ILLOVO SUGAR MALAWI (ISM)

ENVIRONMENTAL SOCIAL IMPACT ASSESSMENT REPORT: NCHALO COGENERATION PROJECT

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Uthenga Ofunikila:

Malawi ndilimodzi mwamaiko amene ali ndi magetsi ochepa mwa anthu 7-12 pa anthu 100 aliwonse ndamene ali ndi magetsi ndipo mmadela akumudzi ndi anthu osaposera awiri pa anthu 100 aliwonse omwe ali ndi magetsi. Kusakhala ndi mphamvu zamagetsi zochuluka ndi limodzi mwamabvuto omwe Malawi likukumana nawo ndipo zikuchitisa kuti ntchito za chuma, zopanga katundu komanso kakhalidwe ka anthu kuti zizitsika. Bungwe lopeleka mphamvu zamagetsi la (ESCOM) limachepesa kapelekedwe kamagetsi pozimitsa magetsi kwina nkuyatsa mbali ina poti magetsi 351MW omwe bungweli lima panga siokwanila kufikila magetsi 400MW omwe akufunika. Poti Malawi limadalila magetsi opangidwa kuchoka kumadzi (mphamvu zamagetsi 98 za 100 zilizonse zimapangidwa kumtsinje wa Shire) kapangidwe Kamagetsi kanatsika kufipa pa 200MW chifukwa champhepo yankuntho ya Ana mu Chaka Cha 2022.

Madela akumudzi amadalila nkhuni ndi makala pophikila chifukwa sangakwanitse magetsi komanso mphamvu yochokela ku m'pweya. Izi zikupangitsa kuti nkhalango zomwe zikutha kale zipitilile kutha mwachangu, izi zupangitsa kuti zachilengedwe komanso mitengo ithe. Popeza kuti mitengo imathandiza pa kapangidwe kamadzi, izi zikupangitsa kuti mulingo wamadzi utsike komanso kapangidwe kamagetsi kasokonekele.

Padakali pano, chigayo cha shuga cha Nchalo chimapanga magetsi okwana 40GWh/yr ndipo ikutumiza magetsi owonjezera okwana 65GWh ku ntchito zaulimi pofuna kukwanitsa mphamvu yokwana 105GWh. Illovo Sugar ikufuna kukhazikitsa malo opangila mphamvu zamagetsi okwana 32MW atsopano kumalo awo a Fakitole yopanga shuga a Nchalo omwe akhala akugwira ntchito kwa zaka 65. Padakali pano Fakitole ya Nchalo yimapanga mphamvu yochoka ku zotsala ku minzimbe zotchedwa bagasi pogwiritsa ntchito ma Boiler asanu ndi ma Turbines anayi. Omwe ndiokwanila kuyendetsa Fakitole panthawi imene ikugwira ntchito. Atatu mwama Boiler-wa anayamba kugwira ntchito nchaka cha 1965 ndipo amagwiritsa ntchito njira zakale zimene zimapangitsa kuti azikonzedwa pafupipafupi. Pokhuzana ndi nkhani za umoyo komanso chitetezo pantchitoyi, kapangidwe ka mphamvu yamagetsi nkofunikadi chifukwa ma Boilers omwe alipo anamangidwa nchaka cha 1965 omwe amagwiritsa ntchito njira zachikare zotchedwa "Dutch oven". Muuvunimu mmayikidwa bagasi yew amaotchedwa. Pali mapaipi achitsulo omwe amalandila mphamvu yokapangira nthunzi. Utsi osasefa ochoka kuntchitoyi umatulutsidwa mmlengalenga omwe umapangitsa kuti m'pweya usakhale wabwino.

Illovo Sugar Malawi ikufuna kuphwasula ma Boilers asanuwa nkupanga Boiler imodzi yomwe izagwirizane ndi mlingo wa m'pweya umene anthu a kupuma (MS 737-1:2021) kuonetseta kuti mphamvu ya nthunzi ndi magetsi okwanila ikupangidwa kupita ku chigayo cha shuga ndikutumiza mphamvu zoonjezera zamagetsi ku ESCOM. Pomanga nyumba yopangila magetsi zitheketsa kapangidwe ka magetsi okwana 144GWh/yr ndipo magetsi okwana 79GW/yr azakhalapo kuti atumizidwe ku ESCOM ndipo magetsi otsalawo amagwiritsidwa ntchito kuchigayo chopanga shuga.

Kufotokozela	Mmene Zilili (GWh/yr)	Mmene Zingakhalire (GWh/yr)
Mphamvu ya Magetsi	40	144
Magetsi akugwilitsidwa Ntchito	-40	-33
Magetsi akuonongeka		-32
Magetsi akutumizidwa kwina	0	-79

Malo opangila mphamvu zamagetsi azakhala ndi ubwino ungapo kumphamvu yamagetsi ya Malawi:

- Kupeleka kupezeka kwa mphamvu ya magetsi amene angathe kutumizidwa kuntchito zina.
- Kupanga ndi kutumiza mphamvu ya magetsi pamene akufunika kwambiri nthawi yakuchepa kwa madzi mudamu.
- Kupeleka mphamvu zamtengo wapamwamba zozungulila kupatsa kuti ndi mphamvu zokhazikika ku magetsi a dziko.
- Kubweretsa kapangidwe kangapo kamagetsi (mphamvu yochoka kumadzi komanso kudzuwa)
- Kapangidwe kamagetsi kosatha.

Malo opangila ntchitoyi ali ku kampani ya Illovo Sugar Malawi yomwe ili ku Nchalo (ku Chikwawa) pafupifupi makilomita makumi asanu ndi atatu kummwera Kwa mzinda wa Blantyre. Malo a opangila nthunzi komanso magetsi ali ku Fakitole ya shuga ndipo ntchitoyi ichitika pa nthambo cha 11kV chomwe chilipo kale kuchoka ku malo opangila magetsi kupita ku substation yomwe ili pafupifupi makilomita asanu ku mpoto kwa Fakitole yashuga ya Nchalo komanso malo ogwirira ntchito. Nthambo yatsopano ya 11kV ilondola nthambo ilipo kale ya 11kV kupita ku substation yolumikizidwa pafupifupi makilomita asanu ku mpoto kwa Fakitole yashuga.

Ntchito yofunsidwayi ikukamba zazochitika zotsatilazi pamalo a chigayo cha shuga cha Nchalo:

- Kuphwasulidwa kwa ma Boiler asanu (3 × 17 bar ndi 2 × 32 bar Boilers).
- Kuyimitsidwa kwa ntchito ya ma Turbines kuphatikiza ma prime movers onse (1 × shredder ndi 2 × mill) pakuti ma prime movers onse akhala oyendera magetsi.
- Kumangidwa mwatsopano kwa 200 t/h (tones per hour) / bar boiler yatsopano yogwiritsa ntchito njira yamakono yotulutsa nthunzi wabwino.
- Kumangidwa kwa Turbine ya 22MW (67bars) yomwe yimazizilisa ndi kuchotsanso nthunzi otsalila omwe umabwelanso ngati madzi;
- Kumangidwa kwa Turbine ya 10MW (67bars) yomwe yimachotsa nthunzi otsalila omwe umabwelanso ngati madzi.
- Kumangidwa kwa tower yozizilitsila madzi.
- Kukhazikitsa kwa malo osungila bagasi.
- Kumangidwa kwa nyumba yatsopano yochosela nyasi mu madzi ochokela ku Fakitole isanatayidwe; ndiponso.
- Kuyika kwa nthambo ina ya 11kV kuchoka kumalo opanga mphamvu yamagetsi kufika ku station yomwe ilipo kale pafupifupi makilomita asanu kumpoto kwa Fakitole yashuga ya Nchalo komanso malo ogwirira ntchito. Nthambo zamagetsi zizakhala pamalo a Illovo ndipo zizayenda mwa nseu omwe ulipo kale. Kusokonezedwa kwa zintchito kuzakhala kochepa.

Palinso ubwino ochuluka popanga magetsi kukakhala obwezeletsa zachilengedwe. Ndipo ubwino umenewu ndi monga;

- Kugwirizana ndi malamulo okhuzana ndi mpweya otuluka (MS 737-1:2021), komanso a chuma cha pa dziko lotchedwa international financial corporation (IFC).
- Kukwera kwa kagwiritsidwe ntchito kabwino kazachuma.
- Kuonjezera anthu olembedwa ntchito komanso kutolera msonkho ngati kuzimazima kwamagetsi kungachepetsedwe.
- Kupeleka magetsi ku madela akumudzi kungapangitse kubwezeletsedwa kwachilengedwe ndimabvuto obwera chifukwa chaizi chifukwa anthu atha kusiya kugwilitsa makala nkupita kumagetsi.
- Kulima kwa nzimbe sikotheka kuchigwa cha Shire popanda kuthilila. Pachifukwa ichi kuonjezera kupanga magetsi kuthandiza esiteti ya Nchalo komanso alimi akunja poti kuthilila sikungasokonezedwe.

Malingana ndi mfundo zakasamalidwe kachilengedwe (EMA) 19 of 2017, chikalata chachilozeza chochokera kwankulu oyendesa zoona za zinthu zofunikila kukhalapo ntchito yomanga malo opanga magetsi isanayambe. Mu chaka cha 1998, bungwe la Environmental Affairs Department inasindikiza mfundo zotsogolela kaonedwe kammene zachilengedwe zingakhudzidwire m'Malawi yolembedwa motere "Chidziwitso chazachilengedwe (mfundo zokhazikika za nchito zofunika kuonedwa kakhuzidwe ka zachilengedwe)". Mfundo zotsogolelazi nzofunika poonetsetsa kuti zodandaulitsa za chilengedwe mu chitukuko chadziko ziunikidwa muntchito zonse zaboma komanso mabungwe oti siaboma malingana ndi mun'ndandanda wa ntchito zopasidwa (n'ndandanda A ndi n'ndandanda B). N'ndandanda A ndi wa ntchito zonse zimene kafukufukuyi ndiokakamiza monga ntchito za mphamvu zamagetsi ndi kugawa. Pachifukwa ichi kuunikidwa mwakuya kwakakhuzidwe ka zachilengedwe ndi kakhalidwe ka anthu (ESIA) zikuchitika pofunsa chilolezo ku Malawi Environmental Protection Authority (MEPA) molingana ndi malamulo a Boma amene akupezeka mu EMA, 2017(act no 19 of 2017).

Ntchito zolowa m'malo mwake

Ndondomeko ya ESIA imafuna mwini ntchito kuti apeze ndi kufufuza ntchito zina zogwirika zolowa mmalo mwake. Ntchito zolowa m'malo mwake zimayambira pa, malo opemphedwa kuti ntchito igwirike, ntunda wa ntchito yomwe yufuna igwirike, kukonza kwantchitoyi, ndipo imathera ku chisankho chosachita ntchitoyi (no go alternative)

- Njira ina malingana ndi ntundu wantchito.

Kukula kwa kubwezeletsa kwa ma Boilers kunafufuzidwa kuti mtengo ukhale otsika wakuthetsela bvuto. Pamene ma Boilers atatu akale a mu Chaka Cha 1965, sakanatheka kuwakonza bwino kuti achepetse utsi omwe amatulutsa komanso kuti agwirizane ndi malamulo a Boma okhuzana ndi utsi (MS 737-1:2021), Boilers yachinayi ndi yachisanu ikanatheka kukonzedwa mogwirizana ndi mulingo watsopano wotulutsa utsi. Kafukufuku wazomangamanga unachitika motsogozona ndi kuunika ziophyezo kuti uone njira yopindulitsa ndiiti pakati paziwirizi.

a) kuphwasula ma boilers onse ndikubweletsa atsopano, kapena
b) kubwezeretsa mbali yochepa, pamene ma boilers awiri angakomzedwenso bwino.

Njira (b) ithera nkupitiliza ndi mitengo yokonzakonza ma Boilers awiriwa mu zaka makumi awiri zikubwerazi kuti mukhale kuchepa kwa chiophyezo chodontha. Pomanga ndikuyika zipangizo zosaophya komanso zabwino kuchilengedwe komanso kuchepesa mitengo yantchito zokonzakonza, gulu lopanga ntchitoyi linaganiza zolimbikitsa kuphwasula ma Boilers onse ndikubweretsa ndiatsopano. Koma ngati ngwirizano wogula magetsi ndi ESCOM susindikizidwa, Illovo Sugar Malawi isankha njira (b). Pakuti Nchalo Illovo Sugar inapatsidwa mpaka chaka cha 2026 kuti ionetsetse kuti utsi otulutsidwa mlengalenga ndiogwirizana ndi malile anayikidwa mu malamulo a

boma (MS 737-1:2021). Pachifukwa ichi chisankho chongokonza ma boilers omwe alipo kale chilipo, ngakhale palibe magetsi owonjezera amene azipangidwa kuti atumizidwe ngati njira itachitidwe.

- Kusintha kwamalo

Kuti malo opangila mphamvu yamagetsi akhale otheka akuyenera kuyandikana ndi Fakitole ya Illovo sugar Nchalo. Pachifukwa ichi, kusintha kwamalo nkomangika ku malo omwe ali kale ku Fakitole ya Illovo Sugar Nchalo ndi malo ozungulila. Pachifukwa ichi kufufuza kwamalo ena sikungakhale kotheka.

- Kusintha kwakasanjidwe ka zinthu

Pantchito yofunsidwayi panapezeka kasanjidwe kazinthu kamitundu iwiri. Njira zonse ziwiri, Boiler house, power house, Cooling Tower ndi zogwirizana ndi zomangamanga zikuyenera kukhala mkati mwa Fakitole ya Illovo, pomwe malo osungira bagasi akuyenera kukhala ku mpoto kwa Fakitole (kasanjidwe koyamba) kapena kumadzulo kwa Fakitole (kasanjidwe kachiwiri). Kuwonongeka kwa chilengedwe komwe kumakhuzana ndi kusungira ndi kutumiza bagasi, kuphatikizapo kuipisa mpweya ndi kutuluka kwa tinthu ting'onoting'ono ta fumbi kuchokera ku zomwe zimatengedwa pa malopo chifukwa cha mphepo ya mkuntho komaso kuyaka kozizimutsa panthawi yosungira bagasi. Popeza malo okhala anthu ku Illovo Sugar Nchalo ali pafupi kwambiri ndi kusintha kwa kasanjidwe kachiwiri izi zikuthanthauza kuti zobvuta zomwe zingagwirizanitsidwe ndi ndondomeko yakasanjidwe kachiwiri (layout alternative 2) ndizokwera kwambiri.

Potsatira kuwunika kwa zovuta zomwe zimagwirizanitsidwa ndi masanjidwe oyamba komaso achiwiri (lay out alternative 1 and 2) zidapezeka kuti zovuta zomwe zimagwirizanitsidwa ndi masanjidwe oyamba sizikukhuza kwambiri chisokonezo kumbali ya chilengedwe komanso chikhalidwe cha anthu.

