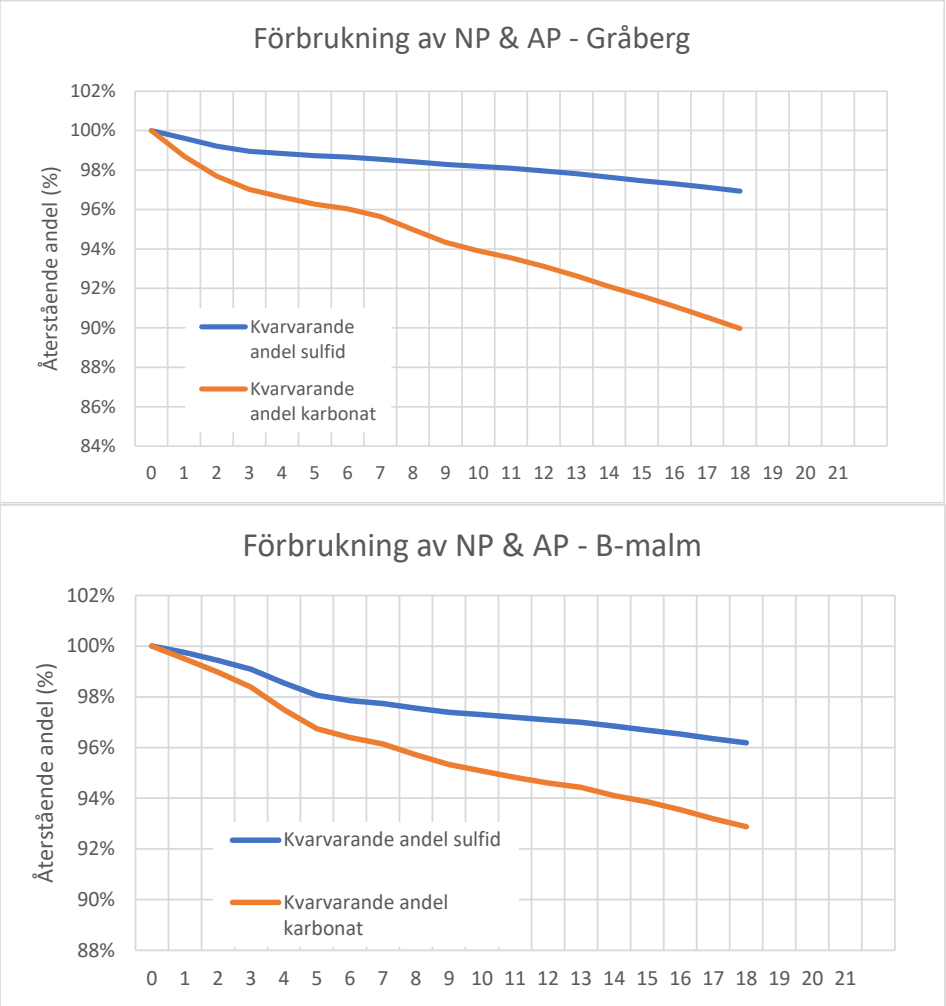


Figur 10 Nickel, uran och vanadin för de tre sammanslagningsproverna i fuktkammarförsök.



Figur 11 Zink och nickel för de tre sammanslagningsproverna.

En bedömning över risken för uppkomst av surt lakvatten (samt i viss mån tidsperioden fram till dess uppkomst i laboratoriet) kan utföras genom att jämföra utlakningen av svavel och Ca+Mg över tid i fuktkammarförsöket. Utlakningen av svavel motsvarar då oxidationen av sulfid och Ca+Mg motsvarar upplösningen av karbonat. Resultatet av beräkningen för gråberg- och B-malmsproverna redovisas i Figur 12. Startmängd för svavelhalt samt karbonatinnehåll har tagits från ABA-testet där den oorganiska C-halten har räknats om till kalcit ($CaCO_3$).



Figur 12 Sammanställning av förbrukningstakt av sulfid samt karbonat i sammanslagningsprov för gråberg samt B-malm.

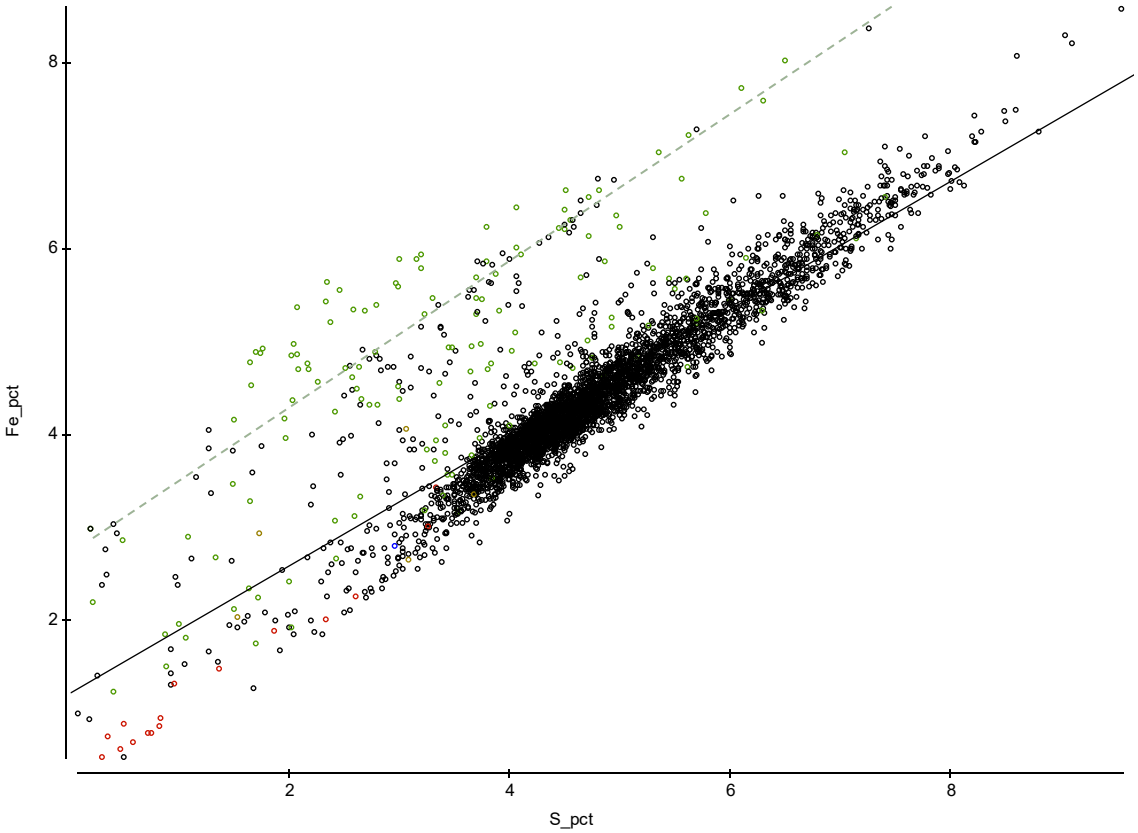
Resultatet, så långt som fuktkammarförsöken har pågått, visar att de båda sammanslagningsproverna på gråberg och B-malm i framtiden kommer att kunna utbilda ett surt lakvatten men att det även under laboratorieförhållandena (som är framtagna för att maximera sulfidvittring och karbonatbuffringsreaktioner) kommer att ta tid. Efter arton veckor återstår i gråbergsprovet ca 90 % av karbonathalten medan ca 97 % av sulfidinnehållet kvarstår och för B-malmsprovet återstår ca 93 % av karbonatinnehållet och drygt 96 % av sulfidinnehållet. Med nuvarande förbrukningstakt och antagande om effektiv buffring fram till dess att all karbonat förbrukats så kommer det således att ta ca 180–250 veckor innan surt lakvatten uppkommer under de optimala förutsättningar för sulfidvittring som råder i försöket.

Statistisk tolkning – geokemi

Vid den statistiska tolkningen har hela prospekteringsdatabasen använts och syftet har varit att fastställa i vilka föreningar som ämnen förekommer samt deras inbördes relationer.

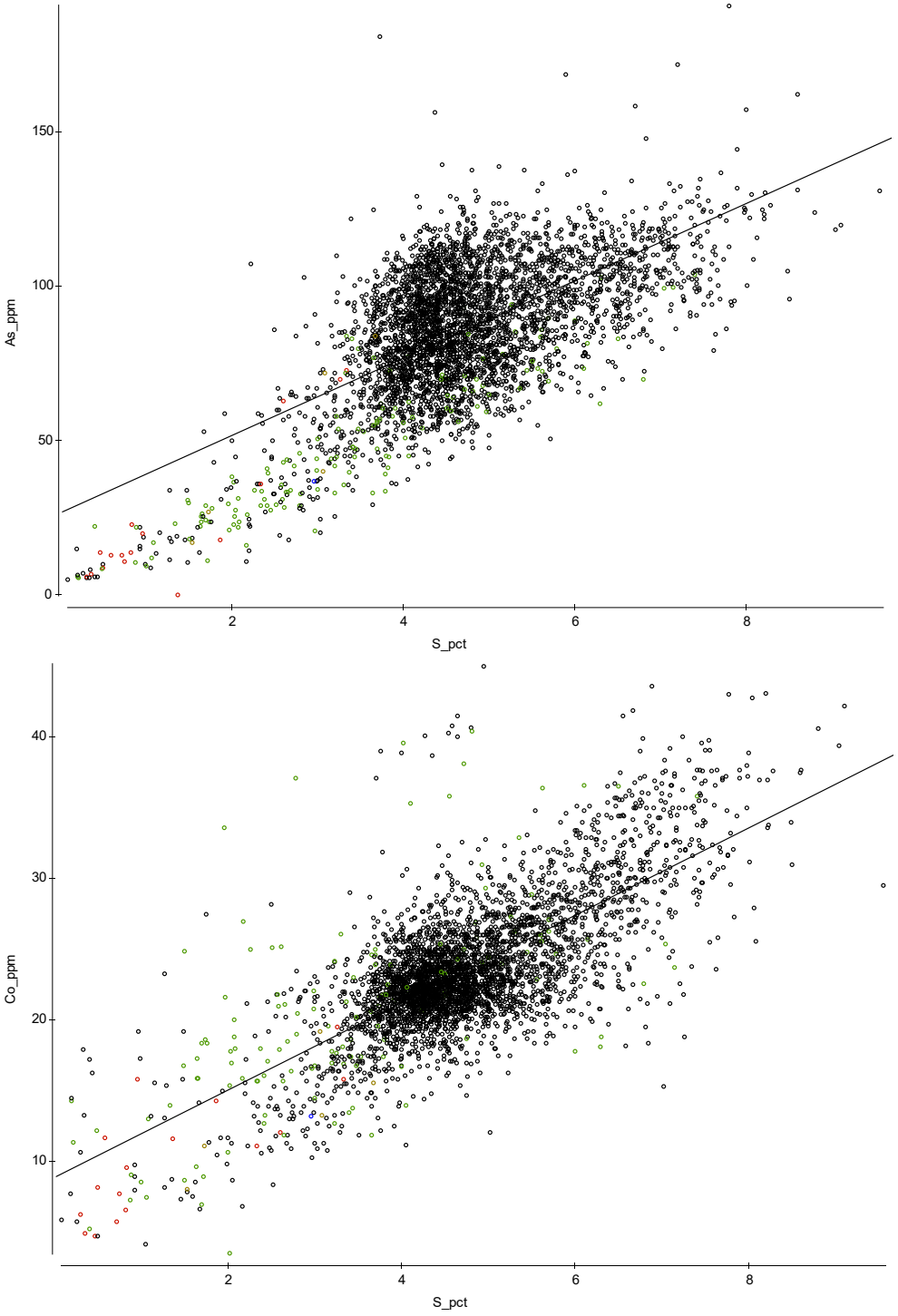
Sulfidrelaterade ämnen är Fe, där den linjära trenden ger en kvot på nära 1. Kvoten visar att det huvudsakliga mineralet som innehåller Fe är pyrit (FeS_2) eftersom förhållandet Fe:S (vikt:vikt) är 1:1,15.

I skifferlitologin är Fe-halten högre relativt svavelhalt än för de övriga litologierna vilket beror på att järn även förekommer i andra mineral än pyrit i denna bergart. Dels kan Fe ingå i silikatmineral och dels kan de även ingå i magnetkis (kvot Fe:S 1:0,57). Den övergripande lutningen är dock densamma varför det dominerande mineralet fortfarande bedöms vara en sulfid (Figur 13).

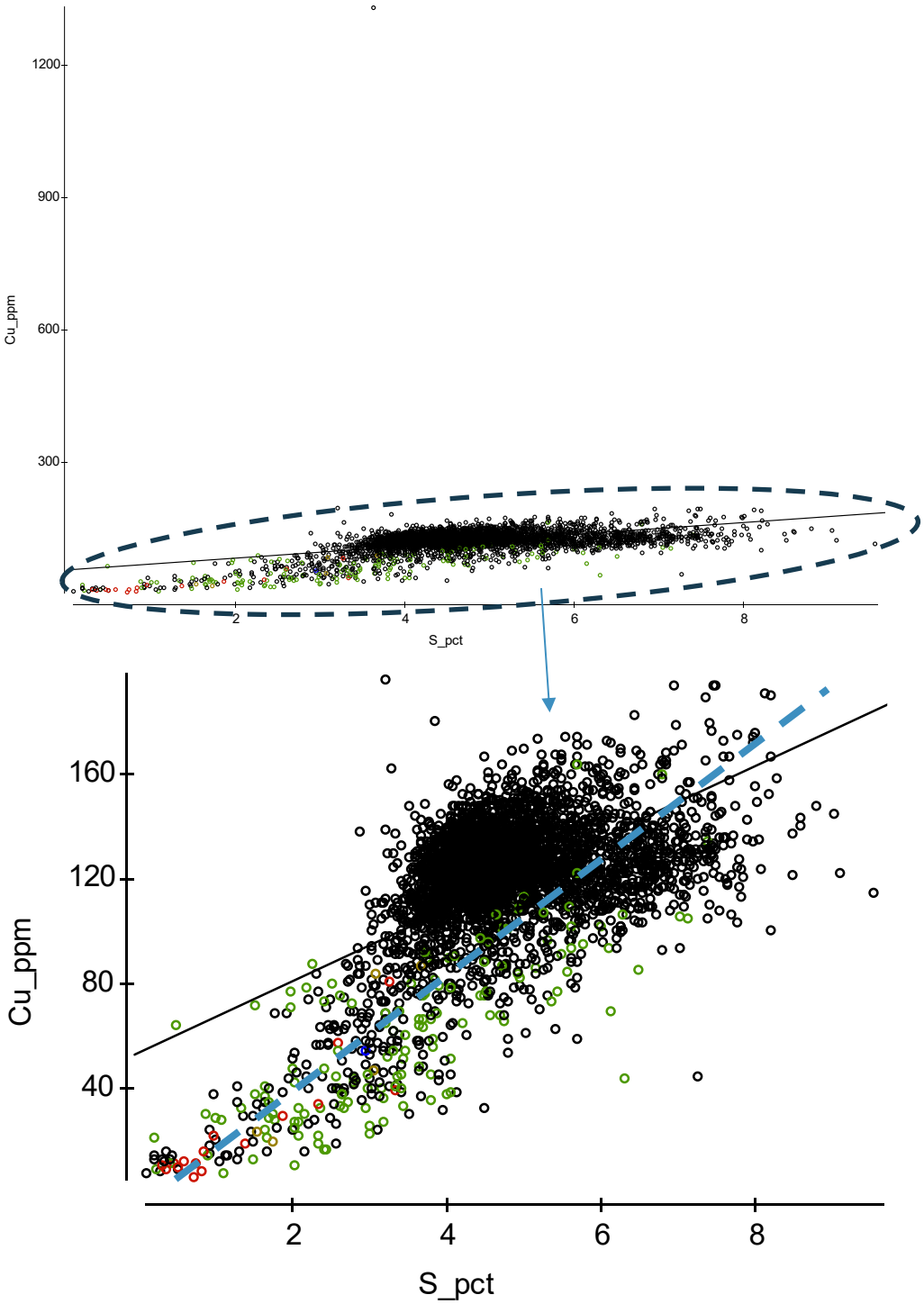


Figur 13 Fe som en funktion av S. Röd anger kalksten (16 prov), svart alunskiffer (2942 prov), blå kvartsit (1 prov), grön skiffer (144 prov) och orange siltsten (5 prov).

Bland spårelementen som uppvisar en tydlig korrelation med svavel så förekommer arsenik, kobolt och koppar (Figur 14–15). Dessa ämnen bedöms substituera i pyrit eftersom halterna är för låga för att de ska kunna bilda egna sulfidmineral.



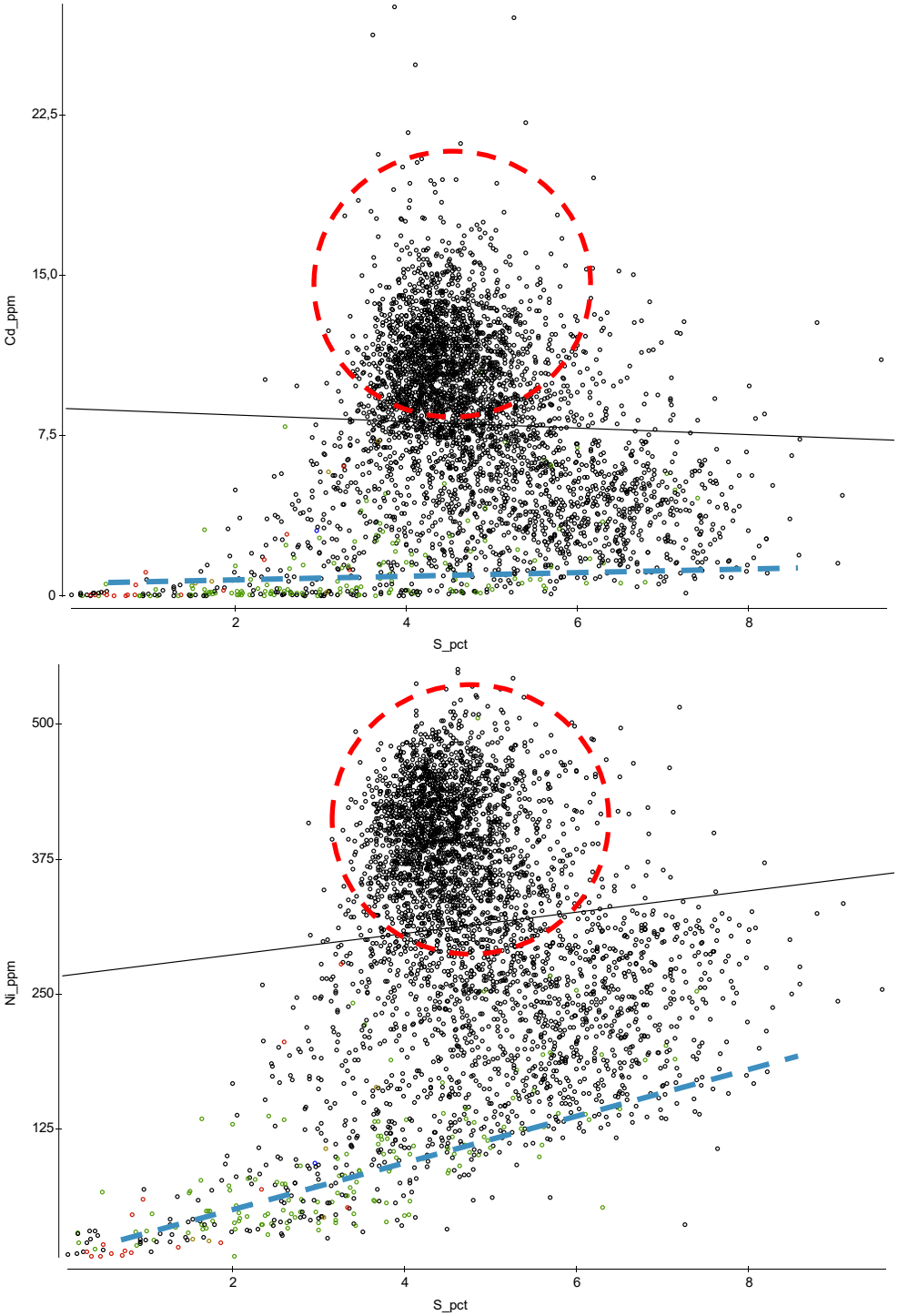
Figur 14 As, Co som har god korrelation till svavel.



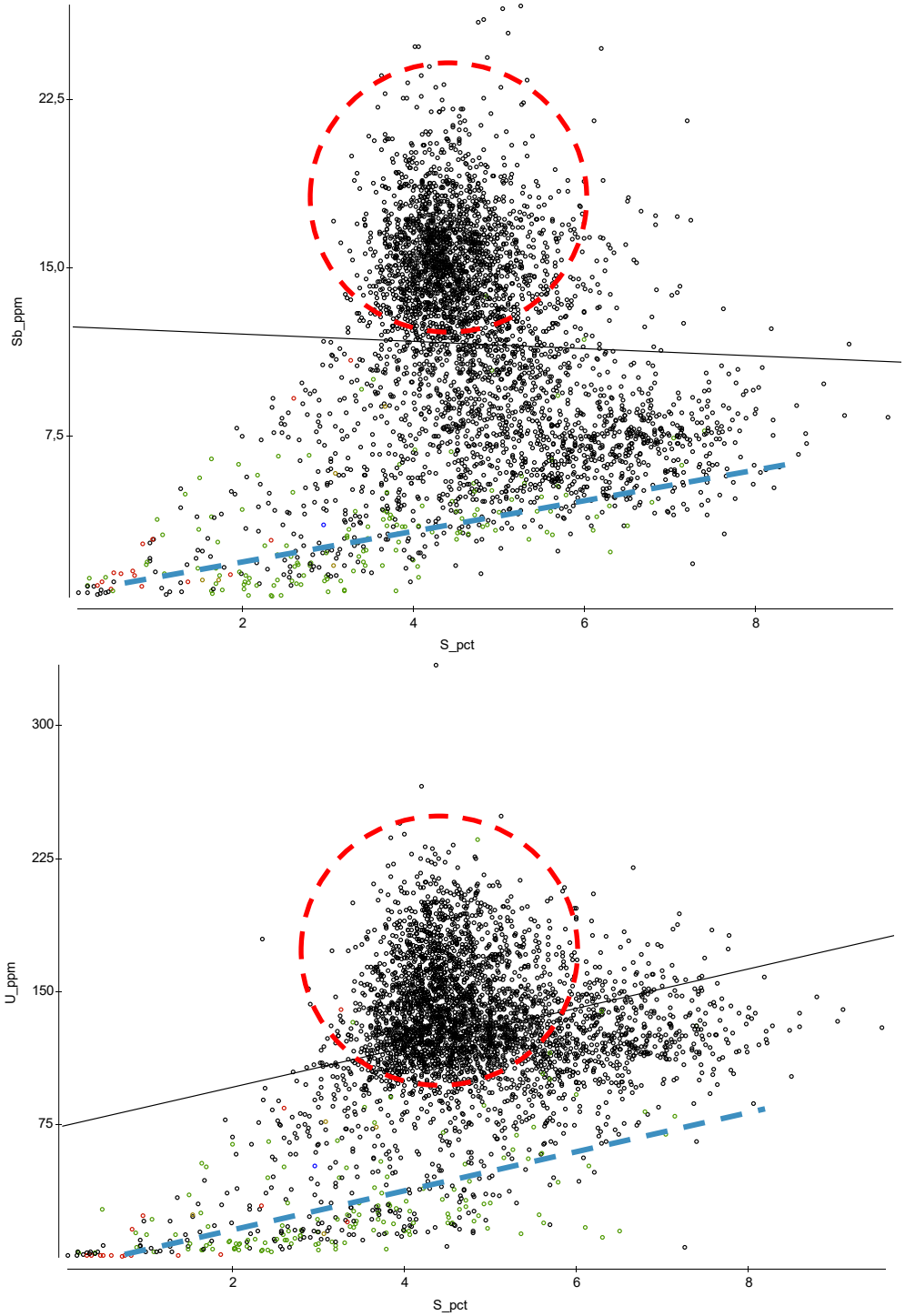
Figur 15 Cu som har god korrelation till svavel. Observera delförstoringen av Cu som funktion av S utan extremvärde medtaget (delförstoring inom streckad cirkel i den nedre figuren).

Ämnen som uppvisar ett mer komplicerat förhållande till svavel är kadmium, nickel, antimon och uran. Dessa element har sin maximala halt i anslutning till medianhalten av svavel och minskar således med både minskande samt ytterligare ökande svavelhalt. Utseendet antyder att det förekommer två delpopulationer inom delproverna för dessa element. Dels en med ett

tämligen linjärt förhållande mellan ämnet och svavel och dels en mer homogen, mer anrikad grupp (Figur 16-17).



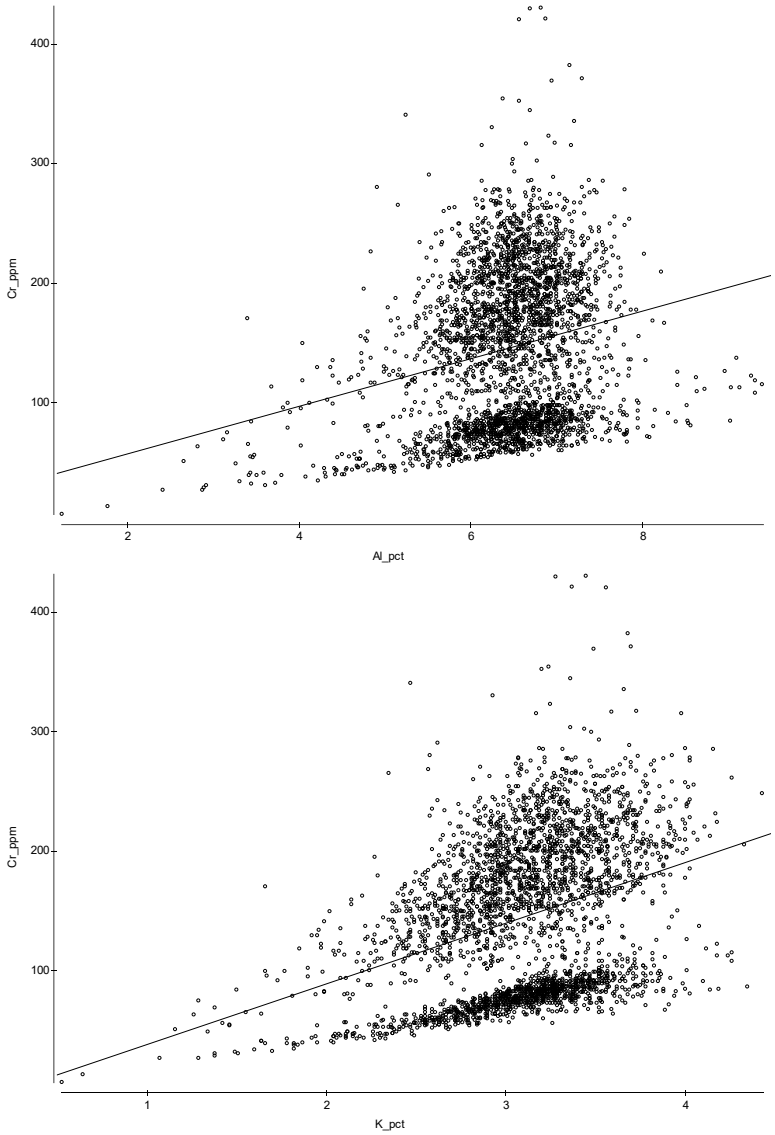
Figur 16 Kadmium och nickel som funktion av svavel. Röd ring anger alunskiffer anrikad med respektive element. Blå streckad linje anger konceptuellt förhållande om anrikade delprover skulle tas bort ur respektive figur.



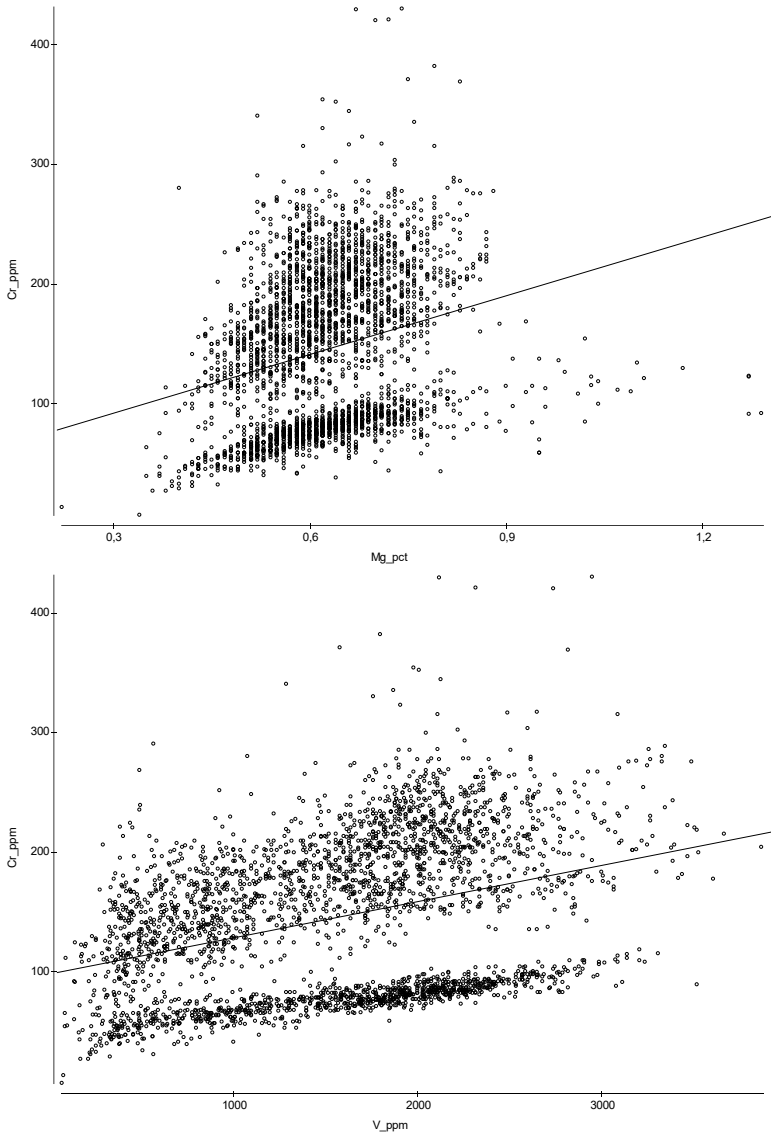
Figur 17 Antimon och uran som funktion av svavel. Röd ring anger alunskiffer anrikad med respektive element. Blå streckad linje anger konceptuellt förhållande om anrikade delprover skulle tas bort ur respektive figur.

Krom har ett förhållande till aluminium, kalium och magnesium (Figur 18-19) vilket påminner om förhållandet mellan kadmium, nickel och antimons förhållande till svavel. Förhållandet innebär att krom är anrikat i en delmängd av alunskiffern på samma sätt som kadmium, nickel och antimon. Anrikningen av krom är dock enbart delvis i samma delprov som anrikningen av kadmium, nickel och antimon (Figur 20–21) eftersom de högsta kromhalterna inte

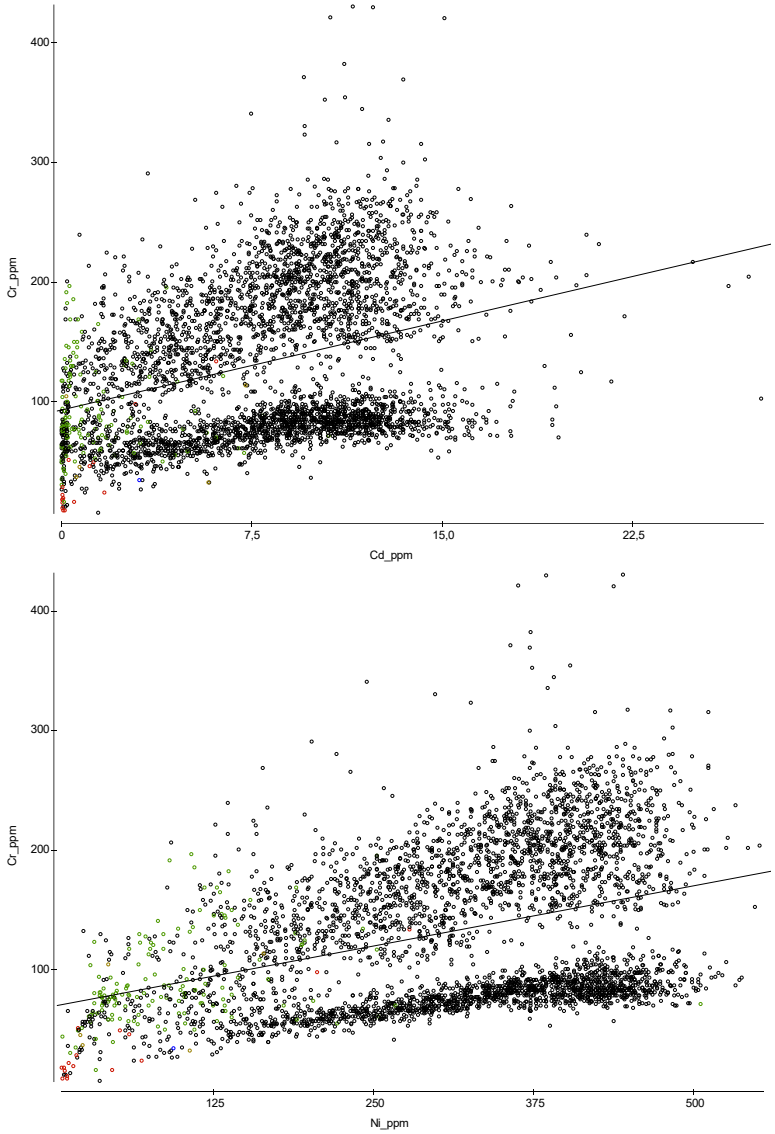
överensstämmer med de högsta halterna av kadmium, nickel och antimon. Krom är inte heller linjärt korrelerad till vanadin (Figur 19) varför det kan antas att anrikningen av krom i en delmängd av proverna inte är relaterad direkt till vanadinmineraliseringen eller till sulfidhalten. Krom ingår däremot troligen i silikatmineral innehållande Al-, K- och Mg och substituerar i dessa. Enligt den mineralogiska undersökningen är de aktuella mineralen mikroklin, klinoklor och muskovit vilka alla förekommer i alunskifferlitologin vilken representerar ett framtida gråberg samt B-malm. Krom har en negativ korrelation till kalcium vilket innebär att det inte ingår i Ca-mineral som kalcit eller gips vilka framförallt förekommer i kalkstenen. Krom har inte heller någon som helst korrelation till natrium vilket innebär att den inte ingår i albit vilken påträffades i gråberg samt B-malmsprovet vid den mineralogiska undersökningen. Därför uppträder alunskiffer, mineraliserad alunskiffer och kalksten som distinkta fördelningar för dessa element.