- Njira zina zokhuza Tekinoloje:

Pankhani ya tekinoloje panali kuthekera komanga famu ya dzuwa kuti ipange mphamvu yowonjezera yomwe ikanathandizanso pothilira minda. Njira imeneyi inakumana ndi zobvuta monga:

i. Kusakhazikika kwa gridi yamagetsi ku Malawi chifukwa cha kudzipereka kopitilira muyeso kwa ukadaulo wa sola kapena kuti mphamvu ya dzuwa ndipo pachifukwa ichi, ESCOM sinavomereze mwayi womanga famu yoyendera mphamvu ya dzuwa kuti apange magetsi owonjezera;
ii. Ngakhale ukadaulo wa dzuwa sudzabweretsa ziwonongeko zilizonse, ma Boilers adzafunikabe popanga shuga. Ndipo ma Boiler omwe alipo kale azayenerabe kusinthidwa.

Chifukwa cha zovuta zotelezi, mwayi womanga malo oyika makina oyendera dzuwa sunaloledwe.

- Njira Zina za kayalidwe

Mapangidwe a magetsi amenewa adawunikidwanso pakati pa:

- Ma boilers otsika (32 bars ndi 45 bars); ndi
- Ma boilers okwera (67, 82, kapena 105 bars)

Kuwunika kwa zoophya kunachitika komanso kuwunikanso kwa mtengo wa mayankho osiyanasiyana ndipo zidapezeka kuti chifukwa chakuti mpheroyo imafunikira nthunzi kuti igwire ntchito, njira yabwino kwambiri yopangira magetsi ku Illovo Nchalo ndikuika Boilers imodzi ya 67 bar.

- No-Go Alternative

Njira ya "No-Go Alternative" idafufuzidwanso imene ikutanthauza kuti ntchito yobweletsa magetsi a 32MW ku Illovo Nchalo Sugar isapitilire. Njira iyi yomwe ingabweretse zotsatirazi:

- Mpweya wotuluka m’ma Boiler omwe ulipo upitirizabe kukhala wosatsata malamulo a Boma (MS 737-1:2021), komanso miyezo ya International Finance Corporation (IFC);
- Palibe magetsi owonjezera omwe adzapangidwe ndipo akupezeka kuti atumizidwe ku nthambo za Boma. Choncho ESCOM itaya mphamvu ya magetsi 79GWh/yr yomwe ikanatha kugulitsidwa kunja;
- Mwayi wa ntchito zachindunji ndi zopanda chindunji zidzatayika.

Chifukwa cha zifukwa zomwe zatchulidwa pamwambazi, njira ya “No-Go alternative” sinakondedwe.

Ndondomeko ndi Malamulo a Kapangidwe ka Zinthu

Fakitole ya Nchalo Sugar yakhala ikugwira ntchito kwa zaka pafupifupi 80 ndipo pakali pano, Fakitole ili ndi ziphatso zosiyanasiyana zokhudzana ndi chilengedwe komanso/ kapena ziphatso za ntchito yomwe ilipo.

Kwa makina atsopano opangira magetsi, ndondomeko zosiyanasiyana, malamulo ndi ndondomeko zapadziko lonse lapansi zinaganiziridwa ndipo kutsata ndondomeko ndi malamulo onse a m'deralo ndi apadziko lonse adzakhala anzeru. Zilolezo ndi mgwirizano onse omwe unalipo wafotokozedwa mu Gawo 3 la Lipoti la ESIA ndipo ndondomeko ndi malamulo onse a m’delaro ndi a mayiko ena okhudzana ndi makina opangira magetsi atsopano afotokozedwa mu Gawo 4 la Lipoti la ESIA.

Ndondomeko ya kutengapo mbali kwa anthu

Ndondomeko ya ESIA ikuchitika motsatira ndondomeko ya EIA Guidelines yomwe inakhazikitsidwa mchaka cha 1997 ku Malawi. Malangizowa sali achindunji potengera ndondomeko ya kutenga nawo mbali kwa anthu yomwe iyenera kuchitidwa, komabe chifukwa polojekitiyi iyenera kutsata Miyezo ya IFC, ndikofunikira kuti kukambirana momveka bwino ndi anthu okhudzidwa kuphatikiza magulu okhudzidwa ndi anthu ena achidwi achitike. Njira yokambilana ndi anthu idachitika motsatira malamulo a “IFC Performance.”

Okhudzidwa adadziwika powayika m'magulu otsatirawa: (a) Magulu omwe akhudzidwa ndi polojekitiyi (anthu kapena magulu omwe akhudzidwa kapena omwe angakhudzidwe ndi polojekitiyi): Madela omwe akhudzidwa ndi ntchito za polojekitiyi. (b) Magulu Achidwi (anthu kapena magulu omwe angakhale ndi chidwi ndi polojekitiyi) monga: District Councils; National Authorities; Government Ministries, Departments and Agencies; NGO, CBOs,

Njira zoyenera zoyankhulirana, ndi njira zoyankhulirana zachikhalidwe zidagwiritsidwa ntchito pochita nawo mbali ndi okhudzidwa. Njira zomwe zikugwiritsidwa ntchito komanso zomwe zidzapitilire kugwiritsidwa ntchito pazotsalira zomwe zidzachitike ndi izi:

- Kulumikizana (imelo ndi thenifolo);
- Misonkhano ya munthu m’modzi-m’modzi;
- Misonkhano yokhazikika
- Misonkhano ya paguru
- Misonkhano ya zokambirana za mmaguru
- Magulu azidziwitso
- Ofalitsa Nkhani (nyuzipepala, wailesi);

M'gawo loyang'anira, kukambirana kunachitika ndi abale ndi achidwi ndi okhudzidwa (I&AP's), potsatila izi:

- Kagawidwe ka lipoti lakukonzedwanso kwa achidwi ndi okhuzidwa pa 9 Marichi 2023. Chidule cha Lipoti la Dongosolo Lokonzekera (Draft Scoping Report) chinaperekedwa m'Chichewa ndi Chingelezi ndipo poyamba chinaperekedwa kwa masiku 30 opereka ndemanga, komabe, potsatira ngozi yachilengedwe yomwe idachitika chifukwa cha mphepo yamkuntho yotchedwa Freddy, chigamulo chinatengedwa kuti chiwonjezeke ndi ndemanga za anthu kufikira pa 20 April 2023. ndi cholinga chopatsa okhuzidwa nthawi yochulukirapo kuti awonenso Lipoti Lokonzekera ndikupereka ndemanga kapena mafunso aliwonse. Lipoti la Dongosolo Lokonzekera lidaperekedwa kudzera mu izi:
    - Lipotili lidayikidwa polandirira alendo ku Illovo Sugar Nchalo
    - Lipotili lidagawidwanso kwa magulu onse omwe anali ndi imelo.
- Maguru owonetsa chidwi ndi Okhudzidwa adadziwitsidwa za kupezeka kwa Lipoti la Kukonzekera kwa Ntchito pogwiritsa ntchito zotsatirazi:
    - Kalata yopita ku Madipatimenti onse, Okhudzidwa kuzera munjira ya imelo
    - Tsamba la chidziwitso m'chinenero chakumeneko, Chichewa, linaikidwa pamalopo (pakhomo la Illovo Sugar Nchalo, komanso mmalo momwe anthu amawelengela nkhani);
    - Wailesi ya Capital Radio idaulutsa kwa milungu itatu, ndikupereka chidziwitso chokhudza kupezeka kwa Lipoti la dongosolo lokonzekera kuti anthu awunikenso. Chidziwitsochi chinali ndi kufotokoza kwachidule kwa polojekitiyi, yomwe inali ndi zambiri za komwe kopi ya Lipoti la dongosolo loyang'anira ingapezeke kuti iwunikenso, kufotokoza ndondomeko yopereka ndemanga kapena mafunso ndipo munaphatikizanso mauthenga a mlangizi wa chilengedwe amene angapezeke.

  Chidule cha zokambirana ndi okhudzidwa ndi ndondomeko yogawana nawo anthu zomwe zachitika mpaka pano, zikuphatikizidwa mu Gawo 6 la Lipoti la ESIA. Kutsatira misonkhano ndi zokambirana zomwe zidachitika panthawi yowunika, ndemanga zidawonetsa kuti ntchitoyi idayamikiridwa chifukwa magetsi owonjezera adzapangidwa, komabe, madera ozungulira akufuna kukhala oyamba kupindula ndi magetsi owonjezera omwe apangidwa.

Zotsatira Zakuwunika Kwa Chilengedwe Ndi Chikhalidwe Cha Anthu

Zachilengedwe, zachikhalidwe komanso zachuma zidzakhudzidwa panthawi yomanga, kugwira ntchito ndi kuchotsedwa kwa malo opangira magetsi. Pachifukwa ichi, zotsatira zake zidawunikidwa pazigawo zonse zitatu zachitukuko. Kafukufuku wosiyanasiyana adachitika kuti adziwitse kufunika kwa malo opangira magetsi ophatikizana pazachilengedwe komanso zachikhalidwe. Kuwunika kwakatswiri kumeneku kwafotokozedwa mwachidule mu Gawo 9 la Lipoti la ESIA ndipo lapezeka kuti laphatikizidwa monga zowonjezera D (Appendix C).

Pachikhumbo chilichonse, mulingo (spartial scale), kukula ndi nthawi (nthawi yayitali) zafotokozedwa, mu Gawo 11. Njirazi zidagwiritsidwa ntchito kudziwa tanthauzo la zovutazo, choyamba ngati palibe kuchepetsera kenako ndi njira zochepetsera zogwira mtima kwambiri. Kuchepetsa komwe kwalongosoledwa mu Lipoti la ESIA kukuyimira njira zonse zovomerezeka koma sizikutanthauza kuti zidzakwaniritsidwa.

Chidue cha kufunika kwa zotsatirapo pambuyo pa kuunikako, chikuperekedwa mu tebulo ili m'munsimu.

ZIOPSYEZO	OSAPANGA CHILICHONSE	KUYIKA NDONDOMEKO YA CHITETEZO	ZIOPSYEZO PASANACHITIKE KANTHU	ZIOPSYEZO AKAYIKA NDONDOMEKO
Nthawi Yomanga				
Kutha kwa Nthaka	Zotsika	Zotsika kwambiri	Zapakatikati	Zapakatikati
Kuonongeka kwa Nthaka	Zotsika	Zotsika kwambiri	Zotsika	Zotsika kwambiri
Kuchuluka kwa Fumbi	Zokwelerapo	Zotsika	Zokwelerapo	Zotsika
Kuyendayenda kwa zinthu	Zokwelerapo	Zotsika	Zotsika	Zotsika kwambiri
Kuonongeka kwa Madzi	Zotsika	Zotsika kwambiri	Zokwelerapo	Zotsika
Kuchuluka kwa zinthu zachilendo	Zotsika kwambiri	Zapakatikati	Zakatikati	Zapakatikati
Zinyalala	Zokwelerapo	Zotsika	Zokwelerapo	Zotsika
Kusintha kwa nyengo	Zotsika	Zotsika kwambiri	Zokwelarapo	Zotsika
Chitezo cha anthu	Zokwelerapo	Zotsika	Zokwelerapo	Zotsika
Kutukuka kwa anthu	Zokwelerapo (+)	Zokwelerapo (+)	Zokwera (+)	Zokwera (+)
Kusauka kwa anthu	Zokwelerapo	Zotsika	Zokwera	Zokwelerapo
Nthawi Yogwira Ntchito				
Kutha kwa Nthaka	Zotsika	Zotsika kwambiri	Zotsika	Zotsika kwambiri
Kuonongeka kwa Nthaka	Zokwelerapo	Zotsika	Zapakatikati	Zapakatikati
Kuonongeka kwa Mphweya	Zotsika	Zotsika kwambiri	Zokwelerapo	Zotsika
Kuchuluka kwa Phokoso	Zotsika	Zotsika kwambiri	Zokwelerapo	Zokwelerapo
Ziopsyezo ku Madzi	Zotsika	Zotsika kwambiri	Zotsika	Zotsika kwambiri

Ziopsyezo ku za moyo	Zotsika kwambiri	Zotsika kwambiri	Zotsika kwambiri	Zotsika kwambiri
Kutukuka kwa Za Moyo	Zokwelerapo (+)	Zokwelerapo (+)	Zokwera (+)	Zokwera (+)
Zinyalala monga phulutsa	Zokwelerapo (-)	Zokwelerapo (+)	Zapakatikati	Zapakatikati
Zinyalala za m'manyumba	Zokwelerapo	Zotsika	Zapakatikati	Zapakatikati
Zinyalala zoopsya	Zokwelerapo	Zotsika	Zapakatikati	Zapakatikati
Zinyalala za phulutsa lowuluka	Zotsika	Zotsika kwambiri	Zapakatikati	Zapakatikati
Madzi owonongeka kuchokela ku fakitala	Zokwelerapo	Zotsika	Zapakatikati	Zapakatikati
Zinyalala za ku Chipatala	Zokwelerapo	Zotsika	Zapakatikati	Zapakatikati
Kusintha kwa Nyengo	Zapakatikati	Zapakatikati	Zapakatikati	Zapakatikati
Ziopsyezo ku moyo wa anthu	Zotsika	Zotsika kwambiri	Zokwelerapo	Zotsika
Ziopsyezo ku moyo wa anthu (Kosungila Bagasse – layout alternative 1)	Zotsika	Zotsika kwambiri	Zotsika	Zotsika kwambiri
Ziopsyezo ku Moyo wa anthu (Kosungila Bagasse– layout alternative 2)	Zokwelerapo	Zotsika	Zokwelerapo	Zotsika
Kutukuka kwa anthu- Kuonjezala mphamvu ya magetsi	Zokwera (+)	Zokwera (+)	Zokwera (+)	Zokwera (+)
Kutukuka kwa anthu – Kusintha kwa kupezeka kwa ntchito	Zotsika	Zapakatikati	Zotsika	Zapakatikati

Kutukuka kwa anthu – kupunzitsa ogwira ntchito	Zokwelerapo (+)	Zokwelerapo (+)	Zokwelerapo (+)	Zokwelerapo (+)
Socio-economic impact – impact on long-term contractors	Zapakatikati	Zapakatikati	Zapakatikati	Zapakatikati
Nthawi Yotseka Pulojeketi				
Soil erosion	Zotsika	Zotsika kwambiri		
Soil contamination	Zotsika	Zotsika kwambiri		
Dust generation	Zokwelerapo	Zotsika		
Kuchuluka kwa Phokoso	Zotsika	Zotsika kwambiri		
Kayendende ka zinthu	Zokwelerapo	Zotsika		
Ziopsyezo ku madzi	Zokwelerapo	Zotsika		
Zinyalala zopezeka nthawi yotseka pulojeketi	Zokwelerapo	Zotsika		
Chitetezo cha anthu	Zokwelerapo	Zotsika		
Kutukuka kwa anthu	Zokwelerapo (+)	Zokwelerapo (+)		
Negative socio-economic impact	Zokwelerapo	Zotsika		

Mapeto a Nkhani

Kuwunika kwa zotsatira kwa akatswiri komwe kunachitika, kunawonetsa kuti zovuta zambiri zitha kuchepetsedwa potsatira kukhazikitsidwa kwa njira zochepetsera panthawi yomanga, kugwira ntchito ndi kuyimitsa ntchito. Zinapezekanso kuti kukhudzidwa kwa chilengedwe ndi chikhalidwe cha anthu okhudzana ndi masanjidwe 1, kunali kocheperako poyerekeza ndi masanjidwe amitundu iwiri ndipo pachifukwa ichi, masanjidwe oyamba (layout alternative 1) ndi njira yabwino yopangira magetsi.

Zikudziwikanso kuti malo opangira magetsi ophatikizana adzakhala akulowa m'malo mwa zida zopangira magetsi zomwe zilipo kale ndipo chifukwa chake zobvuta zina zomwe zikukhudzana ndi ntchito yopangira magetsi yomwe ilipo, ingosinthidwa ndi ntchito yatsopanoyo ndipo chifukwa chake zovuta zina zimawoneka ngati zopanda ndale. Kutsatira kuunikaku, zovuta zina zidzayenda bwino kwambiri kuchokera pakugwira ntchito kwa makina atsopano opangira magetsi opangidwa mwaukadaulo wapamwamba kwambiri.
Zotsatira zabwino kwambiri zomwe zimachitika chifukwa cha ntchitoyi ndi izi:

- Kuchuluka kwa mphamvu zopangira magetsi, zomwe zimakhudza kwambiri chikhalidwe cha anthu ndi zachuma, kuchepetsa kudulidwa kwa nkhalango (kukhudzidwa kwabwino kwa zamoyo zosiyanasiyana) popeza nkhuni zochepa zingafunikire pogwiritsa ntchito ophikira;
- Kuwongolera kwa mpweya wabwino monga malo atsopano opangira magetsi opangidwa ndi tekinoloji yatsopano. Izi zichepesa kuononga kwa mphweya umene anthu akupuma chifukwa utsi wake uzikhala wabwino. Gome lowunika lidawonetsabe kuti zotsatira zake zimakhala zoyipa chifukwa ntchitoyi ikadapangitsa kuti mpweya utulutsidwe, komabe, chifukwa cha zida zochepetsera, zotsatira zake zizikhala kwambiri.
- Kuwongolera thanzi ndi chitetezo pakugwira ntchito. Njira yopangira magetsi yomwe ilipo pano ndiyowopsya pa thanzi komanso chitetezo chifukwa ma Boiler akale amafuna kuti ogwira ntchito azigwira ntchito m'malo otsekeka pomwe akukumana ndi kutentha kwambiri akamagwira ntchito ndi manja. Ma Boilers atsopano adzakhala otetezedwa komanso odzipangira okha, kuchepetsa zoopsa zomwe zimapezeka anthu akagwira ntchito mma Boilers. Monga ogwira ntchito adzagwirabe ntchito ndi makina ndi zipangizo, chiopsezo cha thanzi ndi chitetezo cha ogwira ntchito chizakhalapobe, komabe, chiopsezochi chizachepetsedwa kwambiri.
- Zotsatira zabwino pazachuma pa nthawi yogwira ntchito pomwe magetsi ochulukirapo akuchulukirachulukira komanso magetsi ochulukirapo akupezeka kuti agawidwe ku mafakitale ena, kukhala ndi zotsatira zabwino pamafakitale, kukulitsa mphamvu zake zopezera ndalama, zomwe zimapangitsa kuti pakhale mwayi wochulukira ntchito ndipo potero kupititsa patsogolo chikhalidwe cha anthu ndi zachuma kwa Amalawi.

Choncho polojekitiyi ikulimbikitsidwa chifukwa pamwamba pokwanilitsa mulingo umene Boma linakhazikitsa pokhuzana ndi utsi ochekela ku ma Boilers (MS 737-1:2021), adzapanganso magetsi owonjezera, zomwe ndizofunikira kwambiri ku dziko la Malawi, popanda kuwononga chilengedwe komanso chikhalidwe cha anthu. Ngati njira zomwe zili mu ESMP (Ndime 14) ndi Environmental and Social Management System (ESMS) ya Illovo Sugar Malawi zikhazikitsidwe, zovuta zonse zitha kupewedwa bwino kapena ngati sizingapewedwe, zitha kuchepetsedwa kukhala zosafunikira.

EXECUTIVE SUMMARY

Project Information:

Malawi is among the least electrified countries in the world with only 7–12 % of the population connected to the grid while the rural electrification rate remains below 2%. Inadequate energy supply is one of the major problems confronting Malawi and limiting its social, economic and industrial development. The national utility Energy Supply Corporation of Malawi (ESCOM) needs to ration power supply by regular load-shedding as the maximum installed capacity of 351MW cannot feed an estimated energy demand of about 400MW. Due to Malawi's high dependency on hydro-power (almost 98% of the electricity is generated from the Shire River) the generation capacity went down to below 200MW after the storm Freddy in 2022.

Rural populations within Malawi are almost entirely dependent on biofuels. Since grid connections and gas fuels are not affordable to most, a huge number of the rural families are left with no choice but to rely on firewood and charcoal for cooking. This puts excessive pressure on the already fast depleting forests, leading to environmental degradation and deforestation. However, as trees are part of the natural water cycle, these interruptions eventually have a direct impact on the water levels, hence on electricity generation.

At present, the Nchalo Sugar Mill is generating 40 GWh/yr and importing an additional 65GWh of power for agriculture to satisfy its 105GWh of electrical load. Illovo Sugar Malawi is therefore proposing to establish a new 32MW biomass power plant within the existing footprint of Nchalo Sugar Mill Factory which has been operational for approximately 65 years. At present, the Nchalo Sugar Mill Factory operates five boilers and 4 turbines which generates steam and power, sufficient for consumption of the factory only during the operation of the factory. Three of those boilers date back to 1965 and is therefore operating with old technology which requires a lot of maintenance. In terms of the health and safety of the operation, the proposed Cogeneration Power Plant is also much needed as the existing boilers were constructed in 1965, consisting of old technology referred to as Dutch oven. The "oven" is stacked with bagasse and then lit on fire. There are steel pipes to recover the energy to produce steam. The flue gas is then rejected into the atmosphere without any filter, having an impact on air quality.

Illovo Sugar Malawi (with an option to embed the investment into an SPV), is proposing the decommissioning of the five existing boilers and replacing these boilers with one new boiler which will comply with the current Ambient Air Quality Standards and Emission Limits (MS 737-1:2021) to ensure sufficient steam and power to the sugar mill and to export the excess renewable electricity to the grid. The construction of the proposed Cogeneration Power Plant will enable an electricity generation of 144 GWh/yr of which 79 GWh/yr will be available to be exported to the ESCOM grid while the remainder will be used to generate electricity for the Sugar Mill.

Description	As per today GWh/yr	Future Scenario GWh/yr
Generation	40	144
Consumption	-40	-33
Parasitics		-32
Export	0	-79

The proposed Cogeneration Power Plant will also have a number of benefits for the Malawian national power grid such as:

- Offering high availability, base-load quality for export;
- Produces and exports power during the high demand season for the national grid, when the water levels of the dams are low;
- Provides high quality rotating power, resulting to strong static and dynamic stability to the national grid;
- Diversifies the National Grid energy mix (hydro and solar power);
- It is 100% renewable

The proposed project site is located within the footprint of the Illovo Sugar Malawi Nchalo Estate which is located in Chikwawa district approximately 80km south of the city of Blantyre. The Cogeneration Power Plant is proposed within the footprint of the Sugar Factory while the proposed upgrade of the 11kV powerline is proposed along the existing 11kV powerline running from the Cogeneration Power Plant to the existing substation approximately 5km north-east of the Nchalo Sugar Factory and project site. It is proposed that the new 11kV powerline will follow the existing 11kV powerline route to the substation which is connected approximately 5km north-east of the Sugar Factory.

The proposed project would entail the following activities which is all proposed within the existing footprint of the Nchalo Sugar Mill in Malawi:

- Decommissioning of the five existing boilers (3 x 17 bar and 2 x 32 bar boilers):
- Retiring the four existing steam turbines including all prime movers (1 x shredder and 2 x mill) as all prime movers will be electrified;
- Construction of one new modern 200 t/h (tons per hour) / 67 bar boiler with emission abatement technologies;
- Construction of one condensing and extraction turbine of 22MW (67 bars);
- Construction of one extraction turbine of 10MW (67 bars);
- Construction of new cooling tower;
- Establishment of larger bagasse storage yard area;
- Construction of new effluent treatment plant; and

- Replacement of the 11kV powerline from the new Cogeneration Power Plant to the existing substation approximately 5km north-east of the Nchalo Sugar Factory and project site. The electrical power lines are and will be on Illovo's private land and will run along the existing road. Interruptions to operations will be minimal.

There are also significant positive benefits to increased power generation when it is renewable. These positive benefits include:

- Compliance with the Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021), as well as the International Finance Corporation (IFC) Standards;
- Increased capacity utilisation in the economy;
- Creating additional jobs and improved tax collections can be expected if power cuts through insufficient or intermittent power supply are reduced.
- In turn, potential greater rural electrification can have the benefit of reduced environmental degradation and its associated costs as people convert from charcoal to electricity.
- Sugarcane in the Shire Valley is not viable without irrigation. For this reason, increased power generation will be beneficial to the Nchalo Estate as well as Outgrowers, as irrigation would be uninterrupted.

In accordance with the Environmental Management Act (EMA) 19 of 2017, a Director's certificate terms and conditions are required prior to the commencement of the construction of an energy production facility. In 1998, the Environmental Affairs Department published the Guidelines of Environmental Impact Assessment for Malawi, cited as "*Environment (Specification of Projects Requiring Environmental Impact Assessment) Notice, 1998"*.The purpose of the guidelines is to integrate environmental concerns in national development and are applicable to all types of projects in the public and private sectors for which ESIA studies may be required, as identified in the lists of prescribed projects (List A and List B) appended to the guidelines. List A identifies projects for which an ESIA is mandatory and includes energy and transmission projects. For this reason, an in-depth Environmental and Social Impact Assessment (ESIA) is being undertaken to apply to the Malawian Environmental Protection Authority (MEPA), for an Environmental Certificate in accordance with the EMA, 2017 (Act No 19 of 2017).

Project Alternatives:

The ESIA process requires the developer to identify and investigate/assess feasible and reasonable alternatives. The project alternatives range from the location where the activity is proposed, type of activity to be undertaken, design the of activity, technology to be used in the activity, to the option of not implementing the activity (No-Go Alternative).

- Alternative in terms of type of activity:

The scope of the replacement of the boilers were assessed to reduce the cost of the solution. While the three very old boilers dated 1965, could not be upgraded safely to improve the emissions levels

and ensure compliance in terms of the Ambient Air Quality Standards and Emission Limits (MS 737-1:2021), boiler 4 and 5 could have been upgraded to comply with the new emissions levels. A value engineering assessment was performed followed by a risks analysis to determine which of the two following solutions were the most beneficial:

a) a decommissioning of all boilers on site and a complete replacement thereof; or
b) a partial replacement where the two retained boilers will be upgraded.

Solution (b) would result to the continuation of the massive maintenance costs on the retained boilers for the following 20 years to reduce the possibility of leaks. To construct and install safer equipment, environmentally friendly assets, and reduce future maintenance costs, the project team decided to validate the complete replacement of all existing boilers. But, if the Power Purchase Agreement to export power to the grid with ESCOM is not signed, the Illovo Sugar Malawi might opt for solution b, as Nchalo Illovo Sugar was given until 2026 to ensure that the emissions emitted into the air, is within the thresholds included within the Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021). For this reason, the option of only upgrading the existing boilers exist, however, no additional electricity will be generated for export is solution b is implemented.

- Location Alternatives:

In order for the Cogeneration Power Plant to be feasible, the Power Plant would have to be within a close proximity to the existing Nchalo Illovo Sugar Factory. For this reason, the project location alternatives are restricted to an available area within the Sugar Factory footprint and immediate surrounding area. Therefore, no other location alternatives could be feasibly investigated.

- Layout Alternatives:

Two different layout alternatives were identified for the proposed project. For both alternatives, the Boiler House, Powerhouse, Cooling Tower and associated structures and infrastructures are proposed within the footprint of the existing Illovo Sugar Factory, while the location for the bagasse storage area are proposed either towards the north of the existing Illovo Sugar Factory (Layout Alternative 1) or towards the west of the existing Illovo Sugar Factory (Layout Alternative 2). Environmental impacts associated with the storage and transportation of bagasse, includes air pollution with the generation of small dust particles being transported off site during windy conditions as well as spontaneous combustion during the storage of the bagasse. As the Illovo Sugar Nchalo residential area is located within a very close proximity to Layout Alternative 2 (west of the Illovo Sugar Factory), the significance of the impacts associated with Layout Alternative 2 is higher.

Following the assessment of the impacts associated with Layout Alternative 1 and 2, it was found that the impacts associated with Layout Alternative 1 (with the bagasse storage yard located to the north of the proposed cogeneration power plant), will have the least impact on environmental and social aspects.

- Technology Alternatives:

In terms of technology alternatives, the possibility of constructing a solar farm to produce additional power was also assessed. This technology would have matched the irrigation load. This alternative however, faced various difficulties such as:

i. Power grid instability is created in Malawi due to over commitment of solar technology and for this reason, ESCOM did not authorise the option of constructing a solar farm to create additional power;
ii. While the solar technology will not result in any pollutants emitted, boilers will still be required for the sugar mill. The existing boilers would still have to be replaced.

Due to permitting constraints, the option of constructing a solar facility was not retained.

- Design Alternatives:

The design specifications adopted for the Cogeneration Power Plant was also assessed between:

  - low pressure boilers (32 bars and 45 bars); and
  - high pressure boilers (67, 82 or 105 bars).

A risks analysis was performed along with a costing review of the different solutions and it was found that due to the fact that the sugar mill requires steam for operational purposes, the optimum solution for the Illovo Nchalo Cogeneration Power Plant is the construction of one 67 bar boilers.

- No-Go Alternative:

The No-Go Alternative was also investigated and would imply that the 32MW Cogeneration Power Plant at the Illovo Nchalo Sugar Factory is not constructed. This alternative which would result in the following:

  - The air emissions emanating from the existing boilers will continue to be Non-Compliant with Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021), as well as the International Finance Corporation (IFC) Standards;
  - No additional electricity will be generated and be available for export to the National Grid. ESCOM would therefore loose the potential of 79GWh/yr which would have been available for export; and
  - Potential direct and indirect job opportunities will be lost.

Due to the above reasons, the no-go alternative would not be preferred.

Policy, Legal and Administrative Framework

The Nchalo Sugar Mill Factory has been operating for approximately 80 years and at present, the factory is in possession of the various environmental related certificates and/or licenses for the existing operation.

For the new cogeneration power plant, various policies, regulations and international frameworks were considered and compliance with all applicable local and international policies and regulations will be prudent. All existing permits and licenses are outlined in Section 3 of the ESIA Report and all local and international policies and regulations applicable to the new cogeneration power plant are described in Section 4 of the ESIA Report.

Public Participation Process

The ESIA Process is undertaken in accordance with the EIA Guidelines of Malawi which was developed in 1997. These guidelines are not very specific in terms of the public participation process which must be undertaken, however as the project will need to comply with the IFC Standards, it is required that meaningful consultations with relevant stakeholders including affected groups and other interested parties are undertaken. The public consultation process was therefore undertaken in compliance with the IFC Performance Standards.

Stakeholders were identified by means of categorized the stakeholders as follows: (a) Project Affected Parties (individual or groups who are affected or likely to be affected by the project): Communities impacted by project activities. (b) Interested Parties (individual or groups who may have an interest in the project): District Councils; National Authorities; Government Ministries, Departments and Agencies; NGO, CBOs, etc.