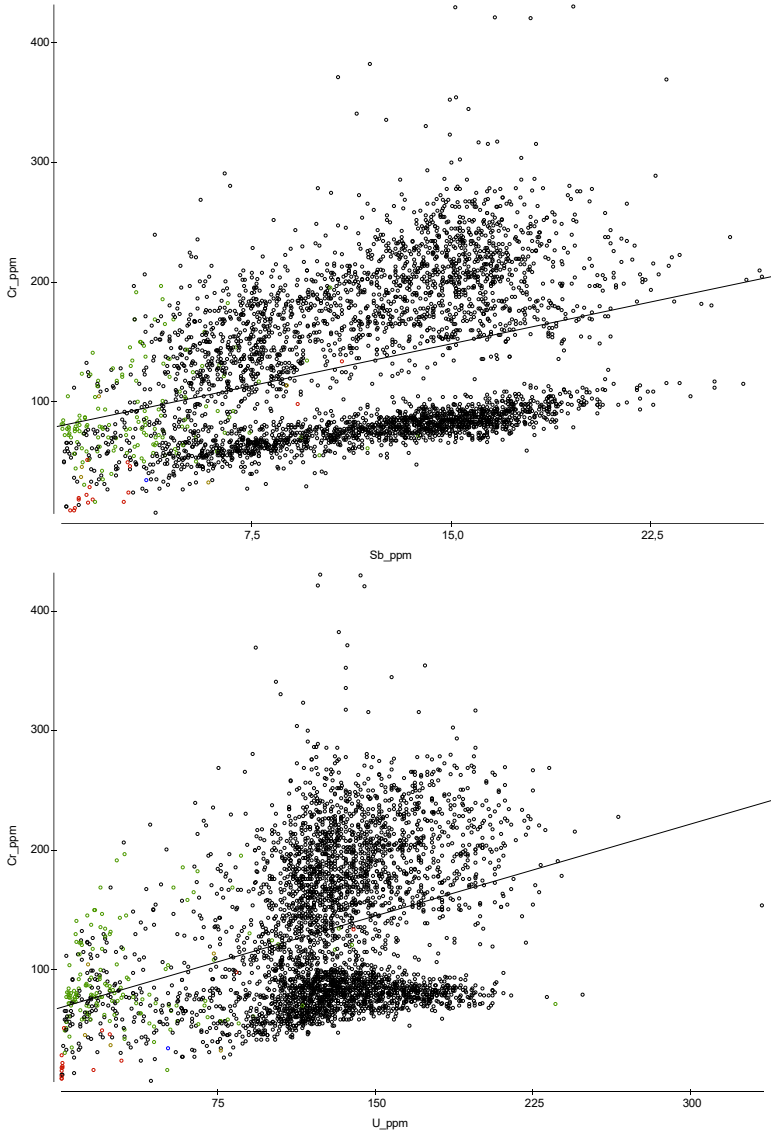
Figur 18 Förhållandet mellan Al, K, Mg och Cr.



Figur 19 Förhållandet mellan Mg, V och Cr.

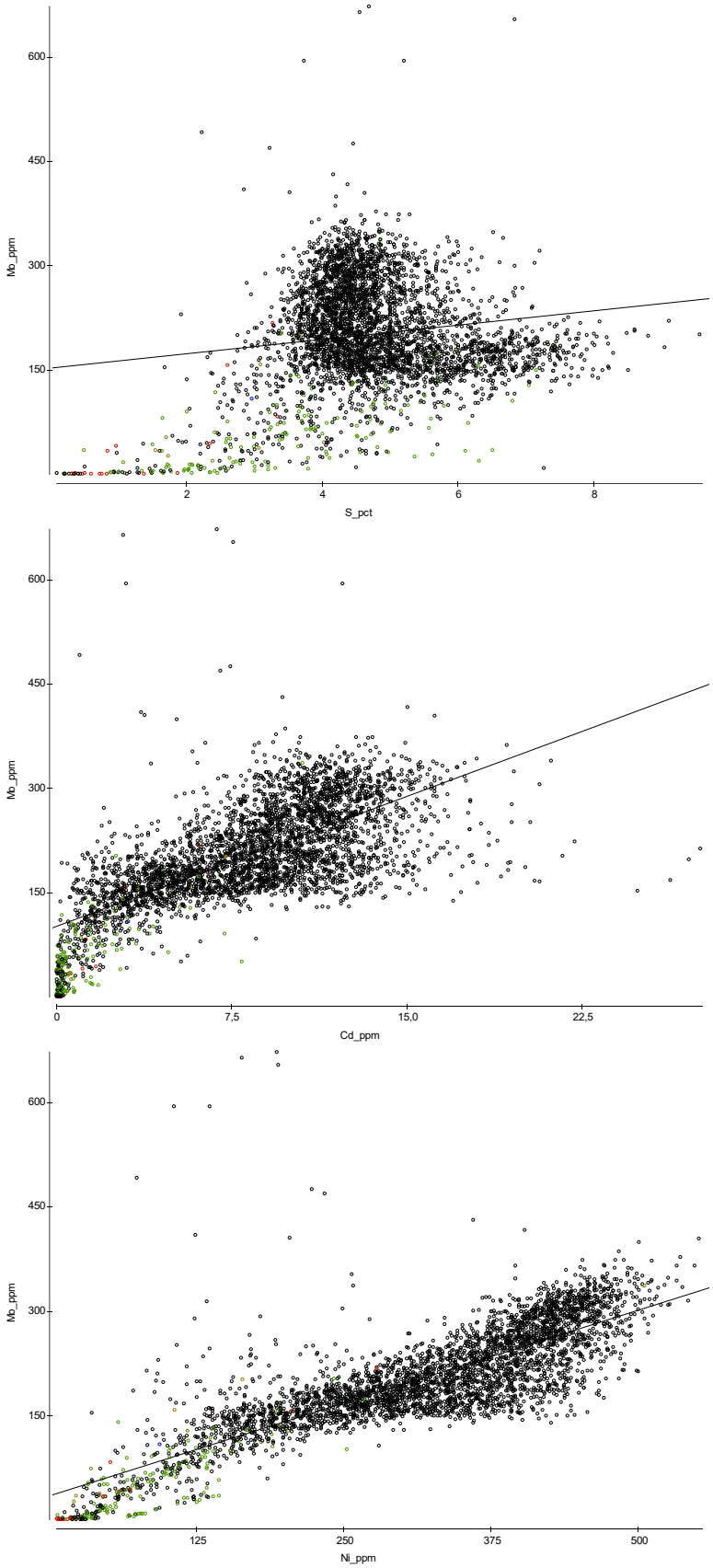


Figur 20 Förhållande mellan Cd, Ni och U.



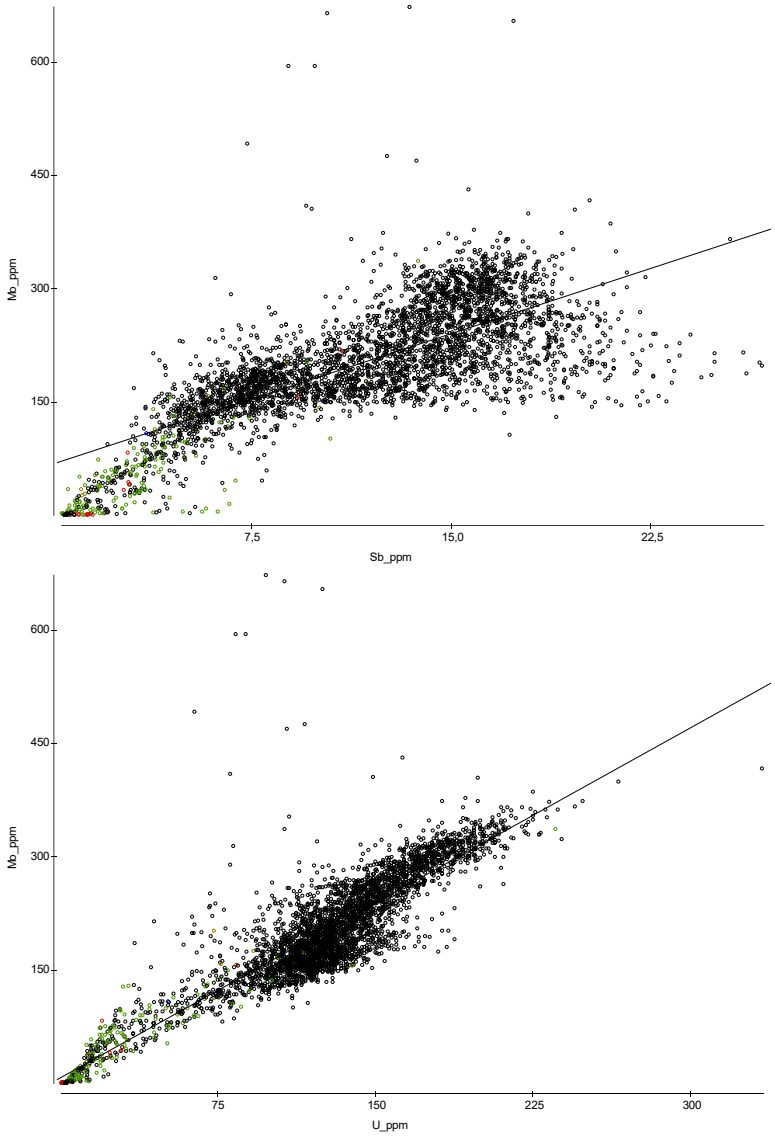
Figur 21 Förhållande mellan Cr, Sb och U.

Molybdens korrelation till svavel påminner om den för kadmium, nickel, antimon och uran med en uppdelning i två populationen med en mer homogen anrikning av Mo inom intervallet 4–6 vikt-% S. Korrelationen mellan Mo, Cd, Ni, Sb och U är linjär (Figur 22-23) varför halterna av respektive mineral är direkt korrelerad med varandra, dvs. de ingår troligen i samma mineral och då troligen som sulfider eller associerade till sulfiders bildningsmiljö vilket troligen är fallet för uran som kan fällas ut som uraninit (UO_2) i reducerande miljöer vid kontakt med pyrit eller adsorberats till organiskt material i en reducerande miljö där det även är troligt att sulfider bildas.



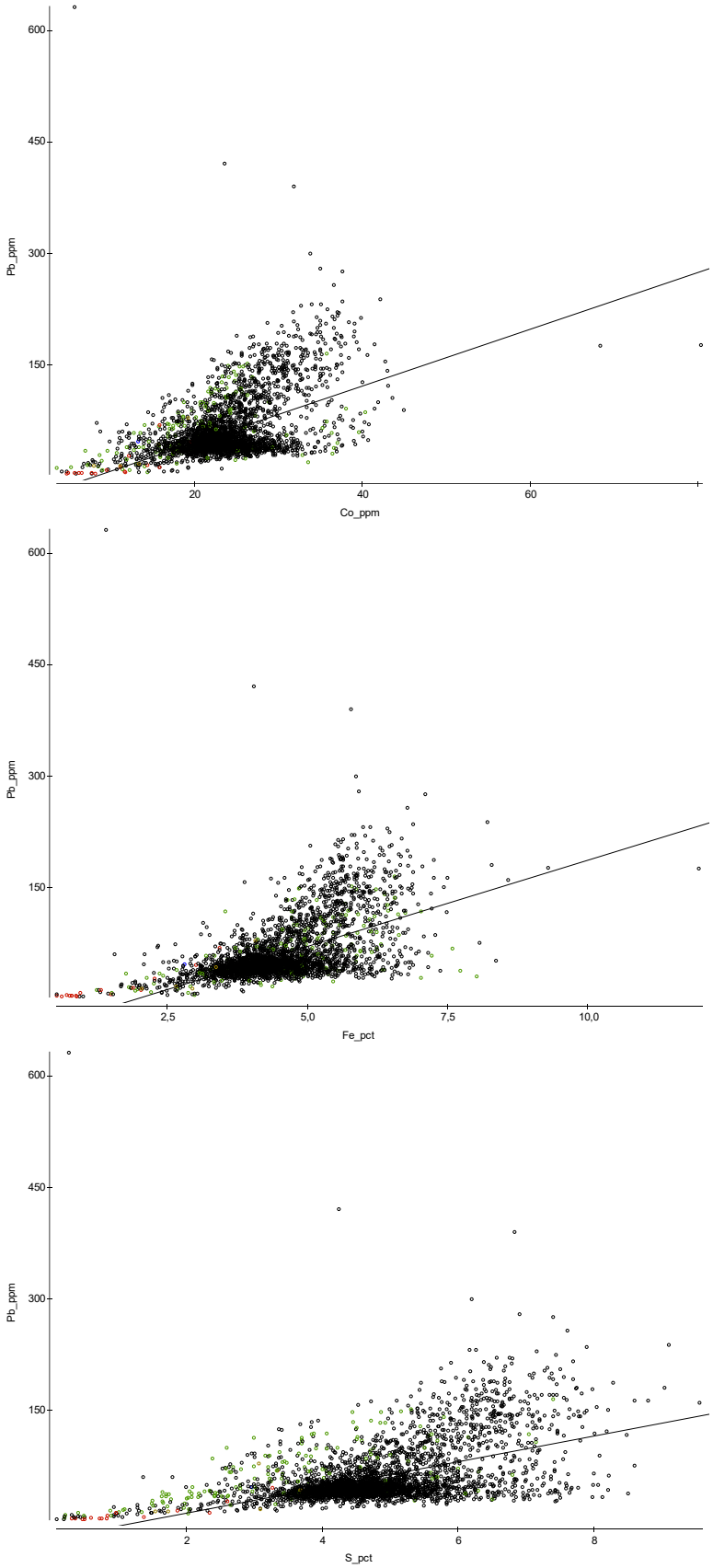
Figur 22 Mo som funktion av S, Cd och Ni.

Projektnummer: SE2300368
Projektidentitet: Häggån BK Vanadis



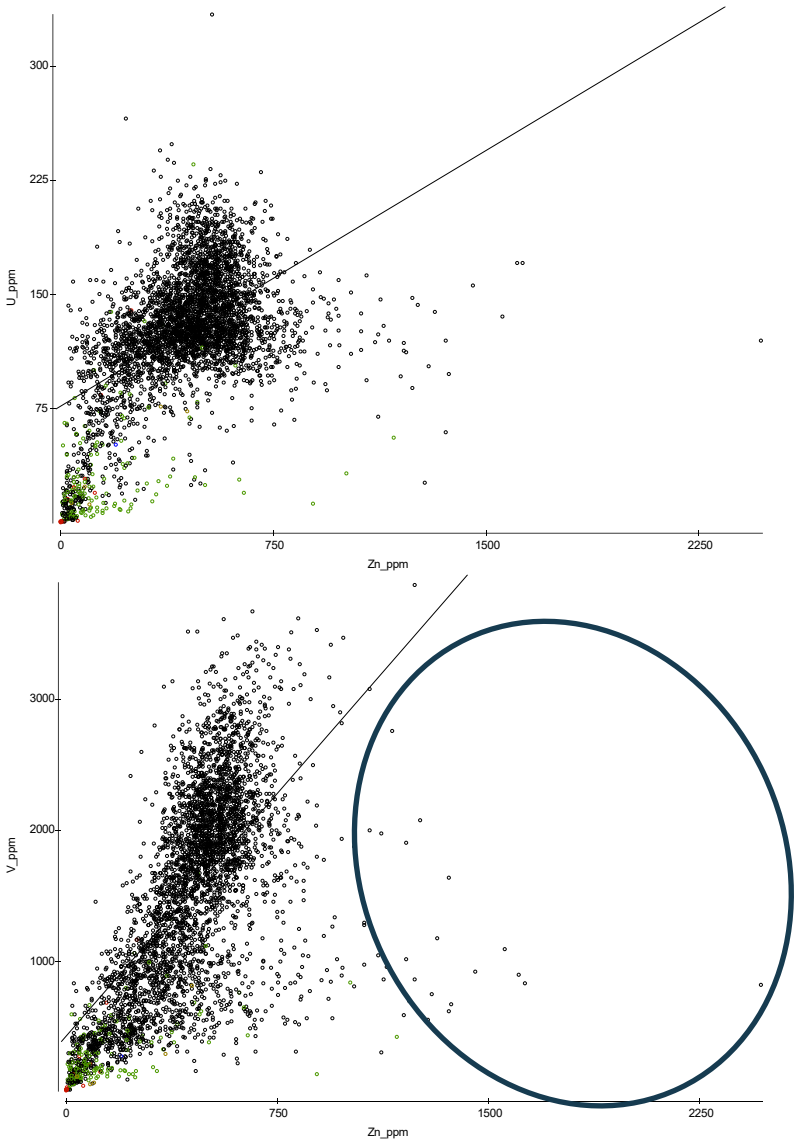
Figur 23 Mo som funktion av Sb och U.

Bly har en viss korrelation till kobolt samt järn och svavel (Figur 24). Korrelationen till kobolt visar en variation vilket troligen innebär att de till viss del förekommer i samma mineral vilket till övervägande delen borde vara i sulfidmineral givet korrelationen till järn och svavel. Bly uppvisar inte samma anrikning mellan 4–6 vikt-% svavel som flera av de övriga, troligen, sulfidrelaterade ämnena.



Figur 24 Förhållande mellan Pb och Co, Fe, S.

Uran uppvisar som tidigare redovisats en korrelation med kadmium, nickel, antimon och molybden men även med zink. Förhållandet är mindre tydligt för zink än de övriga ämnena, mest beroende på att trenden är relativt linjär upp till ca 100 ppm uran med en större spridning avseende zink ju högre halten blir (Figur 25). Troligen på grund av att zink är förekommande i andra mineral än enbart sulfider, exempelvis har vanadin och zink en korrelation vilket skulle kunna antyda att även zink i viss utsträckning förekommer i vanadiummineralet roscoelit ($K(V,Al,Mg)_2AlSi_3O_{10}(OH)_2$) medan uran enbart återfinns i direkt anslutning till sulfider. De högsta zinkhalterna, markerade med en cirkel i Figur 25, representerar även de högsta svavelhalterna (>4,5 vikt-%) varför det är troligt att zink i dessa prover förekommer i sulfider.



Figur 25 Förhållandet mellan U och Zn samt V och Zn.

Klassificering

Utvinningsavfall som gråberg klassificeras enligt bilaga 3 till avfallsförordningen (2020:614).

Gråberg klassificeras alltid som;

01 01 01 - Avfall från brytning av metallhaltiga material

Detta gäller oavsett om gråberget uppvisar farliga egenskaper eller inte. Denna klassificering gäller således både för gråberg från alunskiffer samt från kalksten.

Vid en kontroll av resultaten mot utvinningsavfallsförordningens (SFS2013:319) krav för inert avfall (6 §) så kan det fastställas att gråberget till viss del kan komma att sönderfalla eller lösas upp och detta då genom sulfidvittring och buffringsreaktioner. Avfallet innehåller även mer än 1 procent sulfidsvavel varför det inte kan klassificeras som inert med avseende på syrabildande egenskaper och utförda ABA-test visar att det är potentiellt syrabildande medan det däremot inte riskerar att självantända eller brinna som helhet. Gråberget innehåller som helhet högre halter av flertalet av de särskilt omnämnda ämnena än vad som bedömts vara svensk bakgrundshalt. Det är däremot att bedöma som fritt från sådana ämnen som används vid utvinning vilket utgörs av eventuellt odetonerat sprängämne. Gråberget kan således inte klassificeras som inert utan har bedömts ha potentiellt syrabildande egenskaper.

Halterna i gråberget från alunskiffer är generellt, för de särskilt omnämnda ämnena i 6 § p.4 samt uran och svavel, inte mer förhöjda än cirka en tiopotens, några andra ämnen av intresse som är förhöjda i samma eller högre utsträckning har inte identifierats. Detta innebär att en utvärdering relativt de 15 farliga egenskaper som generellt skall utföras i detta fall inte utförs eftersom haltgränserna för dessa egenskaper ligger på tiondels procent upp till procent medan gråberget som högst har en halt av 0,04 vikt-% som uppmätts för vanadin. Inte heller summerade halter kommer att leda till att haltgränserna kan överskridas.

Kalkstenen har extremt goda nettobuffrande egenskaper och innehåller ämneshalter under eller i paritet med svensk bakgrundshalt. Kalkstenen bedöms kunna klassificeras som inert utvinningsavfall i enlighet med 6§ utvinningsavfallsförordningen givet de olika upplösningsmetoderna för analys av ämneshalter.

B-malm klassificeras inte eftersom den inte utgör ett utvinningsavfall utan mellanlagras i avvaktan på anrikning.

Sammanfattningsvis så betraktas gråberget från alunskiffer som helhet ha potentiellt syrabildande egenskaper baserat på ABA-test och pågående kinetiska försök där karbonatförbrukningen överstiger sulfidförbrukningen. Samdeponering med kalksten skulle kunna leda till att nettobuffrande egenskaper kan erhållas totalt sett.

Slutsats

Gråberget från alunskiffer har klassificerats som *01 01 01 - Avfall från brytning av metallhaltiga material* och en jämförelse med kriterier för inert avfall (6§ i SFS 2013:319) har utförts. Slutsatsen är att gråberget från alunskiffer är potentiellt syrabildande vilket även så här långt bekräftats av de pågående kinetiska försöken (även om resultaten antyder att det kommer att ta mycket lång

tid). Därutöver så innehåller gråberget förhöjda halter av de särskilt omnämnda ämnena samt uran dock inte i sådana halter så att det uppfyller kriterier för farliga egenskaper[6].

Även den kalksten som kommer att brytas har karakteriserats och klassificerats. Den erhåller samma avfallskod som gråberg dvs. *01 01 01 - Avfall från brytning av metallhaltiga material* men klassificeras som nettobuffrande med halter i paritet med svensk bakgrund. Bedömning är således att kalksten borde gå att klassificera som inert avfall enligt 6§ utvinningsavfallsförordningen. De goda buffrande egenskaperna gör det lämpligt för samdeponering med det potentiellt syrabildande gråberget från alunskiffer.

Även B-malm har karakteriserats men denna klassificeras inte eftersom B-malm inte utgör ett avfall utan en resurs som avses anrikas. Egenskaperna är relativt likvärdiga gråberg från alunskiffer med den skillnaden att karbonatinnehållet och ämneshalterna är högre generellt. Detta medför att B-malm balanserar på gränsen till att bedömas som osäkert avseende dess syrabildande egenskaper och utvärdering av ABA-test. Det pågående kinetiska försöket, som startats upp för att undersöka dess potentiellt syrabildande förmåga visar så här långt, att B-malmen kommer att kunna bilda surt lakvatten på lång sikt. Inte heller B-malmen skulle klassificeras som farligt avfall utgående från dess halter.

[6] Egenskaper (HP1 till HP15) och faroangivelsekoder som finns listade i Avfall Sveriges rapport 2019:01 samt gränsvärden för farligt avfall enligt EG 2018/C 124/01

Bilaga 1
Provtagningsplan

Projektnummer: SE2300368
Projektidentitet: Häggån BK Vanadis

Geosyntec Consultants AB
Västra varvsgatan 3
972 36 Luleå

Provtagningsplan

Häggån

2023-06-20

Projektnummer: SE2300368
Projektidentitet: Häggån BK Vanadis

	Step	Resultat
	Definiera de huvudsakliga stegen i provtagningsplan	
1	**Identifiera sakägare**	
	2.1	Ägare: Vanadis Battery Metals AB
		Myndigheter:
		Tillsynsmyndighet: Länsstyrelsen i Jämtlands län
		Prövningsmyndighet: Bergsstaten
		Oberoende konsult: Geosyntec Consultants AB
2	**Identifiera målsättning**	
		Målet med provtagningsplanen är att uppfylla kraven på karakterisering såsom sammanställda i CEN/TR16365:2013 som är implementeringen av EU:s direktiv om utvinningsavfall. Detta är implementerat genom SFS 2013:319, utvinningsavfallsförordningen, i svensk lagstiftning.
	2.2	Detta är en systematiskt framtagen provtagningsplan för karakterisering av gråberg från en framtida utvinning av V, Mo, Ni och Zn. Denna provtagningsplan omfattar gråberg från representativa prov på bergarter från prospekteringsborrning inom fyndigheten. Prover är utvalda baserat på geokemiska analysresultat från genomförda prospekteringsborrningar.
3	**Bakgrundsinformation**	
	2.3	Vanadis Battery Metals AB planerar att bryta malm och anrika denna på plats. Malmen förekommer i en större mineralisering som påträffas 20–100 m under markytan. Brytning planeras att ske i dagbrott (flera) och gråberg samt anrikningssand kommer att nyttjas för löpande återfyllning.
		Nederbörd som infiltrerar, bland annat genom återfyllt utvinningsavfall bildar lakvatten som avrinner till pumpgrop i dagbrottet så länge som detta länshålls. Därefter kommer dagbrottet att vattenfyllas genom inträngande grundvatten och direkt nederbörd. Under drift blir således bildat lakvatten en del av gruvans process- och länshållningsvatten.

		Anrikningsprocessen omfattar flera steg med bland annat särhållning av gråberg respektive B-malm från malmen som rostas och lakas. Anrikningssand (lakrest) samt fällningsprodukter uppkommer inne i anrikningsverket. Anrikningssand avvattnas och särhålls från vått avfall som uppkommer vid rening av lakvätska.
		Vanadin är det huvudsakliga malmmineralet även om andra metaller som Mo, Ni och Zn utgör en del av den totala malmmängden och uppträder i relativt konstanta halter utöver mineraliseringen.
		Framtida gråbergsenheter (främst karbonatbergart) i Häggån har tidigare provtagits systematiskt vilket ge underlag till en grundläggande karakterisering. Karakterisering av Häggån utgörs av ett uttag av representativa prover på förekommande bergarter, i huvudsak kalksten (baserat på deras kemiska signatur). Även på marginalmalm (alunskiffer <1560 ppm V) utförs en fördjupad karakterisering där provurval av representativa prover baseras på tidigare systematisk provtagning och analys. Sammanslagningsprov används för att karakterisera i huvudsak bergarternas lakningsbeteende över tid. Resultaten används slutligen för att utföra en karakterisering och klassificering enligt SFS 2013:319.
4	**Identifierade detaljerade mål**	
	2.4	Avsikten med provtagning är:
		a. Grundläggande karakterisering av framtida gråberg och anrikningssand från Häggån vanadinfyndighet
		b. Utvärdera om utvinningsavfallet kan klassificeras som inert avfall i enlighet med riktlinjer i SFS 2013:319
		c. Fördjupad karakterisering på framtida gråberg och anrikningssand med avsikt att utvärdera utlakningspotentialen för huvud- och spårelement
5	**Bestäm generell nivå**	
	2.5	Grundläggande och fördjupad karakterisering för att möjliggöra en klassificering av framtida utvinningsavfall från Häggån.
6	**Identifiera analyser och vilka element som skall ingå**	
	2.6	**Framtida utvinningsavfall (gråberg och anrikningssand), analyser:**

		1. Krossning, malning, neddelning av delprov utförs av ALS, sammanslagningsprov utförs av ALS.
		2. Huvud- och spårelement (ME-MS61, four acid digestion ICPMS/ICPAES, 48–52 element, ALS) på delprov.
		3. ABA test enligt EN 15875 /2011 av ALS (inklusive svavelspeciering) på delprov.
		4. Mineralogisk analys av ALS (XRD enligt Rietvelds metod) på sammanslagningsprov som används till kinetiska försök.
		5. Långtidsutlakningstester (kinetiska försök, utförs på samlingsprov av respektive bergart samt på representativt prov av anrikningssand)
7	**Hälsa- och säkerhetsaspekter vid provtagning**	
	2.7	Inga tillämpliga. Uttag av borrkärna eller reject sker av Vanadis:s personal enligt tillämpliga rutiner
8	**Välj/ta fram provtagningsmetodik**	
	Identifiera målsättning (teknisk)	
	2.8.1	Framtida gråberg, anrikningssand och marginalmalm
		Syftet är att utvärdera utlakningsbeteendet för framtida gråberg samt anrikningssand och marginalmalm. Det ska också bedömas om det framtida utvinningsavfallet kan klassificeras som inert enligt kriterier i SFS 2013:319. Resultaten ska framgent kunna utgöra underlag för utvärdering av lakvattnens påverkan på recipienter.
9	**Identifiera provtagningspopulationen**	
	2.8.1.1	Det finns två huvudtyper av utvinningsavfall: Gråberg från gruva och sovringsprocessen samt anrikningssand från anrikningsprocessen. Därtill tillkommer fällningsprodukter från processvattnet.
10	**Bestäm provtagningsomfattning**	
	2.8.1.1	Gråberg utvärderas dels baserat på prospekteringsanalyser (fullanalys) och dels genom uttag av representativa delprov på gråberg för ABA som motsvarar låg till hög svavelhalt. Sammanslagningsprov används för mineralogi samt kinetiska försök. Antalet delprov för fullanalys skall överstiga minsta rekommenderade antal. Provtagning sker från borrkärna eller rejects och utförs av bolaget. Anrikningssand undersöks på representativt prov från anrikningsförsök. Representativa prov på fällningsprodukter kan inte erhållas pga provmängd.
11	**Bedöm variabiliteten**	

	2.8.1.2	Gråberg representerar den delmängd som bryts i dagbrott och som inte innehåller värdemineral. Gråberget består enligt de geologiska karteringarna av kalksten respektive alunskiffer. Båda bergarterna undersöks. Haltvariationerna i respektive bergart bedöms genom de befintliga analyser som finns i bolagets prospekteringsdatabas. I utvärderingen kommer medel, median, min och max att bedömas för respektive bergart. Anrikningssanden utgörs av pilotanrikning på representativt sammanslaget malmprov som motsvarar förväntad genomsnittlig sammansättning. Anrikningsverket kommer att köras med en relativt konstant ingående halt varför variabiliteten över tid kommer att vara låg.
12	**Identifiera omfattningen**	
	2.8.1.3	Antalet delprov för respektive gråbergstyp skall överstiga kravet för slumpmässig provtagning för det aktuella tonnaget (MEND 1994). Gråbergsprover kommer från systematisk provtagning i djup och över dagbrottets yta. Antalet delprov på anrikningssand är ett och är baserat på ett större antal delprover från borrkärna som representerar en typisk förväntad sammansättning avseende värdemineral.
13	**Välj statistiskt angreppssätt**	
	2.8.1.4	Systematisk för gråberg i djup och utbredning uppdelat per bergart.
14	**Välj önskad konfidensgrad**	
	2.8.1.5	För att bedöma om materialet kan karakteriseras som inert avseende syrabildande egenskaper så skall genomsnittshalten av sulfidsvavel vara lika med eller lägre än 0,1 vikt-% alternativt mellan 0,1 och 1 vikt-% med en NPR-kvot om 3 eller högre.
15	**Välj statistisk parameter**	Svavel
16	**Identifiera provtagningssystematik**	
	2.8.2.1	Systematisk analys genom hela fyndigheten samt statistisk utvärdering av hela borrdatabasen med analyser. Prover analyseras som delsträcka per borrkärna i form av kvarts- eller halvkärna. Duplikat och referensprov för att bedöma analysmetodens noggrannhet har lämnats in tillsammans med borrkärna för analys.
17	**Identifiera minsta provavstånd samt provstorlek**	
	2.8.2.2	Ej relevant. Borrkärneanalys sker per meter borrlängd och bryts vid bergartsgräns. För anrikningssand tillverkas ett sammanslagningsprov baserat på anrikning av malm. Av detta tas ca 5 kg ut för karakterisering. Neddelning sker med provdelare.
18	**Bestäm antalet delprov**	
	2.8.2.2	För gråberg ska som tidigare redovisats antalet delprov överstiga minimikravet för slumpmässig provtagning från borrkärna och dessa prov är systematiskt utplacerade i djup och yta. Detta för båda gråbergstyperna. För anrikningssand har ett representativt malmprov från en större mängd borrkärna tillverkats och där delprov valts ut baserat på dess halt av värdemineral.

19	**Bestäm fördelning mellan sammanslagningsprov och delprov**	
	2.8.2.3	Initialt sker utvärdering av totalhalter samt statistiska samband för de två bergartstyperna på enskilda delprov från borrning tillsammans med resultat från geologisk kartering. För fortsatt arbete utnyttjas resultatet från den statistiska bearbetningen där exempelvis svavelhalt är en parameter som skall återspeglas från låg till hög i de delprov som utgör underlag för ABA-test. Dessa prov, som sammantaget skall ha en svavelhalt motsvarande medelhalt i alla analyserade prover för bergarten används därefter för mineralogi och kinetiska försök. Sammanslagningsprov sker per bergart. Anrikningssandprovet är ett sammanslagningsprov på ett större antal representativa prov på malm.
20	**Identifiera lämplig provtagningsmetodik**	
	2.9	För gråberg planeras ingen fältprovtagning. Analyser från systematisk analys under prospekteringsarbetet finns tillgängligt och fortsatt urval genomförs efter statistisk analys av dessa. Anrikningssand erhålls som restprodukt i pilotanrikningsförsök.
21	**Möjliga problem som kan uppkomma under arbetet**	
		Att utvalda delprov för fortsatt analysarbete inte är tillgängliga (finns enbart kvartskärna kvar) är det mest troliga problem som kan uppkomma. Om borrkärna saknas så noteras detta och motsvarande alternativ tas fram efter genomgång av resultatet från den statistiska utvärderingen.
22	**Fastställ noggrant provtagningens lokalisering**	
		Koordinat, borrhålets vinkel samt borrmeter finns redan tillgängligt för borrhål. Detta innebär att alla gråbergsprov samt även malmprov för anrikningsförsök är koordinatsatta.
23	**Fastställ noggrant datum och tid för provtagning**	
		Utfört i och med att borrning redan utförts liksom analyser (halter) med noterade datum.
24	**Fastställ vilka som skall närvara vid provtagning**	
		Ingen från Geosyntec eftersom borrkärna redan är upptagen och i förråd. Bolagets geolog tar ut delprov efter instruktion från Geosyntec. Geosyntec ombesörjer analysbeställning hos lab.
25	**Detaljkrav för fältnoteringar (på plats)**	
		Ej aktuellt
26	**Fastställ metodik för provmärkning**	
		Enligt borrkärnekarteringens provbeteckning.
27	**Metodik för provberedning/neddelning**	

		Delprov på gråberg sågas och neddelas på laboratorium (ALS) i samband med provberedning inför analys. Resterande andel av neddelat prov sparas tills vidare. Ej använd del av borrkärna returneras till bolaget. Anrikningssand splittas efter anrikning till ca 5 kg delprov och skickas till lab där vidare neddelning sker (ALS) i samband med provberedning inför analys.
28	**Konservering av prov**	
		Prov torkas vid maximalt 50 °C. Ingen annan konservering av prov sker.
29	**Provförpackning**	
		Prov lagras och transporteras i plasthinkar, plastpåsar eller i trälåda.
30	**Lagring**	
		Borrkärna lagras i bolagets borrkärneförråd. Resterade prover som inte använts till analyser lagras under en övergångsperiod hos lab (ALS)
31	**Transport**	
		Standardtransport till lab med ”chain of custody” schema
32	**Instruktioner till laboratoriet**	
		Gråberg i form av borrkärna skickas till ALS. Geosyntec skickar analysbeställning. Bolaget skickar anrikningssand till ALS. Geosyntec skickar analysbeställning. Restmaterial sparas och skickas efter en mellanlagring tillbaka till bolaget.
33	**Analytiskt laboratorium**	
		ALS Piteå

Bilaga 2
Analysrapporter

ALS Scandinavia AB
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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Finalized Date: 7-MAR-2024
Account: STOCEG

CERTIFICATE PI24032186

Project: SE 2300368 Haggan BK Vanadis

P.O. No.: SE2300368

This report is for 41 samples of Drill Core submitted to our lab in Pitea, Sweden on 3-FEB-2024.