Appropriate consultation techniques, and culturally appropriate consultation methods were used to engage the respective parties and stakeholders. The techniques used and which will continue to be used for the remainder of consultations to be undertaken are as follows:

- Correspondences (email and telephone);
- One-on-one meetings;
- Formal meetings;
- Public meetings;
- Focus group meetings;
- Information boards;
- Media (newspaper, community radio);

During the scoping phase, consultation was undertaken with Stakeholders and Interested and Affected Parties (I&AP's), by means of the following:

- Distribution of the Draft Scoping Report to Stakeholders, Departments and I&AP's on 9 March 2023. The Executive Summary of the Draft Scoping Report was provided in both Chichewa and English and was initially made available for a 30-day commenting period, however, following the natural disaster caused by Cyclone Freddy, a decision was taken to extend the public review and comment period to 24 April 2023, in order to provide I&AP's with more time to review the Draft Scoping Report and submit any comments or questions. The Draft Scoping Report was made available by means of the following:
    - Hard copy of the Draft Scoping Report was placed at the reception of Illovo Sugar Nchalo;
    - An electronic copy of the Draft Scoping Report was distributed to all parties who had an email address.
- Stakeholders and Interested and Affected Parties were made aware of the availability of the Draft Scoping Report by means of the following:
    - Electronic letter to all Departments, Stakeholders and I&AP's with email addresses;

- Site Notice boards in the local language, Chichewa, was placed on site (at the entrance of Illovo Sugar Nchalo, as well as the notification board of Illovo Sugar);
- Radio Advert in the local language, Chichewa, was broadcasted on Capital Radio, Malawi, running for three weeks, providing information on the availability of the Draft Scoping Report for public review. This notice included a short description of the project, contained information about where a copy of the Draft Scoping Report could be obtained for review, described the process of submitting any comments and/or questions and included contact information of the environmental consultant who could be contacted if any clarification is required.

A summary of the stakeholder consultations and public participation process undertaken to date, is included in Section 6 of the ESIA Report. Following the meetings and consultations undertaken during the scoping phase, feedback indicated that the project is appreciated as additional electricity would be generated, however, surrounding communities would like to be the first to benefit from the additional electricity generated.

Environmental and Social Impact Assessment Results

The biophysical, social and economic environment will be impacted during the construction, operation and decommissioning phases of the cogeneration power plant. For this reason, the impacts were assessed for all three phases of the development.

Various specialist investigations were undertaken to inform the significance of the impact of the cogeneration power station on the surrounding social and environmental aspects. These specialist assessments have been summarized in Section 9 of the ESIA Report and is found attached as Appendix C.

For each impact, the extent (spatial scale), magnitude and duration (time scale) are described, in Section 11. These criteria were then used to determine the significance of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the ESIA Report represents the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.

A summary of the significance of the impacts following the assessment, is provided in the table below.

IMPACT	SIGNIFICANCE BEFORE MITIGATION MEASURES	SIGNIFICANCE AFTER MITIGATION MEASURES	CUMULATIVE IMPACT PRIOR TO MITIGATION	CUMULATIVE IMPACT AFTER MITIGATION
Construction Phase				
Soil erosion	Low	Very Low	Neutral	Neutral
Soil contamination	Low	Very Low	Low	Very Low
Dust generation	Medium	Low	Medium	Low
Impact on traffic flow	Medium	Low	Low	Very Low
Impact on water consumption	Low	Very Low	Medium	Low
Spreading of alien invasive species	Very Low	Neutral	Neutral	Neutral
Waste generation	Medium	Low	Medium	Low
Impact on climate change	Low	Very Low	Medium	Low
Impact on health and safety	Medium	Low	Medium	Low
Positive socio-economic impact	Medium (+)	Medium (+)	High (+)	High (+)
Negative socio-economic impact	Medium	Low	High	Medium
Operational Phase				
Soil erosion	Low	Very Low	Low	Very Low
Soil contamination	Medium	Low	Neutral	Neutral
Impact on air quality	Low	Very Low	Medium	Low
Noise generation	Low	Very Low	Medium	Medium
Impact on water resources	Low	Very Low	Low	Very Low
Negative impact on biodiversity	Very Low	Very Low	Very Low	Very Low
Positive impact on biodiversity	Medium (+)	Medium (+)	High (+)	High (+)

Impact of waste generated (bottom ash)	Medium (-)	Medium (+)	Neutral	Neutral
Impact of waste generated (domestic waste)	Medium	Low	Neutral	Neutral
Impact of waste generated (hazardous waste)	Medium	Low	Neutral	Neutral
Impact of waste generated (fly ash)	Low	Very Low	Neutral	Neutral
Impact of waste generated (effluent)	Medium	Low	Neutral	Neutral
Impact of waste generated (medical waste)	Medium	Low	Neutral	Neutral
Impact on climate change	Neutral	Neutral	Neutral	Neutral
Impact on health and safety	Low	Very Low	Medium	Low
Impact on health and safety (Bagasse storage area – layout alternative 1)	Low	Very Low	Low	Very Low
Impact on health and safety (Bagasse storage area – layout alternative 2)	Medium	Low	Medium	Low
Socio-economic impact – additional electricity capacity	High (+)	High (+)	High (+)	High (+)
Socio-economic impact – changes to existing employment	Low	Neutral	Low	Neutral
Socio-economic impact – training of staff members	Medium (+)	Medium (+)	Medium (+)	Medium (+)

Socio-economic impact – impact on long-term contractors	Neutral	Neutral	Neutral	Neutral
Decommissioning Phase				
Soil erosion	Low	Very Low		
Soil contamination	Low	Very Low		
Dust generation	Medium	Low		
Noise generation	Low	Very Low		
Impact on traffic flow	Medium	Low		
Impact on water resources	Medium	Low		
Waste generation during decommissioning	Medium	Low		
Health and Safety	Medium	Low		
Positive socio-economic impact	Medium (+)	Medium (+)		
Negative socio-economic impact	Medium	Low		

Conclusion

The assessment of the impacts following the respective specialist assessments undertaken, indicated that most of the negative impacts can be reduced to be of low to very low significance following the implementation of mitigation measures during the construction, operational and decommissioning phases of the project. It was also found that the environmental and social impacts associated with layout alternative 1, was less than the impacts associated with layout alternative two and for this reason, layout alternative 1 is the preferred option for the proposed cogeneration power plant.

It is also noted that the cogeneration power plant will be replacing the existing power generation structures and infrastructure and therefore some of the impacts associated with the existing power generation operation, will just be replaced with the new operation and therefore some impacts are regarded to be neutral. Following the assessment, some of the negative impacts will improve significantly from the operation of the new technologically advanced cogeneration power plant.
The most significant positive impacts resulting from this operation includes the following:

- Increased electricity generation capacity, indirectly impacting the socio-economic environment positively, reducing deforestation (positive impact on biodiversity) as less wood would be required as fuel for cooking purposes;
- Improvement in the current air quality as the new technologically advanced cogeneration power plant, will result to less pollutants being emitted into the atmosphere. The impact on air quality will reduce significantly from being of high significance with the current emissions being emitted into the atmosphere, to being low. The assessment table still noted the impact to be of negative significance as the operation will still result to emissions being emitted, however, due to the abatement equipment, the impact is significantly reduced.
- Improved health and safety impact during operation. The current power generating process is a health and safety hazard as the old boilers requires workers to work in confined spaces while experiencing extreme heat conditions when manually deashing these boilers. The new boilers will be insulated and automated, reducing the risks associated with the manual deashing of the boilers. As workers will still be working with machinery and equipment, the risk on the health and safety of employees remains, however, this risk is significantly reduced from a negative impact of high significance to an impact of low significance.
- Positive socio-economic impact during operation as more electricity capacity is increased and more electricity is available for distribution to other industries, having a positive impact on the industries, increasing its revenue potential, which results to more job opportunities and thereby improving the socio-economic environment of the residents of Malawi.

The project is therefore recommended as it will not only resolve the current non-compliances associated with the emissions in accordance with the Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021) but will also generate additional electricity from a renewable resource, which is much needed for the country of Malawi, without having a significant negative impact on the physical and social environment. If mitigation measures included within the ESMP (Section 14) are implemented and existing Environmental and Social Management System (ESMS) of Illovo Sugar Malawi is adhered to, all impacts can be successfully prevented or if not prevented, reduced to be of low significance.

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ABBREVIATIONS

AMSL	Above Mean Sea Level
CBL	Convective Boundary Layer
CBO	Community Based Organisation
CFD	Computational Fluid Dynamics
EMA	Environment Management Act
ESIA	Environmental and Social Impact Assessment
ESCOM	Electricity Supply Corporation of Malawi
GW	Gigawatts
HA	Hectare
IFC	International Finance Corporation
kV	Kilovolt
kW	Kilowatt
MEPA	Malawi Environment Protection Authority
MFD	Mechanical Flow Diagrams
MM	Millimeter
MS	Malawian Standard
MSDS	Material Safety Data Sheets
MW	Mega Watt
NGO	Non-Governmental Organisation
ODS	Ozone Depleting Substances
PM	Particulate Matter
SBL	Stable Boundary Layer
SOR	Sources of Release
SPV	Special Purpose Vehicle
TA	Turbo Alternator

1. OVERVIEW OF THE PROJECT

1.1 Introduction

Illovo Sugar is the largest sugarcane producer in Africa and has operations in South Africa, Malawi, Zambia, Eswatini, Tanzania and Mozambique. Illovo Sugar produces raw and refined sugar from sugar cane supplied by its own farms and independent out growers. Illovo Group Africa also has vast experience in cogeneration of electrical power from bagasse as it operates 40 bagasse fired boilers around Africa generating high pressure steam by consuming approximately 4 – 4.5 million tons of bagasse per annum which drives 33 power generation steam driven turbo alternator (TA) sets. The combined power generation capacity of the Africa operations is 169MW generating over 60% of the companies' own electrical requirements. Across the group, surplus power is exported to non-estate consumers and national power utilities. The Nchalo Sugar Mill operates for approximately 33 weeks per year and is already generating its own power through cogeneration and the powerhouse is already established, giving Illovo Sugar Malawi the capacity to deliver power for the sugar production. In 2021, Illovo Sugar Africa (Pty) Ltd developed a technical solution to deliver the best return on investment for the owner while making it easy to operate for the Sugar Mill and maximizing the export of electricity to the grid.

Illovo Sugar (Malawi) is subsequently proposing to establish a new 32MW biomass power plant within the existing footprint of Nchalo Sugar Mill Factory which has been operational for approximately 65 years. The proposed power plant is to be operated as part of the ISM Nchalo mill with an option to set up a stand-alone commercial entity Special Purpose Vehicle – SPV). The power plant will be located within the existing Sugar Mill Factory premisses but fenced to contain hazards. The power plant will be sharing some of the site services to reduce operating expenditure. Illovo Sugar (Malawi) will own and operate the assets (exact ownership of the SPV to be confirmed at later stage) of the Power Plant.

At present, the Nchalo Sugar Mill Factory operates five boilers and 4 turbines which generates steam and power, sufficient for consumption during the operation of the factory. Three of those boilers date back to 1965 and is therefore operating with old technology which requires a lot of maintenance. Illovo Sugar Malawi is proposing the decommissioning of the five existing boilers and replacing these boilers with one new boiler which will comply with the current Ambient Air Quality Standards and Emission Limits (MS 737-1:2021) to ensure sufficient steam and power to the sugar mill and to export the excess renewable electricity to the grid.

1.2 ESIA Approach and Objectives

The Environment Management Act (EMA), No. 19 of 2017 provides the legal framework for protection and management of the environment of Malawi, as well the preparation of environmental and social impact assessment (ESIAs) for prescribed projects.

Section 2(f) of the EMA states that an ESIA is a legal requirement for any project that may significantly affect the environment and use of natural resources. The general principles also state that precautionary

measures must be taken to prevent or mitigate possible deleterious environmental effects of any project, even where scientific evidence is not certain. In 1998, the Environmental Affairs Department published the Guidelines of Environmental Impact Assessment for Malawi, cited as "*Environment (Specification of Projects Requiring Environmental Impact Assessment) Notice, 1998"*. The purpose of the guidelines is to integrate environmental concerns in national development and are applicable to all types of projects in the public and private sectors for which ESIA studies may be required, as identified in the lists of prescribed projects (List A and List B) appended to the guidelines. List A identifies projects for which an ESIA is mandatory and includes energy and transmission projects.

In accordance with the Environmental Management Act (EMA) 19 of 2017, a Director's certificate terms and conditions are required prior to the commencement of the construction of an energy production facility by means of conducting and ESIA. The ESIA process is generally undertaken in three distinct phases, namely the Project Brief, Environmental Scoping and ESIA Phases.

A Project Brief was submitted to the MEPA on 9 December 2023 to initiate the ESIA process for the Project. The MEPA indicated that, based on the nature and scale of the activities, an ESIA is required to be undertaken and an ESIA Report are to be submitted, which must be compliant with the Guidelines of Environmental Impact Assessment.

This ESIA process for the project took cognisance of other relevant Malawian legislation, policies and standards. In the absence of specific guidelines and standards under Malawi legislation, good international industry practice (GIIP) will be adhered to, and where relevant, international guidelines and standards applied, such as the International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (IFC, 2012). The IFC Industry Sector Guidelines (2016) and Environmental, Health and Safety Guidelines for Thermal Power Plants (2017) will also be adhered to.

1.3 ESIA Phase Objectives

The main aim of the ESIA phase is to assess the potential impacts which have been identified during the scoping phase of the proposed project.

During the scoping phase, various stakeholders were engaged in order to identify issues and concerns of importance to them. The process was therefore highly consultative by nature.

The specific objectives of the scoping phase were to:

- Provide opportunity for all key project stakeholders i.e., the relevant authorities, stakeholder groups and community members in the project area to exchange information and express their views and concerns regarding the Project;
- Identify key issues and concerns that require further assessment during the ESIA phase;
- Determine the ToR for a variety of specialist studies to be undertaken; and
- Determining the extent of, and approach to, the ESIA.

The draft environmental scoping report (ESR) provided a description of the proposed project, information on the existing biophysical and social environment; identified potential environmental and

social issues that require detailed investigation and assessment during the ESIA phase; and ToR for the required specialist studies. Stakeholders and Interested and Affected Parties were initially given a 30-day review and comment period while initial consultations were being undertaken. However, following devastating effect and impact on the project area caused by Cyclone Freddy, a decision was taken to extend the scoping phase by an additional 14-days, thereby giving community member sufficient time to undertake an initial view of the Scoping Report and provide comments on the proposed development.

The key objectives of the ESIA are:

a) To outline the scope and the rationale for the proposed development.
b) To identify necessary statutory and regulatory approvals and licences to be obtained from government licensing agencies to ensure that the project is in line with sound environmental management practices.
c) To assess the physical, biological, social and economic conditions of the project area.
d) To assess the main potential environmental and social impacts of the project.
e) To identify and recommend measures to mitigate the negative impacts.
f) To prepare an environmental and social management plan (ESMP) for the project
g) To prepare an environmental monitoring plan for the environmental management plan.

Following the submission of the Project Brief to MEPA on 9 December 2022, the following Terms of Reference for ESIA for the project was received:

TERMS OF REFERENCE ***(As per communication submitted by MEPA on 12 December 2022)***		**SECTION WHERE REQUIREMENT IS ADDRESSED**
Provide a full description of the nature/components of the proposed project with respect to the following:	Name of the proponent	Section 1.5
	Postal Address	Section 1.5
	Aim of the objectives of the project	Section 1.3
	Spatial location of the site for the project	Section 1.7
	The estimated cost of the project	Section 2
	The size of the land for project site;	Section 1.7
	Proof of land ownership	Appendix E
	Evidence of permits	Appendix D
	The number of people to work on the area (breakdown of males and females, locals and non-locals)	Section 2.2
Provide a site-specific map of the area (Scale1:50,000) showing the proposed project site and (1:100,000) showing the existing establishment in the proposed area and surrounding areas. A Site Plan of the project should also be provided		Appendix A
Describe the main activities to be undertaken in implementation of the proposed project at the site covering:	Pre-construction	Section 2.1
	Construction	Section 2.2
	Operation	Section 2.3
	Decommissioning	Section 2.4
In the description include the nature of the project including detailed description of each project component, describing the:	Type of machinery to be used	Section 2.2
	Source of raw materials	Section 2.2
	Ancillary facilities associated with the proposed project	Section 2
	Nature and estimated quantity of wastes (both solid and liquid) that will be generated	Section 2.3
	Circularity to waste management i.e. state the means of reducing waste to a minimum by reusing and recycling the wastes, facilities for appropriate disposal of waste that cannot be reused or recycled	Section 2.3

Describe the project alternatives especially those which are significantly different from an environment perspective		Section 7
Provide a concise description of the existing biophysical characteristics and the socio-economic environment status of the proposed area by identifying and analysing:	Physical conditions: Soil, geology, site topography, temperature, rainfall patterns including climate projections and drainage system (watercourses)	Section 8
	Biological Resources: Scope of vegetative resources of the project area including riparian vegetation, extent of terrestrial and aquatic fauna	Section 8.7
	Climate Change: Current climate conditions and trends as well as future climate projections	Section 8.3
	Socio-Economic conditions: Demographic trend within and around the project area, main land uses, including current use of the proposed project site, the distance from the nearest settlements/houses, agriculture and marketing, business activities, basic infrastructure and health situation including description of HIV and AIDS prevalence rates, gender issues in terms of effect of gender inequalities on the environment and how environment issues affects women, youth and other vulnerable gender categories as well as access to and control over productive resources, decision making, access to information , literacy levels and gender division of labour.	Section 8.8
	Physical cultural resource: list the physical cultural resources existing in the project area by type	N/A – no cultural resources are affected by the project
Review the legal framework pertaining to the proposed project and indicate their impacts on the project. Reference should at least by made to	Environmental Management Act	Section 4.2
	Forestry Act	Section 4.4
	Water Resources Act	Section 4.7
	National Water Policy	Section 4.8
	National Environmental Policy	Section 4.1
	National Energy Policy	Section 4.6

	Malawi National Land Policy	Section 4.11
	Sanitation Policy	Section 4.12
	Energy Regulation Act	Section 4.5
	Public Health Act	Section 4.13
	Occupational Safety, Health and Welfare Act,	Section 4.14
	Malawi Vision 2063	Section 4.17
	Gender Equality Act	Section 4.18
	HIV and AIDS Act	Section 4.19
	Irrigation Policy	Section 4.20
	Education Policy	Section 4.21
Provide an account of all regulatory licences and approvals obtained for the proposed project to ensure that they are in line with sound environmental management practices and are in compliance with relevant existing legislation		Section 3 *(Existing licenses issued for the operation of Nchalo Illovo Sugar – Appendix D)*
Identify, assess and analyse environmental, social and climate change impacts associated with the proposed activities at and around the site, focusing on both the positive and negative impacts. In the analysis distinguish between significant positive and negative impacts, direct and indirect impacts, immediate and long-term impacts, reversible and irreversible and cumulative impacts. The impacts should include, Project location, Project design, construction works, and project operation.		Section 11
Propose measures to eliminate, reduce or mitigate the identified negative environmental and social impact and measures to enhance the positive effects.		Section 14
Propose an Environmental and Social Management Plan (ESMP) by which all the measures proscribed in above will be carried out.	Review capacities of institutions to implement recommended measure and identify support to strengthen capacity needs (human resources, training, technical assistance etc.)	Section 14.1

	Indicate the budget for the recommended mitigation measures, specifications of who will be responsible for these measures and the schedule when these measures would be implemented (planning, construction, operation and decommissioning)	Section 14
	The ESMP must include the activities frequency of monitoring, key monitoring indicators, resources required and the authorities responsible for monitoring compliance. It should also include measures to ensure meaningful and inclusive community participation in the monitoring.	Section 14
Undertake stakeholder consultation. Ensure that social inclusion is key in the consultation with the youth, woman and other vulnerable groups.		Section 6
Ensure that the District Commissioner and Environment District Officer (EDO) for Chikwawa District Council are adequately consulted on the proposed project.		Section 6 *Minutes of the meeting undertaken with the Chikwawa District Council is included in Appendix B*
Submit two hard copies to the Malawi Environment Protection Authority for preliminary review before submission of 15 hard copies for Advisory Committee on Environmental and Social Assessment Review and a soft copy of the ESIA Report to the Director General of the Malawi Environment Protection Authority		Noted
Attach the TORs and letter accompanying the TORs in the appendices part of the report		Appendix F
Provide the names of the ESIA Team and their respective fields and attach them as annex of the ESIA report.		Section 1.6

1.4 Project and Process Description

The proposed design utilises proven, highly efficient and reliable biomass power generation technology. The boiler will feature suspension firing, a single pass bi-drum unit and a continuous ash discharge removal for low emissions. A flue gas cleaning system will also be installed to further reduce air emissions.

The high-pressure steam produced by the boilers will be used by a steam turbine to rotate electric alternators. The alternators will produce very high-quality rotating power with a power factor of one. The selected design will make use of both a back pressure steam turbine and an extraction condensing steam turbine. The low-pressure steam will be used for industrial purposes to extract sugar from the cane by evaporation of the water contained in the juice.

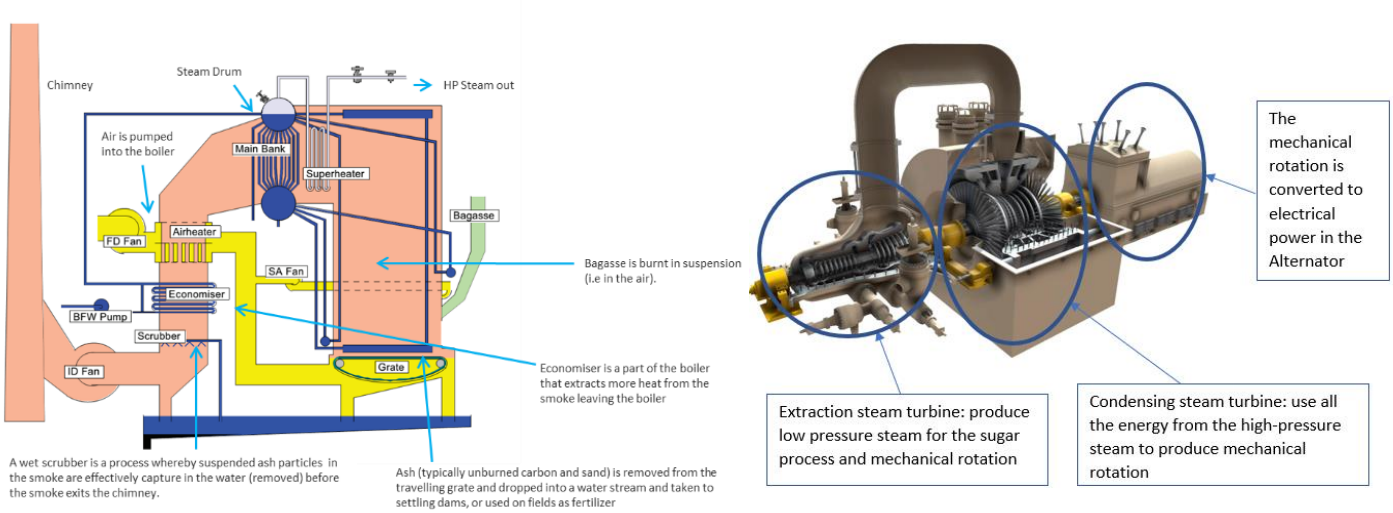

FIGURE 1-1: TYPICAL BIOMASS BOILER (LEFT) AND TURBO ALTERNATOR TA (RIGHT) CONFIGURATIONS

FIGURE 1-2: EXAMPLES OF MODERN BOILER (LEFT) AND STEAM TURBINE (RIGHT)

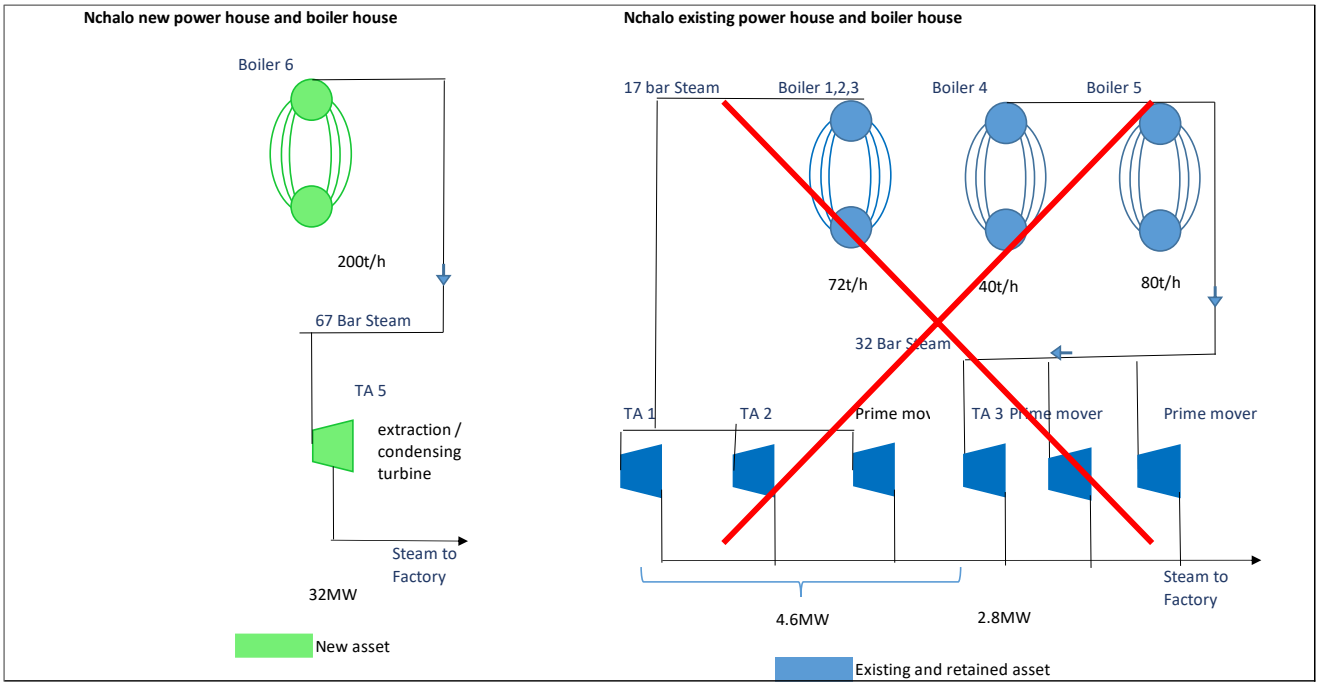

FIGURE 1-3: PROCESS DIAGRAM

1.5 Project Proponent Details

Name of Proponent:	Illovo Sugar Malawi
Postal Address:	Private Bag 580, Limbe Malawi

1.6 Details of the Environmental Consultant and Specialists

Core Environmental Services has been appointed by Illovo Sugar (Malawi) Ltd as the independent Environmental Consultant to undertake the Environmental and Social Impact Assessment (ESIA) for the proposed. Table 1-1 below, presents the details of the Environmental Consultant.

TABLE 1-1: DETAILS OF THE ENVIRONMENTAL CONSULTANT:

Name of Company	Core Environmental Services
Person Responsible	Anne-Mari White
Professional Registration	Environmental Assessment Practitioners Association of South Africa (EAPASA Reg No: 2020/602) South African Council for Natural Scientific Professionals as a Certificated Natural Scientist (Reg. No 300067/15)
Address	10 Nartjie street Mbombela 1200
Telephone Number	+2760 878 1591
Email	Anne-mari@coreenviro.co.za
Qualifications & Experience	**BSc. Environmental Management** 14 years of experience

Various experts were consulted to undertake specialist investigations to determine the impact of the project on air quality, health and safety as well as the social environment. The details specialists consulted are included within Table 1-2 below.

TABLE 1-2: DETAILS OF THE ENVIRONMENTAL CONSULTANT:

Name of Company	EHRCON *(Air Quality Impact Assessment)*	E&D Consulting *(Socio-Economic Impact Assessment)*	Ottolaus *(Health and Risk Assessment)*	EAR *(Noise Impact Assessment)*
Person Responsible	Uno Nevelling	Paul Scherzer	Sarieet Theron	Morne de Jager
Address	Colbyn, Pretoria South Africa	Felixton, KZN South Africa	Lichtenburg South Africa	Moreleta Park Pretoria South Africa
Telephone Number	+2786 143 0585	+2784 207 6031 +2761 477 5914	+2782 611 0834	+2782 565 4059
Email	info@ehrcon.com	paul@edcs.co.za	sarieet@ottalaus.co.za	morne@eares.co.za
Qualifications & Experience	BSc. (1997), BSc. Hons (1998) and MSc. *Cum Laude* (1999) in Industrial Physiology from the Potchefstroom University for Christian Higher Education	MA Food, Society and International Food Governance (specializing in Food Security, Food Systems Assessment, and Impact Assessment of Development Projects) BSc (Agriculture) 25 years' experience in conducting environmental and social impact assessments across a	Hons. Degree in Human Resource Management Explolabs - Hazardous Area Classification PHAST Dispersion Calculation	B.Ing. (Chemical Engineering) [Pretoria University]

		wide range of industries and sectors within South Africa as well as in seven other Southern and Central African countries, including Malawi.		

1.7 Location and extent of the proposed project

The proposed project site is located within the footprint of the Illovo Sugar Malawi Nchalo Estate which is located in Chikwawa district approximately 80km south of the city of Blantyre. The proposed Cogeneration Power Plant is proposed within the footprint of the Sugar Factory and is approximately 3.5Ha in extent. The bagasse storage yard will have to be extended to the area currently used for the cultivation of sugar cane. The additional area required for the purposes of this bagasse storage is approximately 25 000m^2. The proposed 11kV powerline is proposed along the existing 11kV powerline running from the Cogeneration Power Plant to the existing substation approximately 5km north-east of the Nchalo Sugar Factory and project site. It is proposed that the new 11kV powerline will be follow the same route of the existing 11kV powerline, along the road, approximately 5km north-east of the Sugar Factory.