The following have access to data associated with this certificate:

ERIK KARLSSON HELENA KARLSSON	HELENA KARLSSON	ERIK KARLSSON

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-22	Sample login - Rcd w/o BarCode
CRU-31	Fine crushing - 70% <2mm
SPL-22	Split sample - rotary splitter
SPLIT-Z	Pulp split for send out
SPLIT-Y	Reject split for send out
SAM-COR01	Sample Core from Boxes - Regular
LOG-SAW01	Log Sample derived from Core Saw Process
ROL-21	Manual Sheet Rolling
SPL-22Y	Split Sample - Boyd Rotary Splitter
PUL-31d	Pulverize Split - duplicate
PUL-31	Pulverize up to 250g 85% <75 um
CRU-QC	Crushing QC Test
PUL-QC	Pulverizing QC Test

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
S-IR08	Total Sulphur (IR Spectroscopy)	LECO
S-ICP19	Sulphate Sulphur / By ICP-AES	ICP-AES
S-CAL19	Sulphide Sulphur (Calculated)	LECO
C-IR07	Total Carbon (IR Spectroscopy)	LECO
C-IR06	Non-Carbonate C by HCl Leach, IR Spec	LECO
C-CAL04	Inorganic Carbon	LECO
OA-VOL08EU	AP & NP of Sulphidic Waste	
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 *****

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

Signature:

Andrey Tairov, Technical Manager, Ireland

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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

Sample Description / Method / Analyte / Units / LOD	WEI-21 Recvd Wt. kg 0.02	CRU-QC Pass2mm % 0.01	PUL-QC Pass75um % 0.01	ME-MS61 Ag ppm 0.01	ME-MS61 Al % 0.01	ME-MS61 As ppm 0.2	ME-MS61 Ba ppm 10	ME-MS61 Be ppm 0.05	ME-MS61 Bi ppm 0.01	ME-MS61 Ca % 0.01	ME-MS61 Cd ppm 0.02	ME-MS61 Ce ppm 0.01	ME-MS61 Co ppm 0.1	ME-MS61 Cr ppm 1	ME-MS61 Cs ppm 0.05
19DDHG091 2.6 - 3.1	0.31	86.8	96.0	0.06	1.72	5.0	320	0.56	0.21	30.9	0.04	24.1	9.2	12	1.52
19DDHG091 5.75 - 6.28	0.42	81.3	94.0	0.01	1.48	5.3	260	0.48	0.07	31.1	0.03	22.1	5.3	10	1.54
19DDHG091 10 - 10.54	0.42			<0.01	2.37	12.8	260	0.71	0.11	27.6	0.03	33.8	6.8	17	3.04
19DDHG089 4.72 - 5.25	0.48			0.03	1.86	11.8	230	0.63	0.10	30.0	0.05	23.5	10.8	13	2.43
19DDHG089 6.48 - 6.98	0.36			0.03	2.53	24.5	280	0.81	0.17	27.6	0.11	26.7	19.8	17	3.38
19DDHG089 10.74 - 11.29	0.33			0.02	2.36	6.6	200	0.70	0.12	27.8	0.04	32.4	13.6	16	3.83
19DDHG088 3.07 - 3.55	0.42			<0.01	2.20	2.9	300	0.77	0.17	29.3	0.04	31.8	8.7	15	2.42
19DDHG088 5.95 - 6.45	0.36			<0.01	2.06	3.5	160	0.61	0.07	29.0	0.04	28.6	5.2	14	2.47
19DDHG086 5.27 - 5.8	0.34			<0.01	1.97	2.4	120	0.66	0.11	29.6	0.03	27.9	7.3	12	2.23
19DDHG086 10.8 - 11.3	0.42			<0.01	2.27	5.1	130	0.76	0.06	28.7	0.03	27.9	7.5	14	3.13
19DDHG086 15 - 15.54	0.42			<0.01	2.40	8.1	120	0.77	0.10	28.4	0.05	30.0	8.2	15	3.77
19DDHG085 7.45 - 8	0.32			0.03	3.56	136.5	270	2.31	0.18	15.85	<0.02	46.9	21.9	32	7.00
19DDHG085 10.93 - 11.5	0.40			0.14	8.17	16.1	520	2.77	0.30	1.01	0.02	94.5	20.7	80	13.35
19DDHG085 20.75 - 21.23	0.37			0.04	1.36	44.4	100	0.70	0.04	30.0	0.13	26.4	4.2	11	2.80
19DDHG080 3.89 - 4.4	0.35			<0.01	2.28	0.9	1480	0.74	0.09	28.3	0.03	28.7	7.0	16	2.59
19DDHG080 5.48 - 5.9	0.35			<0.01	1.83	4.1	470	0.60	0.09	29.8	0.05	26.3	8.4	12	2.03
19DDHG080 11.9 - 12.45	0.41			0.02	2.46	4.5	200	0.75	0.12	28.4	<0.02	31.2	7.9	16	3.49
19DDHG079 3.45 - 3.96	0.35			<0.01	2.17	11.2	370	0.73	0.61	29.1	0.03	27.9	8.1	14	2.51
19DDHG079 8.85 - 9.38	0.36			0.01	2.06	7.7	180	0.68	0.15	29.7	0.03	26.2	6.9	13	2.63
19DDHG079 11.36 - 11.85	0.38			0.01	2.29	3.0	170	0.71	0.11	29.5	0.02	30.2	6.1	14	3.06
19DDHG078 5 - 5.48	0.36			0.05	2.44	37.6	230	1.18	0.07	23.1	0.77	37.7	5.3	21	7.51
19DDHG078 5.73 - 6.23	0.30			0.02	1.28	6.7	140	0.69	0.04	31.8	0.03	22.4	2.4	9	2.64
19DDHG077 5.35 - 5.85	0.27			<0.01	1.62	1.1	5440	0.48	0.09	29.8	0.04	27.6	6.0	16	1.32
19DDHG077 11.85 - 12.34	0.34			<0.01	1.48	0.7	1550	0.52	0.19	32.1	0.05	29.2	6.5	11	1.53
19DDHG077 14.33 - 14.85	0.44			<0.01	1.88	2.5	810	0.63	0.10	30.5	0.07	27.2	7.3	12	2.06
19DDHG076 4 - 4.5	0.36			<0.01	1.86	2.6	530	0.61	0.09	30.6	0.04	25.9	7.5	11	2.08
19DDHG076 6.49 - 7.08	0.37			<0.01	2.01	6.4	230	0.64	0.07	30.1	0.03	27.7	10.6	12	2.29
19DDHG076 11.64 - 12.12	0.38			0.01	3.36	4.5	220	1.01	0.11	24.3	0.04	43.1	9.6	22	5.13
19DDHG075 4.93 - 5.46	0.35			0.01	1.38	0.5	490	0.49	0.12	32.1	0.04	25.9	5.6	10	1.32
19DDHG075 9.57 - 10.11	0.37			<0.01	2.06	0.9	640	0.70	0.12	29.8	0.02	28.0	7.3	13	2.11
19DDHG075 14.23 - 14.75	0.40			<0.01	1.92	6.6	610	0.67	0.25	30.0	0.03	28.2	11.8	13	1.96
19DDHG074 5.27 - 5.79	0.39			<0.01	1.86	2.4	4510	0.53	0.08	29.3	0.06	26.9	5.9	18	1.62
19DDHG074 7.5 - 8	0.34			<0.01	2.54	1.2	5260	0.82	0.11	27.7	0.06	33.3	8.3	21	2.55
19DDHG074 13.49 - 14.03	0.31			<0.01	2.47	0.3	1050	0.87	0.11	28.1	0.03	33.5	8.9	18	2.60
18DDHG072 2.23 - 2.8	0.37			<0.01	1.38	5.2	1180	0.51	0.10	31.8	0.04	28.0	6.6	11	1.26
18DDHG072 13.72 - 14.28	0.38			<0.01	1.66	3.7	240	0.55	0.10	31.4	0.05	23.9	7.7	12	1.94
19DDHG090 5.31 - 5.85	0.40			0.11	1.43	27.4	110	0.96	0.05	29.4	0.08	28.2	3.1	14	2.65
19DDHG090 5.85 - 6.35	0.40			0.06	3.09	16.7	210	1.41	0.11	22.3	0.04	45.4	6.5	30	6.72
18DDHG071 2.33 - 2.86	0.38			0.01	1.70	4.4	170	0.56	0.07	30.4	0.04	24.1	6.7	11	1.87
18DDHG071 5.45 - 5.95	0.37			<0.01	2.99	5.9	240	0.89	0.11	26.4	0.02	38.3	8.5	20	4.18

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

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118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

Sample Description / Method / Analyte / Units / LOD	ME-MS61 Cu ppm 0.2	ME-MS61 Fe % 0.01	ME-MS61 Ga ppm 0.05	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	ME-MS61 In ppm 0.005	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2
19DDHG091 2.6 - 3.1	29.5	1.16	4.55	0.12	0.8	0.021	0.75	10.0	8.9	0.40	1105	0.54	0.06	2.9	12.2
19DDHG091 5.75 - 6.28	8.2	1.08	3.89	0.12	0.7	0.016	0.67	10.1	7.6	0.41	1100	0.23	0.03	2.5	11.0
19DDHG091 10 - 10.54	11.6	1.33	6.07	0.12	1.2	0.033	1.10	15.4	11.2	0.60	1060	0.28	0.05	4.3	11.2
19DDHG089 4.72 - 5.25	25.0	1.24	4.81	0.07	0.8	0.017	0.87	10.1	8.7	0.46	1035	0.88	0.04	3.2	16.6
19DDHG089 6.48 - 6.98	6.6	1.38	6.69	0.09	1.1	0.021	1.20	11.4	9.9	0.52	993	1.39	0.07	4.3	22.9
19DDHG089 10.74 - 11.29	20.4	2.05	6.24	0.10	1.4	0.041	1.14	14.8	10.0	0.58	1095	1.58	0.06	4.3	12.5
19DDHG088 3.07 - 3.55	5.6	1.58	5.68	0.09	1.3	0.022	0.86	14.0	17.1	0.52	1235	0.30	0.12	3.9	15.0
19DDHG088 5.95 - 6.45	9.7	1.18	5.28	0.10	1.0	0.029	0.91	12.6	11.2	0.57	1240	0.18	0.04	3.5	9.1
19DDHG086 5.27 - 5.8	13.5	1.05	5.14	0.09	0.9	0.019	0.89	11.4	10.4	0.51	1440	0.12	0.05	3.3	13.4
19DDHG086 10.8 - 11.3	19.8	1.18	5.79	0.07	1.0	0.020	1.04	13.2	12.1	0.60	1235	0.25	0.05	4.0	13.0
19DDHG086 15 - 15.54	5.2	1.34	6.39	0.07	1.1	0.022	1.07	13.8	13.0	0.61	1250	0.62	0.08	4.5	14.2
19DDHG085 7.45 - 8	24.8	6.21	10.65	0.10	1.8	0.032	1.67	23.8	33.0	0.81	791	4.26	0.15	7.5	17.3
19DDHG085 10.93 - 11.5	35.2	3.14	23.1	0.20	4.2	0.061	3.79	41.3	43.8	1.12	204	1.54	0.55	16.8	50.0
19DDHG085 20.75 - 21.23	9.3	1.69	3.50	0.07	0.7	0.013	0.69	12.4	10.2	0.36	822	8.62	0.04	2.8	8.8
19DDHG080 3.89 - 4.4	2.1	1.68	5.93	0.06	1.1	0.021	0.93	13.2	14.2	0.52	1040	0.36	0.05	4.1	14.0
19DDHG080 5.48 - 5.9	13.8	1.17	4.92	0.07	0.8	0.024	0.82	11.7	9.8	0.42	1085	0.44	0.03	3.4	13.5
19DDHG080 11.9 - 12.45	9.9	1.18	6.65	0.11	1.1	0.028	1.16	15.0	10.4	0.53	1175	0.20	0.04	4.7	11.0
19DDHG079 3.45 - 3.96	6.7	1.26	5.75	0.09	0.9	0.024	0.98	12.9	11.5	0.48	980	0.34	0.04	4.0	13.8
19DDHG079 8.85 - 9.38	9.2	1.05	5.59	0.10	1.0	0.020	0.98	12.4	8.9	0.49	1045	0.34	0.03	3.9	11.6
19DDHG079 11.36 - 11.85	6.0	1.14	6.07	0.09	1.0	0.024	1.09	14.2	9.6	0.52	1240	0.22	0.03	4.4	10.1
19DDHG078 5 - 5.48	12.6	5.49	6.00	0.10	1.2	0.030	1.22	17.6	17.8	0.45	743	7.51	0.11	4.6	11.0
19DDHG078 5.73 - 6.23	4.9	0.93	3.11	0.06	0.6	0.018	0.64	11.3	8.9	0.36	857	1.44	0.02	2.7	3.9
19DDHG077 5.35 - 5.85	4.3	1.40	4.44	0.07	0.9	0.023	0.58	13.6	13.2	0.43	1370	0.42	0.10	3.7	14.0
19DDHG077 11.85 - 12.34	1.7	1.12	4.17	0.07	0.8	0.015	0.63	13.2	8.4	0.36	1440	0.20	0.06	3.1	11.4
19DDHG077 14.33 - 14.85	1.7	1.18	5.09	0.07	0.9	0.021	0.81	12.6	10.6	0.42	1340	0.56	0.07	3.7	12.8
19DDHG076 4 - 4.5	15.5	1.21	5.01	0.07	0.8	0.016	0.85	12.0	9.7	0.45	1085	0.25	0.04	3.5	12.9
19DDHG076 6.49 - 7.08	14.0	1.27	5.22	0.07	0.9	0.023	0.92	13.2	10.6	0.50	1110	0.23	0.03	3.8	13.8
19DDHG076 11.64 - 12.12	37.4	1.57	8.77	0.10	1.6	0.039	1.59	21.8	16.2	0.72	918	0.16	0.11	6.4	13.3
19DDHG075 4.93 - 5.46	1.4	1.05	3.73	0.06	0.7	0.018	0.59	11.0	8.2	0.37	1280	0.28	0.05	2.8	10.4
19DDHG075 9.57 - 10.11	2.0	1.32	5.34	0.08	0.9	0.019	0.92	13.0	10.2	0.44	1380	0.32	0.06	3.8	13.4
19DDHG075 14.23 - 14.75	17.0	1.20	5.13	0.08	0.9	0.017	0.88	13.1	9.3	0.41	1205	0.44	0.07	3.6	13.6
19DDHG074 5.27 - 5.79	2.5	1.46	4.81	0.08	1.0	0.024	0.68	13.2	14.3	0.48	1495	0.23	0.12	3.5	15.2
19DDHG074 7.5 - 8	2.3	1.71	6.75	0.07	1.2	0.028	1.04	16.1	15.4	0.51	1345	0.26	0.11	4.7	18.8
19DDHG074 13.49 - 14.03	1.8	1.60	6.57	0.06	1.2	0.018	1.05	16.0	14.2	0.51	1355	0.24	0.11	4.7	17.0
18DDHG072 2.23 - 2.8	1.8	0.98	3.77	0.09	0.7	0.020	0.57	12.8	8.2	0.36	1350	0.38	0.08	2.8	10.4
18DDHG072 13.72 - 14.28	27.5	1.32	4.32	0.06	0.8	0.020	0.76	11.4	8.8	0.46	1175	0.52	0.03	3.2	11.8
19DDHG090 5.31 - 5.85	9.3	1.90	3.68	0.07	0.7	0.018	0.68	14.0	9.9	0.32	820	5.28	0.05	2.9	9.6
19DDHG090 5.85 - 6.35	15.8	2.38	8.52	0.06	1.5	0.028	1.40	21.7	19.2	0.54	767	2.71	0.17	6.0	14.0
18DDHG071 2.33 - 2.86	16.6	1.10	4.53	0.07	0.8	0.016	0.79	11.6	8.3	0.46	1125	0.35	0.03	3.4	11.0
18DDHG071 5.45 - 5.95	19.4	1.44	7.78	0.08	1.4	0.029	1.40	18.7	14.9	0.68	1005	0.27	0.08	5.7	13.9

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
Hammarvagen 22
SE-943 36, Ojebyn
www.alsglobal.com/geochemistry

To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

Sample Description / Method / Analyte / Units / LOD	ME-MS61 P ppm 10	ME-MS61 Pb ppm 0.5	ME-MS61 Rb ppm 0.1	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.01	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02
19DDHG091 2.6 - 3.1	230	14.0	37.8	<0.002	0.03	1.16	4.1	2	0.7	236	0.20	0.18	2.64	0.098	0.22
19DDHG091 5.75 - 6.28	220	3.6	33.0	<0.002	0.04	0.63	3.5	3	0.6	298	0.17	0.13	2.43	0.084	0.20
19DDHG091 10 - 10.54	320	4.5	52.6	<0.002	0.10	0.98	5.8	1	0.9	271	0.31	0.10	4.14	0.142	0.37
19DDHG089 4.72 - 5.25	250	6.3	41.4	<0.002	0.35	1.22	4.2	2	0.8	239	0.25	0.17	3.09	0.108	0.35
19DDHG089 6.48 - 6.98	260	4.9	58.2	<0.002	0.39	1.57	5.5	2	1.0	253	0.32	0.14	4.08	0.146	0.48
19DDHG089 10.74 - 11.29	360	6.8	54.3	<0.002	1.04	0.85	5.5	1	1.0	265	0.30	0.10	4.19	0.141	0.50
19DDHG088 3.07 - 3.55	260	4.6	44.0	<0.002	0.03	0.68	5.6	3	0.9	262	0.29	0.17	3.65	0.135	0.31
19DDHG088 5.95 - 6.45	250	2.7	43.2	<0.002	0.04	0.26	4.9	2	0.8	363	0.26	0.10	3.54	0.122	0.44
19DDHG086 5.27 - 5.8	240	1.7	43.5	<0.002	0.01	0.70	4.7	1	0.8	278	0.25	0.17	3.11	0.112	0.28
19DDHG086 10.8 - 11.3	280	2.4	52.5	<0.002	0.06	0.62	5.4	2	0.8	242	0.28	0.10	3.79	0.129	0.38
19DDHG086 15 - 15.54	270	4.3	54.0	<0.002	0.22	0.92	5.5	2	0.9	271	0.33	0.12	4.47	0.139	0.50
19DDHG085 7.45 - 8	680	20.7	87.2	<0.002	5.00	3.41	6.7	1	1.4	147.0	0.53	0.14	8.17	0.222	0.89
19DDHG085 10.93 - 11.5	1600	9.6	163.5	0.010	0.62	3.38	18.6	1	3.2	36.2	1.16	0.08	14.75	0.556	1.79
19DDHG085 20.75 - 21.23	390	9.1	36.6	0.006	1.44	1.10	2.9	2	0.6	369	0.19	<0.05	3.95	0.081	1.02
19DDHG080 3.89 - 4.4	270	2.6	50.1	<0.002	0.05	0.73	5.2	1	0.9	226	0.28	0.11	3.76	0.127	0.28
19DDHG080 5.48 - 5.9	230	8.2	43.2	<0.002	0.10	0.97	4.5	2	1.7	232	0.26	0.09	3.14	0.103	0.25
19DDHG080 11.9 - 12.45	290	2.7	60.4	<0.002	0.08	0.57	6.0	2	0.9	238	0.33	0.13	4.50	0.146	0.45
19DDHG079 3.45 - 3.96	250	3.0	52.0	<0.002	0.08	1.08	5.1	1	0.8	223	0.29	0.12	3.63	0.123	0.28
19DDHG079 8.85 - 9.38	230	4.2	51.6	<0.002	0.09	0.86	4.8	2	0.8	231	0.28	0.12	3.76	0.120	0.33
19DDHG079 11.36 - 11.85	260	2.8	55.4	<0.002	0.05	0.55	5.4	2	0.9	237	0.33	0.11	4.17	0.135	0.40
19DDHG078 5 - 5.48	580	38.1	64.9	0.004	5.38	1.40	4.4	<1	0.8	269	0.34	<0.05	6.49	0.141	1.26
19DDHG078 5.73 - 6.23	240	5.1	32.1	<0.002	0.65	0.27	2.7	1	0.5	315	0.19	<0.05	3.12	0.079	0.43
19DDHG077 5.35 - 5.85	250	3.2	31.7	<0.002	0.14	0.36	4.4	1	0.6	320	0.22	0.08	3.09	0.095	0.17
19DDHG077 11.85 - 12.34	240	3.7	35.1	<0.002	0.05	0.65	4.7	2	0.6	285	0.20	0.29	2.92	0.090	0.18
19DDHG077 14.33 - 14.85	240	4.3	43.8	<0.002	0.02	0.90	5.1	2	0.8	236	0.26	0.11	3.23	0.108	0.22
19DDHG076 4 - 4.5	250	4.4	44.9	<0.002	0.07	0.90	4.6	2	0.7	228	0.27	0.09	3.22	0.106	0.22
19DDHG076 6.49 - 7.08	240	3.5	47.3	<0.002	0.08	0.66	4.8	2	0.7	229	0.27	0.07	3.63	0.116	0.25
19DDHG076 11.64 - 12.12	420	3.8	80.1	<0.002	0.06	0.46	7.5	<1	1.3	237	0.45	0.08	6.29	0.202	0.54
19DDHG075 4.93 - 5.46	260	3.1	31.4	<0.002	0.01	0.61	4.1	2	0.5	302	0.18	0.15	2.85	0.084	0.14
19DDHG075 9.57 - 10.11	260	3.5	48.7	<0.002	0.03	0.96	5.2	2	0.8	321	0.27	0.14	3.57	0.119	0.21
19DDHG075 14.23 - 14.75	250	3.8	47.4	<0.002	0.08	1.93	4.6	2	0.7	258	0.28	0.13	3.33	0.110	0.20
19DDHG074 5.27 - 5.79	240	2.5	35.8	<0.002	0.14	0.65	4.9	2	0.7	335	0.22	0.08	3.26	0.104	0.18
19DDHG074 7.5 - 8	280	3.2	56.1	<0.002	0.17	1.10	6.1	1	0.9	266	0.35	0.16	4.23	0.145	0.25
19DDHG074 13.49 - 14.03	230	3.6	57.2	<0.002	0.05	1.05	6.4	<1	0.9	226	0.34	0.14	4.32	0.148	0.25
18DDHG072 2.23 - 2.8	220	3.1	30.0	<0.002	0.05	0.58	4.1	1	0.6	288	0.20	0.12	2.64	0.085	0.16
18DDHG072 13.72 - 14.28	250	2.5	39.9	<0.002	0.34	0.85	4.1	2	0.6	269	0.22	0.07	2.97	0.096	0.28
19DDHG090 5.31 - 5.85	710	8.6	35.0	0.002	1.87	0.90	2.8	2	0.5	328	0.21	0.05	3.97	0.087	0.88
19DDHG090 5.85 - 6.35	680	9.8	72.6	0.003	1.59	1.02	6.7	1	1.2	280	0.42	<0.05	6.83	0.192	1.24
18DDHG071 2.33 - 2.86	240	2.5	40.2	<0.002	0.19	0.80	4.1	1	0.7	237	0.25	0.12	3.13	0.099	0.26
18DDHG071 5.45 - 5.95	350	3.1	70.9	<0.002	0.07	0.60	6.9	1	1.2	257	0.40	0.12	5.57	0.177	0.51

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
Hammarvagen 22
SE-943 36, Ojebyn
www.alsglobal.com/geochemistry

To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

Sample Description / Method / Analyte / Units / LOD	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1	ME-MS61 W ppm 0.1	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5	S-IR08 S % 0.01	S-ICP19 S % 0.01	S-CAL19 S % 0.01	C-IR07 C % 0.01	C-IR06 C organi % 0.01	C-CAL04 C inorga % 0.01	OA-VOL08EU NP tCaCO3/1Kt 1	OA-VOL08EU AP tCaCO3/1Kt 0.3	OA-VOL08EU NPR Unity 0.01
19DDHG091 2.6 - 3.1	0.5	20	0.6	10.6	20	26.2									
19DDHG091 5.75 - 6.28	0.4	19	0.5	9.3	16	22.6									
19DDHG091 10 - 10.54	0.8	31	0.7	16.0	24	38.5									
19DDHG089 4.72 - 5.25	1.0	25	0.6	10.3	19	29.2									
19DDHG089 6.48 - 6.98	1.5	34	0.7	10.5	26	38.9									
19DDHG089 10.74 - 11.29	0.9	29	0.7	17.2	25	39.8									
19DDHG088 3.07 - 3.55	0.9	27	0.7	15.0	22	38.1									
19DDHG088 5.95 - 6.45	0.7	27	0.6	13.8	15	31.9									
19DDHG086 5.27 - 5.8	0.6	23	0.7	12.3	16	29.6									
19DDHG086 10.8 - 11.3	1.1	29	0.7	12.0	17	34.8									
19DDHG086 15 - 15.54	0.8	34	0.8	12.7	19	37.5									
19DDHG085 7.45 - 8	15.0	118	1.6	17.6	15	62.5									
19DDHG085 10.93 - 11.5	10.9	287	1.5	32.1	43	148.5									
19DDHG085 20.75 - 21.23	4.9	32	0.4	11.8	29	24.2									
19DDHG080 3.89 - 4.4	0.7	29	0.7	11.6	18	34.1									
19DDHG080 5.48 - 5.9	1.0	23	0.6	10.5	13	29.1									
19DDHG080 11.9 - 12.45	0.8	29	0.7	14.4	16	39.6									
19DDHG079 3.45 - 3.96	0.8	27	0.7	11.6	18	33.8									
19DDHG079 8.85 - 9.38	0.7	26	0.6	10.8	15	33.1									
19DDHG079 11.36 - 11.85	0.7	28	0.8	13.6	17	35.9									
19DDHG078 5 - 5.48	5.4	60	0.8	14.9	278	39.8									
19DDHG078 5.73 - 6.23	2.3	24	0.4	10.0	7	22.0									
19DDHG077 5.35 - 5.85	0.9	21	0.5	13.6	16	33.8									
19DDHG077 11.85 - 12.34	0.5	17	0.6	15.1	17	27.5									
19DDHG077 14.33 - 14.85	0.7	21	0.6	13.0	15	31.1									
19DDHG076 4 - 4.5	0.6	22	0.6	11.0	14	29.4									
19DDHG076 6.49 - 7.08	0.7	27	0.6	11.0	16	33.1									
19DDHG076 11.64 - 12.12	1.0	42	0.9	19.1	24	56.8									
19DDHG075 4.93 - 5.46	0.7	15	0.6	14.1	11	24.1									
19DDHG075 9.57 - 10.11	0.6	24	0.6	13.4	16	31.9									
19DDHG075 14.23 - 14.75	0.7	24	0.6	11.8	13	29.9									
19DDHG074 5.27 - 5.79	0.6	24	0.5	13.4	17	34.2									
19DDHG074 7.5 - 8	0.7	32	0.7	14.2	22	41.5									
19DDHG074 13.49 - 14.03	0.8	28	0.8	15.2	17	41.2									
18DDHG072 2.23 - 2.8	0.8	16	0.5	14.4	16	24.9									
18DDHG072 13.72 - 14.28	0.5	21	0.6	10.8	14	26.7									
19DDHG090 5.31 - 5.85	5.3	41	0.5	13.6	10	24.9									
19DDHG090 5.85 - 6.35	5.6	64	0.8	18.0	10	54.7									
18DDHG071 2.33 - 2.86	0.6	22	0.6	10.8	12	27.7									
18DDHG071 5.45 - 5.95	1.1	39	0.9	16.0	19	48.4									

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
Hammarvagen 22
SE-943 36, Ojebyn
www.alsglobal.com/geochemistry

To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Finalized Date: 7-MAR-2024
Account: STOCEG

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

Sample Description / Method / Analyte / Units / LOD	OA-VOL08EU NNP tCaCO3/1Kt 1
19DDHG091 2.6 - 3.1 19DDHG091 5.75 - 6.28 19DDHG091 10 - 10.54 19DDHG089 4.72 - 5.25 19DDHG089 6.48 - 6.98	
19DDHG089 10.74 - 11.29 19DDHG088 3.07 - 3.55 19DDHG088 5.95 - 6.45 19DDHG086 5.27 - 5.8 19DDHG086 10.8 - 11.3	
19DDHG086 15 - 15.54 19DDHG085 7.45 - 8 19DDHG085 10.93 - 11.5 19DDHG085 20.75 - 21.23 19DDHG080 3.89 - 4.4	
19DDHG080 5.48 - 5.9 19DDHG080 11.9 - 12.45 19DDHG079 3.45 - 3.96 19DDHG079 8.85 - 9.38 19DDHG079 11.36 - 11.85	
19DDHG078 5 - 5.48 19DDHG078 5.73 - 6.23 19DDHG077 5.35 - 5.85 19DDHG077 11.85 - 12.34 19DDHG077 14.33 - 14.85	
19DDHG076 4 - 4.5 19DDHG076 6.49 - 7.08 19DDHG076 11.64 - 12.12 19DDHG075 4.93 - 5.46 19DDHG075 9.57 - 10.11	
19DDHG075 14.23 - 14.75 19DDHG074 5.27 - 5.79 19DDHG074 7.5 - 8 19DDHG074 13.49 - 14.03 18DDHG072 2.23 - 2.8	
18DDHG072 13.72 - 14.28 19DDHG090 5.31 - 5.85 19DDHG090 5.85 - 6.35 18DDHG071 2.33 - 2.86 18DDHG071 5.45 - 5.95	

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

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MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

Sample Description	Method / Analyte / Units / LOD	WEI-21 Recvd Wt. kg 0.02	CRU-QC Pass2mm % 0.01	PUL-QC Pass75um % 0.01	ME-MS61 Ag ppm 0.01	ME-MS61 Al % 0.01	ME-MS61 As ppm 0.2	ME-MS61 Ba ppm 10	ME-MS61 Be ppm 0.05	ME-MS61 Bi ppm 0.01	ME-MS61 Ca % 0.01	ME-MS61 Cd ppm 0.02	ME-MS61 Ce ppm 0.01	ME-MS61 Co ppm 0.1	ME-MS61 Cr ppm 1	ME-MS61 Cs ppm 0.05
LST Sammanslagningsprov																

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

Sample Description	Method / Analyte / Units / LOD	ME-MS61 Cu ppm 0.2	ME-MS61 Fe % 0.01	ME-MS61 Ga ppm 0.05	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	ME-MS61 In ppm 0.005	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2
LST Sammanslagningsprov																

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

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118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

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	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl
	Units	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm
	LOD	10	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
LST Sammanslagningsprov																

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

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CERTIFICATE OF ANALYSIS PI24032186

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	S-IR08	S-ICP19	S-CAL19	C-IR07	C-IR06	C-CAL04	OA-VOL08EU	OA-VOL08EU	OA-VOL08EU
	Analyte	U	V	W	Y	Zn	Zr	S	S	S	C	C organi	C inorga	NP	AP	NPR
	Units	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	%	%	%	tCaCO3/1Kt	tCaCO3/1Kt	Unity
	LOD	0.1	1	0.1	0.1	2	0.5	0.01	0.01	0.01	0.01	0.01	0.01	1	0.3	0.01
LST Sammanslagningsprov								0.26	0.01	0.25	9.63	0.03	9.60	784	7.8	100.35

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
Hammarvagen 22
SE-943 36, Ojebyn
www.alsglobal.com/geochemistry

To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

Sample Description	Method Analyte Units LOD	OA-VOL08EU NNP tCaCO3/1Kt 1
LST Sammanslagningsprov		776

Comments: Samples were received on 28-Dec-2023 and the SSF/Request on 3-Feb-2024.

***** See Appendix Page for comments regarding this certificate *****

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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

An INAB accredited testing laboratory Reg. No. 173T. Accredited methods are listed in the Scope of Accreditation available on request.

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24032186

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

Applies to Method: REEs may not be totally soluble in this method.
ME-MS61

Applies to Method: OA-VOL08EU Units: tCaCO3/1Kt = tCaCO3/1000t ore
OA-VOL08EU

ACCREDITATION COMMENTS

Applies to Method: The methods immediately below this line are ISO 17025:2017 Accredited. INAB Registration No: 173T

C-IR07	ME-MS61	S-IR08

LABORATORY ADDRESSES

Applies to Method: Processed at ALS Pitea located at Hammarvagen 22, SE-943 36, Ojebyn, Sweden.

CRU-31	CRU-QC	LOG-22	LOG-SAW01
PUL-31	PUL-31d	PUL-QC	ROL-21
SAM-COR01	SPL-22	SPL-22Y	SPLIT-Y
SPLIT-Z	WEI-21		

Applies to Method: Processed at ALS Loughrea located at Dublin Road, Loughrea, Co. Galway, Ireland.

C-CAL04	C-IR06	C-IR07	ME-MS61
OA-VOL08EU	S-CAL19	S-ICP19	S-IR08

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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Finalized Date: 20-MAR-2024
Account: STOCEG

CERTIFICATE PI24061674

Project: SE 2300368 Haggan BK Vanadis
P.O. No.: SE2300368
This report is for 1 sample of Drill Core submitted to our lab in Pitea, Sweden on 7-MAR-2024.
The following have access to data associated with this certificate:

ERIK KARLSSON HELENA KARLSSON	HELENA KARLSSON	ERIK KARLSSON

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
FND-02	Find Sample for Addn Analysis

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
ME-MS61	48 element four acid ICP-MS	
Hg-MS42	Trace Hg by ICPMS	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:

Andrey Tairov, Technical Manager, Ireland

ALS Scandinavia AB
Hammarvagen 22
SE-943 36, Ojebyn
www.alsglobal.com/geochemistry

To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24061674

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	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga
	Units	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm
	LOD	0.01	0.01	0.2	10	0.05	0.01	0.01	0.02	0.01	0.1	1	0.05	0.2	0.01	0.05
LST Sammanslagningsprov		0.02	1.96	6.6	710	0.73	0.11	28.8	0.04	28.5	7.9	14	2.68	12.2	1.34	5.12

***** See Appendix Page for comments regarding this certificate *****

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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24061674

Sample Description	Method Analyte Units LOD	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	Hg-MS42 Hg ppm 0.005	ME-MS61 In ppm 0.005	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2	ME-MS61 P ppm 10	ME-MS61 Pb ppm 0.5
LST Sammanslagningsprov		0.06	1.0	<0.005	0.026	0.90	12.8	11.2	0.45	1145	0.94	0.08	4.0	13.6	280	5.7

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24061674

Sample Description	Method Analyte Units LOD	ME-MS61 Rb ppm 0.1	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.01	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1
LST Sammanslagningsprov		45.2	<0.002	0.28	0.85	5.0	2	0.8	258	0.26	0.10	3.70	0.117	0.38	1.1	27

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Finalized Date: 20-MAR-2024
Account: STOCEG

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24061674

Sample Description	Method / Analyte / Units / LOD	ME-MS61 W ppm 0.1	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5
LST Sammanslagningsprov		0.6	12.7	33	34.3

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Finalized Date: 20-MAR-2024
Account: STOCEG

An INAB accredited testing laboratory Reg. No. 173T. Accredited methods are listed in the Scope of Accreditation available on request.

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24061674

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

Applies to Method: REEs may not be totally soluble in this method.
ME-MS61

ACCREDITATION COMMENTS

Applies to Method: The methods immediately below this line are ISO 17025:2017 Accredited. INAB Registration No: 173T
ME-MS61

LABORATORY ADDRESSES

Applies to Method: Processed at ALS Loughrea located at Dublin Road, Loughrea, Co. Galway, Ireland.
FND-02 Hg-MS42 ME-MS61

ALS Scandinavia AB
Hammarvagen 22
SE-943 36, Ojebyn
www.alsglobal.com/geochemistry

To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Finalized Date: 11-APR-2024
Account: STOCEG

CERTIFICATE PI24071300

Project: SE 2300368 Haggan BK Vanadis
P.O. No.: SE 2300368
This report is for 25 samples of Pulp submitted to our lab in Pitea, Sweden on 13-MAR-2024.
The following have access to data associated with this certificate:

ERIK KARLSSON HELENA KARLSSON	HELENA KARLSSON	ERIK KARLSSON

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-24	Pulp Login - Rcd w/o Barcode
HOM-01	Homogenize by light pulverizing
BAG-01	Bulk Master for Storage
SPLIT-Z	Pulp split for send out

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
S-IR08	Total Sulphur (IR Spectroscopy)	LECO
S-ICP19	Sulphate Sulphur / By ICP-AES	ICP-AES
S-CAL19	Sulphide Sulphur (Calculated)	LECO
C-IR07	Total Carbon (IR Spectroscopy)	LECO
C-IR06	Non-Carbonate C by HCl Leach, IR Spec	LECO
C-CAL04	Inorganic Carbon	LECO
OA-VOL08EU	AP & NP of Sulphidic Waste	
ME-MS61	48 element four acid ICP-MS	
Hg-MS42	Trace Hg by ICPMS	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 *****
Comments: Samples were received on 13-Mar-2024 and the SSF/Request on 13-Mar-2024.

Signature: 
Andrey Tairov, Technical Manager, Ireland

ALS Scandinavia AB
Hammarvagen 22
SE-943 36, Ojebyn
www.alsglobal.com/geochemistry

To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Finalized Date: 11-APR-2024
Account: STOCEG

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24071300

Sample Description	Method Analyte Units LOD	WEI-21 Recvd Wt. kg 0.02	S-IR08 S % 0.01	S-ICP19 S % 0.01	S-CAL19 S % 0.01	C-IR07 C % 0.01	C-IR06 C organi % 0.01	C-CAL04 C inorga % 0.01	OA-VOL08EU NP tCaCO3/1Kt 1	OA-VOL08EU AP tCaCO3/1Kt 0.3	OA-VOL08EU NPR Unity 0.01	OA-VOL08EU NNP tCaCO3/1Kt 1	ME-MS61 Ag ppm 0.01	ME-MS61 Al % 0.01	ME-MS61 As ppm 0.2	ME-MS61 Ba ppm 10
S111149		0.22														
S111458		0.22														
S111489		0.22														
S111505		0.22														
S102022		0.24														
Sammanslagningsprov gråberg			4.63	0.11	4.52	5.03	3.73	1.30	82	141.5	0.58	-60	0.53	7.51	70.1	160
S111095		0.22														
S111123		0.20														
S111139		0.20														
S111559		0.23														
S111681		0.21														
S111706		0.20														
S111773		0.24														
S111795		0.24														
S111920		0.19														
S111993		0.24														
S102008		0.20														
S102036		0.25														
S113150		0.21														
S113179		0.21														
S113193		0.23														
S106853		0.21														
S106854		0.18														
S106876		0.18														
Sammanslagningsprov B-malm			4.93	0.16	4.77	11.45	9.29	2.16	146	149.0	0.98	-4	1.18	6.49	87.3	100

Comments: Samples were received on 13-Mar-2024 and the SSF/Request on 13-Mar-2024.

***** See Appendix Page for comments regarding this certificate *****

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Hammarvagen 22
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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

An INAB accredited testing laboratory Reg. No. 173T. Accredited methods are listed in the Scope of Accreditation available on request.

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24071300

Sample Description / Method / Analyte / Units / LOD	ME-MS61 Be ppm 0.05	ME-MS61 Bi ppm 0.01	ME-MS61 Ca % 0.01	ME-MS61 Cd ppm 0.02	ME-MS61 Ce ppm 0.01	ME-MS61 Co ppm 0.1	ME-MS61 Cr ppm 1	ME-MS61 Cs ppm 0.05	ME-MS61 Cu ppm 0.2	ME-MS61 Fe % 0.01	ME-MS61 Ga ppm 0.05	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	Hg-MS42 Hg ppm 0.005	ME-MS61 In ppm 0.005
S111149 S111458 S111489 S111505 S102022															
Sammanslagningsprov gråberg S111095 S111123 S111139 S111559	2.99	0.30	3.48	1.15	80.9	21.3	75	21.4	77.4	5.64	21.6	0.14	3.7	0.111	0.054
S111681 S111706 S111773 S111795 S111920															
S111993 S102008 S102036 S113150 S113179															
S113193 S106853 S106854 S106876 Sammanslagningsprov B-malm	3.99	0.35	6.31	5.25	73.5	26.5	72	11.60	129.0	4.81	19.70	0.13	2.8	0.240	0.052

Comments: Samples were received on 13-Mar-2024 and the SSF/Request on 13-Mar-2024.

***** See Appendix Page for comments regarding this certificate *****

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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24071300

Sample Description	Method Analyte Units LOD	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2	ME-MS61 P ppm 10	ME-MS61 Pb ppm 0.5	ME-MS61 Rb ppm 0.1	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05
S111149																
S111458																
S111489																
S111505																
S102022																
Sammanslagningsprov gräberg		3.42	38.5	40.2	0.76	536	81.4	0.09	15.2	107.0	910	101.5	181.5	0.026	4.74	3.13
S111095																
S111123																
S111139																
S111559																
S111681																
S111706																
S111773																
S111795																
S111920																
S111993																
S102008																
S102036																
S113150																
S113179																
S113193																
S106853																
S106854																
S106876																
Sammanslagningsprov B-malm		3.18	37.5	33.9	0.62	671	168.5	0.10	13.8	289	1270	70.8	136.5	0.122	5.11	8.33

Comments: Samples were received on 13-Mar-2024 and the SSF/Request on 13-Mar-2024.

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
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118 26 STOCKHOLM

An INAB accredited testing laboratory Reg. No. 173T. Accredited methods are listed in the Scope of Accreditation available on request.

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24071300

Sample Description	Method Analyte Units LOD	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.01	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1	ME-MS61 W ppm 0.1	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5
S111149																
S111458																
S111489																
S111505																
S102022																
Sammanslagningsprov gråberg		14.5	5	2.7	78.3	0.96	0.14	11.40	0.444	5.09	41.0	325	2.0	33.3	165	144.0
S111095																
S111123																
S111139																
S111559																
S111681																
S111706																
S111773																
S111795																
S111920																
S111993																
S102008																
S102036																
S113150																
S113179																
S113193																
S106853																
S106854																
S106876																
Sammanslagningsprov B-malm		12.1	8	2.6	134.5	0.90	0.30	10.90	0.398	6.68	127.5	1090	2.6	40.7	355	104.5

Comments: Samples were received on 13-Mar-2024 and the SSF/Request on 13-Mar-2024.

***** See Appendix Page for comments regarding this certificate *****

ALS Scandinavia AB
Hammarvagen 22
SE-943 36, Ojebyn
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To: GEOSYNTEC CONSULTANTS AB
MEDBORGARPLATSEN 3
118 26 STOCKHOLM

Project: SE 2300368 Haggan BK Vanadis

CERTIFICATE OF ANALYSIS PI24071300

CERTIFICATE COMMENTS

ANALYTICAL COMMENTS

Applies to Method: REEs may not be totally soluble in this method.
ME-MS61

Applies to Method: OA-VOL08EU Units: tCaCO3/1Kt = tCaCO3/1000t ore
OA-VOL08EU

ACCREDITATION COMMENTS

Applies to Method: The methods immediately below this line are ISO 17025:2017 Accredited. INAB Registration No: 173T
C-IR07 ME-MS61 S-IR08

LABORATORY ADDRESSES

Applies to Method: Processed at ALS Pitea located at Hammarvagen 22, SE-943 36, Ojebyn, Sweden.
BAG-01 HOM-01 LOG-24 SPLIT-Z
WEI-21

Applies to Method: Processed at ALS Loughrea located at Dublin Road, Loughrea, Co. Galway, Ireland.
C-CAL04 C-IR06 C-IR07 Hg-MS42
ME-MS61 OA-VOL08EU S-CAL19 S-ICP19
S-IR08

Analyscertifikat

Ordernummer	: **ST2405973**	Sida	: 1 av 2
Kund	: **Geosyntec Consultants AB**	Projekt	: SE 2300368 Haggan BK Vanadis
Kontaktperson	: Erik Karlsson	Beställningsnummer	: SE2300368
Adress	: Medborgarplatsen 3 118 26 Stockholm	Provtagare	: ----
		Provtagningspunkt	: ----
		Ankomstdatum, prover	: 2024-02-23 12:00
E-post	: erik.karlsson@geosyntec.com	Analys påbörjad	: 2024-03-15
Telefon	: ----	Utfärdad	: 2024-03-15 14:16
C-O-C-nummer (eller Orderblankett-nummer)	: ----	Antal ankomna prover	: 1
Offertnummer	: ST2021SE-GEO-SYN0003 (OF211186)	Antal analyserade prover	: 1

Generell kommentar

Denna rapport får endast återges i sin helhet, om inte utfärdande laboratorium i förväg skriftligen godkänt annat. Resultatet gäller endast materialet såsom det har mottagits, identifierats och testats. Laboratoriet tar inget ansvar för information i denna rapport som har lämnats av kunden, eller resultat som kan ha påverkats av sådan information. Beträffande laboratoriets ansvar i samband med uppdrag, se vår webbplats www.alsglobal.se

Signatur	*Position*
Niels-Kristian Terkildsen	Laboratoriechef

Laboratorium	: ALS Scandinavia AB	hemsida	: www.alsglobal.se
Adress	: Rinkebyvägen 19C 182 36 Danderyd Sverige	E-post	: info.ta@alsglobal.com
		Telefon	: +46 8 5277 5200

Analysresultat

Provbeteckning **LST Sammanslagningsprov**
Laboratoriets provnummer **ST2405973-001**
Provtagningsdatum / tid **ej specificerad**
Matris **MATERIAL**

Parameter	Resultat	MU	Enhet	LOR	Metod	Utf.
Provberedning						
Provberedning						
Provberedning	**Ingen extra prep. ***	----	-	-	PP-Provb./RO	RO
Rapport						
G-11C						
bilaga	**Ja**	----	-	-	XRD/RO	RO

Metodsammanfattningar

Analysmetoder	Metod
PP-Provb./RO	Provberedning
XRD/RO	Mineralanalys enligt DIN EN 13925-1, -2:2003, -3:2005 och DIN EN 1330-11:2007.

Nyckel: LOR = Den rapporteringsgräns (LOR) som anges är standard för respektive parameter i metoden. Rapporteringsgränsen kan påverkas vid t.ex. spädning p.g.a. matrisstörningar, begränsad provmängd eller låg torrsubstanshalt.

MU = Mätosäkerhet

* = Asterisk efter resultatet visar på ej ackrediterat test, gäller både egna lab och underleverantör

Mätosäkerhet:

Mätosäkerheten anges som en utvidgad osäkerhet (enligt definitionen i "Evaluation of measurement data- Guide to the expression of uncertainty in measurement", JCGM 100:2008 Corrected version 2010) beräknad med täckningsfaktor lika med 2 vilket ger en konfidensnivå på ungefär 95%.
Mätosäkerhet anges endast för detekterade ämnen med halter över rapporteringsgränsen.

Mätosäkerhet från underleverantör anges oftast som en utvidgad osäkerhet beräknad med täckningsfaktor 2. För ytterligare information kontakta laboratoriet.

Utförande laboratorium (teknisk enhet inom ALS Scandinavia eller anlitat laboratorium (underleverantör)).

	Utf.
RO	*Analys utförd av* Röntgenlabor Dr Ermrich, Am Kandelborn 7 Reinheim Tyskland 64354 Ackrediterad av: DAkkS Ackrediteringsnummer: D-PL-18075-01-00

ST2405973

Geosyntec Consultants AB

Erik Karlsson

Medborgarplatsen 3

118 26 Stockholm

Analysresultat

Analyspaket	*G-11c*	*Utförande lab:*	*ST*
Matris:	Material		
Projekt / Beställningsnummer:	**SE 2300368 Haggan BK Vanadis**		

ST2405973

Laboratoriets provnummer	**ST2405973-001**
Provbeteckning	LST Sammanslagningsprov

Parameter	Resultat %[m/m]	Enhet	Metod
Provberedning			1
XRD analys			2
Amorf / finkristallin andel	Ej signifikant		
Kalcit Ca_6CO_3 PDF# 04-008-0198	83.1 ± 1.0	Vikt %	
Kvarts SiO_2 PDF#00-46-1045	8.1 ± 0.5	Vikt %	
Muskovit KaI2(Si,Al)4(OH)2 PDF#00-058-2036	4.3 ± 0.5	Vikt %	
Klinoklor $Mg_{2.8}Fe_{1.75}Al_{2.7}Si_{2.65}O_{10}(OH)_8$ PDF# 04-013-2805	4.5 ± 0.5	Vikt %	

Laboratorium : ALS Scandinavia AB
Adress : Rinkebyvägen 19C
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Sverige

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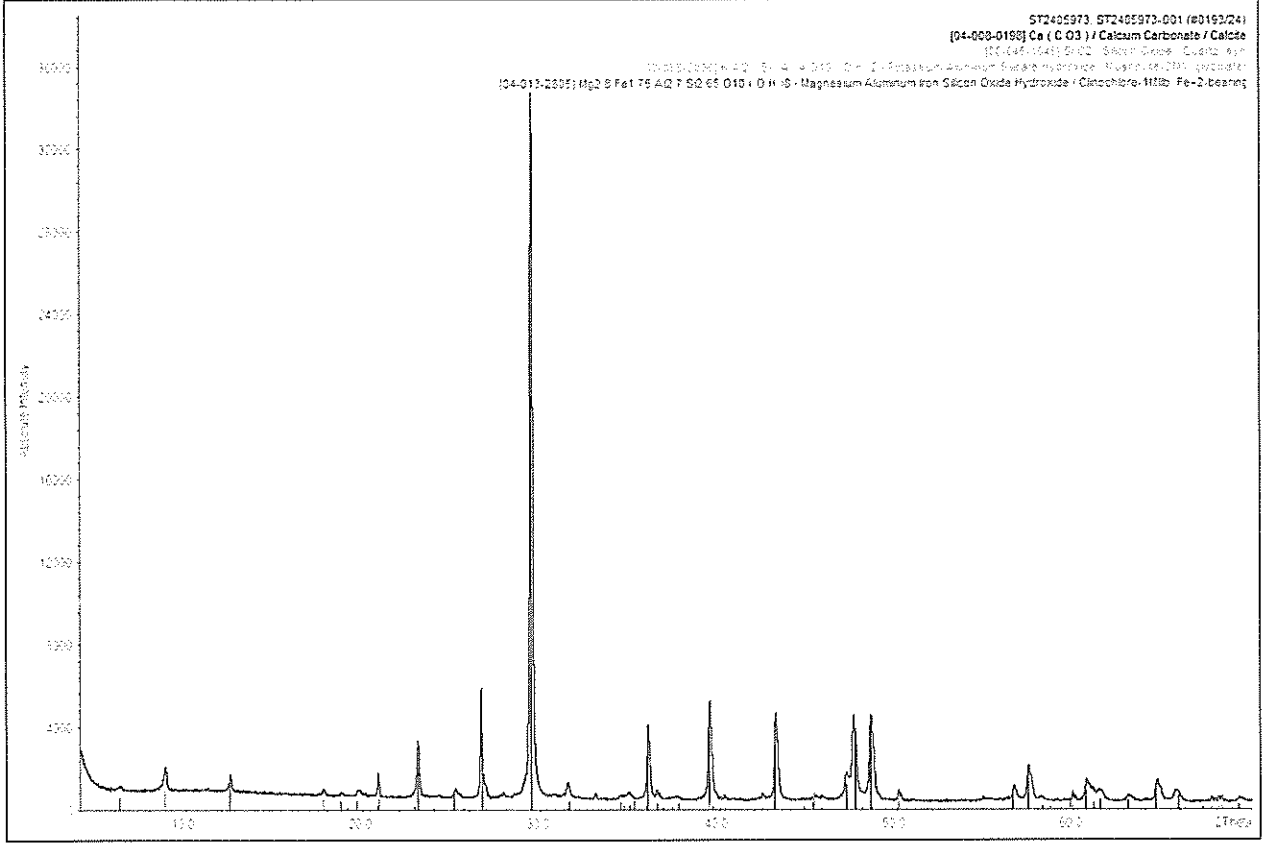
ST2405973

STOE Powder Diffraction System	X- Ray Laboratory Dr. Ermrich - a division of Sensotec GmbH -	28-Feb-2024



Laboratorium : ALS Scandinavia AB
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ST2405973

*indikerar oackrediterad analys

Metod	
1	Provberedning.
2	Paket G-11C. Mineralkvantifiering av kristallina faser (Rietvelds metod). Provet har finmalts och undersökts på en röntgendiffraktometer (XRD) med CuK_{α} röntgenrör. Haltbestämningen sker genom Rietveld - analys. Halterna har beräknats för de kristallina faserna och nominerats till 100 %. Halterna är angivna i viktprocent.

Utförande lab	
UL	*Analys utförd av* Röngenlabor Dr Ermrich-Sensotech, Bismarckstr.: 29, D-64853 Otzberg/Lengfeld Ackrediterad av: DAkkS Ackrediteringsnummer: D-PL-18075-01-00

Generell kommentar

Denna rapport får endast återges i sin helhet, om inte utfärdande laboratorium i förväg skriftligen godkänt annat. Laboratoriet tar inget ansvar för information i denna rapport som har lämnats av kunden, eller resultat som kan ha påverkats av sådan information. Beträffade laboratoriets ansvar i samband med uppdrag, se aktuell produktkatalog eller vår webbplats www.alsglobal.se .

Analyscertifikat

Ordernummer	: **ST2410767**	Sida	: 1 av 3
Kund	: **Geosyntec Consultants AB**	Projekt	: SE 2300368 Haggan BK Vanadis
Kontaktperson	: Erik Karlsson	Beställningsnummer	: ----
Adress	: Medborgarplatsen 3 118 26 Stockholm	Provtagare	: ----
		Provtagningspunkt	: ----
		Ankomstdatum, prover	: 2024-03-27 15:00
E-post	: erik.karlsson@geosyntec.com	Analys påbörjad	: 2024-04-10
Telefon	: ----	Utfärdad	: 2024-04-10 08:18
C-O-C-nummer (eller Orderblankett-nummer)	: ----	Antal ankomna prover	: 2
Offertnummer	: ST2021SE-GEO-SYN0003 (OF211186)	Antal analyserade prover	: 2

Generell kommentar

Denna rapport får endast återges i sin helhet, om inte utfärdande laboratorium i förväg skriftligen godkänt annat. Resultatet gäller endast materialet såsom det har mottagits, identifierats och testats. Laboratoriet tar inget ansvar för information i denna rapport som har lämnats av kunden, eller resultat som kan ha påverkats av sådan information. Beträffande laboratoriets ansvar i samband med uppdrag, se vår webbplats www.alsglobal.se

Signatur	*Position*
Niina Veuro	Laboratoriechef

Niina Veuro

Laboratorium	: ALS Scandinavia AB	hemsida	: www.alsglobal.se
Adress	: Rinkebyvägen 19C 182 36 Danderyd Sverige	E-post	: niina.veuro@alsglobal.com
		Telefon	: +46 8 5277 5200

Analysresultat

Provbeteckning **Sammanslagningsprov gråberg**
Laboratoriets provnummer **ST2410767-001**
Provtagningsdatum / tid **ej specificerad**
Matris **MATERIAL**

Parameter	Resultat	MU	Enhet	LOR	Metod	Utf.
Provberedning						
Provberedning						
Provberedning	**Ingen extra prep. ***	----	-	-	PP-Provb./RO	RO
Rapport						
G-11C						
bilaga	**Ja**	----	-	-	XRD/RO	RO
S-XRD-Release						
avkodning	**Ja ***	----	-	-	S-XRD-Release	ST

Provbeteckning **Sammanslagningsprov B-malm**
Laboratoriets provnummer **ST2410767-002**
Provtagningsdatum / tid **ej specificerad**
Matris **MATERIAL**

Parameter	Resultat	MU	Enhet	LOR	Metod	Utf.
Provberedning						
Provberedning						
Provberedning	**Ingen extra prep. ***	----	-	-	PP-Provb./RO	RO
Rapport						
G-11C						
bilaga	**Ja**	----	-	-	XRD/RO	RO
S-XRD-Release						
avkodning	**Ja ***	----	-	-	S-XRD-Release	ST

Metodsammanfattningar

Analysmetoder	*Metod*
PP-Provb./RO	Provberedning
XRD/RO	Mineralanalys enligt DIN EN 13925-1, -2:2003, -3:2005 och DIN EN 1330-11:2007.
S-XRD-Release*	XRD, admistrativ kod

Nyckel: LOR = Den rapporteringsgräns (LOR) som anges är standard för respektive parameter i metoden. Rapporteringsgränsen kan påverkas vid t.ex. spädning p.g.a matrisstörningar, begränsad provmängd eller låg torrsubstanshalt.

MU = Mätosäkerhet

* = Asterisk efter resultatet visar på ej ackrediterat test, gäller både egna lab och underleverantör

Mätosäkerhet:

Mätosäkerheten anges som en utvidgad osäkerhet (enligt definitionen i "Evaluation of measurement data- Guide to the expression of uncertainty in measurement", JCGM 100:2008 Corrected version 2010) beräknad med täckningsfaktor lika med 2 vilket ger en konfidensnivå på ungefär 95%.
Mätosäkerhet anges endast för detekterade ämnen med halter över rapporteringsgränsen.

Mätosäkerhet från underleverantör anges oftast som en utvidgad osäkerhet beräknad med täckningsfaktor 2. För ytterligare information kontakta laboratoriet.

Utförande laboratorium (teknisk enhet inom ALS Scandinavia eller anlitat laboratorium (underleverantör)).

	Utf.
RO	*Analys utförd av* Röntgenlabor Dr Ermrich, Am Kandelborn 7 Reinheim Tyskland 64354 Ackrediterad av: DAkkS Ackrediteringsnummer: D-PL-18075-01-00
ST	*Analys utförd av* ALS Scandinavia AB, Rinkebyvägen 19C Danderyd Sverige 182 36 Ackrediterad av: SWEDAC Ackrediteringsnummer: 2030, ISO/IEC 17025

ST2410767

Geosyntec Consultants AB

Erik Karlsson

Medborgarplatsen 3

118 26 Stockholm

Analysresultat

Analyspaket	*G-11c*	*Utförande lab:*	*ST*
Matris:	Material		
Projekt / Beställningsnummer:	**SE 2300368 Haggan BK Vanadis**		

ST2410767

Laboratoriets provnummer	**ST2410767-001**
Provbeteckning	Sammanslagningsprov gråberg

Parameter	Resultat %[m/m]	Metod
Provberedning		1
XRD analys		2
Amorf / finkristallin andel	Ej signifikant	
Kvarts SiO_2 PDF#00-46-1045	44.5 ± 1.0	
Albit $NaAlSi_3O_8$ PDF#00-009-0466	0.8 ± 0.2	
Mikroklin $KAlSi_3O_8$ PDF# 00-019-0926	0.6 ± 0.2	
Kalcit $CaCO_3$ PDF# 00-005-0586	6.5 ± 0.5	
Gips $Ca(SO_4)(H_2O)_2$ PDF# 04-008-9805	0.5 ± 0.2	
Pyrit FeS_2 PDF# 04-004-6511	7.0 ± 0.5	
Muskovit $KAl_2(Si,Al)_4O_{10}(OH)_2$ PDF# 00-058-2036	35.2 ± 1.0	
Klinoklor $Mg_{2.8}Fe_{1.75}Al_{2.7}Si_{2.65}O_{10}(OH)_8$ PDF# 04-013-2805	4.9 ± 0.5	

Laboratorium : ALS Scandinavia AB
Adress : Rinkebyvägen 19C
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Sverige

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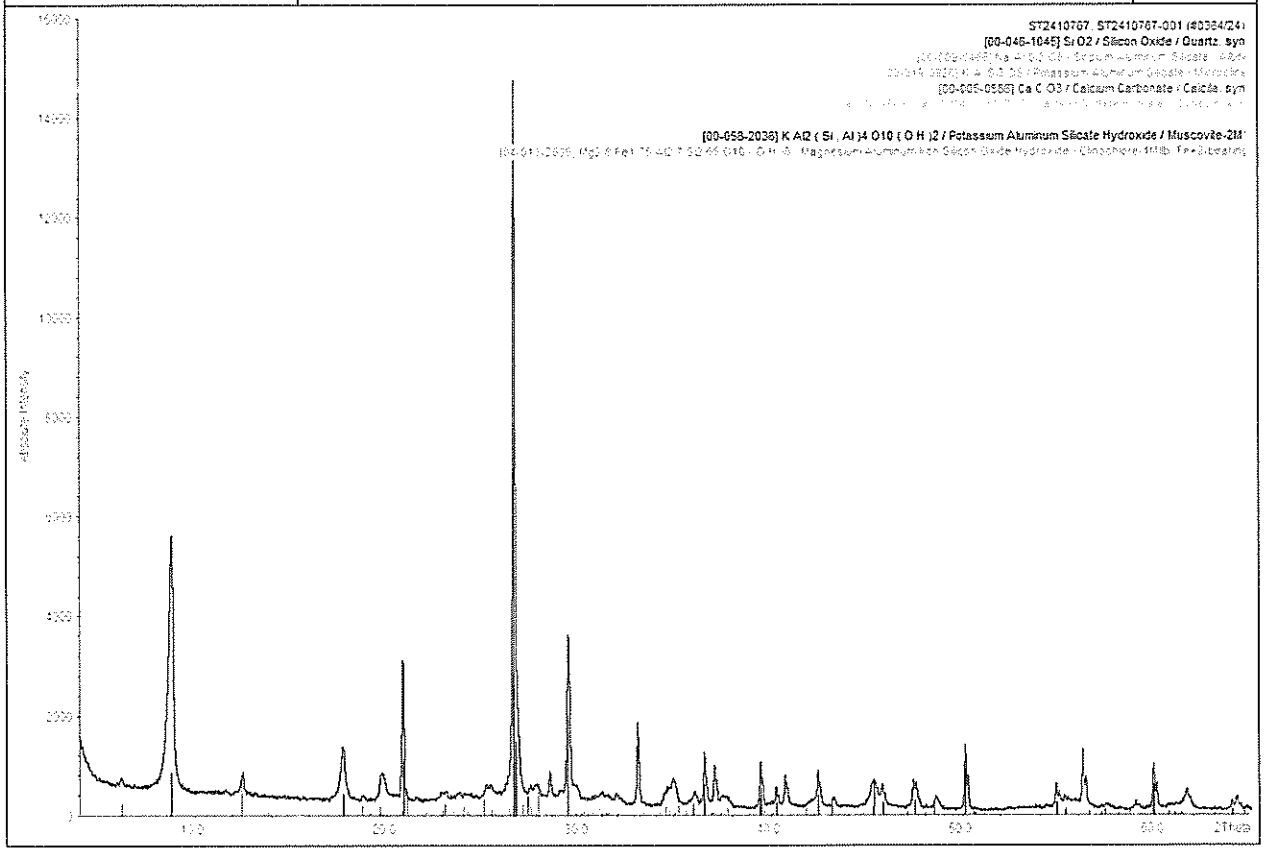
ST2410767

STOE Powder Diffraction System	X- Ray Laboratory Dr. Ermrich - a division of Sensotec GmbH -	09-Apr-2024



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Telefon : +46 8 5277 5200

ST2410767

Laboratoriets provnummer	**ST2410767-002**
Provbeteckning	Sammanslagningsprov B-malm

Parameter	Resultat %[m/m]	Metod
Provberedning		1
XRD analys		2
Amorf / finkristallin andel	Ej signifikant	
Kvarts SiO_2 PDF#00-46-1045	39.3 ± 1.0	
Albit $NaAlSi_3O_8$ PDF#00-009-0466	0.8 ± 0.2	
Mikroklin $KAlSi_3O_8$ PDF# 00-019-0926	1.3 ± 0.2	
Kalcit $CaCO_3$ PDF# 00-005-0586	16.0 ± 0.8	
Gips $Ca(SO_4)(H_2O)_2$ PDF# 04-008-9805	0.9 ± 0.2	
Pyrit FeS_2 PDF# 04-004-6511	7.9 ± 0.5	
Muskovit $KAl_2(Si,Al)_4O_{10}(OH)_2$ PDF# 00-058-2036	33.8 ± 1.0	

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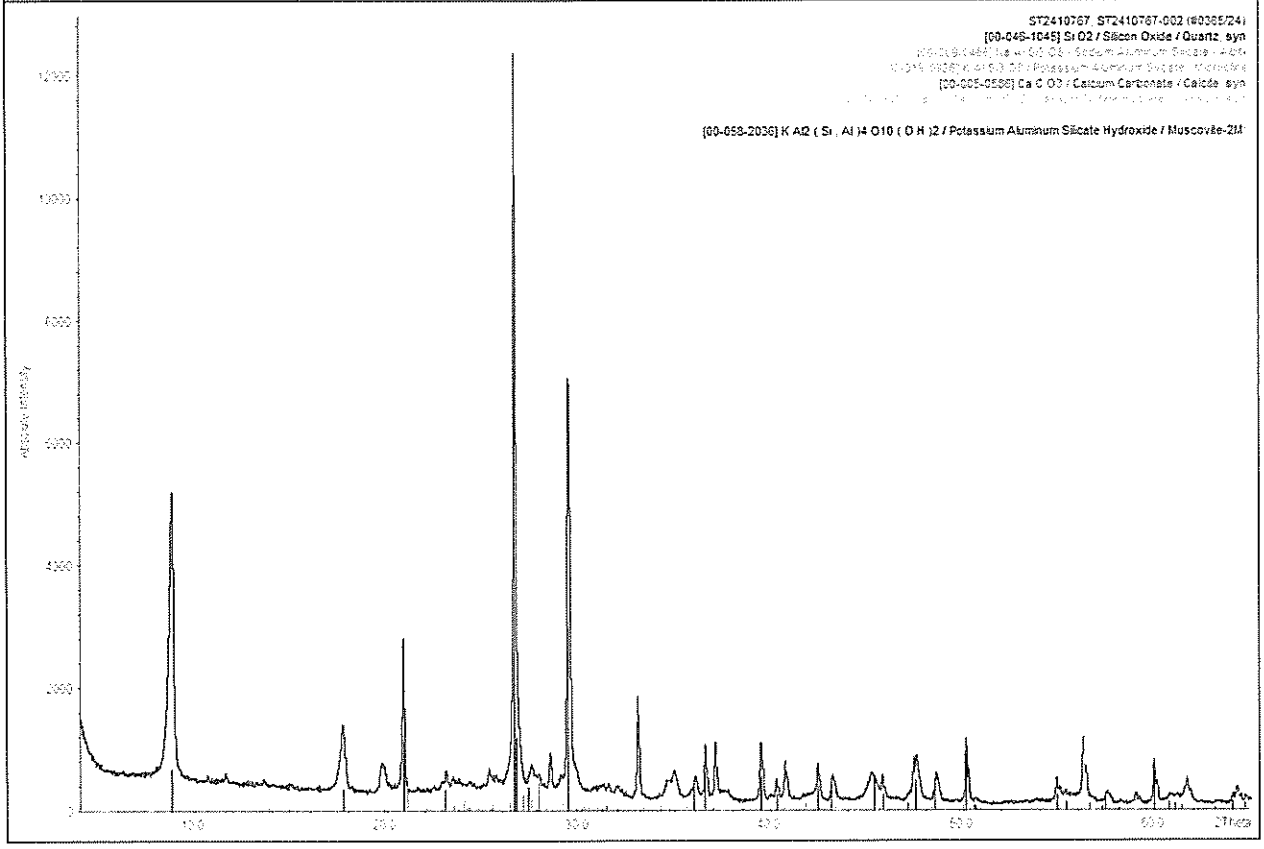
STOE Powder Diffraction System	X- Ray Laboratory Dr. Ermrich - a division of Sensotec GmbH -	09-Apr-2024



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ST2410767

*indikerar oackrediterad analys

Metod	
1	Provberedning.
2	Paket G-11C. Mineralkvantifiering av kristallina faser (Rietvelds metod). Provet har finmalts och undersökts på en röntgendiffraktometer (XRD) med CuK_α röntgenrör. Haltbestämningen sker genom Rietveld - analys. Halterna har beräknats för de kristallina faserna och nominerats till 100 %. Halterna är angivna i viktprocent.