The sugar mill and the estate are 100% owned by the Government of Malawi. Illovo Sugar Malawi signed in 1966 a 99-year lease agreement with the landowner, the Government of Malawi. Please refer to Appendix E for the proof of ownership in terms of the lease agreement with the Government of Malawi.

Please refer to Figure 1-4 and 1-5 below indicating the locality of the Nchalo sugar Mill where the Cogeneration Plant is proposed as well as the route proposed for the replacement of the 11kV powerline.

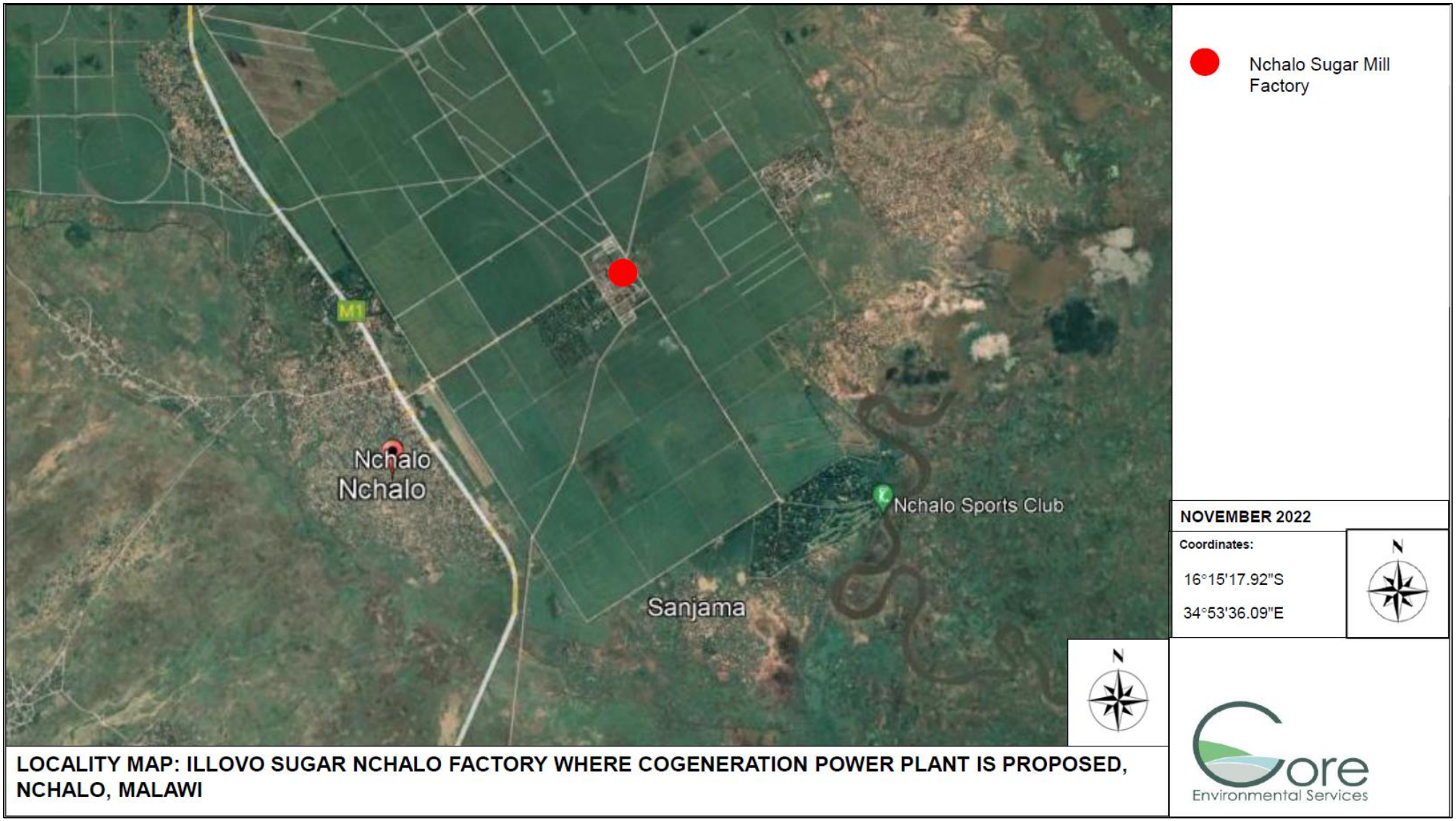

FIGURE 1-4: LOCALITY MAP OF PROPOSED NCHALO COGENERATION POWER PLANT, NCHALO, MALAWI

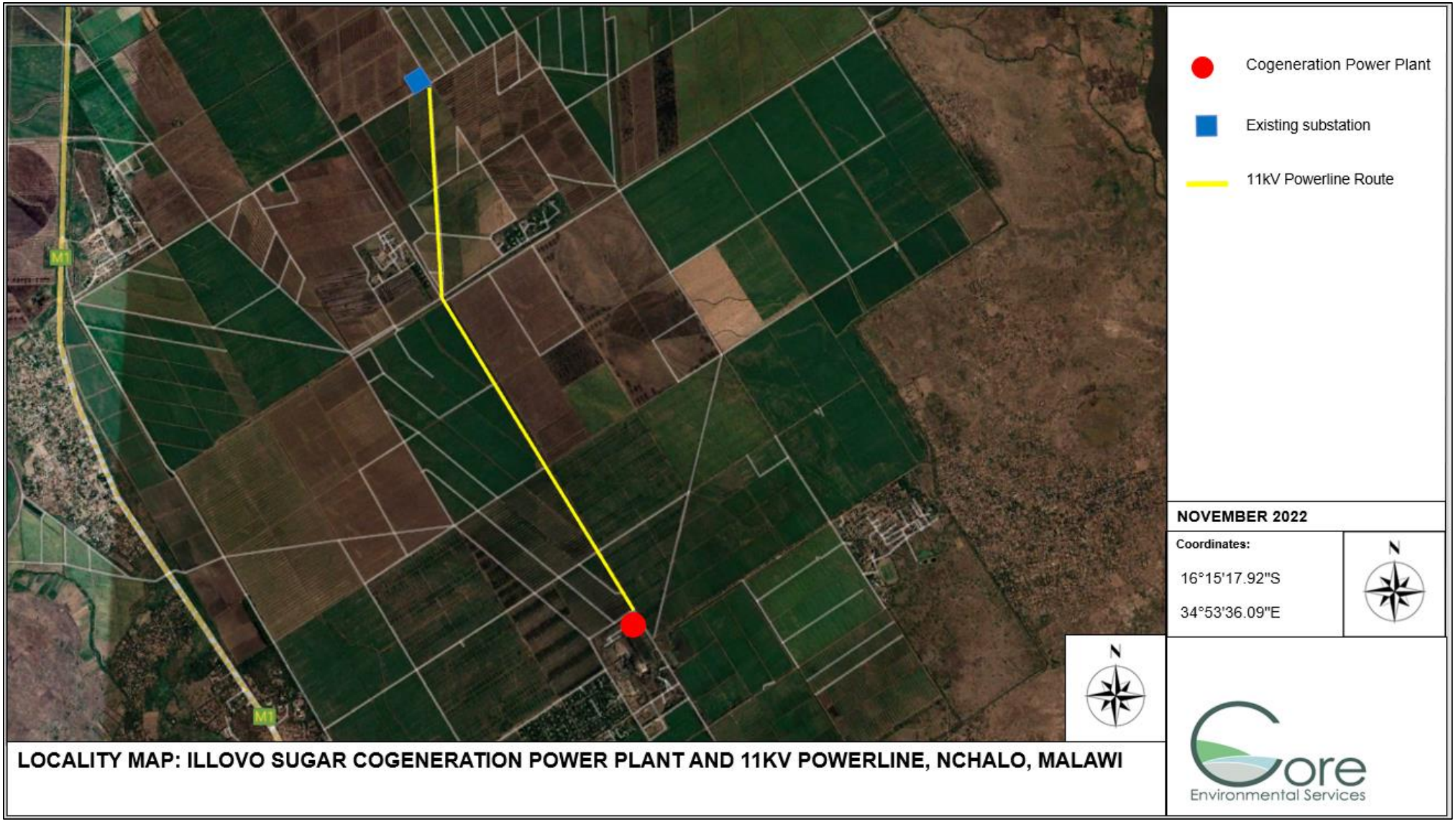

FIGURE 1-5: LOCALITY MAP – COGENERATION POWER PLANT AND 11KV POWERLINE

2. CURRENT AND PROPOSED PROJECT ACTIVITIES

The proposed project would entail the following activities which is all proposed within the existing footprint of the Nchalo Sugar Mill in Malawi:

- Decommissioning of the five existing boilers (3 x 17 bar and 2 x 32 bar boilers):
- Retiring the four existing steam turbines including all prime movers (1 x shredder and 2 x mill) as all prime movers will be electrified;
- Construction of one new modern 200 t/h (tons per hour) / 67 bar boiler with abatement technologies;
- Construction of one condensing and extraction turbine of 22MW (67 bars);
- Construction of one extraction turbine of 10MW (67 bars);
- Construction of new cooling tower;
- Establishment of larger bagasse storage yard area;
- Construction of new effluent treatment plant; and
- Replacement of the 11kV powerline from the new Cogeneration Power Plant to the existing substation approximately 5km north-east of the Nchalo Sugar Factory and project site. The electrical power lines are and will be on Illovo's private land and will run along the existing road and powerline. Interruptions to operations will be minimal.

The total cost for the proposed cogeneration power plant is estimated to be 65M$.

FIGURE 2-1: EXISTING BOILERS TO BE DECOMMISSIONED AND REPLACED

FIGURE 2-2: IMAGE OF THE AREA TO BE AFFECTED BY THE 11KV POWERLINE TO CONNECT WITH THE EXISTING SUBSTATION (SAME POWERLINE ROUTE AS INDICATED WITHIN THE IMAGE WILL BE FOLLOWED)

At present, the Nchalo Sugar Mill is generating 40 GWh/yr and also consuming the same amount of electricity generated. The construction of the proposed Cogeneration Power Plant will enable an electricity generation of 144 GWh/yr of which 79 GWh/yr will be available to be exported to the ESCOM grid while the remainder will be used to generate electricity for the Sugar Mill.

TABLE 2-1: CURRENT AND PROJECTED POWER BALANCE

Description	As per today GWh/yr	Future Scenario GWh/yr
Generation	40	144
Consumption	-40	-33
Parasitics		-32
Export	0	-79

Cogeneration in a sugar factory makes use of bagasse as a fuel source, which is the fibrous residue which remains after the sugar cane has been crushed. This proposed project will optimise the existing fuel source, as it is proposed that all of the biomass feedstock (bagasse), will be supplied by the Nchalo Sugar Estate, which currently cultivates 16 029Ha of sugarcane. Illovo Sugar Malawi's supply of sugar cane at Nchalo is highly secure as approximately 90% of the sugar cane processed at Nchalo comes from the Illovo Sugar Malawi farms. The average annual cane harvest is around 1.3 million tons/annum and nets approximately 370,000 tons/annum bagasse. There is a small variation in crop-size from year to year of approximately 5% due to environmental factors. However, sufficient, readily available and secure feedstock is available for the proposed Cogeneration Power Plant.

Waste generated following the combustion in the power plant includes bottom and fly ash. Bottom ash is part of the non-combustible residue which is a by-product following the combustion of the bagasse for steam generation. Bottom ash is collected following the combustion process and is recycled into the existing sugarcane fields as fertilizer. Fly ash is the portion of the ash which escapes

from the stack and is released into the atmosphere, having a negative impact on the air quality of the surrounding environment and adding to the effects of climate change. The process of waste generation, collection and recycling will remain the same with the bottom ash being collected and recycled to the sugarcane fields as fertilizer, however, abatement equipment will be installed to remove pollutants from the fly ash prior to being emitted into the atmosphere.

2.1 Pre-Construction Phase

The rational of the project is to export electricity to the grid. There is a regulatory Independent Power Producer Framework describing the steps to sign a Power Purchase Agreement (PPA) with the ESCOM (Energy Supply Company of Malawi). Several workstreams have to be achieved for that purpose during the pre-construction phase:

- Technical feasibility of the project: including planning, design
- Costing with a construction contract signed
- Bankability feasibility of the project
- Have all permits agreed (including and not limited to grid connection and Environmental and Social Impact Assessment

The project is currently in the pre-construction phase with the design, bankability and application processes being undertaken.

As part of this pre-application phase, the ESIA is being undertaken to apply for approval from the Malawi Environment Protection Authority (MEPA).

2.2 Construction Phase

As soon as the Power Purchase Agreement (PPA) is signed with ESCOM and all conditions of precedent of the PPA and other agreements such as the ESIA are cleared, the construction process can commence.

To prepare the construction area, the existing access road north of the factory will be relocated alongside the existing compound and the following structures and infrastructure will be constructed for the cogeneration power plant:

- Power house;
- Boiler house;
- Water Treatment plant;
- Cooling tower;
- Bagasse stockpile area;
- Transformer and compressors;
- Effluent treatment plant;
- Time office, security and excise offices;

- Canteen;
- Dispensary;
- Workers toilet;
- Space for fabrication yard and storage;
- Space for temporary site labours hutments;
- Raw water storage for the cogeneration power plant and fire fighting purposes.

The duration of the construction period is estimated to be 2 years. It is proposed that the Nchalo Illovo Sugar Factory will continue with their current electricity generation operation for the estate, as well as obtaining additional electricity from ESCOM until the construction of the Cogeneration Power Plant has been completed and is operational.

The site office for the construction of the power plant as well as the associated workshops is proposed to be located within the footprint of the development area. (Site C in Figure 2-3 below). The construction staff is proposed to be housed in temporary structures such as containers, within the areas noted as A, B and possibly D in Figure 2-3 below. All of the areas noted for the contractor's camp have already been transformed. The contractors camp will be fenced, and permitter lighting will be installed. A turnstile will also be installed between the factory and the compound. Water, electricity, and sewer services are available on these sites and will be managed by Nchalo Illovo Sugar.