Utförande lab	
UL	*Analys utförd av* Röngenlabor Dr Ermrich-Sensotech, Bismarckstr.: 29, D-64853 Otzberg/Lengfeld Ackrediterad av: DAkkS Ackrediteringsnummer: D-PL-18075-01-00

Generell kommentar

Denna rapport får endast återges i sin helhet, om inte utfärdande laboratorium i förväg skriftligen godkänt annat. Laboratoriet tar inget ansvar för information i denna rapport som har lämnats av kunden, eller resultat som kan ha påverkats av sådan information. Beträffade laboratoriets ansvar i samband med uppdrag, se aktuell produktkatalog eller vår webbplats www.alsglobal.se .

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A5513**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 16-Mar-2024 08:31
PO	: SE2300368, Cycle#0	Date Analysis Commenced	: 16-Mar-2024
C-O-C number	: ----	Issue Date	: 23-Mar-2024 15:03
Sampler	: JJ		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Production/Validation Manager	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Sam Silveira	Analyst	Metals, Burnaby, British Columbia

General Comments

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

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

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

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

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
µS/cm	microsiemens per centimetre
mg/L	milligrams per litre
mL	millilitres
pH units	pH units

<: less than.

>: greater than.

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

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

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

Qualifiers

Qualifier	*Description*
DLCI	*Detection Limit Raised: Chromatographic interference due to co-elution.*

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-0	----	----	----	----
					Client sampling date / time	16-Mar-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24A5513-001	--------	--------	--------	--------	
					Result	---	---	---	---	
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	0.153	----	----	----	----	
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	15.8	----	----	----	----	
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	<0.126 DLCI	----	----	----	----	
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0094	----	----	----	----	
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0337	----	----	----	----	
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	16.6	----	----	----	----	
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.215	----	----	----	----	
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00412	----	----	----	----	
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00092	----	----	----	----	
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.210	----	----	----	----	
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----	
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.064	----	----	----	----	
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----	
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	25.1	----	----	----	----	
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----	
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----	
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----	
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0324	----	----	----	----	
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	2.03	----	----	----	----	
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00877	----	----	----	----	
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.0307	----	----	----	----	
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----	
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	21.2	----	----	----	----	

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

					Client sample ID	LST Sammanslagningsprov-0	----	----	----	----
					Client sampling date / time	16-Mar-2024 00:00	----	----	----	----
Analyte	*CAS Number*	*Method/Lab*	*LOR*	*Unit*		VA24A5513-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00017	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		1.20	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		6.34	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.158	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		6.44	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.000084	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		0.000944	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		<0.0000050	----	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		64.3	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		256	----	----	----	----
pH	----	E117/VA	0.10	pH units		7.99	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL		500	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL		750	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		64.3	----	----	----	----

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

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

ALS Canada Ltd.

right solutions. right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	:**VA24A5513**	Page	: 1 of 9
Client	:**Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	:Erik Karlsson	Account Manager	: Virginia Smith
Address	:Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	:8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:---	Telephone	:+1 604 253 4188
Project	:SE 2300368 Haggan BK Vanadis	Date Samples Received	: 16-Mar-2024 08:31
PO	: SE2300368, Cycle#0	Issue Date	: 23-Mar-2024 15:04
C-O-C number	:----		
Sampler	:JJ		
Site	:ALS Scandinavia AB/ALS Minerals		
Quote number	:VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	:1		
No. of samples analysed	:1		

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

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

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

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Leachable Metals	QC-1370690-001	----	Barium, leachable	7440-39-3	E448	0.00055 [B] mg/L	0.0001 mg/L	Blank result exceeds permitted value

Result Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group : Analytical Method / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Leachable Anions & Nutrients : Alkalinity Species by Titration (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E291	16-Mar-2024	18-Mar-2024	14 days	3 days	✓	19-Mar-2024	14 days	4 days	✓
Leachable Anions & Nutrients : Bromide by IC (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E245.Br	16-Mar-2024	18-Mar-2024	28 days	3 days	✓	18-Mar-2024	28 days	3 days	✓
Leachable Anions & Nutrients : Chloride by IC (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E245.Cl	16-Mar-2024	18-Mar-2024	28 days	3 days	✓	18-Mar-2024	28 days	3 days	✓
Leachable Anions & Nutrients : Fluoride by IC (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E245.F	16-Mar-2024	18-Mar-2024	28 days	3 days	✓	18-Mar-2024	28 days	3 days	✓
Leachable Anions & Nutrients : Nitrate by IC (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E245.NO3	16-Mar-2024	18-Mar-2024	3 days	3 days	✓	18-Mar-2024	3 days	3 days	✓
Leachable Anions & Nutrients : Nitrite by IC (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E245.NO2	16-Mar-2024	18-Mar-2024	3 days	3 days	✓	18-Mar-2024	3 days	3 days	✓
Leachable Anions & Nutrients : Sulfate by IC (Humidity Cell) (Low Level)										
HDPE LST Sammanslagningsprov-0	E245.SO4-L	16-Mar-2024	18-Mar-2024	28 days	3 days	✓	18-Mar-2024	28 days	3 days	✓

Matrix: **Water**

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

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Metals : Dissolved Mercury by CVAAS (Humidity Cell)										
Glass vial dissolved (hydrochloric acid) LST Sammanslagningsprov-0	E517	16-Mar-2024	20-Mar-2024	28 days	5 days	✓	20-Mar-2024	28 days	5 days	✓
Leachable Metals : Dissolved Metals by CRC ICPMS (Humidity Cell)										
HDPE dissolved (nitric acid) LST Sammanslagningsprov-0	E448	16-Mar-2024	18-Mar-2024	180 days	3 days	✓	19-Mar-2024	180 days	3 days	✓
Leachable Physical Tests : Acidity by Titration (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E286	16-Mar-2024	18-Mar-2024	14 days	3 days	✓	19-Mar-2024	14 days	3 days	✓
Leachable Physical Tests : Conductivity (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E104	16-Mar-2024	18-Mar-2024	28 days	3 days	✓	19-Mar-2024	28 days	4 days	✓
Leachable Physical Tests : pH by Meter (Humidity Cell)										
HDPE LST Sammanslagningsprov-0	E117	16-Mar-2024	18-Mar-2024	12 hrs	60 hrs	× EHTL	19-Mar-2024	12 hrs	87 hrs	× EHTL
Physical Tests : Volume In/Out (Humidity Cells)										
HDPE LST Sammanslagningsprov-0	E099	16-Mar-2024	----	----	----		16-Mar-2024	----	1 days	

Legend & Qualifier Definitions

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration (Humidity Cell)	E286	1370327	1	13	7.6	5.0	✓
Alkalinity Species by Titration (Humidity Cell)	E291	1370319	1	13	7.6	5.0	✓
Bromide by IC (Humidity Cell)	E245.Br	1370325	1	13	7.6	5.0	✓
Chloride by IC (Humidity Cell)	E245.Cl	1370323	1	13	7.6	5.0	✓
Conductivity (Humidity Cell)	E104	1370318	1	20	5.0	5.0	✓
Dissolved Mercury by CVAAS (Humidity Cell)	E517	1374159	1	13	7.6	5.0	✓
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448	1370690	1	7	14.2	5.0	✓
Fluoride by IC (Humidity Cell)	E245.F	1370322	1	13	7.6	5.0	✓
Nitrate by IC (Humidity Cell)	E245.NO3	1370320	1	13	7.6	5.0	✓
Nitrite by IC (Humidity Cell)	E245.NO2	1370321	1	13	7.6	5.0	✓
pH by Meter (Humidity Cell)	E117	1370317	1	20	5.0	5.0	✓
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L	1370324	1	13	7.6	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration (Humidity Cell)	E286	1370327	1	13	7.6	5.0	✓
Alkalinity Species by Titration (Humidity Cell)	E291	1370319	1	13	7.6	5.0	✓
Bromide by IC (Humidity Cell)	E245.Br	1370325	1	13	7.6	5.0	✓
Chloride by IC (Humidity Cell)	E245.Cl	1370323	1	13	7.6	5.0	✓
Conductivity (Humidity Cell)	E104	1370318	1	20	5.0	5.0	✓
Dissolved Mercury by CVAAS (Humidity Cell)	E517	1374159	1	13	7.6	5.0	✓
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448	1370690	1	7	14.2	5.0	✓
Fluoride by IC (Humidity Cell)	E245.F	1370322	1	13	7.6	5.0	✓
Nitrate by IC (Humidity Cell)	E245.NO3	1370320	1	13	7.6	5.0	✓
Nitrite by IC (Humidity Cell)	E245.NO2	1370321	1	13	7.6	5.0	✓
pH by Meter (Humidity Cell)	E117	1370317	1	20	5.0	5.0	✓
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L	1370324	1	13	7.6	5.0	✓
Method Blanks (MB)							
Acidity by Titration (Humidity Cell)	E286	1370327	1	13	7.6	5.0	✓
Alkalinity Species by Titration (Humidity Cell)	E291	1370319	1	13	7.6	5.0	✓
Bromide by IC (Humidity Cell)	E245.Br	1370325	1	13	7.6	5.0	✓
Chloride by IC (Humidity Cell)	E245.Cl	1370323	1	13	7.6	5.0	✓
Conductivity (Humidity Cell)	E104	1370318	1	20	5.0	5.0	✓
Dissolved Mercury by CVAAS (Humidity Cell)	E517	1374159	1	13	7.6	5.0	✓
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448	1370690	1	7	14.2	5.0	✓
Fluoride by IC (Humidity Cell)	E245.F	1370322	1	13	7.6	5.0	✓
Nitrate by IC (Humidity Cell)	E245.NO3	1370320	1	13	7.6	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Nitrite by IC (Humidity Cell)	E245.NO2	1370321	1	13	7.6	5.0	✓
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L	1370324	1	13	7.6	5.0	✓
Matrix Spikes (MS)							
Bromide by IC (Humidity Cell)	E245.Br	1370325	1	13	7.6	5.0	✓
Chloride by IC (Humidity Cell)	E245.Cl	1370323	1	13	7.6	5.0	✓
Dissolved Mercury by CVAAS (Humidity Cell)	E517	1374159	1	13	7.6	5.0	✓
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448	1370690	1	7	14.2	5.0	✓
Fluoride by IC (Humidity Cell)	E245.F	1370322	1	13	7.6	5.0	✓
Nitrate by IC (Humidity Cell)	E245.NO3	1370320	1	13	7.6	5.0	✓
Nitrite by IC (Humidity Cell)	E245.NO2	1370321	1	13	7.6	5.0	✓
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L	1370324	1	13	7.6	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Description
Volume In/Out (Humidity Cells)	E099 ALS Environmental - Vancouver	Water		Deionized water is added to the humidity cell and the amount of water added and collected is measured.
Conductivity (Humidity Cell)	E104 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 2510 (mod)	A conductivity cell with platinum electrodes is immersed in a leachate of a soil sample prepared in a humidity cell. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter (Humidity Cell)	E117 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on a leachate of a soil sample prepared in a humidity cell. The pH is then measured by a standard pH probe.
Bromide by IC (Humidity Cell)	E245.Br ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Chloride by IC (Humidity Cell)	E245.Cl ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Fluoride by IC (Humidity Cell)	E245.F ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Nitrite by IC (Humidity Cell)	E245.NO2 ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Nitrate by IC (Humidity Cell)	E245.NO3 ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Acidity by Titration (Humidity Cell)	E286 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 2310 B (mod)	Acidity is determined by potentiometric titration to a specified endpoint on a leachate of a soil sample prepared in a humidity cell.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Description
Alkalinity Species by Titration (Humidity Cell)	E291 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on a leachate of a soil sample prepared in a humidity cell. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 3030B/6020B (mod)	Leachate is prepared according to ASTM D5744 and MEND (Price, 2009). Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Mercury by CVAAS (Humidity Cell)	E517 ALS Environmental - Vancouver	Water	ASTM D5744/EPA 1631E (mod)	A leachate of a soil sample prepared in a humidity cell is filtered (0.45 micron), preserved with hydrochloric acid, and then undergoes a cold oxidation by bromine monochloride prior to reduction with stannous chloride, with analysis by either CVAAS.

QUALITY CONTROL REPORT

Work Order	: **VA24A5513**	Page	: 1 of 10
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Hammarvägen 22 Pitea Sweden SE-943 36	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 16-Mar-2024 08:31
PO	: SE2300368, Cycle#0	Date Analysis Commenced	: 16-Mar-2024
C-O-C number	: ----	Issue Date	: 23-Mar-2024 15:04
Sampler	: JJ ----		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Production/Validation Manager	Vancouver Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Sam Silveira	Analyst	Vancouver Metals, Burnaby, British Columbia

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Leachable Anions & Nutrients (QC Lot: 1370319)											
VA24A5508-001	Anonymous	Alkalinity, bicarbonate (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0.00%	200%	----
		Alkalinity, carbonate (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0.00%	200%	----
		Alkalinity, hydroxide (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0.00%	200%	----
		Alkalinity, phenolphthalein (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
		Alkalinity, total (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1370320)											
VA24A5508-001	Anonymous	Nitrate (as N)	14797-55-8	E245.NO3	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1370321)											
VA24A5508-001	Anonymous	Nitrite (as N)	14797-65-0	E245.NO2	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1370322)											
VA24A5508-001	Anonymous	Fluoride	16984-48-8	E245.F	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1370323)											
VA24A5508-001	Anonymous	Chloride	16887-00-6	E245.Cl	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1370324)											
VA24A5508-001	Anonymous	Sulfate (as SO4)	14808-79-8	E245.SO4-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1370325)											
VA24A5508-001	Anonymous	Bromide	24959-67-9	E245.Br	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Leachable Metals (QC Lot: 1370690)											
VA24A5507-001	Anonymous	Aluminum, leachable	7429-90-5	E448	0.0100	mg/L	3.21	3.21	0.200%	20%	----
		Antimony, leachable	7440-36-0	E448	0.00020	mg/L	0.00031	0.00030	0.000002	Diff <2x LOR	----
		Arsenic, leachable	7440-38-2	E448	0.00020	mg/L	0.00584	0.00594	1.76%	20%	----
		Barium, leachable	7440-39-3	E448	0.00020	mg/L	0.0187	0.0185	1.25%	20%	----
		Beryllium, leachable	7440-41-7	E448	0.00020	mg/L	0.00023	0.00027	0.00004	Diff <2x LOR	----
		Bismuth, leachable	7440-69-9	E448	0.00100	mg/L	<0.00100	<0.00100	0	Diff <2x LOR	----
		Boron, leachable	7440-42-8	E448	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		Cadmium, leachable	7440-43-9	E448	0.000020	mg/L	0.0187	0.0187	0.0143%	20%	----
		Calcium, leachable	7440-70-2	E448	0.100	mg/L	3.22	3.43	6.46%	20%	----
		Chromium, leachable	7440-47-3	E448	0.00100	mg/L	0.00964	0.00996	0.00032	Diff <2x LOR	----
		Cobalt, leachable	7440-48-4	E448	0.00020	mg/L	0.0151	0.0151	0.000199%	20%	----
		Copper, leachable	7440-50-8	E448	0.00100	mg/L	6.47	6.44	0.433%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Leachable Metals (QC Lot: 1370690) - continued											
VA24A5507-001	Anonymous	Iron, leachable	7439-89-6	E448	0.060	mg/L	35.3	35.6	0.928%	20%	----
		Lead, leachable	7439-92-1	E448	0.000100	mg/L	0.000421	0.000410	0.000011	Diff <2x LOR	----
		Lithium, leachable	7439-93-2	E448	0.0020	mg/L	0.0040	0.0041	0.0001	Diff <2x LOR	----
		Magnesium, leachable	7439-95-4	E448	0.0100	mg/L	1.12	1.11	0.897%	20%	----
		Manganese, leachable	7439-96-5	E448	0.00020	mg/L	0.260	0.259	0.223%	20%	----
		Molybdenum, leachable	7439-98-7	E448	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		Nickel, leachable	7440-02-0	E448	0.00100	mg/L	0.0147	0.0147	0.160%	20%	----
		Phosphorus, leachable	7723-14-0	E448	0.60	mg/L	<0.60	<0.60	0	Diff <2x LOR	----
		Potassium, leachable	7440-09-7	E448	0.100	mg/L	0.251	0.254	0.003	Diff <2x LOR	----
		Selenium, leachable	7782-49-2	E448	0.00020	mg/L	0.00358	0.00368	2.83%	20%	----
		Silicon, leachable	7440-21-3	E448	0.100	mg/L	2.86	2.99	4.44%	20%	----
		Silver, leachable	7440-22-4	E448	0.000020	mg/L	0.000046	0.000044	0.000001	Diff <2x LOR	----
		Sodium, leachable	7440-23-5	E448	0.100	mg/L	0.108	0.109	0.0003	Diff <2x LOR	----
		Strontium, leachable	7440-24-6	E448	0.00040	mg/L	0.0272	0.0269	1.05%	20%	----
		Sulfur, leachable	7704-34-9	E448	1.00	mg/L	59.4	61.5	3.56%	20%	----
		Thallium, leachable	7440-28-0	E448	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		Tin, leachable	7440-31-5	E448	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		Titanium, leachable	7440-32-6	E448	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
		Uranium, leachable	7440-61-1	E448	0.000020	mg/L	0.000600	0.000595	0.718%	20%	----
		Vanadium, leachable	7440-62-2	E448	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
		Zinc, leachable	7440-66-6	E448	0.0060	mg/L	1.56	1.59	2.49%	20%	----
Leachable Metals (QC Lot: 1374159)											
VA24A5507-001	Anonymous	Mercury, leachable	7439-97-6	E517	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Leachable Physical Tests (QC Lot: 1370317)											
VA24A5508-001	Anonymous	pH	----	E117	0.10	pH units	5.41	5.56	2.73%	5%	----
Leachable Physical Tests (QC Lot: 1370318)											
VA24A5508-001	Anonymous	Conductivity	----	E104	3.0	µS/cm	<3.0	<3.0	0	Diff <2x LOR	----
Leachable Physical Tests (QC Lot: 1370327)											
VA24A5507-001	Anonymous	Acidity (as CaCO3)	----	E286	3.0	mg/L	168	150	11.7%	20%	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Anions & Nutrients (QCLot: 1370319)						
Alkalinity, bicarbonate (as CaCO3)	---	E291	2	mg/L	<2.0	---
Alkalinity, carbonate (as CaCO3)	---	E291	2	mg/L	<2.0	---
Alkalinity, hydroxide (as CaCO3)	---	E291	2	mg/L	<2.0	---
Alkalinity, phenolphthalein (as CaCO3)	---	E291	2	mg/L	<2.0	---
Alkalinity, total (as CaCO3)	---	E291	2	mg/L	<2.0	---
Leachable Anions & Nutrients (QCLot: 1370320)						
Nitrate (as N)	14797-55-8	E245.NO3	0.005	mg/L	<0.0050	---
Leachable Anions & Nutrients (QCLot: 1370321)						
Nitrite (as N)	14797-65-0	E245.NO2	0.003	mg/L	<0.0030	---
Leachable Anions & Nutrients (QCLot: 1370322)						
Fluoride	16984-48-8	E245.F	0.02	mg/L	<0.020	---
Leachable Anions & Nutrients (QCLot: 1370323)						
Chloride	16887-00-6	E245.Cl	0.5	mg/L	<0.50	---
Leachable Anions & Nutrients (QCLot: 1370324)						
Sulfate (as SO4)	14808-79-8	E245.SO4-L	0.05	mg/L	<0.050	---
Leachable Anions & Nutrients (QCLot: 1370325)						
Bromide	24959-67-9	E245.Br	0.05	mg/L	<0.050	---
Leachable Metals (QCLot: 1370690)						
Aluminum, leachable	7429-90-5	E448	0.005	mg/L	<0.0050	---
Antimony, leachable	7440-36-0	E448	0.0001	mg/L	<0.00010	---
Arsenic, leachable	7440-38-2	E448	0.0001	mg/L	<0.00010	---
Barium, leachable	7440-39-3	E448	0.0001	mg/L	# 0.00055	B
Beryllium, leachable	7440-41-7	E448	0.0001	mg/L	<0.00010	---
Bismuth, leachable	7440-69-9	E448	0.0005	mg/L	<0.00050	---
Boron, leachable	7440-42-8	E448	0.01	mg/L	<0.010	---
Cadmium, leachable	7440-43-9	E448	0.00001	mg/L	<0.000010	---
Calcium, leachable	7440-70-2	E448	0.05	mg/L	<0.050	---
Chromium, leachable	7440-47-3	E448	0.0005	mg/L	<0.00050	---
Cobalt, leachable	7440-48-4	E448	0.0001	mg/L	<0.00010	---
Copper, leachable	7440-50-8	E448	0.0005	mg/L	<0.00050	---
Iron, leachable	7439-89-6	E448	0.03	mg/L	<0.030	---
Lead, leachable	7439-92-1	E448	0.00005	mg/L	<0.000050	---

Sub-Matrix: Water

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Metals (QCLot: 1370690) - continued						
Lithium, leachable	7439-93-2	E448	0.001	mg/L	<0.0010	----
Magnesium, leachable	7439-95-4	E448	0.005	mg/L	<0.0050	----
Manganese, leachable	7439-96-5	E448	0.0001	mg/L	<0.00010	----
Molybdenum, leachable	7439-98-7	E448	0.00005	mg/L	<0.000050	----
Nickel, leachable	7440-02-0	E448	0.0005	mg/L	<0.00050	----
Phosphorus, leachable	7723-14-0	E448	0.3	mg/L	<0.30	----
Potassium, leachable	7440-09-7	E448	0.05	mg/L	<0.050	----
Selenium, leachable	7782-49-2	E448	0.0001	mg/L	<0.00010	----
Silicon, leachable	7440-21-3	E448	0.05	mg/L	<0.050	----
Silver, leachable	7440-22-4	E448	0.00001	mg/L	<0.000010	----
Sodium, leachable	7440-23-5	E448	0.05	mg/L	<0.050	----
Strontium, leachable	7440-24-6	E448	0.0002	mg/L	<0.00020	----
Sulfur, leachable	7704-34-9	E448	0.5	mg/L	<0.50	----
Thallium, leachable	7440-28-0	E448	0.00001	mg/L	<0.000010	----
Tin, leachable	7440-31-5	E448	0.0001	mg/L	<0.00010	----
Titanium, leachable	7440-32-6	E448	0.01	mg/L	<0.010	----
Uranium, leachable	7440-61-1	E448	0.00001	mg/L	<0.000010	----
Vanadium, leachable	7440-62-2	E448	0.001	mg/L	<0.0010	----
Zinc, leachable	7440-66-6	E448	0.003	mg/L	<0.0030	----
Leachable Metals (QCLot: 1374159)						
Mercury, leachable	7439-97-6	E517	0.000005	mg/L	<0.0000050	----
Leachable Physical Tests (QCLot: 1370318)						
Conductivity	----	E104	3	µS/cm	<3.0	----
Leachable Physical Tests (QCLot: 1370327)						
Acidity (as CaCO3)	----	E286	3	mg/L	<3.0	----

Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Leachable Anions & Nutrients (QCLot: 1370319)									
Alkalinity, phenolphthalein (as CaCO3)	----	E291	2	mg/L	229 mg/L	107	75.0	125	----
Alkalinity, total (as CaCO3)	----	E291	2	mg/L	500 mg/L	107	85.0	115	----
Leachable Anions & Nutrients (QCLot: 1370320)									
Nitrate (as N)	14797-55-8	E245.NO3	0.005	mg/L	2.5 mg/L	100	85.0	115	----
Leachable Anions & Nutrients (QCLot: 1370321)									
Nitrite (as N)	14797-65-0	E245.NO2	0.003	mg/L	0.5 mg/L	97.3	85.0	115	----
Leachable Anions & Nutrients (QCLot: 1370322)									
Fluoride	16984-48-8	E245.F	0.02	mg/L	1 mg/L	96.7	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1370323)									
Chloride	16887-00-6	E245.Cl	0.5	mg/L	100 mg/L	100	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1370324)									
Sulfate (as SO4)	14808-79-8	E245.SO4-L	0.05	mg/L	100 mg/L	101	85.0	115	----
Leachable Anions & Nutrients (QCLot: 1370325)									
Bromide	24959-67-9	E245.Br	0.05	mg/L	0.5 mg/L	102	70.0	130	----
Leachable Metals (QCLot: 1370690)									
Aluminum, leachable	7429-90-5	E448	0.005	mg/L	2 mg/L	100	80.0	120	----
Antimony, leachable	7440-36-0	E448	0.0001	mg/L	1 mg/L	94.8	80.0	120	----
Arsenic, leachable	7440-38-2	E448	0.0001	mg/L	1 mg/L	105	80.0	120	----
Barium, leachable	7440-39-3	E448	0.0001	mg/L	0.25 mg/L	99.6	80.0	120	----
Beryllium, leachable	7440-41-7	E448	0.0001	mg/L	0.1 mg/L	102	80.0	120	----
Bismuth, leachable	7440-69-9	E448	0.0005	mg/L	1 mg/L	97.5	80.0	120	----
Boron, leachable	7440-42-8	E448	0.01	mg/L	1 mg/L	102	80.0	120	----
Cadmium, leachable	7440-43-9	E448	0.00001	mg/L	0.1 mg/L	101	80.0	120	----
Calcium, leachable	7440-70-2	E448	0.05	mg/L	50 mg/L	103	80.0	120	----
Chromium, leachable	7440-47-3	E448	0.0005	mg/L	0.25 mg/L	99.9	80.0	120	----
Cobalt, leachable	7440-48-4	E448	0.0001	mg/L	0.25 mg/L	99.1	80.0	120	----
Copper, leachable	7440-50-8	E448	0.0005	mg/L	0.25 mg/L	96.4	80.0	120	----
Iron, leachable	7439-89-6	E448	0.03	mg/L	1 mg/L	95.5	80.0	120	----
Lead, leachable	7439-92-1	E448	0.00005	mg/L	0.5 mg/L	98.5	80.0	120	----
Lithium, leachable	7439-93-2	E448	0.001	mg/L	0.25 mg/L	101	80.0	120	----
Magnesium, leachable	7439-95-4	E448	0.005	mg/L	50 mg/L	99.8	80.0	120	----

Sub-Matrix: Water

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Leachable Metals (QCLot: 1370690) - continued									
Manganese, leachable	7439-96-5	E448	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
Molybdenum, leachable	7439-98-7	E448	0.00005	mg/L	0.25 mg/L	100	80.0	120	----
Nickel, leachable	7440-02-0	E448	0.0005	mg/L	0.5 mg/L	101	80.0	120	----
Phosphorus, leachable	7723-14-0	E448	0.3	mg/L	10 mg/L	108	80.0	120	----
Potassium, leachable	7440-09-7	E448	0.05	mg/L	50 mg/L	98.1	80.0	120	----
Selenium, leachable	7782-49-2	E448	0.0001	mg/L	1 mg/L	102	80.0	120	----
Silicon, leachable	7440-21-3	E448	0.05	mg/L	10 mg/L	105	80.0	120	----
Silver, leachable	7440-22-4	E448	0.00001	mg/L	0.1 mg/L	95.1	80.0	120	----
Sodium, leachable	7440-23-5	E448	0.05	mg/L	50 mg/L	102	80.0	120	----
Strontium, leachable	7440-24-6	E448	0.0002	mg/L	0.25 mg/L	99.1	80.0	120	----
Sulfur, leachable	7704-34-9	E448	0.5	mg/L	50 mg/L	87.0	80.0	120	----
Thallium, leachable	7440-28-0	E448	0.00001	mg/L	1 mg/L	98.4	80.0	120	----
Tin, leachable	7440-31-5	E448	0.0001	mg/L	0.5 mg/L	98.3	80.0	120	----
Titanium, leachable	7440-32-6	E448	0.01	mg/L	0.25 mg/L	94.2	80.0	120	----
Uranium, leachable	7440-61-1	E448	0.00001	mg/L	0.005 mg/L	104	80.0	120	----
Vanadium, leachable	7440-62-2	E448	0.001	mg/L	0.5 mg/L	101	80.0	120	----
Zinc, leachable	7440-66-6	E448	0.003	mg/L	0.5 mg/L	100	80.0	120	----
Leachable Metals (QCLot: 1374159)									
Mercury, leachable	7439-97-6	E517	0.000005	mg/L	0.0001 mg/L	99.3	80.0	120	----
Leachable Physical Tests (QCLot: 1370317)									
pH	----	E117	----	pH units	7 pH units	100	95.0	105	----
Leachable Physical Tests (QCLot: 1370318)									
Conductivity	----	E104	3	µS/cm	146.9 µS/cm	99.2	80.0	120	----
Leachable Physical Tests (QCLot: 1370327)									
Acidity (as CaCO3)	----	E286	3	mg/L	50 mg/L	98.0	85.0	115	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Leachable Anions & Nutrients (QCLot: 1370320)										
VA24A5508-003	Anonymous	Nitrate (as N)	14797-55-8	E245.NO3	45.2 mg/L	50 mg/L	90.4	75.0	125	----
Leachable Anions & Nutrients (QCLot: 1370321)										
VA24A5508-003	Anonymous	Nitrite (as N)	14797-65-0	E245.NO2	8.78 mg/L	10 mg/L	87.8	75.0	125	----
Leachable Anions & Nutrients (QCLot: 1370322)										
VA24A5508-003	Anonymous	Fluoride	16984-48-8	E245.F	18.2 mg/L	20 mg/L	91.2	60.0	140	----
Leachable Anions & Nutrients (QCLot: 1370323)										
VA24A5508-003	Anonymous	Chloride	16887-00-6	E245.Cl	1840 mg/L	2000 mg/L	91.9	60.0	140	----
Leachable Anions & Nutrients (QCLot: 1370324)										
VA24A5508-003	Anonymous	Sulfate (as SO4)	14808-79-8	E245.SO4-L	1820 mg/L	2000 mg/L	90.9	75.0	125	----
Leachable Anions & Nutrients (QCLot: 1370325)										
VA24A5508-003	Anonymous	Bromide	24959-67-9	E245.Br	9.40 mg/L	10 mg/L	94.0	60.0	140	----
Leachable Metals (QCLot: 1370690)										
VA24A5507-002	Anonymous	Aluminum, leachable	7429-90-5	E448	0.200 mg/L	0.2 mg/L	99.9	70.0	130	----
		Antimony, leachable	7440-36-0	E448	0.0182 mg/L	0.02 mg/L	91.0	70.0	130	----
		Arsenic, leachable	7440-38-2	E448	0.0203 mg/L	0.02 mg/L	102	70.0	130	----
		Barium, leachable	7440-39-3	E448	ND mg/L	0.02 mg/L	ND	70.0	130	----
		Beryllium, leachable	7440-41-7	E448	0.0408 mg/L	0.04 mg/L	102	70.0	130	----
		Bismuth, leachable	7440-69-9	E448	0.00985 mg/L	0.01 mg/L	98.5	70.0	130	----
		Boron, leachable	7440-42-8	E448	0.101 mg/L	0.1 mg/L	101	70.0	130	----
		Cadmium, leachable	7440-43-9	E448	0.00381 mg/L	0.004 mg/L	95.3	70.0	130	----
		Calcium, leachable	7440-70-2	E448	ND mg/L	4 mg/L	ND	70.0	130	----
		Chromium, leachable	7440-47-3	E448	0.0389 mg/L	0.04 mg/L	97.2	70.0	130	----
		Cobalt, leachable	7440-48-4	E448	0.0198 mg/L	0.02 mg/L	98.9	70.0	130	----
		Copper, leachable	7440-50-8	E448	0.0191 mg/L	0.02 mg/L	95.5	70.0	130	----
		Iron, leachable	7439-89-6	E448	1.92 mg/L	2 mg/L	96.2	70.0	130	----
		Lead, leachable	7439-92-1	E448	0.0195 mg/L	0.02 mg/L	97.7	70.0	130	----
		Lithium, leachable	7439-93-2	E448	0.0987 mg/L	0.1 mg/L	98.7	70.0	130	----
		Magnesium, leachable	7439-95-4	E448	ND mg/L	1 mg/L	ND	70.0	130	----
		Manganese, leachable	7439-96-5	E448	ND mg/L	0.02 mg/L	ND	70.0	130	----
		Molybdenum, leachable	7439-98-7	E448	0.0190 mg/L	0.02 mg/L	95.0	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Leachable Metals (QCLot: 1370690) - continued										
VA24A5507-002	Anonymous	Nickel, leachable	7440-02-0	E448	0.0401 mg/L	0.04 mg/L	100	70.0	130	----
		Phosphorus, leachable	7723-14-0	E448	10.3 mg/L	10 mg/L	103	70.0	130	----
		Potassium, leachable	7440-09-7	E448	3.87 mg/L	4 mg/L	96.8	70.0	130	----
		Selenium, leachable	7782-49-2	E448	0.0396 mg/L	0.04 mg/L	99.0	70.0	130	----
		Silicon, leachable	7440-21-3	E448	9.91 mg/L	10 mg/L	99.1	70.0	130	----
		Silver, leachable	7440-22-4	E448	0.00390 mg/L	0.004 mg/L	97.6	70.0	130	----
		Sodium, leachable	7440-23-5	E448	1.94 mg/L	2 mg/L	97.2	70.0	130	----
		Strontium, leachable	7440-24-6	E448	ND mg/L	0.02 mg/L	ND	70.0	130	----
		Sulfur, leachable	7704-34-9	E448	20.1 mg/L	20 mg/L	101	70.0	130	----
		Thallium, leachable	7440-28-0	E448	0.00375 mg/L	0.004 mg/L	93.9	70.0	130	----
		Tin, leachable	7440-31-5	E448	0.0190 mg/L	0.02 mg/L	95.3	70.0	130	----
		Titanium, leachable	7440-32-6	E448	0.039 mg/L	0.04 mg/L	96.6	70.0	130	----
		Uranium, leachable	7440-61-1	E448	0.00408 mg/L	0.004 mg/L	102	70.0	130	----
		Vanadium, leachable	7440-62-2	E448	0.0986 mg/L	0.1 mg/L	98.6	70.0	130	----
		Zinc, leachable	7440-66-6	E448	0.405 mg/L	0.4 mg/L	101	70.0	130	----
Leachable Metals (QCLot: 1374159)										
VA24A5507-002	Anonymous	Mercury, leachable	7439-97-6	E517	0.0000992 mg/L	0.0001 mg/L	99.2	70.0	130	----

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A6105**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 23-Mar-2024 09:02
PO	: SE2300368, Cycle#1	Date Analysis Commenced	: 23-Mar-2024
C-O-C number	: ----	Issue Date	: 31-Mar-2024 11:01
Sampler	: JJ		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Organics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate (Matrix: Water)				Client sample ID	LST Sammanslagningsprov-1	----	----	----	----
				Client sampling date / time	22-Mar-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24A6105-001	-------	--------	--------	--------
					Result	---	---	---	---
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	0.072	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	9.33	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.165	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	<0.0192 DLB	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0208	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	26.6	----	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.123	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.0105	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00440	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.0950	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.075	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000020 DLM	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	22.5	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0336	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.46	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00810	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.0602	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	15.5	----	----	----	----

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-1	----	----	----	----
					Client sampling date / time: 22-Mar-2024 00:00	----	----	----	----
					VA24A6105-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00042	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	2.17	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	4.51	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.172	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	11.7	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000064	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00257	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	65.2	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	225	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.11	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	490	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	65.2	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A6660**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 30-Mar-2024 15:25
PO	: SE2300368, Cycle#2	Date Analysis Commenced	: 30-Mar-2024
C-O-C number	: ----	Issue Date	: 08-Apr-2024 09:16
Sampler	: JJ		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate (Matrix: Water)				Client sample ID	LST Sammanslagningsprov-2	----	----	----	----
				Client sampling date / time	28-Mar-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24A6660-001	--------	--------	--------	--------
					Result	---	---	---	---
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	3.77	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.125	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0094	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0166	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	27.4	----	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.135	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00902	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00377	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.0874	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.046	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	19.6	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0200	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.39	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00390	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.0354	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	9.90	----	----	----	----

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

					Client sample ID	LST Sammanslagningsprov-2	----	----	----	----
					Client sampling date / time	28-Mar-2024 00:00	----	----	----	----
Analyte	*CAS Number*	*Method/Lab*	*LOR*	*Unit*		VA24A6660-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00028	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		2.07	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		2.29	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.143	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		9.42	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.000040	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		0.00295	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		<0.0000050	----	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		53.9	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		182	----	----	----	----
pH	----	E117/VA	0.10	pH units		8.03	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL		460	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		53.9	----	----	----	----

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

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

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A7255**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 06-Apr-2024 08:33
PO	: SE2300368, Cycle#3	Date Analysis Commenced	: 06-Apr-2024
C-O-C number	: ----	Issue Date	: 15-Apr-2024 06:39
Sampler	: JJ		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Ghazaleh Khanmirzaei	Analyst	Metals, Burnaby, British Columbia
Kate Dimitrova	Supervisor - Inorganic	Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Rebecca Sit	Supervisor - Organics Extractions	Organics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

					Client sample ID	LST Sammanslagningsprov-3	----	----	----	----
					Client sampling date / time	06-Apr-2024 00:00	----	----	----	----
Analyte	*CAS Number*	*Method/Lab*	*LOR*	*Unit*		VA24A7255-001	-------	--------	--------	--------
						Result	----	----	----	----
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		1.16	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.101	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0117	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0190	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		19.1	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.157	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00676	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00265	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.111	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.034	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		18.6	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		0.000100	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0132	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		2.92	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00940	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.0182	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		6.52	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-3	----	----	----	----
					Client sampling date / time: 06-Apr-2024 00:00	----	----	----	----
					VA24A7255-001	--------	--------	--------	--------
					Result	---	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00018	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.72	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.995	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.119	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	6.20	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000027	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00305	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	55.8	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	156	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.00	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	475	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	55.8	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A7865**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 13-Apr-2024 08:49
PO	: SE2300368, Cycle#4	Date Analysis Commenced	: 13-Apr-2024
C-O-C number	: ----	Issue Date	: 24-Apr-2024 16:22
Sampler	: JJ		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Organics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Sam Silveira	Analyst	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-4	----	----	----	----
					Client sampling date / time	13-Apr-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24A7865-001	--------	--------	--------	--------	--------
					Result	---	---	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	0.57	----	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.099	----	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0127	----	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0130	----	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	17.0	----	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.160	----	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00646	----	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00258	----	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.125	----	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.028	----	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	19.3	----	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0117	----	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	2.98	----	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00549	----	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.0142	----	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	5.52	----	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-4	----	----	----	----
Client sampling date / time					13-Apr-2024 00:00	----	----	----	----
					VA24A7865-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00012	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.68	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.556	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.127	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	5.10	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000022	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00290	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	52.4	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	146	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.05	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	400	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	52.4	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A8481**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 20-Apr-2024 12:00
PO	: SE2300368, Cycle#5	Date Analysis Commenced	: 20-Apr-2024
C-O-C number	: ----	Issue Date	: 29-Apr-2024 09:29
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Inorganics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Rebecca Sit	Supervisor - Organics Extractions	Organics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-5	----	----	----	----
					Client sampling date / time: 20-Apr-2024 00:00	----	----	----	----
					VA24A8481-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	<0.50	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.096	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0144	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	<0.0085 DLB	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	15.3	----	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.132	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00624	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00298	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.124	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.024	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	20.1	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0102	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.44	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.0105	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.0115	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	5.08	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-5	----	----	----	----
					Client sampling date / time: 20-Apr-2024 00:00	----	----	----	----
					VA24A8481-001	--------	--------	--------	--------
					Result	---	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00013	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.70	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.419	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.132	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	5.15	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000021	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00319	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	61.4	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	156	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.14	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	400	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	61.4	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A9121**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 27-Apr-2024 08:34
PO	: SE2300368, Cycle#6	Date Analysis Commenced	: 27-Apr-2024
C-O-C number	: ----	Issue Date	: 06-May-2024 10:38
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

				Client sample ID	LST Sammanslagningsprov-6	----	----	----	----
				Client sampling date / time	27-Apr-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24A9121-001	--------	--------	--------	--------
					Result	---	---	---	---
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	<0.50	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.060	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0099	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0062	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	10.7	----	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.156	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00452	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00230	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.150	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.015	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	15.2	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0071	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	2.80	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00682	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.00792	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	3.77	----	----	----	----

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

					Client sample ID	LST Sammanslagningsprov-6	----	----	----	----
					Client sampling date / time	27-Apr-2024 00:00	----	----	----	----
Analyte	*CAS Number*	*Method/Lab*	*LOR*	*Unit*		VA24A9121-001	-------	--------	-------	--------
						Result	---	---	---	---
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00014	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		1.34	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		0.224	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.104	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		3.53	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.000015	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		0.00306	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		<0.0000050	----	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		48.3	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		117	----	----	----	----
pH	----	E117/VA	0.10	pH units		8.04	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL		430	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		48.3	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A9754**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 04-May-2024 08:59
PO	: SE2300368, Cycle#7	Date Analysis Commenced	: 04-May-2024
C-O-C number	: ----	Issue Date	: 13-May-2024 12:16
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-7	----	----	----	----
					Client sampling date / time	04-May-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24A9754-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<0.50	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.046	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0058	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0079	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		10.9	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.161	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00447	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00223	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.174	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.015	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		16.2	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0074	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.25	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00556	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.00816	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		3.63	----	----	----	----

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-7	----	----	----	----
					Client sampling date / time: 04-May-2024 00:00	----	----	----	----
					VA24A9754-001	----	----	----	----
					Result	---	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00012	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.54	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.203	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.122	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	3.81	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000014	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00283	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	49.6	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	122	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.05	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	400	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	49.6	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B0443**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 11-May-2024 08:40
PO	: SE2300368, Cycle#8	Date Analysis Commenced	: 11-May-2024
C-O-C number	: ----	Issue Date	: 21-May-2024 07:56
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

				Client sample ID	LST Sammanslagningsprov-8	----	----	----	----
				Client sampling date / time	11-May-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24B0443-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	<0.50	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.049	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0066	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0080	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	9.46	----	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.146	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00413	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00205	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.181	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.013	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	14.9	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0069	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.23	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00361	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.00698	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	3.40	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-8	----	----	----	----
					Client sampling date / time: 11-May-2024 00:00	----	----	----	----
					VA24B0443-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.45	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.152	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.121	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	3.62	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000016	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00294	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	50.5	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	121	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.05	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	480	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	50.5	----	----	----	----

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CERTIFICATE OF ANALYSIS

Work Order	: **VA24B1190**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: -----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 18-May-2024 08:41
PO	: SE2300368, Cycle#9	Date Analysis Commenced	: 18-May-2024
C-O-C number	: -----	Issue Date	: 27-May-2024 16:22
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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- Analytical Results

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Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kate Dimitrova	Supervisor - Inorganic	Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-9	----	----	----	----
					Client sampling date / time	18-May-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B1190-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		2.64	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.047	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0084	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0068	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		9.22	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.135	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00363	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00178	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.218	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.011	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		17.6	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0064	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.67	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00320	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.00671	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		3.05	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-9	----	----	----	----
					Client sampling date / time: 18-May-2024 00:00	---	---	---	---
					VA24B1190-001	-------	-------	-------	-------
					Result	---	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.44	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.122	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.128	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	2.95	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000013	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00265	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	61.9	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	129	----	----	----	----
pH	----	E117/VA	0.10	pH units	7.89	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	450	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	61.9	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B1787**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 25-May-2024 10:46
PO	: SE2300368, Cycle#10	Date Analysis Commenced	: 25-May-2024
C-O-C number	: ----	Issue Date	: 03-Jun-2024 11:59
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Ghazaleh Khanmirzaei	Analyst	Metals, Burnaby, British Columbia
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

				Client sample ID	LST Sammanslagningsprov-10	----	----	----	----
				Client sampling date / time	25-May-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24B1787-001	-------	-------	-------	-------
					Result	---	---	---	---
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	3.36	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.036	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0052	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0073	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	7.80	----	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.125	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00332	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00186	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.230	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	18.1	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0056	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.52	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00399	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.00622	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	2.68	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

				Client sample ID	LST Sammanslagningsprov-10	----	----	----	----
				Client sampling date / time	25-May-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24B1787-001	----------	----------	----------	----------
					Result	----	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.39	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.110	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.127	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	2.72	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000011	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00278	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	52.3	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	130	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.09	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	450	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	52.3	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B2489**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 01-Jun-2024 08:32
PO	: SE2300368, Cycle#11	Date Analysis Commenced	: 01-Jun-2024
C-O-C number	: ----	Issue Date	: 10-Jun-2024 08:11
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-11	----	----	----	----
					Client sampling date / time	01-Jun-2024 00:00	----	----	----	----
Analyte	*CAS Number*	*Method/Lab*	*LOR*	*Unit*		VA24B2489-001	--------	--------	--------	--------
						Result	----	----	----	----
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		3.47	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.035	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0117	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0084	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		7.26	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.134	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00268	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00160	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.236	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		17.3	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0050	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.35	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00372	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.00541	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		2.27	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-11	---	---	---	---
					Client sampling date / time	01-Jun-2024 00:00	---	---	---	---
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B2489-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		<0.00010	---	---	---	---
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		1.21	---	---	---	---
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		<0.000010	---	---	---	---
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		0.102	---	---	---	---
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.114	---	---	---	---
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		2.52	---	---	---	---
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.000010	---	---	---	---
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00010	---	---	---	---
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.010	---	---	---	---
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		0.00285	---	---	---	---
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0010	---	---	---	---
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		<0.0030	---	---	---	---
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		<0.0000050	---	---	---	---
Leachable Physical Tests										
Acidity (as CaCO3)	---	E286/VA	3.0	mg/L		<3.0	---	---	---	---
Alkalinity, total (as CaCO3)	---	E291/VA	2.0	mg/L		50.0	---	---	---	---
Conductivity	---	E104/VA	3.0	µS/cm		126	---	---	---	---
pH	---	E117/VA	0.10	pH units		7.87	---	---	---	---
Volume, total out	---	E099/VA	0.10	mL		400	---	---	---	---
Alkalinity, phenolphthalein (as CaCO3)	---	E291/VA	2.0	mg/L		<2.0	---	---	---	---
Volume, total in	---	E099/VA	0.10	mL		500	---	---	---	---
Alkalinity, hydroxide (as CaCO3)	---	E291/VA	2.0	mg/L		<2.0	---	---	---	---
Alkalinity, carbonate (as CaCO3)	---	E291/VA	2.0	mg/L		<2.0	---	---	---	---
Alkalinity, bicarbonate (as CaCO3)	---	E291/VA	2.0	mg/L		50.0	---	---	---	---

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

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

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B3291**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 08-Jun-2024 11:48
PO	: SE2300368, Cycle#12	Date Analysis Commenced	: 08-Jun-2024
C-O-C number	: ----	Issue Date	: 17-Jun-2024 21:07
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

				Client sample ID	LST Sammanslagningsprov-12	----	----	----	----
				Client sampling date / time	08-Jun-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24B3291-001	--------	--------	--------	--------
					Result	---	---	---	---
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	3.04	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.027	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0121	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0081	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	6.14	----	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.138	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00259	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00152	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.266	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	16.9	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0045	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.11	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00398	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.00537	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	2.09	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-12	----	----	----	----
Client sampling date / time					08-Jun-2024 00:00	----	----	----	----
					VA24B3291-001	--------	--------	--------	--------
					Result	---	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.05	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.086	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.116	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	2.30	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.000010	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00280	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	49.4	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	123	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.04	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	425	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	49.4	----	----	----	----

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

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

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B4007**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 15-Jun-2024 09:46
PO	: SE2300368, Cycle#13	Date Analysis Commenced	: 15-Jun-2024
C-O-C number	: ----	Issue Date	: 24-Jun-2024 11:22
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Monica Ko	Lab Assistant	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Rebecca Sit	Supervisor - Organics Extractions	Organics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-13	----	----	----	----
					Client sampling date / time	15-Jun-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B4007-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		3.29	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		<0.020	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0088	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0095	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		6.86	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.162	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00253	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00147	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.246	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		14.2	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0040	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.06	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00318	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.00545	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		1.90	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-13	----	----	----	----
					Client sampling date / time	15-Jun-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B4007-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Metals										
Selenium, leachable	7782-49-2	E448/WA	0.00010	mg/L		<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/WA	0.050	mg/L		1.06	----	----	----	----
Silver, leachable	7440-22-4	E448/WA	0.000010	mg/L		<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/WA	0.050	mg/L		0.090	----	----	----	----
Strontium, leachable	7440-24-6	E448/WA	0.00020	mg/L		0.0990	----	----	----	----
Sulfur, leachable	7704-34-9	E448/WA	0.50	mg/L		2.34	----	----	----	----
Thallium, leachable	7440-28-0	E448/WA	0.000010	mg/L		<0.000010	----	----	----	----
Tin, leachable	7440-31-5	E448/WA	0.00010	mg/L		<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/WA	0.010	mg/L		<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/WA	0.000010	mg/L		0.00257	----	----	----	----
Vanadium, leachable	7440-62-2	E448/WA	0.0010	mg/L		<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/WA	0.0030	mg/L		<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/WA	0.0000050	mg/L		<0.0000050	----	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/WA	3.0	mg/L		<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/WA	2.0	mg/L		43.6	----	----	----	----
Conductivity	----	E104/WA	3.0	µS/cm		112	----	----	----	----
pH	----	E117/WA	0.10	pH units		7.98	----	----	----	----
Volume, total out	----	E099/WA	0.10	mL		470	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/WA	2.0	mg/L		<2.0	----	----	----	----
Volume, total in	----	E099/WA	0.10	mL		500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/WA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/WA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/WA	2.0	mg/L		43.6	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B4772**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ---	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 22-Jun-2024 08:09
PO	: SE2300368, Cycle#14	Date Analysis Commenced	: 22-Jun-2024
C-O-C number	: ---	Issue Date	: 03-Jul-2024 20:18
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-14	----	----	----	----
					Client sampling date / time: 22-Jun-2024 00:00	----	----	----	----
					VA24B4772-001	--------	--------	--------	--------
					Result	---	---	---	---
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	3.54	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.022	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0109	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	<0.0050	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	6.68	----	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.136	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00223	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00138	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.261	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	16.3	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0042	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.01	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00394	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.00518	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	1.88	----	----	----	----

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-14	----	----	----	----
					Client sampling date / time: 22-Jun-2024 00:00	----	----	----	----
					VA24B4772-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	1.01	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.074	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.102	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	2.08	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00264	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	48.1	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	120	----	----	----	----
pH	----	E117/VA	0.10	pH units	7.96	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	440	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	48.1	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B5555**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 29-Jun-2024 10:37
PO	: SE2300368, Cycle#15	Date Analysis Commenced	: 29-Jun-2024
C-O-C number	: ----	Issue Date	: 09-Jul-2024 15:50
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Ghazaleh Khanmirzaei	Analyst	Metals, Burnaby, British Columbia
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Monica Ko	Lab Assistant	Inorganics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-15	----	----	----	----
					Client sampling date / time	29-Jun-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B5555-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		3.79	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.026	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0129	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0081	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		7.10	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.127	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00222	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00134	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.251	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		15.9	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0039	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.06	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00444	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.00559	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		1.82	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-15	----	----	----	----
					Client sampling date / time	29-Jun-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24B5555-001	--------	--------	--------	--------	
					Result	----	----	----	----	
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----	
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	0.965	----	----	----	----	
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----	
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.094	----	----	----	----	
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.106	----	----	----	----	
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	2.02	----	----	----	----	
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----	
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----	
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----	
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00264	----	----	----	----	
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----	
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----	
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----	
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----	
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	48.7	----	----	----	----	
Conductivity	----	E104/VA	3.0	µS/cm	119	----	----	----	----	
pH	----	E117/VA	0.10	pH units	8.01	----	----	----	----	
Volume, total out	----	E099/VA	0.10	mL	410	----	----	----	----	
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----	
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----	
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----	
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----	
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	48.7	----	----	----	----	

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B5991**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 06-Jul-2024 09:23
PO	: SE2300368, Cycle#16	Date Analysis Commenced	: 06-Jul-2024
C-O-C number	: ----	Issue Date	: 15-Jul-2024 13:04
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Ghazaleh Khanmirzaei	Analyst	Metals, Burnaby, British Columbia
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Monica Ko	Lab Assistant	Inorganics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-16	----	----	----	----
					Client sampling date / time	04-Jul-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24B5991-001	----------	----------	----------	----------	
					Result	---	---	---	---	
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	----	----	----	----	
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	3.47	----	----	----	----	
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.021	----	----	----	----	
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0093	----	----	----	----	
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	<0.0050	----	----	----	----	
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	6.45	----	----	----	----	
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.140	----	----	----	----	
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00206	----	----	----	----	
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00130	----	----	----	----	
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.277	----	----	----	----	
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----	
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	<0.010	----	----	----	----	
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----	
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	16.3	----	----	----	----	
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----	
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	----	----	----	----	
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	----	----	----	----	
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0036	----	----	----	----	
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	2.92	----	----	----	----	
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00458	----	----	----	----	
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.00527	----	----	----	----	
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	----	----	----	----	
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	----	----	----	----	
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	1.61	----	----	----	----	

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-16	----	----	----	----
					Client sampling date / time	04-Jul-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B5991-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		0.948	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		0.084	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.0976	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		2.06	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		0.00259	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		<0.0000050	----	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		46.4	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		116	----	----	----	----
pH	----	E117/VA	0.10	pH units		7.96	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL		460	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		46.4	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B6882**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 13-Jul-2024 08:43
PO	: SE2300368, Cycle#17	Date Analysis Commenced	: 13-Jul-2024
C-O-C number	: ----	Issue Date	: 23-Jul-2024 12:41
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Ghazaleh Khanmirzaei	Analyst	Metals, Burnaby, British Columbia
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-17	-----	-----	-----	-----
					Client sampling date / time	13-Jul-2024 00:00	-----	-----	-----	-----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24B6882-001	--------	--------	--------	--------	
					Result	---	---	---	---	
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.050	-----	-----	-----	-----	
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	2.96	-----	-----	-----	-----	
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.021	-----	-----	-----	-----	
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	0.0095	-----	-----	-----	-----	
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	0.0090	-----	-----	-----	-----	
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	6.66	-----	-----	-----	-----	
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	0.119	-----	-----	-----	-----	
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00195	-----	-----	-----	-----	
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00134	-----	-----	-----	-----	
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.307	-----	-----	-----	-----	
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00010	-----	-----	-----	-----	
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00050	-----	-----	-----	-----	
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	<0.010	-----	-----	-----	-----	
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.000010	-----	-----	-----	-----	
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	16.5	-----	-----	-----	-----	
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00050	-----	-----	-----	-----	
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	<0.00010	-----	-----	-----	-----	
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00050	-----	-----	-----	-----	
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.030	-----	-----	-----	-----	
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000050	-----	-----	-----	-----	
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0034	-----	-----	-----	-----	
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.49	-----	-----	-----	-----	
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.00399	-----	-----	-----	-----	
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	0.00513	-----	-----	-----	-----	
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	<0.00050	-----	-----	-----	-----	
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.30	-----	-----	-----	-----	
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	1.59	-----	-----	-----	-----	

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-17	----	----	----	----
					Client sampling date / time: 13-Jul-2024 00:00	----	----	----	----
					VA24B6882-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	0.887	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.088	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.103	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	2.35	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00250	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	50.3	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	122	----	----	----	----
pH	----	E117/VA	0.10	pH units	7.99	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	480	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	50.3	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B7663**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 20-Jul-2024 09:47
PO	: SE2300368, Cycle#18	Date Analysis Commenced	: 20-Jul-2024
C-O-C number	: ----	Issue Date	: 29-Jul-2024 11:13
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Monica Ko	Lab Assistant	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Rebecca Sit	Supervisor - Organics Extractions	Organics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-18	----	----	----	----
					Client sampling date / time	20-Jul-2024 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B7663-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		2.96	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		<0.020	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0122	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0069	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		6.40	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.0972	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00176	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00107	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.283	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		17.4	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0037	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.22	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00370	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.00446	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		1.48	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-18	----	----	----	----
					Client sampling date / time: 20-Jul-2024 00:00	----	----	----	----
					VA24B7663-001	--------	--------	--------	--------
					Result	---	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	0.887	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.105	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.103	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	1.97	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00252	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	51.6	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	120	----	----	----	----
pH	----	E117/VA	0.10	pH units	7.90	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	470	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	51.6	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B8452**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: -----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 27-Jul-2024 08:35
PO	: SE2300368, Cycle#19	Date Analysis Commenced	: 27-Jul-2024
C-O-C number	: -----	Issue Date	: 06-Aug-2024 14:24
Sampler	: ALS		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Monica Ko	Lab Assistant	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

					Client sample ID	LST Sammanslagningsprov-19	----	----	----	----
					Client sampling date / time	27-Jul-2024 00:00	----	----	----	----
Analyte	*CAS Number*	*Method/Lab*	*LOR*	*Unit*		VA24B8452-001	------	--------	--------	-------
						Result	---	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		2.96	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.021	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0235	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0065	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		5.95	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.0946	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00167	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00104	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.303	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		17.0	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0036	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.43	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00426	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.00412	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		1.52	----	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-19	----	----	----	----
					Client sampling date / time: 27-Jul-2024 00:00	----	----	----	----
					VA24B8452-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	0.863	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.076	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.101	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	2.10	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00238	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	52.4	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	125	----	----	----	----
pH	----	E117/VA	0.10	pH units	7.98	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	425	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	52.4	----	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B9275**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 03-Aug-2024 08:34
PO	: SE2300368, Cycle#20	Date Analysis Commenced	: 03-Aug-2024
C-O-C number	: ----	Issue Date	: 08-Aug-2024 12:57
Sampler	: EB		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-002 LST Sammanslagningsprov		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Monica Ko	Lab Assistant	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Rebecca Sit	Supervisor - Organics Extractions	Organics, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	LST Sammanslagningsprov-20	----	----	----	----
					Client sampling date / time	03-Aug-2024 00:00	---	---	---	---
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B9275-001	--------	--------	--------	--------
						Result	---	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	----	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		2.57	----	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		<0.020	----	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		0.0191	----	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		0.0059	----	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		5.35	----	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.0891	----	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00147	----	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00122	----	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.329	----	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		<0.010	----	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000010	----	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		17.2	----	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		<0.00010	----	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	----	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	----	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0033	----	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.68	----	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.00602	----	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		0.00428	----	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		<0.00050	----	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	----	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		1.46	----	----	----	----

Analytical Results

Sub-Matrix: **Leachate**
(Matrix: **Water**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: LST Sammanslagningsprov-20	----	----	----	----
					Client sampling date / time: 03-Aug-2024 00:00	----	----	----	----
					VA24B9275-001	--------	--------	--------	--------
					Result	----	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	0.880	----	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.064	----	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.103	----	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	1.93	----	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	<0.000010	----	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	----	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	----	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.00249	----	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	----	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0030	----	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	----	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	----	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	56.8	----	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	131	----	----	----	----
pH	----	E117/VA	0.10	pH units	8.06	----	----	----	----
Volume, total out	----	E099/VA	0.10	mL	470	----	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	----	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	----	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	56.8	----	----	----	----

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

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

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A7737**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 12-Apr-2024 16:05
PO	: Cycle#0	Date Analysis Commenced	: 12-Apr-2024
C-O-C number	: ----	Issue Date	: 19-Apr-2024 09:16
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Inorganics, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Organics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

General Comments

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

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

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

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

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
µS/cm	microsiemens per centimetre
mg/L	milligrams per litre
mL	millilitres
pH units	pH units

<: less than.

>: greater than.

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

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

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

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagni ngsprov b-malm-0	Sammanslagni ngsprov graberg-0	----	----	----
					Client sampling date / time: 12-Apr-2024 00:00	12-Apr-2024 00:00	----	----	----
					VA24A7737-001	VA24A7737-002	--------	--------	--------
					Result	Result	----	----	----
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.500 DLDS	<1.00 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	5.58	33.5	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	<0.200 DLDS	0.427	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	<0.0300 DLDS	<0.0600 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	<0.0500 DLDS	<0.100 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	980	1720	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	<0.0250 DLA	<0.0250 DLA	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.0160	0.00970	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00378	0.00504	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.0752	0.0984	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00050 DLA	<0.00050 DLA	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00250 DLA	<0.00250 DLA	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.104	0.227	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.00320 DLM	<0.00350 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	337	515	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00250 DLA	<0.00250 DLA	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	0.00444	0.00161	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00250 DLA	<0.00250 DLA	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.150 DLA	<0.150 DLA	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000250 DLA	<0.000250 DLA	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0596	0.341	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	31.1	51.6	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.338	0.671	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	6.18	7.70	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	0.116	0.0389	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<1.50 DLA	<1.50 DLA	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	56.9	179	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-0	Sammanslagningsprov graberg-0	----	----	----
					Client sampling date / time: 12-Apr-2024 00:00	12-Apr-2024 00:00	----	----	----
					VA24A7737-001	VA24A7737-002	--------	--------	--------
					Result	Result	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.0357	0.0279	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	2.87	5.30	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000050 DLA	<0.000050 DLA	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	25.8	84.1	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	1.52	3.48	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	388	701	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00556	0.00292	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00050 DLA	<0.00050 DLA	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.050 DLA	<0.050 DLA	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	1.55	0.851	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0050 DLA	<0.0050 DLA	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	<0.0150 DLA	<0.0150 DLA	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	4.7	9.2	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	52.6	72.4	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	1880	3170	----	----	----
pH	----	E117/VA	0.10	pH units	7.67	7.69	----	----	----
Volume, total out	----	E099/VA	0.10	mL	360	310	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	750	675	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	52.6	72.4	----	----	----

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

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

ALS Canada Ltd.

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	:VA24A7737	Page	: 1 of 10
Client	:Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	:Erik Karlsson	Account Manager	: Virginia Smith
Address	:Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:----	Telephone	: +1 604 253 4188
Project	:SE 2300368 Haggan BK Vanadis	Date Samples Received	: 12-Apr-2024 16:05
PO	: Cycle#0	Issue Date	: 19-Apr-2024 09:16
C-O-C number	:----		
Sampler	:Y		
Site	:ALS Scandinavia AB/ALS Minerals		
Quote number	:VA24-ALSS200-004 B-malm		
No. of samples received	:2		
No. of samples analysed	:2		

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

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Alkalinity Species by Titration (Humidity Cell)										
HDPE Sammanslagningsprov b-malm-0	E291	12-Apr-2024	15-Apr-2024	14 days	4 days	✓	17-Apr-2024	14 days	5 days	✓
Leachable Anions & Nutrients : Alkalinity Species by Titration (Humidity Cell)										
HDPE Sammanslagningsprov graberg-0	E291	12-Apr-2024	15-Apr-2024	14 days	4 days	✓	17-Apr-2024	14 days	5 days	✓
Leachable Anions & Nutrients : Bromide by IC (Humidity Cell)										
HDPE Sammanslagningsprov b-malm-0	E245.Br	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	15-Apr-2024	28 days	4 days	✓
Leachable Anions & Nutrients : Bromide by IC (Humidity Cell)										
HDPE Sammanslagningsprov graberg-0	E245.Br	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	15-Apr-2024	28 days	4 days	✓
Leachable Anions & Nutrients : Chloride by IC (Humidity Cell)										
HDPE Sammanslagningsprov b-malm-0	E245.Cl	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	15-Apr-2024	28 days	4 days	✓
Leachable Anions & Nutrients : Chloride by IC (Humidity Cell)										
HDPE Sammanslagningsprov graberg-0	E245.Cl	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	15-Apr-2024	28 days	4 days	✓
Leachable Anions & Nutrients : Fluoride by IC (Humidity Cell)										
HDPE Sammanslagningsprov b-malm-0	E245.F	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	15-Apr-2024	28 days	4 days	✓

Matrix: **Water**

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

Analyte Group : Analytical Method Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Fluoride by IC (Humidity Cell)										
HDPE Sammanslagningsprov graberg-0	E245.F	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	15-Apr-2024	28 days	4 days	✓
Leachable Anions & Nutrients : Nitrate by IC (Humidity Cell)										
HDPE Sammanslagningsprov b-malm-0	E245.NO3	12-Apr-2024	15-Apr-2024	3 days	3 days	✓	15-Apr-2024	3 days	4 days	✓
Leachable Anions & Nutrients : Nitrate by IC (Humidity Cell)										
HDPE Sammanslagningsprov graberg-0	E245.NO3	12-Apr-2024	15-Apr-2024	3 days	3 days	✓	15-Apr-2024	3 days	4 days	✓
Leachable Anions & Nutrients : Nitrite by IC (Humidity Cell)										
HDPE Sammanslagningsprov b-malm-0	E245.NO2	12-Apr-2024	15-Apr-2024	3 days	3 days	✓	15-Apr-2024	3 days	4 days	✓
Leachable Anions & Nutrients : Nitrite by IC (Humidity Cell)										
HDPE Sammanslagningsprov graberg-0	E245.NO2	12-Apr-2024	15-Apr-2024	3 days	3 days	✓	15-Apr-2024	3 days	4 days	✓
Leachable Anions & Nutrients : Sulfate by IC (Humidity Cell) (Low Level)										
HDPE Sammanslagningsprov b-malm-0	E245.SO4-L	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	15-Apr-2024	28 days	4 days	✓
Leachable Anions & Nutrients : Sulfate by IC (Humidity Cell) (Low Level)										
HDPE Sammanslagningsprov graberg-0	E245.SO4-L	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	15-Apr-2024	28 days	4 days	✓
Leachable Metals : Dissolved Mercury by CVAAS (Humidity Cell)										
Glass vial dissolved (hydrochloric acid) Sammanslagningsprov b-malm-0	E517	12-Apr-2024	13-Apr-2024	28 days	1 days	✓	13-Apr-2024	28 days	1 days	✓
Leachable Metals : Dissolved Mercury by CVAAS (Humidity Cell)										
Glass vial dissolved (hydrochloric acid) Sammanslagningsprov graberg-0	E517	12-Apr-2024	13-Apr-2024	28 days	1 days	✓	13-Apr-2024	28 days	1 days	✓

Matrix: **Water**

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

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Metals : Dissolved Metals by CRC ICPMS (Humidity Cell)										
HDPE dissolved (nitric acid)										
Sammanslagningsprov b-malm-0	E448	12-Apr-2024	15-Apr-2024	180 days	3 days	✓	16-Apr-2024	180 days	5 days	✓
Leachable Metals : Dissolved Metals by CRC ICPMS (Humidity Cell)										
HDPE dissolved (nitric acid)										
Sammanslagningsprov graberg-0	E448	12-Apr-2024	15-Apr-2024	180 days	3 days	✓	16-Apr-2024	180 days	5 days	✓
Leachable Physical Tests : Acidity by Titration (Humidity Cell)										
HDPE										
Sammanslagningsprov b-malm-0	E286	12-Apr-2024	15-Apr-2024	14 days	4 days	✓	16-Apr-2024	14 days	4 days	✓
Leachable Physical Tests : Acidity by Titration (Humidity Cell)										
HDPE										
Sammanslagningsprov graberg-0	E286	12-Apr-2024	15-Apr-2024	14 days	4 days	✓	16-Apr-2024	14 days	4 days	✓
Leachable Physical Tests : Conductivity (Humidity Cell)										
HDPE										
Sammanslagningsprov b-malm-0	E104	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	17-Apr-2024	28 days	5 days	✓
Leachable Physical Tests : Conductivity (Humidity Cell)										
HDPE										
Sammanslagningsprov graberg-0	E104	12-Apr-2024	15-Apr-2024	28 days	4 days	✓	17-Apr-2024	28 days	5 days	✓
Leachable Physical Tests : pH by Meter (Humidity Cell)										
HDPE										
Sammanslagningsprov b-malm-0	E117	12-Apr-2024	15-Apr-2024	12 hrs	85 hrs	× EHTR	17-Apr-2024	12 hrs	125 hrs	× EHTR
Leachable Physical Tests : pH by Meter (Humidity Cell)										
HDPE										
Sammanslagningsprov graberg-0	E117	12-Apr-2024	15-Apr-2024	12 hrs	85 hrs	× EHTR	17-Apr-2024	12 hrs	125 hrs	× EHTR
Physical Tests : Volume In/Out (Humidity Cells)										
HDPE										
Sammanslagningsprov b-malm-0	E099	12-Apr-2024	----	----	----		12-Apr-2024	----	0 days	