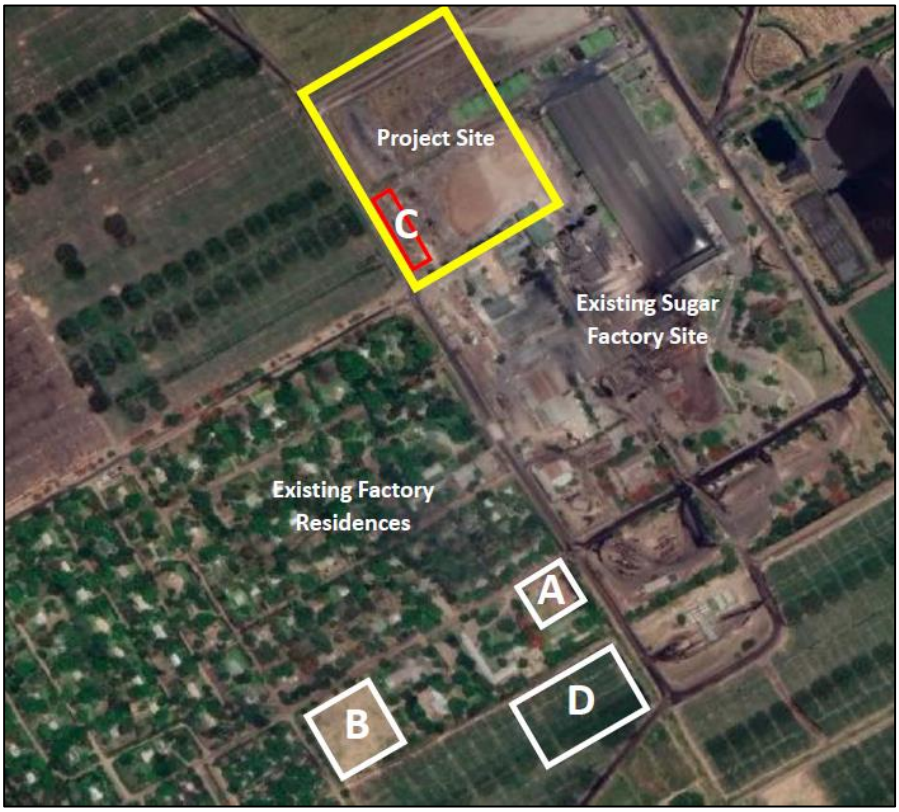

FIGURE 2-3: AREAS PROPOSED FOR THE SITE OFFICE AND TEMPORARY ACCOMMODATION STRUCTURES FOR CONTRACTORS

It is estimated that approximately 200 job opportunities will be created during the construction phase, and a portion of these workers will have to be housed at the proposed construction camp. Of the 200 job opportunities to be created during the construction phase, approximately 50% will be Malawian.

Key construction equipment on site will include the following: Excavators (bucket and pecker), dozers, graders, TLB's (backhoe), pay loaders, trucks ($6m^3$ and $10m^3$), water cart, rollers (impact, smooth, pneumatic tyred and pad foot), graders, bobcats, compressors, concrete batch plant, concrete dumpers ($1m^3$), concrete trucks ($6m^3$), concrete pumps (mounted on truck), asphalt pavers, mobile cranes, forklifts, crane trucks, flatbed trucks, tractor and trailers, cherry pickers, manual trollies and pallet jacks.

Ground preparation requirements for construction will include the clearing of cane and scrap metal at the proposed site. Civil foundation will require the excavation and possibly the erection of some concrete piles for the proposed construction site. Excavated material from the bulk earthworks throughout the site and site excavation (including the rock) will be used as fill material on site. Topsoil from all earthwork's areas will be separated, stockpiled and re-used on site for re-vegetation purposes or will be placed on the adjacent agricultural fields.

Other construction materials (and equipment) include cement, lime, building materials (bricks, doors, windows, tiles, plumbing and sanware, paint etc.), structural steel, sheeting, conveyors, pumps, tanks, vessels, piping, valves, instruments, electrical equipment (motor control centres, motors, cabling, junction boxes, switchgear, cabinets, panels, uninterrupted power supply (UPSs).

Construction material will be primarily sourced in South Africa but also locally from Malawi and internationally from Europe, India and China.

2.3 Operational Phase

Operational process of the cogeneration power plant process:

- During the sugar production process, fibrous material remains after the sucrose have been removed from the sugarcane. This material is referred to as bagasse. Bagasse is therefore a fast-growing renewable plant-based biomass which is used as fuel in the boilers to generate electricity.
- Approximately 200t/hr of water is used during the cogeneration power production process while a maximum of 100t/hr is used during the off season. The water is used in closed loop with only a 5% loss that need to be topped up with fresh water. Prior to being used, fresh water is treated through a reverse osmosis plant and chemical treatments to manage PH and mineral content;
- Water used within the process is treated prior to being used, by means of the following chemicals:
    - Sudfloc;

    - Chlorine;
    - Botsalt;
    - Sudsteam;
    - Cortrol; and
    - Sodium Hydroxide.
- Bagasse's chemical energy is then converted into heat by burning. The heat energy is used in boilers to heat water to produce steam at specified pressures and temperatures;
- Steam from boilers is used to drive the turbines, which convert the heat energy into mechanical energy. This provides the power to turn the equipment for power generation at controlled speeds;
- The turbines are used to turn electrical power generators;
- The remaining exhaust steam is then passed:
    - To the sugar process to convert the sugar juice into crystal sugar, returning to the boiler a condensed water;
    - The excess of process steam is passed through a condenser in which cold water circulates and cools the steam turning it back into water and sends it back to the boiler.
- Wastewater from the power plant is known as "blow-down" water which is water that is drained from the cooling equipment to remove mineral build up. Blow down water could possibly contain high Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and high temperatures. Some water is also used in the condenser as well as some losses within the steam lines. It is estimated that the effluent from the Power Plant would equate to 40m^3/hr. This effluent water ("blow-down water") is diverted to the new effluent pond proposed adjacent and directly north of the existing warehouse, within the footprint of the existing factory. Following treatment, the effluent will be used for irrigation purposes and the quality of the treated effluent will be compliant with Malawian Standard Limits.
- The new boiler is technologically advanced, which results to the automated deashing of the boiler following the burning of the bagasse. Details regarding the boiler ash is provided within the waste management section below.

<u>Bagasse</u>

The bagasse and ash storage area will have to increase in footprint and at present, this area proposed for the expansion is being used for the cultivation of sugar cane. Approximately 25 000m^2 of agricultural area will therefore be affected. As indicated in Figure 2-5 below, it is proposed that the sugar cane field directly adjacent and north of the existing sugar factory be affected if additional footprint is required. It is also proposed that this area be used for the construction laydown area during the construction phase. This area has however already been transformed by agricultural activities and therefore the potential environmental impact associated with the expansion of the footprint of the sugar factory to accommodate the additional areas required, is minimal.

It is proposed that bagasse be transported from the factory to the proposed bagasse storage area via a closed conveyor system, to prevent any loss of fuel along the conveyor system, caused by windy conditions.

Please refer to Figure 2-4 below, indicating the proposed preliminary layout for the Nchalo Cogeneration Power Plant.

FIGURE 2-4: PROPOSED PRELIMINARY LAYOUT OF THE COGENERATION POWER PLANT (AT DESKTOP LEVEL)

FIGURE 2-5: AREA WITHIN THE FOOTPRINT OF THE EXISTING FACTORY WHERE COGENERATION POWER PLANT IS PROPOSED

Waste Management during operation:

Illovo Sugar Africa currently has a Waste Management System in place and all waste generated, stored and disposed of, will be undertaken in accordance with this Waste Management System. Waste generated will be temporarily stored, then either treated on site or re-used, or collected and transported to be disposed of or treated off-site. The integrated waste management process is illustrated in the Figure 2-6 below.

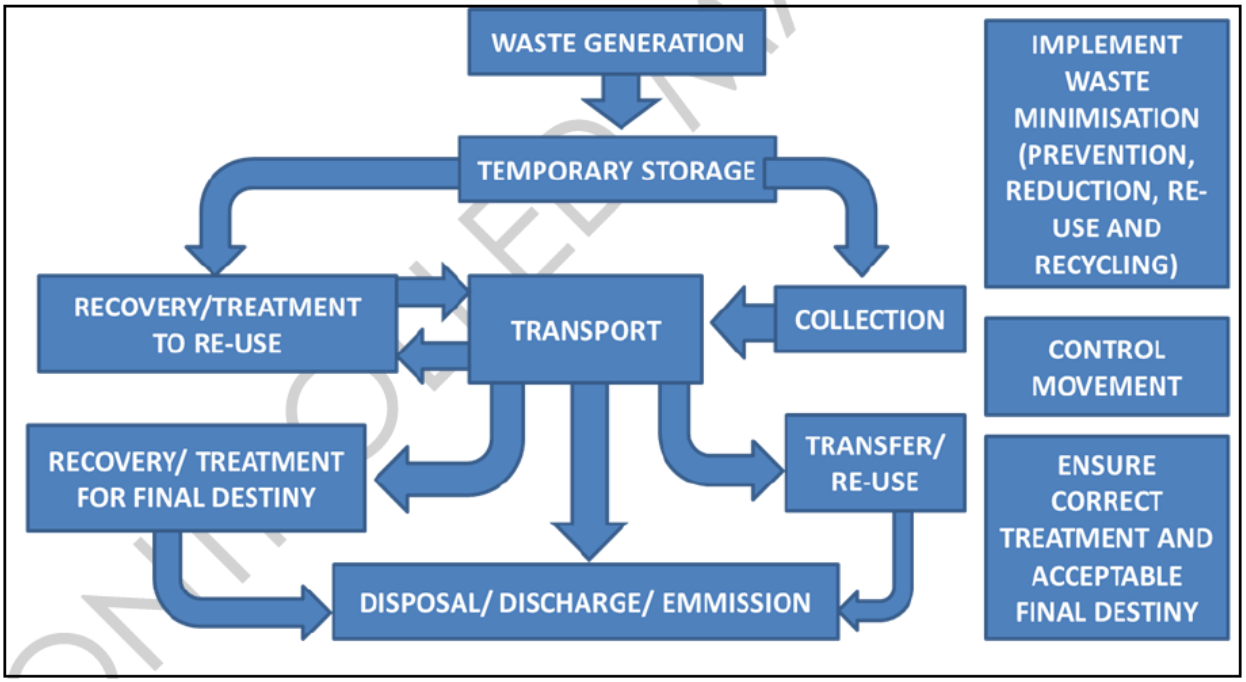

FIGURE 2-6: INTEGRATED WASTE MANAGEMENT PROCESS

The basic concept of the waste hierarchy is to prevent/reduce the generation of waste as much as possible and if waste generation can't be prevented, waste must be disposed of in an environmentally sound manner. The waste hierarchy is presented in the figure below.

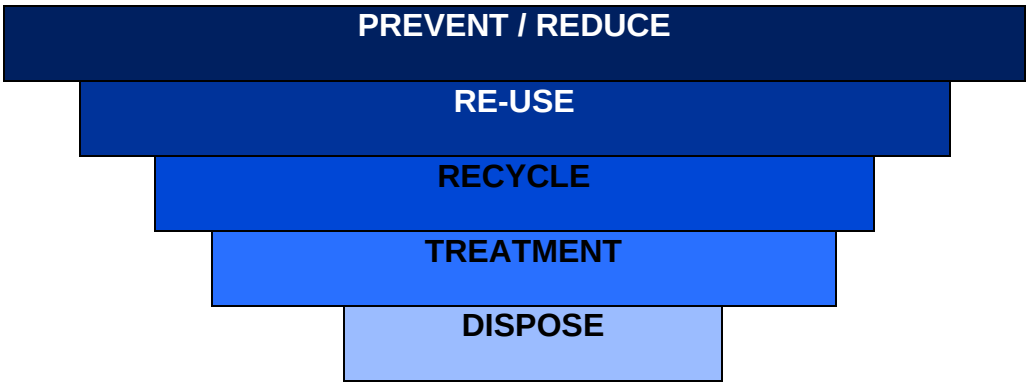

FIGURE 2-7: WASTE HIERARCHY

The different kinds of waste generated and the management thereof, is described in accordance with the waste hierarchy as indicated above.

- **Prevent/Reduce waste**

Atmospheric Emissions emitted from the burning of bagasse:

The most significant pollutant emitted by bagasse-fired boilers is particulate matter, caused by the turbulent movement of combustion gases with respect to the burning of bagasse and resultant ash. Other gaseous emissions emitted by the combustion of bagasse for the generation of steam, include, Sulphur Dioxide (SO_2), Nitrogen Oxide (NO_x), Carbon Monoxide and other organics. The proposed new design for the Cogeneration Power Plant, includes the installation of wet scrubbers or electrostatic filter system which will reduce the emissions emitted into the atmosphere, thereby reducing waste.

Dust generation:

Fugitive dust is generated by truck traffic, as well as cane and bagasse handling operations. Dust can therefore affect surrounding land users, and employees within the immediate area. Measures for the reduction of dust must therefore be implemented. These measures could include the reduction of travelling speed on the surrounding dirt roads and possibly covering of the bagasse storage piles. Other measures to reduce the impact of dust are included within the ESMP.

- **Re-use waste**

Bagasse:

Following the extraction of juice from sugarcane, the dry fibrous material remains and is regarded a waste following the operational process. This is referred to as bagasse and is however found in abundance all over the world and has therefore been used for numerous applications such as energy production, and production of paper, etc. For this proposed project, the bagasse waste which

accumulates following the extraction of juice from the cane, will be re-used as a fuel, generating electricity.

Carbon dioxide:
One of the other by-products generated during the combustion process is carbon dioxide. The accumulation of carbon dioxide adds to the greenhouse gas emissions within the atmosphere, causing global temperatures to rise. The carbon dioxide produced during the combustion process will however be absorbed by the next generation of cane which then makes the process carbon neutral. Carbon Dioxide is therefore re-used.

- **Recycle waste**

Bottom Ash:
Another by-product or waste which is re-used, is the ash resulting from the burning of the bagasse within the boiler. This is known a bottom ash which is removed from the equipment and used as a fertilizer on the existing agricultural areas. According to the IFC Guideline for Converting Biomass to Energy, 2017, biomass ash should preferably be returned to the same type of field that the fuel came from, and approximately in the same amount. A rule of thumb is to limit the amount of ash to less than 3 tons per hectare.

The process with the new cogeneration power plant will remain the same, with bottom ash being used as a fertilizer on existing agricultural lands. The IFC Guideline for Converting Biomass to Energy, 2017, also noted that biomass ash could contain high concentrations of cadmium, lead or zinc. The most recent analysis of the bottom ash does indicate low levels of heavy metals. Ash analysis must therefore be carried out to ensure that ash recycling complies with the local regulations. Illovo Sugar currently has an Ash Disposal and Management Plan in place, to ensure the safe application, temporary dumping, and permanent storage of bottom ash. The recycling of the bottom ash must be undertaken in accordance with the Ash Disposal and Management Plan and according to the IFC Guideline, it must be ensured that concentrations of heavy metals within the bottom ash, is low (as it is at the moment).

Domestic/Solid Waste:
Some domestic/solid waste can be reused and/or recycled. Such waste includes scrap metals, plastics and paper. Metals which can't be reused, and scrap plastics are normally sold for recycling purposes. The recycling/reuse of such materials must be undertaken in accordance with all applicable national and local regulations as well as the site-specific Waste Management Plan drafted for Illovo Sugar Nchalo.

Hazardous Waste (Used oil):
In accordance with the site-specific Waste Management Plan drafted for Illovo Sugar Nchalo, used oil is currently being sold for recycling purposes. In accordance with national and local

regulations, this process of recycling of used oil for the cogeneration power plant will remain the same.