Matrix: **Water**

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

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Volume In/Out (Humidity Cells)										
HDPE										
Sammanslagningsprov graberg-0	E099	12-Apr-2024	----	----	----		12-Apr-2024	----	0 days	

Legend & Qualifier Definitions

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration (Humidity Cell)	E286	1403258	1	15	6.6	5.0	✓
Alkalinity Species by Titration (Humidity Cell)	E291	1403250	1	15	6.6	5.0	✓
Bromide by IC (Humidity Cell)	E245.Br	1403256	1	15	6.6	5.0	✓
Chloride by IC (Humidity Cell)	E245.Cl	1403254	1	15	6.6	5.0	✓
Conductivity (Humidity Cell)	E104	1403257	1	16	6.2	5.0	✓
Dissolved Mercury by CVAAS (Humidity Cell)	E517	1401826	1	18	5.5	5.0	✓
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448	1403065	1	11	9.0	5.0	✓
Fluoride by IC (Humidity Cell)	E245.F	1403253	1	13	7.6	5.0	✓
Nitrate by IC (Humidity Cell)	E245.NO3	1403251	1	15	6.6	5.0	✓
Nitrite by IC (Humidity Cell)	E245.NO2	1403252	1	15	6.6	5.0	✓
pH by Meter (Humidity Cell)	E117	1403249	1	16	6.2	5.0	✓
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L	1403255	1	15	6.6	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration (Humidity Cell)	E286	1403258	1	15	6.6	5.0	✓
Alkalinity Species by Titration (Humidity Cell)	E291	1403250	1	15	6.6	5.0	✓
Bromide by IC (Humidity Cell)	E245.Br	1403256	1	15	6.6	5.0	✓
Chloride by IC (Humidity Cell)	E245.Cl	1403254	1	15	6.6	5.0	✓
Conductivity (Humidity Cell)	E104	1403257	1	16	6.2	5.0	✓
Dissolved Mercury by CVAAS (Humidity Cell)	E517	1401826	1	18	5.5	5.0	✓
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448	1403065	1	11	9.0	5.0	✓
Fluoride by IC (Humidity Cell)	E245.F	1403253	1	13	7.6	5.0	✓
Nitrate by IC (Humidity Cell)	E245.NO3	1403251	1	15	6.6	5.0	✓
Nitrite by IC (Humidity Cell)	E245.NO2	1403252	1	15	6.6	5.0	✓
pH by Meter (Humidity Cell)	E117	1403249	1	16	6.2	5.0	✓
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L	1403255	1	15	6.6	5.0	✓
Method Blanks (MB)							
Acidity by Titration (Humidity Cell)	E286	1403258	1	15	6.6	5.0	✓
Alkalinity Species by Titration (Humidity Cell)	E291	1403250	1	15	6.6	5.0	✓
Bromide by IC (Humidity Cell)	E245.Br	1403256	1	15	6.6	5.0	✓
Chloride by IC (Humidity Cell)	E245.Cl	1403254	1	15	6.6	5.0	✓
Conductivity (Humidity Cell)	E104	1403257	1	16	6.2	5.0	✓
Dissolved Mercury by CVAAS (Humidity Cell)	E517	1401826	1	18	5.5	5.0	✓
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448	1403065	1	11	9.0	5.0	✓
Fluoride by IC (Humidity Cell)	E245.F	1403253	1	13	7.6	5.0	✓
Nitrate by IC (Humidity Cell)	E245.NO3	1403251	1	15	6.6	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Nitrite by IC (Humidity Cell)	E245.NO2	1403252	1	15	6.6	5.0	✓
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L	1403255	1	15	6.6	5.0	✓
Matrix Spikes (MS)							
Bromide by IC (Humidity Cell)	E245.Br	1403256	1	15	6.6	5.0	✓
Chloride by IC (Humidity Cell)	E245.Cl	1403254	1	15	6.6	5.0	✓
Dissolved Mercury by CVAAS (Humidity Cell)	E517	1401826	1	18	5.5	5.0	✓
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448	1403065	1	11	9.0	5.0	✓
Fluoride by IC (Humidity Cell)	E245.F	1403253	1	13	7.6	5.0	✓
Nitrate by IC (Humidity Cell)	E245.NO3	1403251	1	15	6.6	5.0	✓
Nitrite by IC (Humidity Cell)	E245.NO2	1403252	1	15	6.6	5.0	✓
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L	1403255	1	15	6.6	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Description
Volume In/Out (Humidity Cells)	E099 ALS Environmental - Vancouver	Water		Deionized water is added to the humidity cell and the amount of water added and collected is measured.
Conductivity (Humidity Cell)	E104 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 2510 (mod)	A conductivity cell with platinum electrodes is immersed in a leachate of a soil sample prepared in a humidity cell. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter (Humidity Cell)	E117 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on a leachate of a soil sample prepared in a humidity cell. The pH is then measured by a standard pH probe.
Bromide by IC (Humidity Cell)	E245.Br ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Chloride by IC (Humidity Cell)	E245.Cl ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Fluoride by IC (Humidity Cell)	E245.F ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Nitrite by IC (Humidity Cell)	E245.NO2 ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Nitrate by IC (Humidity Cell)	E245.NO3 ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Sulfate by IC (Humidity Cell) (Low Level)	E245.SO4-L ALS Environmental - Vancouver	Water	ASTM D5744/EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection on a leachate of a soil sample prepared in a humidity cell.
Acidity by Titration (Humidity Cell)	E286 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 2310 B (mod)	Acidity is determined by potentiometric titration to a specified endpoint on a leachate of a soil sample prepared in a humidity cell.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Description
Alkalinity Species by Titration (Humidity Cell)	E291 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on a leachate of a soil sample prepared in a humidity cell. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Dissolved Metals by CRC ICPMS (Humidity Cell)	E448 ALS Environmental - Vancouver	Water	ASTM D5744/APHA 3030B/6020B (mod)	Leachate is prepared according to ASTM D5744 and MEND (Price, 2009). Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Mercury by CVAAS (Humidity Cell)	E517 ALS Environmental - Vancouver	Water	ASTM D5744/EPA 1631E (mod)	A leachate of a soil sample prepared in a humidity cell is filtered (0.45 micron), preserved with hydrochloric acid, and then undergoes a cold oxidation by bromine monochloride prior to reduction with stannous chloride, with analysis by either CVAAS.

QUALITY CONTROL REPORT

Work Order	: VA24A7737	Page	: 1 of 10
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Hammarvägen 22 Pitea Sweden SE-943 36	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 12-Apr-2024 16:05
PO	: Cycle#0	Date Analysis Commenced	: 12-Apr-2024
C-O-C number	: ----	Issue Date	: 19-Apr-2024 09:16
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	*Position*	*Laboratory Department*
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Inorganics, Burnaby, British Columbia
Lindsay Gung	Supervisor - Water Chemistry	Vancouver Organics, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Leachable Anions & Nutrients (QC Lot: 1403250)											
VA24A7725-001	Anonymous	Alkalinity, bicarbonate (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0.00%	200%	----
		Alkalinity, carbonate (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0.00%	200%	----
		Alkalinity, hydroxide (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0.00%	200%	----
		Alkalinity, phenolphthalein (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
		Alkalinity, total (as CaCO3)	----	E291	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1403251)											
VA24A7725-001	Anonymous	Nitrate (as N)	14797-55-8	E245.NO3	0.0050	mg/L	0.0074	0.0069	0.0005	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1403252)											
VA24A7725-001	Anonymous	Nitrite (as N)	14797-65-0	E245.NO2	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1403253)											
VA24A7725-001	Anonymous	Fluoride	16984-48-8	E245.F	0.020	mg/L	<0.020	<0.020	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1403254)											
VA24A7725-001	Anonymous	Chloride	16887-00-6	E245.Cl	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1403255)											
VA24A7725-001	Anonymous	Sulfate (as SO4)	14808-79-8	E245.SO4-L	0.050	mg/L	19.7	19.6	0.452%	20%	----
Leachable Anions & Nutrients (QC Lot: 1403256)											
VA24A7725-001	Anonymous	Bromide	24959-67-9	E245.Br	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Leachable Metals (QC Lot: 1401826)											
VA24A7593-001	Anonymous	Mercury, leachable	7439-97-6	E517	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Leachable Metals (QC Lot: 1403065)											
VA24A7726-001	Anonymous	Aluminum, leachable	7429-90-5	E448	0.0250	mg/L	9.28	9.15	1.41%	20%	----
		Antimony, leachable	7440-36-0	E448	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Arsenic, leachable	7440-38-2	E448	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Barium, leachable	7440-39-3	E448	0.00050	mg/L	0.0173	0.0168	2.66%	20%	----
		Beryllium, leachable	7440-41-7	E448	0.00050	mg/L	<0.00050	0.00051	0.00001	Diff <2x LOR	----
		Bismuth, leachable	7440-69-9	E448	0.00250	mg/L	<0.00250	<0.00250	0	Diff <2x LOR	----
		Boron, leachable	7440-42-8	E448	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		Cadmium, leachable	7440-43-9	E448	0.000050	mg/L	0.0266	0.0261	1.63%	20%	----
		Calcium, leachable	7440-70-2	E448	0.250	mg/L	23.4	24.7	5.38%	20%	----
		Chromium, leachable	7440-47-3	E448	0.00250	mg/L	<0.00250	<0.00250	0	Diff <2x LOR	----

Sub-Matrix: Water

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Leachable Metals (QC Lot: 1403065) - continued											
VA24A7726-001	Anonymous	Cobalt, leachable	7440-48-4	E448	0.00050	mg/L	0.0463	0.0459	1.01%	20%	----
		Copper, leachable	7440-50-8	E448	0.00250	mg/L	26.0	25.7	0.879%	20%	----
		Iron, leachable	7439-89-6	E448	0.150	mg/L	<0.150	<0.150	0	Diff <2x LOR	----
		Lead, leachable	7439-92-1	E448	0.000250	mg/L	6.31	6.41	1.58%	20%	----
		Lithium, leachable	7439-93-2	E448	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		Magnesium, leachable	7439-95-4	E448	0.0250	mg/L	0.469	0.469	0.140%	20%	----
		Manganese, leachable	7439-96-5	E448	0.00050	mg/L	0.0580	0.0571	1.62%	20%	----
		Molybdenum, leachable	7439-98-7	E448	0.000250	mg/L	<0.000250	<0.000250	0	Diff <2x LOR	----
		Nickel, leachable	7440-02-0	E448	0.00250	mg/L	<0.00250	0.00254	0.00004	Diff <2x LOR	----
		Phosphorus, leachable	7723-14-0	E448	1.50	mg/L	<1.50	<1.50	0	Diff <2x LOR	----
		Potassium, leachable	7440-09-7	E448	0.250	mg/L	5.74	5.61	2.15%	20%	----
		Selenium, leachable	7782-49-2	E448	0.00050	mg/L	0.00620	0.00611	1.52%	20%	----
		Silicon, leachable	7440-21-3	E448	0.250	mg/L	14.6	14.4	1.03%	20%	----
		Silver, leachable	7440-22-4	E448	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Sodium, leachable	7440-23-5	E448	0.250	mg/L	0.310	0.315	0.005	Diff <2x LOR	----
		Strontium, leachable	7440-24-6	E448	0.00100	mg/L	0.0140	0.0140	0.521%	20%	----
		Sulfur, leachable	7704-34-9	E448	2.50	mg/L	42.9	41.3	3.77%	20%	----
		Thallium, leachable	7440-28-0	E448	0.000050	mg/L	0.000678	0.000703	3.61%	20%	----
		Tin, leachable	7440-31-5	E448	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Titanium, leachable	7440-32-6	E448	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		Uranium, leachable	7440-61-1	E448	0.000050	mg/L	0.00148	0.00145	2.43%	20%	----
		Vanadium, leachable	7440-62-2	E448	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
		Zinc, leachable	7440-66-6	E448	0.0150	mg/L	6.22	6.18	0.743%	20%	----
Leachable Physical Tests (QC Lot: 1403249)											
VA24A7725-001	Anonymous	pH	----	E117	0.10	pH units	3.52	3.50	0.02	Diff <2x LOR	----
Leachable Physical Tests (QC Lot: 1403257)											
VA24A7725-001	Anonymous	Conductivity	----	E104	3.0	µS/cm	131	142	8.04%	10%	----
Leachable Physical Tests (QC Lot: 1403258)											
VA24A7727-001	Anonymous	Acidity (as CaCO3)	----	E286	3.0	mg/L	<3.0	<3.0	0	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Anions & Nutrients (QCLot: 1403250)						
Alkalinity, bicarbonate (as CaCO3)	---	E291	2	mg/L	<2.0	---
Alkalinity, carbonate (as CaCO3)	---	E291	2	mg/L	<2.0	---
Alkalinity, hydroxide (as CaCO3)	---	E291	2	mg/L	<2.0	---
Alkalinity, phenolphthalein (as CaCO3)	---	E291	2	mg/L	<2.0	---
Alkalinity, total (as CaCO3)	---	E291	2	mg/L	<2.0	---
Leachable Anions & Nutrients (QCLot: 1403251)						
Nitrate (as N)	14797-55-8	E245.NO3	0.005	mg/L	<0.0050	---
Leachable Anions & Nutrients (QCLot: 1403252)						
Nitrite (as N)	14797-65-0	E245.NO2	0.003	mg/L	<0.0030	---
Leachable Anions & Nutrients (QCLot: 1403253)						
Fluoride	16984-48-8	E245.F	0.02	mg/L	<0.020	---
Leachable Anions & Nutrients (QCLot: 1403254)						
Chloride	16887-00-6	E245.Cl	0.5	mg/L	<0.50	---
Leachable Anions & Nutrients (QCLot: 1403255)						
Sulfate (as SO4)	14808-79-8	E245.SO4-L	0.05	mg/L	<0.050	---
Leachable Anions & Nutrients (QCLot: 1403256)						
Bromide	24959-67-9	E245.Br	0.05	mg/L	<0.050	---
Leachable Metals (QCLot: 1401826)						
Mercury, leachable	7439-97-6	E517	0.000005	mg/L	<0.0000050	---
Leachable Metals (QCLot: 1403065)						
Aluminum, leachable	7429-90-5	E448	0.005	mg/L	<0.0050	---
Antimony, leachable	7440-36-0	E448	0.0001	mg/L	<0.00010	---
Arsenic, leachable	7440-38-2	E448	0.0001	mg/L	<0.00010	---
Barium, leachable	7440-39-3	E448	0.0001	mg/L	<0.00010	---
Beryllium, leachable	7440-41-7	E448	0.0001	mg/L	<0.00010	---
Bismuth, leachable	7440-69-9	E448	0.0005	mg/L	<0.00050	---
Boron, leachable	7440-42-8	E448	0.01	mg/L	<0.010	---
Cadmium, leachable	7440-43-9	E448	0.00001	mg/L	<0.000010	---
Calcium, leachable	7440-70-2	E448	0.05	mg/L	<0.050	---
Chromium, leachable	7440-47-3	E448	0.0005	mg/L	<0.00050	---
Cobalt, leachable	7440-48-4	E448	0.0001	mg/L	<0.00010	---
Copper, leachable	7440-50-8	E448	0.0005	mg/L	<0.00050	---

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Metals (QCLot: 1403065) - continued						
Iron, leachable	7439-89-6	E448	0.03	mg/L	<0.030	----
Lead, leachable	7439-92-1	E448	0.00005	mg/L	<0.000050	----
Lithium, leachable	7439-93-2	E448	0.001	mg/L	<0.0010	----
Magnesium, leachable	7439-95-4	E448	0.005	mg/L	<0.0050	----
Manganese, leachable	7439-96-5	E448	0.0001	mg/L	<0.00010	----
Molybdenum, leachable	7439-98-7	E448	0.00005	mg/L	<0.000050	----
Nickel, leachable	7440-02-0	E448	0.0005	mg/L	<0.00050	----
Phosphorus, leachable	7723-14-0	E448	0.3	mg/L	<0.30	----
Potassium, leachable	7440-09-7	E448	0.05	mg/L	<0.050	----
Selenium, leachable	7782-49-2	E448	0.0001	mg/L	<0.00010	----
Silicon, leachable	7440-21-3	E448	0.05	mg/L	<0.050	----
Silver, leachable	7440-22-4	E448	0.00001	mg/L	<0.000010	----
Sodium, leachable	7440-23-5	E448	0.05	mg/L	<0.050	----
Strontium, leachable	7440-24-6	E448	0.0002	mg/L	<0.00020	----
Sulfur, leachable	7704-34-9	E448	0.5	mg/L	<0.50	----
Thallium, leachable	7440-28-0	E448	0.00001	mg/L	<0.000010	----
Tin, leachable	7440-31-5	E448	0.0001	mg/L	<0.00010	----
Titanium, leachable	7440-32-6	E448	0.01	mg/L	<0.010	----
Uranium, leachable	7440-61-1	E448	0.00001	mg/L	<0.000010	----
Vanadium, leachable	7440-62-2	E448	0.001	mg/L	<0.0010	----
Zinc, leachable	7440-66-6	E448	0.003	mg/L	<0.0030	----
Leachable Physical Tests (QCLot: 1403257)						
Conductivity	----	E104	3	µS/cm	<3.0	----
Leachable Physical Tests (QCLot: 1403258)						
Acidity (as CaCO3)	----	E286	3	mg/L	<3.0	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: Water

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Leachable Anions & Nutrients (QCLot: 1403250)									
Alkalinity, phenolphthalein (as CaCO3)	----	E291	2	mg/L	229 mg/L	101	75.0	125	----
Alkalinity, total (as CaCO3)	----	E291	2	mg/L	500 mg/L	108	85.0	115	----
Leachable Anions & Nutrients (QCLot: 1403251)									
Nitrate (as N)	14797-55-8	E245.NO3	0.005	mg/L	2.5 mg/L	101	85.0	115	----
Leachable Anions & Nutrients (QCLot: 1403252)									
Nitrite (as N)	14797-65-0	E245.NO2	0.003	mg/L	0.5 mg/L	101	85.0	115	----
Leachable Anions & Nutrients (QCLot: 1403253)									
Fluoride	16984-48-8	E245.F	0.02	mg/L	1 mg/L	98.9	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1403254)									
Chloride	16887-00-6	E245.Cl	0.5	mg/L	100 mg/L	103	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1403255)									
Sulfate (as SO4)	14808-79-8	E245.SO4-L	0.05	mg/L	100 mg/L	103	85.0	115	----
Leachable Anions & Nutrients (QCLot: 1403256)									
Bromide	24959-67-9	E245.Br	0.05	mg/L	0.5 mg/L	102	70.0	130	----
Leachable Metals (QCLot: 1401826)									
Mercury, leachable	7439-97-6	E517	0.000005	mg/L	0 mg/L	96.7	80.0	120	----
Leachable Metals (QCLot: 1403065)									
Aluminum, leachable	7429-90-5	E448	0.005	mg/L	2 mg/L	100	80.0	120	----
Antimony, leachable	7440-36-0	E448	0.0001	mg/L	1 mg/L	105	80.0	120	----
Arsenic, leachable	7440-38-2	E448	0.0001	mg/L	1 mg/L	103	80.0	120	----
Banum, leachable	7440-39-3	E448	0.0001	mg/L	0.25 mg/L	98.5	80.0	120	----
Beryllium, leachable	7440-41-7	E448	0.0001	mg/L	0.1 mg/L	98.6	80.0	120	----
Bismuth, leachable	7440-69-9	E448	0.0005	mg/L	1 mg/L	96.4	80.0	120	----
Boron, leachable	7440-42-8	E448	0.01	mg/L	1 mg/L	100	80.0	120	----
Cadmium, leachable	7440-43-9	E448	0.00001	mg/L	0.1 mg/L	98.8	80.0	120	----
Calcium, leachable	7440-70-2	E448	0.05	mg/L	50 mg/L	97.5	80.0	120	----
Chromium, leachable	7440-47-3	E448	0.0005	mg/L	0.25 mg/L	102	80.0	120	----
Cobalt, leachable	7440-48-4	E448	0.0001	mg/L	0.25 mg/L	97.1	80.0	120	----
Copper, leachable	7440-50-8	E448	0.0005	mg/L	0.25 mg/L	96.0	80.0	120	----
Iron, leachable	7439-89-6	E448	0.03	mg/L	1 mg/L	94.1	80.0	120	----
Lead, leachable	7439-92-1	E448	0.00005	mg/L	0.5 mg/L	98.4	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Leachable Metals (QCLot: 1403065) - continued									
Lithium, leachable	7439-93-2	E448	0.001	mg/L	0.25 mg/L	93.8	80.0	120	----
Magnesium, leachable	7439-95-4	E448	0.005	mg/L	50 mg/L	110	80.0	120	----
Manganese, leachable	7439-96-5	E448	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
Molybdenum, leachable	7439-98-7	E448	0.00005	mg/L	0.25 mg/L	98.9	80.0	120	----
Nickel, leachable	7440-02-0	E448	0.0005	mg/L	0.5 mg/L	98.2	80.0	120	----
Phosphorus, leachable	7723-14-0	E448	0.3	mg/L	10 mg/L	104	80.0	120	----
Potassium, leachable	7440-09-7	E448	0.05	mg/L	50 mg/L	103	80.0	120	----
Selenium, leachable	7782-49-2	E448	0.0001	mg/L	1 mg/L	100	80.0	120	----
Silicon, leachable	7440-21-3	E448	0.05	mg/L	10 mg/L	105	80.0	120	----
Silver, leachable	7440-22-4	E448	0.00001	mg/L	0.1 mg/L	88.5	80.0	120	----
Sodium, leachable	7440-23-5	E448	0.05	mg/L	50 mg/L	107	80.0	120	----
Strontium, leachable	7440-24-6	E448	0.0002	mg/L	0.25 mg/L	97.9	80.0	120	----
Sulfur, leachable	7704-34-9	E448	0.5	mg/L	50 mg/L	91.4	80.0	120	----
Thallium, leachable	7440-28-0	E448	0.00001	mg/L	1 mg/L	101	80.0	120	----
Tin, leachable	7440-31-5	E448	0.0001	mg/L	0.5 mg/L	94.1	80.0	120	----
Titanium, leachable	7440-32-6	E448	0.01	mg/L	0.25 mg/L	101	80.0	120	----
Uranium, leachable	7440-61-1	E448	0.00001	mg/L	0.005 mg/L	94.9	80.0	120	----
Vanadium, leachable	7440-62-2	E448	0.001	mg/L	0.5 mg/L	103	80.0	120	----
Zinc, leachable	7440-66-6	E448	0.003	mg/L	0.5 mg/L	100	80.0	120	----
Leachable Physical Tests (QCLot: 1403249)									
pH	----	E117	----	pH units	7 pH units	100	95.0	105	----
Leachable Physical Tests (QCLot: 1403257)									
Conductivity	----	E104	3	µS/cm	147 µS/cm	99.7	80.0	120	----
Leachable Physical Tests (QCLot: 1403258)									
Acidity (as CaCO3)	----	E286	3	mg/L	50 mg/L	96.6	85.0	115	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Leachable Anions & Nutrients (QCLot: 1403251)										
VA24A7725-002	Anonymous	Nitrate (as N)	14797-55-8	E245.NO3	2.73 mg/L	2.5 mg/L	109	75.0	125	----
Leachable Anions & Nutrients (QCLot: 1403252)										
VA24A7725-002	Anonymous	Nitrite (as N)	14797-65-0	E245.NO2	0.514 mg/L	0.5 mg/L	103	75.0	125	----
Leachable Anions & Nutrients (QCLot: 1403253)										
VA24A7725-002	Anonymous	Fluoride	16984-48-8	E245.F	1.05 mg/L	1 mg/L	105	60.0	140	----
Leachable Anions & Nutrients (QCLot: 1403254)										
VA24A7725-002	Anonymous	Chloride	16887-00-6	E245.Cl	110 mg/L	100 mg/L	110	60.0	140	----
Leachable Anions & Nutrients (QCLot: 1403255)										
VA24A7725-002	Anonymous	Sulfate (as SO4)	14808-79-8	E245.SO4-L	108 mg/L	100 mg/L	108	75.0	125	----
Leachable Anions & Nutrients (QCLot: 1403256)										
VA24A7725-002	Anonymous	Bromide	24959-67-9	E245.Br	0.525 mg/L	0.5 mg/L	105	60.0	140	----
Leachable Metals (QCLot: 1401826)										
VA24A7597-001	Anonymous	Mercury, leachable	7439-97-6	E517	0.0000953 mg/L	0 mg/L	95.3	70.0	130	----
Leachable Metals (QCLot: 1403065)										
VA24A7726-002	Anonymous	Aluminum, leachable	7429-90-5	E448	ND mg/L	----	ND	70.0	130	----
		Antimony, leachable	7440-36-0	E448	0.0964 mg/L	0.1 mg/L	96.4	70.0	130	----
		Arsenic, leachable	7440-38-2	E448	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		Barium, leachable	7440-39-3	E448	0.0985 mg/L	0.1 mg/L	98.5	70.0	130	----
		Beryllium, leachable	7440-41-7	E448	0.203 mg/L	0.2 mg/L	101	70.0	130	----
		Bismuth, leachable	7440-69-9	E448	0.0458 mg/L	0.05 mg/L	91.6	70.0	130	----
		Boron, leachable	7440-42-8	E448	0.517 mg/L	0.5 mg/L	103	70.0	130	----
		Cadmium, leachable	7440-43-9	E448	ND mg/L	----	ND	70.0	130	----
		Calcium, leachable	7440-70-2	E448	19.9 mg/L	20 mg/L	99.4	70.0	130	----
		Chromium, leachable	7440-47-3	E448	0.199 mg/L	0.2 mg/L	99.5	70.0	130	----
		Cobalt, leachable	7440-48-4	E448	0.0991 mg/L	0.1 mg/L	99.1	70.0	130	----
		Copper, leachable	7440-50-8	E448	ND mg/L	----	ND	70.0	130	----
		Iron, leachable	7439-89-6	E448	9.59 mg/L	10 mg/L	95.9	70.0	130	----
		Lead, leachable	7439-92-1	E448	ND mg/L	----	ND	70.0	130	----
		Lithium, leachable	7439-93-2	E448	0.479 mg/L	0.5 mg/L	95.9	70.0	130	----
		Magnesium, leachable	7439-95-4	E448	4.89 mg/L	5 mg/L	97.7	70.0	130	----
		Manganese, leachable	7439-96-5	E448	ND mg/L	----	ND	70.0	130	----
		Molybdenum, leachable	7439-98-7	E448	0.0979 mg/L	0.1 mg/L	97.9	70.0	130	----
		Nickel, leachable	7440-02-0	E448	0.197 mg/L	0.2 mg/L	98.6	70.0	130	----
		Phosphorus, leachable	7723-14-0	E448	48.0 mg/L	50 mg/L	96.1	70.0	130	----
		Potassium, leachable	7440-09-7	E448	20.5 mg/L	20 mg/L	103	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Leachable Metals (QCLot: 1403065) - continued										
VA24A7726-002	Anonymous	Selenium, leachable	7782-49-2	E448	0.193 mg/L	0.2 mg/L	96.5	70.0	130	----
		Silicon, leachable	7440-21-3	E448	49.6 mg/L	50 mg/L	99.2	70.0	130	----
		Silver, leachable	7440-22-4	E448	0.0188 mg/L	0.02 mg/L	94.1	70.0	130	----
		Sodium, leachable	7440-23-5	E448	11.0 mg/L	10 mg/L	110	70.0	130	----
		Strontium, leachable	7440-24-6	E448	0.101 mg/L	0.1 mg/L	101	70.0	130	----
		Sulfur, leachable	7704-34-9	E448	97.6 mg/L	100 mg/L	97.6	70.0	130	----
		Thallium, leachable	7440-28-0	E448	0.0185 mg/L	0.02 mg/L	92.5	70.0	130	----
		Tin, leachable	7440-31-5	E448	0.0939 mg/L	0.1 mg/L	93.9	70.0	130	----
		Titanium, leachable	7440-32-6	E448	0.202 mg/L	0.2 mg/L	101	70.0	130	----
		Uranium, leachable	7440-61-1	E448	0.0185 mg/L	0.02 mg/L	92.3	70.0	130	----
		Vanadium, leachable	7440-62-2	E448	0.508 mg/L	0.5 mg/L	102	70.0	130	----
		Zinc, leachable	7440-66-6	E448	ND mg/L	----	ND	70.0	130	----

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A8347**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 19-Apr-2024 14:09
PO	: Cycle#1	Date Analysis Commenced	: 19-Apr-2024
C-O-C number	: ----	Issue Date	: 25-Apr-2024 23:05
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-1	Sammanslagningsprov graberg-1	----	----	----
					Client sampling date / time	19-Apr-2024 00:00	19-Apr-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24A8347-001	VA24A8347-002	-------	-------	-------
						Result	Result	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.500 DLDS	<1.00 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		17.2	35.8	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.296	0.589	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0300 DLDS	<0.0600 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0500 DLDS	<0.100 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		946	1250	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0100 DLA	<0.0100 DLA	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.0194	0.0134	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00292	0.00676	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0656	0.0595	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00020 DLA	<0.00020 DLA	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.121	0.216	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000820 DLM	<0.000550 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		340	395	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00100 DLA	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.00619	0.00272	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00100 DLA	0.00113	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.060 DLA	<0.060 DLA	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000100 DLA	0.000259	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0842	0.281	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		28.3	39.8	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.833	1.08	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		2.71	2.47	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.155	0.0421	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.60 DLA	<0.60 DLA	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		50.8	107	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagningsprov b-malm-1	Sammanslagningsprov graberg-1	----	----	----
					Client sampling date / time	19-Apr-2024 00:00	19-Apr-2024 00:00	----	----	----
						VA24A8347-001	VA24A8347-002	----	----	----
						Result	Result	----	----	----
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.0345	0.0205	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		3.25	5.88	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		0.000872	0.000348	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		20.0	49.8	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		1.62	2.89	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		385	512	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.00564	0.00172	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00020 DLA	<0.00020 DLA	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.020 DLA	<0.020 DLA	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		0.961	0.242	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0020 DLA	<0.0020 DLA	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		0.0139	0.0074	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		0.0000283	<0.0000050	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		4.9	7.2	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		79.0	96.2	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		1950	2520	----	----	----
pH	----	E117/VA	0.10	pH units		7.87	7.93	----	----	----
Volume, total out	----	E099/VA	0.10	mL		475	430	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		79.0	96.2	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A9008**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 26-Apr-2024 12:00
PO	: Cycle#2	Date Analysis Commenced	: 26-Apr-2024
C-O-C number	: ----	Issue Date	: 02-May-2024 15:12
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-2	Sammanslagningsprov graberg-2	----	----	----
					Client sampling date / time: 26-Apr-2024 00:00	26-Apr-2024 00:00	----	----	----
					VA24A9008-001	VA24A9008-002	--------	--------	--------
					Result	Result	---	---	---
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<1.00 DLDS	<0.500 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	18.3	25.5 RRV	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	<0.400 DLDS	1.02 RRV	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	<0.0600 DLDS	<0.0300 DLDS, HTDC	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	<0.100 DLDS	<0.0500 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	1120 RRV	825	----	----	----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	<0.0100 DLA	<0.0150 DLM	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.0138	0.0169	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00353	0.00422	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.0569	0.0488	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00020 DLA	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00100 DLA	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.134	0.161	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.00192 DLM	<0.000330 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	396	264	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00100 DLA	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	0.0115	0.00239	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00100 DLA	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.060 DLA	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000100 DLA	0.000118	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0885	0.166	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	30.1	28.1	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	1.81	1.35	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	1.89	1.15	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	0.234	0.0203	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.60 DLA	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	53.1	63.8	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-2	Sammanslagningsprov graberg-2	----	----	----
					Client sampling date / time: 26-Apr-2024 00:00	26-Apr-2024 00:00	----	----	----
					VA24A9008-001	VA24A9008-002	--------	--------	--------
					Result	Result	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.0326	0.0113	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	3.76	5.86	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	0.000689	0.000139	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	19.1	29.8	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	1.87	2.00	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	436	328	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00549	0.000917	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00020 DLA	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.020 DLA	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.637	0.0368	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0020 DLA	0.0011	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0712	0.0073	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	0.0000917	<0.0000050	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	8.4	5.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	114	91.3	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	2100	1750	----	----	----
pH	----	E117/VA	0.10	pH units	7.77	7.92	----	----	----
Volume, total out	----	E099/VA	0.10	mL	450	420	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	114	91.3	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24A9645**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 03-May-2024 12:00
PO	: Cycle#3	Date Analysis Commenced	: 03-May-2024
C-O-C number	: ----	Issue Date	: 13-May-2024 09:03
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Sam Silveira	Analyst	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-3	Sammanslagningsprov graberg-3	-----	-----	-----
					Client sampling date / time	03-May-2024 00:00	03-May-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24A9645-001	VA24A9645-002	--------	--------	--------
						Result	Result	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<1.00 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		17.6	10.7	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		<0.400 DLDS	0.856	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0600 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.100 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		1580	372	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0100 DLA	0.0138	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.0125	0.0122	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00373	0.00377	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0383	0.118	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00020 DLA	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.216	0.155	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00464 DLM	<0.000710 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		606	155	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.0112	0.00110	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		0.00143	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.060 DLA	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000100 DLA	<0.000050	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.120	0.111	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		36.4	14.8	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		2.53	0.536	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		2.96	1.85	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.224	0.0218	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.60 DLA	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		62.9	42.2	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-3	Sammanslagningsprov graberg-3	----	----	----
					Client sampling date / time: 03-May-2024 00:00	03-May-2024 00:00	----	----	----
					VA24A9645-001	VA24A9645-002	--------	--------	--------
					Result	Result	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.0354	0.00629	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	6.62	5.30	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	0.00120	0.000027	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	18.6	13.7	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	2.53	1.32	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	644	180	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00405	0.000870	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00020 DLA	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.020 DLA	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.405	0.128	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0020 DLA	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.109	<0.0030	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	0.000129 RRV	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	3.1	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	130	96.6	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	2670	1020	----	----	----
pH	----	E117/VA	0.10	pH units	7.99	8.11	----	----	----
Volume, total out	----	E099/VA	0.10	mL	490	420	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	500	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	130	96.6	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B0312	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 10-May-2024 15:02
PO	: Cycle#4	Date Analysis Commenced	: 10-May-2024
C-O-C number	: ----	Issue Date	: 17-May-2024 08:18
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagni ngsprov b-malm-4	Sammanslagni ngsprov graberg-4			
					Client sampling date / time	10-May-2024 00:00	10-May-2024 00:00			
						VA24B0312-001	VA24B0312-002			
						Result	Result			
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<1.00 DLDS	<0.250 DLDS			
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<10.0 DLDS	6.55			
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		<0.400 DLDS	0.734			
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0600 DLDS HTDC	<0.0150 DLDS HTDC			
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.100 DLDS HTDC	<0.0250 DLDS HTDC			
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		1370	332			
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0250 DLA	0.0116			
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.0147	0.0116			
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00310	0.00391			
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0335	0.0461			
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00050 DLA	<0.00010			
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00050			
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.197	0.167			
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00280 DLM	<0.000450 DLM			
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		521	142			
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00050			
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.00814	0.00094			
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00250 DLA	0.00069			
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.150 DLA	<0.030			
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000250 DLA	<0.000050			
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0594	0.0864			
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		20.1	13.6			
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		1.55	0.379			
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		5.23	1.95			
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.184	0.00774			
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<1.50 DLA	<0.30			
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		41.1	37.4			

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-4	Sammanslagningsprov graberg-4	----	----	----
Client sampling date / time					10-May-2024 00:00	10-May-2024 00:00	----	----	----
					VA24B0312-001	VA24B0312-002	----	----	----
					Result	Result	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.0149	0.00232	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	6.02	6.12	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	0.00109	0.000222	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	7.97	8.39	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	1.97	1.31	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	531	201	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00345	0.000524	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00050 DLA	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.050 DLA	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.657	0.0574	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0050 DLA	0.0012	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0953	0.0042	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	0.0000828	0.0000115	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	111	118	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	2330	980	----	----	----
pH	----	E117/VA	0.10	pH units	8.12	8.27	----	----	----
Volume, total out	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	111	118	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B1044	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: -----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 17-May-2024 15:35
PO	: Cycle#5	Date Analysis Commenced	: 17-May-2024
C-O-C number	: -----	Issue Date	: 27-May-2024 12:18
Sampler	: y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-5	Sammanslagningsprov graberg-5	-----	-----	-----
					Client sampling date / time: 17-May-2024 00:00	17-May-2024 00:00	-----	-----	-----
					VA24B1044-001	VA24B1044-002	-----	-----	-----
					Result	Result	-----	-----	-----
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.250 DLDS	<0.050	-----	-----	-----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	2.84	2.34	-----	-----	-----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.374	0.660	-----	-----	-----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	<0.0150 DLDS	0.0040	-----	-----	-----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	<0.0250 DLDS	<0.0050	-----	-----	-----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	570	195	-----	-----	-----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	<0.0100 DLA	0.0204	-----	-----	-----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.0124	0.00623	-----	-----	-----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00240	0.00202	-----	-----	-----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.0430	0.0483	-----	-----	-----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00020 DLA	<0.00010	-----	-----	-----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00100 DLA	<0.00050	-----	-----	-----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.110	0.107	-----	-----	-----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.00190 DLM	<0.000460 DLM	-----	-----	-----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	247	97.1	-----	-----	-----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00100 DLA	<0.00050	-----	-----	-----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	0.00491	0.00058	-----	-----	-----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00100 DLA	<0.00050	-----	-----	-----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.060 DLA	<0.030	-----	-----	-----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000100 DLA	<0.000050	-----	-----	-----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0234	0.0456	-----	-----	-----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	6.85	6.79	-----	-----	-----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.577	0.284	-----	-----	-----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	5.14	1.68	-----	-----	-----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	0.110	0.00647	-----	-----	-----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<0.60 DLA	<0.30	-----	-----	-----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	22.2	26.5	-----	-----	-----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-5	Sammanslagningsprov graberg-5	----	----	----
					Client sampling date / time: 17-May-2024 00:00	17-May-2024 00:00	----	----	----
					VA24B1044-001	VA24B1044-002	----	----	----
					Result	Result	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00933	0.00206	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	3.50	3.48	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	0.000168	0.000093	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	2.84	3.58	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.938	0.781	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	245	121	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00323	0.000379	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00020 DLA	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.020 DLA	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	0.806	0.0726	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0020 DLA	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0399	<0.0030	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	0.0000201	0.0000086	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	3.4	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	73.2	72.5	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	1250	666	----	----	----
pH	----	E117/VA	0.10	pH units	8.05	8.12	----	----	----
Volume, total out	----	E099/VA	0.10	mL	530	460	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	73.2	72.5	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B1611	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 24-May-2024 15:05
PO	: Cycle#6	Date Analysis Commenced	: 24-May-2024
C-O-C number	: ----	Issue Date	: 03-Jun-2024 22:44
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Ghazaleh Khanmirzaei	Analyst	Metals, Burnaby, British Columbia
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

				Client sample ID	Sammanslagningsprov b-malm-6	Sammanslagningsprov graberg-6	-----	-----	-----
				Client sampling date / time	24-May-2024 00:00	24-May-2024 00:00	-----	-----	-----
Analyte	CAS Number	Method/Lab	LOR	Unit	VA24B1611-001	VA24B1611-002	-----	-----	-----
					Result	Result	-----	-----	-----
Leachable Anions & Nutrients									
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L	<0.250 DLDS	<0.250	-----	-----	-----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L	<2.50 DLDS	<2.50 DLDS	-----	-----	-----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L	0.274	0.487	-----	-----	-----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L	<0.0150 DLDS	<0.0150 DLDS	-----	-----	-----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L	<0.0250 DLDS	<0.0250 DLDS	-----	-----	-----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L	351	360	-----	-----	-----
Leachable Metals									
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L	<0.0250 DLA	0.0164	-----	-----	-----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L	0.00879	0.00470	-----	-----	-----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L	0.00184	0.00152	-----	-----	-----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L	0.0371	0.0444	-----	-----	-----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L	<0.00050 DLA	<0.00020 DLA	-----	-----	-----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L	<0.00250 DLA	<0.00100 DLA	-----	-----	-----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L	0.076	0.089	-----	-----	-----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L	<0.00246 DLM	<0.000930 DLM	-----	-----	-----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L	179	158	-----	-----	-----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L	<0.00250 DLA	<0.00100 DLA	-----	-----	-----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L	0.00375	0.00100	-----	-----	-----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L	<0.00250 DLA	<0.00100 DLA	-----	-----	-----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L	<0.150 DLA	<0.060 DLA	-----	-----	-----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L	<0.000250 DLA	<0.000100 DLA	-----	-----	-----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L	0.0150	0.0401	-----	-----	-----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L	3.76	10.4	-----	-----	-----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L	0.450	0.409	-----	-----	-----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L	4.85	2.61	-----	-----	-----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L	0.0706	0.00971	-----	-----	-----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L	<1.50 DLA	<0.60 DLA	-----	-----	-----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L	13.2	31.8	-----	-----	-----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagni ngsprov b-malm-6	Sammanslagni ngsprov graberg-6	----	----	----
					Client sampling date / time	24-May-2024 00:00	24-May-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B1611-001	VA24B1611-002	--------	--------	--------
						Result	Result	----	----	----
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00628	0.00275	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		2.69	3.41	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		0.000171	0.000153	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		1.48	3.35	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.605	1.07	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		158	212	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.00217	0.000465	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00050 DLA	<0.00020 DLA	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.050 DLA	<0.020 DLA	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		0.665	0.159	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0050 DLA	<0.0020 DLA	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		0.0292	<0.0060 DLA	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		0.0000251	0.0000158	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		70.8	63.3	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		837 RRV	957	----	----	----
pH	----	E117/VA	0.10	pH units		7.98	7.92	----	----	----
Volume, total out	----	E099/VA	0.10	mL		475	430	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		70.8	63.3	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B2356	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 31-May-2024 14:29
PO	: Cycle#7	Date Analysis Commenced	: 31-May-2024
C-O-C number	: ----	Issue Date	: 06-Jun-2024 14:43
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kate Dimitrova	Supervisor - Inorganic	Inorganics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagningsprovb-malm-7	Sammanslagningsprovgraberg-7	-----	-----	-----
					Client sampling date / time	31-May-2024 00:00	31-May-2024 00:00	-----	-----	-----
						VA24B2356-001	VA24B2356-002	----------	----------	----------
						Result	Result	-----	-----	-----
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	-----	-----	-----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		2.59	<2.50 DLDS	-----	-----	-----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.334	0.507	-----	-----	-----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	-----	-----	-----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	-----	-----	-----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		634	584	-----	-----	-----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0250 DLA	0.0112	-----	-----	-----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.0159	0.00566	-----	-----	-----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00301	0.00229	-----	-----	-----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0436	0.0524	-----	-----	-----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00050 DLA	<0.00020 DLA	-----	-----	-----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	-----	-----	-----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.147	0.122	-----	-----	-----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00405 DLM	<0.00120 DLM	-----	-----	-----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		303	270	-----	-----	-----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	-----	-----	-----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.00785	0.00166	-----	-----	-----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	-----	-----	-----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.150 DLA	<0.060 DLA	-----	-----	-----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000250 DLA	<0.000100 DLA	-----	-----	-----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0264	0.0539	-----	-----	-----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		6.90	14.8	-----	-----	-----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.707	0.629	-----	-----	-----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		10.9	4.29	-----	-----	-----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.162	0.0152	-----	-----	-----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<1.50 DLA	<0.60 DLA	-----	-----	-----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		19.8	36.0	-----	-----	-----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-7	Sammanslagningsprov graberg-7	----	----	----
Client sampling date / time					31-May-2024 00:00	31-May-2024 00:00	----	----	----
					VA24B2356-001	VA24B2356-002	--------	--------	--------
					Result	Result	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.0121	0.00317	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	4.62	4.33	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	0.000788	0.000382	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	2.28	3.54	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	1.13	1.63	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	294	352	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00255	0.000494	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00050 DLA	<0.00020 DLA	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.050 DLA	<0.020 DLA	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	3.63	0.373	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0050 DLA	<0.0020 DLA	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0726	0.0084	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	0.0000567	0.0000271	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	99.2	74.2	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	1440	1460	----	----	----
pH	----	E117/VA	0.10	pH units	7.97	7.77	----	----	----
Volume, total out	----	E099/VA	0.10	mL	425	300	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	99.2	74.2	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B3134	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 07-Jun-2024 12:00
PO	: Cycle#8	Date Analysis Commenced	: 07-Jun-2024
C-O-C number	: ----	Issue Date	: 17-Jun-2024 15:13
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Brieanna Allen	Production/Validation Manager	Inorganics, Burnaby, British Columbia
Caitlin Macey	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-8	Sammanslagningsprov graberg-8	----	----	----
					Client sampling date / time	07-Jun-2024 00:00	07-Jun-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B3134-001	VA24B3134-002	--------	--------	--------
						Result	Result	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		2.52	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.377	0.551	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		478	473	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0250 DLA	0.0128	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.0155	0.00535	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00318	0.00241	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0816	0.0446	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00050 DLA	<0.00020 DLA	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.153	0.144	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00377 DLM	<0.00155 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		268	267	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.00781	0.00135	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.150 DLA	<0.060 DLA	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000250 DLA	<0.000100 DLA	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0241	0.0551	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		5.28	12.7	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.559	0.459	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		9.06	4.20	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.146	0.0127	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<1.50 DLA	<0.60 DLA	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		17.4	35.2	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-8	Sammanslagningsprov graberg-8	----	----	----
					Client sampling date / time: 07-Jun-2024 00:00	07-Jun-2024 00:00	----	----	----
					VA24B3134-001	VA24B3134-002	--------	--------	--------
					Result	Result	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00728	0.00175	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	4.86	4.76	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	0.000709	0.000433	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	1.54	2.43	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.902	1.20	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	246	310	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00342	0.000463	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00050 DLA	<0.00020 DLA	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.050 DLA	<0.020 DLA	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	3.57	0.403	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0050 DLA	<0.0020 DLA	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0348	0.0082	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	0.0000654	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	3.0	3.2	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	102	87.8	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	1160	1230	----	----	----
pH	----	E117/VA	0.10	pH units	8.20	8.12	----	----	----
Volume, total out	----	E099/VA	0.10	mL	460	380	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	102	87.8	----	----	----

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

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

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: VA24B3847	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 14-Jun-2024 14:02
PO	: Cycle#9	Date Analysis Commenced	: 14-Jun-2024
C-O-C number	: ----	Issue Date	: 23-Jun-2024 09:08
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

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- Analytical Results

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Lindsay Gung	Supervisor - Water Chemistry	Organics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Sam Silveira	Analyst	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagningsprovb-malm-9	Sammanslagningsprovgraberg-9	-----	-----	-----
					Client sampling date / time	14-Jun-2024 00:00	14-Jun-2024 00:00	-----	-----	-----
						VA24B3847-001	VA24B3847-002	----------	----------	----------
						Result	Result	-----	-----	-----
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	-----	-----	-----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<2.50 DLDS	<2.50 DLDS	-----	-----	-----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.378	0.560	-----	-----	-----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	-----	-----	-----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	-----	-----	-----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		284	336	-----	-----	-----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0250	0.0138	-----	-----	-----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.0147	0.00485	-----	-----	-----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00288	0.00212	-----	-----	-----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0422	0.0349	-----	-----	-----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00050	<0.00020	-----	-----	-----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00250	<0.00100	-----	-----	-----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.126	0.121	-----	-----	-----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00215 DLM	<0.000810 DLM	-----	-----	-----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		183	178	-----	-----	-----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00250	<0.00100	-----	-----	-----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.00678	0.00118	-----	-----	-----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00250	<0.00100	-----	-----	-----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.150	<0.060	-----	-----	-----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000250	<0.000100	-----	-----	-----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0181	0.0382	-----	-----	-----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.67	3.55	-----	-----	-----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.476	0.365	-----	-----	-----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		7.51	3.94	-----	-----	-----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.111	0.00972	-----	-----	-----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<1.50	<0.60	-----	-----	-----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		13.9	25.9	-----	-----	-----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagningsprov b-malm-9	Sammanslagningsprov graberg-9	----	----	----
					Client sampling date / time	14-Jun-2024 00:00	14-Jun-2024 00:00	----	----	----
						VA24B3847-001	VA24B3847-002	----	----	----
						Result	Result	----	----	----
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00710	0.00189	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		4.51	4.42	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		0.000445	0.000234	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		0.952	1.54	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.611	1.02	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		176	239	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.00202	0.000390	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00050	<0.00020	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.050	<0.020	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		2.73	0.340	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0050	<0.0020	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		0.0468	0.0060	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		0.0000491	<0.0000250 QCLM	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		114	87.3	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		923	1010	----	----	----
pH	----	E117/VA	0.10	pH units		8.28	8.15	----	----	----
Volume, total out	----	E099/VA	0.10	mL		500	420	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		114	87.3	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: **VA24B4710**	Page	: 1 of 4
Client	: **Geosyntec Consultants International, Inc.**	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 21-Jun-2024 12:00
PO	: Cycle#10	Date Analysis Commenced	: 21-Jun-2024
C-O-C number	: ----	Issue Date	: 27-Jun-2024 22:12
Sampler	: Y		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-10	Sammanslagningsprov graberg-10	----	----	----
					Client sampling date / time	21-Jun-2024 00:00	21-Jun-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B4710-001	VA24B4710-002	--------	--------	--------
						Result	Result	----	----	----
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<2.50 DLDS	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.362	<0.760 DLM	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		309	297	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0250 DLA	0.0122	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.0145	0.00416	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00269	0.00127	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0400	0.0855	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00050 DLA	<0.00020 DLA	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.118	0.095	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00600 DLM	<0.00232 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		176	152	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.00614	0.00189	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00250 DLA	<0.00100 DLA	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.150 DLA	<0.060 DLA	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000250 DLA	<0.000100 DLA	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0183	0.0319	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.73	7.17	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.383	0.389	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		6.35	2.95	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.100	0.0164	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<1.50 DLA	<0.60 DLA	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		13.2	20.9	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-10	Sammanslagningsprov graberg-10	----	----	----
					Client sampling date / time: 21-Jun-2024 00:00	21-Jun-2024 00:00	----	----	----
					VA24B4710-001	VA24B4710-002	--------	--------	--------
					Result	Result	---	---	---
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00652	0.00214	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	4.63	3.47	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	0.000609	0.000142	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.841	1.10	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.790	0.852	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	186	202	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00207	0.000602	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00050 DLA	<0.00020 DLA	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.050 DLA	<0.020 DLA	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	3.09	0.379	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0050 DLA	<0.0020 DLA	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0358	<0.0060 DLA	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	0.0000440	<0.0000250 DLM	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	111	78.7	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	948	923	----	----	----
pH	----	E117/VA	0.10	pH units	8.17	8.10	----	----	----
Volume, total out	----	E099/VA	0.10	mL	475	425	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	111	78.7	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B5411	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 28-Jun-2024 15:50
PO	: Cycle#11	Date Analysis Commenced	: 28-Jun-2024
C-O-C number	: ----	Issue Date	: 08-Jul-2024 16:31
Sampler	: AS, CD		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Sam Silveira	Analyst	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-11	Sammanslagningsprov graberg-11	----	----	----
					Client sampling date / time	28-Jun-2024 00:00	28-Jun-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B5411-001	VA24B5411-002	-------	-------	-------
						Result	Result	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<2.50 DLDS	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.321	0.453	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		251	332	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0100 DLA	0.0102	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.0130	0.00399	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00222	0.00163	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0374	0.0358	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00020 DLA	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.090	0.088	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00104 DLM	<0.000470 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		154	178	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.00471	0.00137	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.060 DLA	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000100 DLA	<0.000050	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0131	0.0289	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		2.64	6.82	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.328	0.606	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		4.84	2.58	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.0708	0.0103	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.60 DLA	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		9.99	21.0	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagni ngsprov b-malm-11	Sammanslagni ngsprov graberg-11	----	----	----
Client sampling date / time					28-Jun-2024 00:00	28-Jun-2024 00:00	----	----	----
					VA24B5411-001	VA24B5411-002	-------	-------	-------
					Result	Result	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00593	0.00146	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	4.07	3.98	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	0.000538	0.000127	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.521	0.815	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.628	0.829	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	140	213	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00163	0.000338	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00020 DLA	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.020 DLA	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	2.39	0.394	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0020 DLA	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0292	0.0065	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	0.0000445	0.0000183	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	105	92.2	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	747	925	----	----	----
pH	----	E117/VA	0.10	pH units	8.16	8.12	----	----	----
Volume, total out	----	E099/VA	0.10	mL	590	550	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	105	92.2	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B5985	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 05-Jul-2024 17:25
PO	: Cycle#12	Date Analysis Commenced	: 05-Jul-2024
C-O-C number	: ----	Issue Date	: 12-Jul-2024 16:13
Sampler	: AS		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagningsprov b-malm-12	Sammanslagningsprov graberg-12	----	----	----
					Client sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	----	----	----
						VA24B5985-001	VA24B5985-002	--------	--------	--------
						Result	Result	----	----	----
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.050	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		0.84	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.352	0.586	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0030 HTDC	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0050 HTDC	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		272	434	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0100 DLA	0.0110	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00921	0.00354	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00149	0.00155	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0361	0.0365	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00020 DLA	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.060	0.061	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00197 DLM	<0.00112 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		125	201	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.00475	0.00202	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.060 DLA	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000100 DLA	<0.000050	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0103	0.0302	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		2.04	6.67	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.288	0.929	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		3.18	1.87	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.0628	0.0149	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.60 DLA	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		7.97	17.4	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagni ngsprov b-malm-12	Sammanslagni ngsprov graberg-12	----	----	----
					Client sampling date / time	04-Jul-2024 00:00	04-Jul-2024 00:00	----	----	----
						VA24B5985-001	VA24B5985-002	--------	--------	--------
						Result	Result	----	----	----
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00499	0.00134	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		2.81	3.88	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		0.000221	0.000060	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		0.345	0.615	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.524	0.883	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		106	190	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.00176	0.000350	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00020 DLA	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.020 DLA	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		1.87	0.434	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0020 DLA	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		0.0137	0.0082	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		0.0000309	<0.0000050	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		79.9	89.5	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		697	1030	----	----	----
pH	----	E117/VA	0.10	pH units		8.02	8.11	----	----	----
Volume, total out	----	E099/VA	0.10	mL		490	450	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		79.9	89.5	----	----	----

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

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

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: VA24B6728	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 12-Jul-2024 12:00
PO	: Cycle#13	Date Analysis Commenced	: 12-Jul-2024
C-O-C number	: ----	Issue Date	: 24-Jul-2024 22:47
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Ghazaleh Khanmirzaei	Analyst	Metals, Burnaby, British Columbia
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagni ngsprov b-malm-13	Sammanslagni ngsprov graberg-13	----	----	----
					Client sampling date / time	12-Jul-2024 00:00	12-Jul-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B6728-001	VA24B6728-002	--------	--------	--------
						Result	Result	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<2.50 DLDS	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.269	0.550	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		492	533	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0050	0.0097	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00953	0.00223	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00158	0.00137	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0476	0.0326	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.085	0.072	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00295 DLM	<0.000850 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		227	228	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.0119	0.00234	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	<0.000050	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0154	0.0269	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.28	6.64	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.738	1.17	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		3.33	1.40	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.146	0.0173	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		10.0	16.8	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagni ngsprov b-malm-13	Sammanslagni ngsprov graberg-13	----	----	----
					Client sampling date / time	12-Jul-2024 00:00	12-Jul-2024 00:00	----	----	----
						VA24B6728-001	VA24B6728-002	--------	--------	--------
						Result	Result	---	---	---
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00600	0.00050	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		3.90	3.57	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		0.000019	0.000019	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		0.453	0.514	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.792	0.659	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		174	197	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.00196	0.000343	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00010	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.010	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		2.91	0.335	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0010	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		0.0550	0.0105	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		<0.0000050	<0.0000050	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		103	78.4	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		1040	1090	----	----	----
pH	----	E117/VA	0.10	pH units		8.25	8.17	----	----	----
Volume, total out	----	E099/VA	0.10	mL		425	450	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		103	78.4	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B7503	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 19-Jul-2024 14:28
PO	: Cycle#14	Date Analysis Commenced	: 19-Jul-2024
C-O-C number	: ----	Issue Date	: 29-Jul-2024 08:02
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

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- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-14	Sammanslagningsprov graberg-14	----	----	----
					Client sampling date / time	19-Jul-2024 00:00	19-Jul-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B7503-001	VA24B7503-002	--------	--------	--------
						Result	Result	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<2.50 DLDS	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.264	0.460	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		401	543	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		<0.0100 DLA	0.0120	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00722	0.00182	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00112	0.00119	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0459	0.0300	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00020 DLA	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.055	0.055	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00156 DLM	<0.000580 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		178	205	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.0102	0.00214	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00100 DLA	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.060 DLA	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000100 DLA	<0.000050	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0103	0.0214	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		2.54	6.14	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.627	1.13	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		2.40	1.16	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.119	0.0156	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.60 DLA	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		7.52	14.4	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-14	Sammanslagningsprov graberg-14	----	----	----
					Client sampling date / time	19-Jul-2024 00:00	19-Jul-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B7503-001	VA24B7503-002	--------	--------	--------
						Result	Result	----	----	----
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00554	0.00070	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		2.66	2.95	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		<0.000020 DLA	0.000023	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		0.307	0.391	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.587	0.803	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		145	192	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.00219	0.000302	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00020 DLA	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.020 DLA	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		1.80	0.259	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0020 DLA	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		0.0141	0.0074	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		<0.0000050	<0.0000050	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		75.5	68.2	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		887	1120	----	----	----
pH	----	E117/VA	0.10	pH units		8.12	8.09	----	----	----
Volume, total out	----	E099/VA	0.10	mL		575	425	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		75.5	68.2	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B8326	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 26-Jul-2024 12:00
PO	: Cycle#15	Date Analysis Commenced	: 26-Jul-2024
C-O-C number	: ----	Issue Date	: 06-Aug-2024 08:12
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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Signatories

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Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Miles Gropen	Department Manager - Inorganics	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-15	Sammanslagningsprov graberg-15	----	----	----
					Client sampling date / time	26-Jul-2024 00:00	26-Jul-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B8326-001	VA24B8326-002	--------	--------	--------
						Result	Result	---	---	---
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<2.50 DLDS	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.186	0.414	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		494	552	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.0070	0.0107	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00702	0.00163	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00103	0.00113	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0448	0.0312	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.055	0.057	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00277 DLM	<0.00129 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		220	223	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.0136	0.00366	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	<0.000050	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0115	0.0235	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		2.54	5.68	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		0.823	1.37	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		2.29	0.921	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.152	0.0255	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		7.56	13.4	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	Sammanslagningsprov b-malm-15	Sammanslagningsprov graberg-15	----	----	----
					Client sampling date / time	26-Jul-2024 00:00	26-Jul-2024 00:00	----	----	----
						VA24B8326-001	VA24B8326-002	--------	--------	--------
						Result	Result	---	---	---
Leachable Metals										
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L		0.00617	0.00082	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L		2.74	3.19	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L		<0.000010	0.000031	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L		0.338	0.415	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L		0.658	0.749	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L		169	197	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L		0.00234	0.000378	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L		<0.00010	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L		<0.010	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L		1.83	0.248	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L		<0.0010	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L		0.0216	0.0115	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L		<0.0000050	<0.0000050	----	----	----
Leachable Physical Tests										
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L		<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L		77.1	75.3	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm		1010	1130	----	----	----
pH	----	E117/VA	0.10	pH units		7.94	7.98	----	----	----
Volume, total out	----	E099/VA	0.10	mL		450	400	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL		500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L		<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L		77.1	75.3	----	----	----

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

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

CERTIFICATE OF ANALYSIS

Work Order	: VA24B9096	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 02-Aug-2024 14:54
PO	: Cycle#16	Date Analysis Commenced	: 02-Aug-2024
C-O-C number	: ----	Issue Date	: 09-Aug-2024 22:35
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-16	Sammanslagningsprov graberg-16	----	----	----
					Client sampling date / time	02-Aug-2024 00:00	02-Aug-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B9096-001	VA24B9096-002	--------	--------	--------
						Result	Result	----	----	----
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<2.50 DLDS	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.200	0.353	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		577	564	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.0304 RRV	0.0105	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00594	0.00149	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00117	0.00104	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0411	0.0290	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.057	0.048	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.00153 DLM	<0.000670 DLM	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		254	231	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.0232 RRV	0.00397	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		0.000061 RRV	<0.000050	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0117	0.0201	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		3.06	5.47	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		1.29	1.52	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		2.25	0.817	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.213	0.0268	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		7.56	13.5	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagningsprov b-malm-16	Sammanslagningsprov graberg-16	----	----	----
Client sampling date / time					02-Aug-2024 00:00	02-Aug-2024 00:00	----	----	----
					VA24B9096-001	VA24B9096-002	--------	--------	--------
					Result	Result	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00791	0.00082	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	3.08	2.77	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	0.000011	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.344	0.349	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.704	0.725	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	218	214	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00216	0.000394	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	2.09	0.246	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0530	0.0084	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	91.2	74.5	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	1190	1160	----	----	----
pH	----	E117/VA	0.10	pH units	7.99	8.12	----	----	----
Volume, total out	----	E099/VA	0.10	mL	450	410	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	91.2	74.5	----	----	----

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

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

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: VA24B9839	Page	: 1 of 4
Client	: Geosyntec Consultants International, Inc.	Laboratory	: ALS Environmental - Vancouver
Contact	: Erik Karlsson	Account Manager	: Virginia Smith
Address	: Medborgarplatsen 3 SE-118 Stockholm Sweden	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: SE 2300368 Haggan BK Vanadis	Date Samples Received	: 09-Aug-2024 15:13
PO	: Cycle#17	Date Analysis Commenced	: 09-Aug-2024
C-O-C number	: ----	Issue Date	: 16-Aug-2024 08:20
Sampler	: YY		
Site	: ALS Scandinavia AB/ALS Minerals		
Quote number	: VA24-ALSS200-004 B-malm		
No. of samples received	: 2		
No. of samples analysed	: 2		

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This Certificate of Analysis contains the following information:

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- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Leon Yang	Analyst	Inorganics, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

					Client sample ID	Sammanslagningsprov b-malm-17	Sammanslagningsprov graberg-17	----	----	----
					Client sampling date / time	09-Aug-2024 00:00	09-Aug-2024 00:00	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		VA24B9839-001	VA24B9839-002	--------	--------	--------
						Result	Result	----	----	----
Leachable Anions & Nutrients										
Bromide	24959-67-9	E245.Br/VA	0.050	mg/L		<0.250 DLDS	<0.250 DLDS	----	----	----
Chloride	16887-00-6	E245.Cl/VA	0.50	mg/L		<2.50 DLDS	<2.50 DLDS	----	----	----
Fluoride	16984-48-8	E245.F/VA	0.020	mg/L		0.319	0.363	----	----	----
Nitrite (as N)	14797-65-0	E245.NO2/VA	0.0030	mg/L		<0.0150 DLDS	<0.0150 DLDS	----	----	----
Nitrate (as N)	14797-55-8	E245.NO3/VA	0.0050	mg/L		<0.0250 DLDS	<0.0250 DLDS	----	----	----
Sulfate (as SO4)	14808-79-8	E245.SO4-L/VA	0.050	mg/L		564	615	----	----	----
Leachable Metals										
Aluminum, leachable	7429-90-5	E448/VA	0.0050	mg/L		0.0088	0.0064	----	----	----
Antimony, leachable	7440-36-0	E448/VA	0.00010	mg/L		0.00506	0.00142	----	----	----
Arsenic, leachable	7440-38-2	E448/VA	0.00010	mg/L		0.00086	0.00081	----	----	----
Barium, leachable	7440-39-3	E448/VA	0.00010	mg/L		0.0309	0.0275	----	----	----
Beryllium, leachable	7440-41-7	E448/VA	0.00010	mg/L		<0.00010	<0.00010	----	----	----
Bismuth, leachable	7440-69-9	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Boron, leachable	7440-42-8	E448/VA	0.010	mg/L		0.051	0.051	----	----	----
Cadmium, leachable	7440-43-9	E448/VA	0.000010	mg/L		<0.000990 DLM	0.000644	----	----	----
Calcium, leachable	7440-70-2	E448/VA	0.050	mg/L		226	243	----	----	----
Chromium, leachable	7440-47-3	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Cobalt, leachable	7440-48-4	E448/VA	0.00010	mg/L		0.0190	0.00566	----	----	----
Copper, leachable	7440-50-8	E448/VA	0.00050	mg/L		<0.00050	<0.00050	----	----	----
Iron, leachable	7439-89-6	E448/VA	0.030	mg/L		<0.030	<0.030	----	----	----
Lead, leachable	7439-92-1	E448/VA	0.000050	mg/L		<0.000050	<0.000050	----	----	----
Lithium, leachable	7439-93-2	E448/VA	0.0010	mg/L		0.0100	0.0199	----	----	----
Magnesium, leachable	7439-95-4	E448/VA	0.0050	mg/L		2.52	5.50	----	----	----
Manganese, leachable	7439-96-5	E448/VA	0.00010	mg/L		1.17	1.88	----	----	----
Molybdenum, leachable	7439-98-7	E448/VA	0.000050	mg/L		2.11	0.758	----	----	----
Nickel, leachable	7440-02-0	E448/VA	0.00050	mg/L		0.168	0.0354	----	----	----
Phosphorus, leachable	7723-14-0	E448/VA	0.30	mg/L		<0.30	<0.30	----	----	----
Potassium, leachable	7440-09-7	E448/VA	0.050	mg/L		6.15	12.1	----	----	----

Analytical Results

Sub-Matrix: Leachate
(Matrix: Water)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: Sammanslagni ngsprov b-malm-17	Sammanslagni ngsprov graberg-17	----	----	----
					Client sampling date / time: 09-Aug-2024 00:00	09-Aug-2024 00:00	----	----	----
					VA24B9839-001	VA24B9839-002	--------	--------	--------
					Result	Result	----	----	----
Leachable Metals									
Selenium, leachable	7782-49-2	E448/VA	0.00010	mg/L	0.00671	0.00067	----	----	----
Silicon, leachable	7440-21-3	E448/VA	0.050	mg/L	2.63	2.93	----	----	----
Silver, leachable	7440-22-4	E448/VA	0.000010	mg/L	<0.000010	0.000015	----	----	----
Sodium, leachable	7440-23-5	E448/VA	0.050	mg/L	0.260	0.299	----	----	----
Strontium, leachable	7440-24-6	E448/VA	0.00020	mg/L	0.604	0.737	----	----	----
Sulfur, leachable	7704-34-9	E448/VA	0.50	mg/L	194	225	----	----	----
Thallium, leachable	7440-28-0	E448/VA	0.000010	mg/L	0.00196	0.000446	----	----	----
Tin, leachable	7440-31-5	E448/VA	0.00010	mg/L	<0.00010	<0.00010	----	----	----
Titanium, leachable	7440-32-6	E448/VA	0.010	mg/L	<0.010	<0.010	----	----	----
Uranium, leachable	7440-61-1	E448/VA	0.000010	mg/L	1.73	0.244	----	----	----
Vanadium, leachable	7440-62-2	E448/VA	0.0010	mg/L	<0.0010	<0.0010	----	----	----
Zinc, leachable	7440-66-6	E448/VA	0.0030	mg/L	0.0300	0.0171	----	----	----
Mercury, leachable	7439-97-6	E517/VA	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
Leachable Physical Tests									
Acidity (as CaCO3)	----	E286/VA	3.0	mg/L	<3.0	<3.0	----	----	----
Alkalinity, total (as CaCO3)	----	E291/VA	2.0	mg/L	84.3	81.6	----	----	----
Conductivity	----	E104/VA	3.0	µS/cm	1110	1210	----	----	----
pH	----	E117/VA	0.10	pH units	8.04	8.02	----	----	----
Volume, total out	----	E099/VA	0.10	mL	430	430	----	----	----
Alkalinity, phenolphthalein (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Volume, total in	----	E099/VA	0.10	mL	500	450	----	----	----
Alkalinity, hydroxide (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, carbonate (as CaCO3)	----	E291/VA	2.0	mg/L	<2.0	<2.0	----	----	----
Alkalinity, bicarbonate (as CaCO3)	----	E291/VA	2.0	mg/L	84.3	81.6	----	----	----

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

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