- **Treatment of waste**

Wastewater:

Within the operational process, water is heated, generating steam. The steam from the boilers drives the turbines. The remaining exhaust steam is then passed to the sugar process to convert the sugar juice into crystal sugar, returning to the boiler a condensed water. The excess of process steam is passed through a condenser in which cold water circulates and cools the steam turning it back into water and sending it back to the boiler. The water which is then drained from the cooling equipment is known as "blow-down" water. Blow down water could possibly contain high Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and high temperatures. The proposed power generation facility proposes the blow-down water to be diverted to the new effluent treatment plant where the water will be treated by means of stabilising organic material through natural processes involving sunlight, water, nutrients, algae, atmospheric oxygen, and bacterial action. It is estimated that the effluent from the Power Plant would equate to $40m^3$/hr. Treated wastewater will have to comply with the Malawian Standards and limits included within the Effluent Discharge Permit prior to being used for irrigation. These standards indicate that the following variables will have to comply with the following limits:

i. Biochemical Oxygen Demand (BOD) < 20mg/l
ii. Chemical Oxygen Demand (COD) < 60mg/l
iii. PH 6.0 – 9.0:
iv. Dissolved Oxygen (DO) > 5mg/l
v. Total Suspended Solids (TSS) < 30mg/l

- **Dispose of waste**

Waste to be disposed of includes the following:

Fly Ash

Fly ash is the ash captured by the abatement equipment before gasses are emitted into the atmosphere. At the moment the fly ash is not collected. As a consequence, no measurement of heavy metals content is available. The fly ash normally contains high levels of heavy metals and if high levels of heavy metals are found within the fly ash, it should rather be landfilled and not used as fertilizer. However, if the heavy metal content within the fly ash is below limits as per the IFC Standards, it can be mixed with the bottom ash and used as a fertiliser on existing agricultural land.

Domestic/Solid Waste

Domestic/solid waste which cannot be recycled, are currently transported and disposed of at the nearest approved landfill site. The process for the cogeneration power plant will remain the same with all unrecyclable domestic/solid waste being transported to the landfill site. This waste

disposal process must be undertaken in accordance with the national and local legislation as well as the site-specific Waste Management Plan drafted for Nchalo Illovo Sugar.

Hazardous Waste

Hazardous waste associated with the cogeneration power plant includes oil rugs and used chemical containers. Oily rags must be contained within a closed can or sealable bag and be removed to a hazardous waste disposal site. This process of collection and disposal must be undertaken in accordance with the site-specific Waste Management Plan.

Medical Waste:

Some first-aid waste could be expected from the boiler house and at present, such waste is placed within a sealable container and transported to the clinic for disposal. This collection and disposal of medical waste process will remain the same and must therefore be executed in accordance with national and local regulations and the site-specific Waste Management Plan draft for Illovo Sugar Nchalo.

2.4 Decommissioning Phase

The decommissioning phase is divided into two sections:

1. Decommissioning of the existing boilers, steam turbines and prime movers; and
2. Decommissioning of the proposed cogeneration power plant if no longer to be utilised in future.

Both decommissioning processes are described below:

Decommissioning of the exisitng boilers, steam turbines and movers:

Once the Cogeneration Power Plant has proven safe operation, the existing boilers will be decommissioned. For back up reason, the existing boiler and turbines will be retained for at least a full year after commissioning.

This decommissioning process will however entail the following:

- Decommissioning of the five existing boilers (3 x 17 bar and 2 x 32 bar boilers):
- Retiring the four existing steam turbines including all prime movers (1 x shredder and 2 x mill)

This process will be undertaken after a year of operation of the new power plant A contractor and work force willl therefore return to site to decomission the existing boilers.

The structures will be disassembled and parts which could still be used for other equipment on site, will be retained while other parts will either be sold or be disposed of as scrap metal. It is however noted that the existing boilers will not be sold as an operational structure to be used by

any other entity, as these boilers are very old and its emission levels are non-complaint with the Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021).

Equipment to be used during the decommissioning phase of the existing boilers, steam turbines and prime movers includes TLB's (backhoe), pay loaders, trucks ($6m^3$ and $10m^3$), water cart, compressors, mobile cranes, forklifts, crane trucks, flatbed trucks, tractor and trailers, cherry pickers, manual trollies and pallet jacks.

Decommissioning of the proposed cogeneration power plant

If at some point in future, the cogeneration power plant is no longer in operation and requires to be decommissioned, the following activities will be undertaken as part of the decommissioning process:

- Shutdown: During this process the power generation process is halted and it is announced that the power generation unit will shut down. Site re-use options are investigated to inform the clean-up decisions and determine the appropriate level of work needed for the decommissioning.
- Decommissioning: During this phase, the decommissioning plan drafted during the shutdown, is executed. This could include the following:
    - Removing all structures associated with the cogeneration power plant which includes:
        - Power house;
        - Boiler house;
        - Water treatment plant;
        - Cooling tower;
        - Transformers and compressors;
        - Electrical powerlines and equipment no longer to be used;
        - Effluent treatment plant;
        - Offices;
        - Canteen; and
        - Dispensary.
    - This phase will also include the recycling of material which can be used in other equipment and structures/infrastructure.
    - Discarding hazardous, construction (cement) and domestic waste and materials as per the Waste Management Standard of Illovo Sugar and in accordance with the national and local regulations.
- Remediation: The cost and extent of the remediation, will depend on the anticipated reuse of the project property. For example, if industrial use is planned for the area where the power generation facility is decommissioned, the cleanup requirements could be less stringent. The remediation phase will entail the collection of soil and groundwater samples to investigate and document any possible contamination and remediate if any pollution is detected.

Similar to the construction phase of the cogeneration power plant, the same equipment will be required during the decommissioning phase of the development and a contractors camp will have to be established to temporarily accommodate the construction workers during this phase. As decommissioning of the proposed cogeneration power plant is not being proposed at this stage of the development and it is unclear when and if it would be required, no recommendations can be made in terms of the location of the construction camp.

3. EXISTING ENVIRONMENTAL MANAGEMENT

The Nchalo Sugar Mill Factory has been operating for approximately 80 years while it has been operating the existing power plant for 60 years. At present, the current agricultural and sugar processing operations are being undertaken in accordance with the following Environmental Management Systems and Group Guidelines and compliance with these guidelines will still be applicable for the cogeneration power plant:

- Illovo Group Guideline on Spill Response, Clean Up and Remediation (ISPL_Z_G 8.2.1.1/3.0)
- Illovo Group Guideline on Pollution Prevention (ISPL_Z_G 8.2.1/3.0)
- Illovo Group Guideline on Water Use, Wastewater and Ambient Water Quality (ISPL_Z_G 8.2.5/0.0)
- Illovo Group Guideline on Environmental / Ambient Noise (ISPL_Z_G 8.2.9/0.0)
- Illovo Group Guideline on Biodiversity (ISPL_Z_G 8.2.11/0.0)
- Illovo Group Guideline on Water Foot Printing (ISPL_Z_G 8)
- Illovo Group Guideline on Contaminated Land (ISPL_Z_G 8.2.10/0.0)
- Illovo Group Guideline on Material Use (ISPL_Z_G 8.2.4/0.0)
- Illovo Group Guideline on Greenhouse Gas Emissions Management (ISPL_Z_F 8.2.2.1/0.0)
- Illovo Group Guideline on Notices, Signs and colour Coding (ISPL_Z_G 8.1.7/0.0)
- Illovo Group Guideline on Air Quality Management (ISPL_Z_G 8.2.2/0.0)
- Illovo Group Guideline on Hazardous Materials Management (ISPL_Z_G 8.2.6/0.0)
- Illovo Group Guideline on Waste Management (ISPL_Z_G 8.2.8/0.0)
- Illovo Group Guideline on Buildings and Structures (ISPL_Z_G 8.1.8/0.0)
- IFC Environmental Health and Safety Guidelines

Existing cane lands and farming activities (both owned by ISM and from independent growers) are being managed according to the Sustainable Sugarcane Farm Management System (SusFarMS / https://sasri.org.za/susfarms), which is an HSE system to ensure sustainable agricultural production with the least number of negative impacts on the environment, through the implementation of better management practises. SusFarMS management system is to certify that the company "reduce negative impacts on the environment, comply with legislation, maintain a high level of social responsibility and assist in ensuring financial sustainability". As the bagasse is used as fuel for the power generation, the applicable measures contained within the Sustainable Sugarcane Farm Management System demonstrates transparency on the agricultural practices to ensure the sustainability of the input material for the power generation.

At present, the factory is also in possession of the following environmental related certificates and/or licenses:

TABLE 3-1: EXISTING LICENSES AND PERMITS

Existing Licenses / Permits	Description	Act / Regulation	Permit / Licence Number
Gaseous Emissions License	Description of emitted material: i. Carbon Monoxide; ii. Carbon Dioxide; iii. Nitrogen Oxides; iv. Sulphur Dioxide; v. Fine Particulate Matter	Environmental Management Act Chapter 60:02	EAD-12-01-010-19-12
Effluent Discharge Permit	The effluent discharge rate shall not exceed 600m^3 per day. Prior to discharge into the environment, the discharge composition shall be within Malawi Standard Limits – within tolerance limits for domestic effluent. vi. Biochemical Oxygen Demand (BOD) < 20mg/l vii. Chemical Oxygen Demand (COD) < 60mg/l viii. PH 6.0 – 9.0: ix. Dissolved Oxygen (DO) > 5mg/l x. Total Suspended Solids (TSS) < 30mg/l	Water Resources Act 2013 Water Resources Regulations, 2018	TE2/2021 File Nr: WRA 57
Licence for Groundwater Abstraction, Mlambe (Abstraction from groundwater)	The maximum amount of water which may be taken is 360m^3/day for domestic purposes	Water Resources Act 2013 Water Resources Regulations, 2018	GL 3/1990 File Nr: WRA 57
Licence for Groundwater Abstraction, Alumenda (Abstraction from Shire River)	The maximum amount of water which may be taken is 483 840m^3/day for domestic and irrigation purposes	Water Resources Act 2013 Water Resources Regulations, 2018	SL 3/2008 File Nr: WRA 57
Licence for Groundwater Abstraction, M1/L1 (Abstraction from Shire River)	The maximum amount of water which may be taken is: 1, 156 464 m^3/day For domestic, irrigation and industrial purposes	Water Resources Act 2013 Water Resources Regulations, 2018	SL 656/1979 File Nr: WRA 57

Licence for Groundwater Abstraction, Mwanza (Abstraction from Mwanza River)	The maximum amount of water which may be taken is: 432 000 m^3/day for irrigation purposes	Water Resources Act 2013 Water Resources Regulations, 2018	SL 3/2002 File Nr: WRA 57
Licence for Groundwater Abstraction, River Side (Abstraction from Shire River)	The maximum amount of water which may be taken is: 159 667 m3/day for domestic and irrigation purposes	Water Resources Act 2013 Water Resources Regulations, 2018	SL 393/1973 File Nr: WRA 57
Licence for Groundwater Abstraction, Sande (Abstraction from Shire River)	The maximum amount of water which may be taken is: 89 856 m3/day for domestic and irrigation purposes	Water Resources Act 2013 Water Resources Regulations, 2018	SL 4/2008 File Nr: WRA 57
Waste License: Handling and Storage of Waste: 1. General Waste; 2. Industrial Waste Valid from 1 June 2022 – 30 May 2023		Environmental Management Act No. 19 of 2017 Environmental Management (Waste Management and Sanitation) Regulations	MEPA-12-07-010-01-22
Waste License: Operate a Waste Disposal Site Valid from 1 June 2022 – 30 May 2023		Environmental Management Act No. 19 of 2017 Environmental Management (Waste Management and Sanitation) Regulations	EAD-12-07-010-05-22
Waste License: Transportation of Hazardous Waste Valid from 1 June 2022 – 30 May 2023		Environmental Management Act No. 19 of 2017 Environmental Management (Waste Management and Sanitation) Regulations	MEPA-12-7-010-10-22

Waste License: Transportation of Hazardous Waste Valid from 1 June 2022 – 30 May 2023		Environmental Management Act No. 19 of 2017 Environmental Management (Waste Management and Sanitation) Regulations	MEPA-12-7-010-02-22

Air Emissions Monitoring is undertaken by an independent and accredited company on an annual basis. Due to the fact that the existing boilers are too old to be retrofitted to comply with the revised emission standards, the Illovo Sugar Nchalo team decided to implement a complete replacement of the boilers. This plan was submitted to MEPA and at the moment, the Nchalo Sugar Mill Factory was given permission to continue with operation, subject to the implementation of the exposed plan. The Malawi Environmental Protection Authority (MEPA) granted Nchalo Sugar Mill until 2026 to ensure compliance with the local gaseous emission standards and more specifically the new emission standards issued (MS 737-2021).

The proposal of replacing all the existing boilers with modern units containing flue gas desulfurization technology, which complies with both international standards as well as the new, more stringent local standards, will resolve the current non-compliance found in terms of gaseous emissions.

4. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

4.1 National Environmental Policy 2004

The Government of Malawi adopted a National Environmental Policy in 1996 to provide guidance and set standards for development of sector policies in environment and natural resources. It provided an overall framework against which relevant sectoral environmental policies were revised and adopted to ensure that these are consistent with the principles of sustainable development. More specifically, the National Environmental Policy sought to:

- Promote the efficient utilization and management of our natural resources;
- Facilitate the rehabilitation and management of essential ecosystems and ecological processes;
- Enhance public awareness of the importance of sound environmental management; and
- Promote cooperation between Government, local communities, and women groups, non-governmental organizations and the private sector in the management and sustainable utilization of the natural resources and the environment;
- Integrate sustainable environment and natural resources management into the decentralised governance systems and ensure that the institutional framework for the management of the environment and natural resources support environmental governance in local government authorities;
- Develop and regularly update environmental information systems to facilitate planning and decision-making at local, national and international levels;
- Facilitate development and regular review of policies and legislation to promote sustainable management of the environmental and natural resources;
- Facilitate development of mechanisms for management of conflicts in the environment and natural resources sector.

The guiding principles of the National Environmental Policy of 2004, includes the following:

- Every person has a right to a clean and healthy environment and a duty to maintain and enhance the environment.
- It is the obligation of every person to take measures to promote sustainable utilization and management of the environment and natural resources, including taking legal action against any person whose activities or omissions have or are likely to have adverse effects on the environment.
- Children and the youth should be sensitised in environmental issues to facilitate their participation in the conservation, protection and management of the environment as future custodians.
- Women should effectively participate in policy, program and project design and implementation to enhance their role in natural resource use and management activities.

- While sectoral environment and natural resources management is inevitable, there is need for effective co-coordination mechanisms so as to promote an ecosystems management approach.
- The use of renewable natural resources should be sustainable for the benefit of the present and future generations.
- Malawi's economy is highly dependent on natural resources. If these are depleted or degraded, long-term food security and sustainable economic growth will be seriously affected.
- The participation of the private sector, NGOs, and Community Based Organizations (CBOs), is critical to improved protection, conservation, management and sustainable utilization of Malawi's natural resources.
- Community-based management and revenue sharing from the sustainable utilization of natural resources on customary and public lands will be encouraged.
- Regulations will be complemented by social and economic incentives to influence behaviour for individuals or organizations to invest in sustainable environment and natural resources management.
- Regular and accurate assessment, monitoring, and dissemination of information on environmental conditions will be facilitated through appropriate legislative instruments.
- Trade-offs between economic development and environmental degradation will be minimized through use of environmental impact assessment and natural resource monitoring.
- Rational and secure tenure over land and resources is a fundamental requirement for sustainable natural resource management.
- Environmental management principles should be incorporated in development planning and decision-making processes at all levels.
- Conflict management is essential for sustainable environment and natural resources management.
- Some of Malawi's natural resources such as Lake Malawi, National Parks and Wildlife Reserves and Forest Reserves are shared with and are very much affected by the activities of her neighbours and those of the region at large. This calls for concerted efforts in preparation of policies and plans for their utilization, management and conservation to ensure sustainable national and regional development.

4.2 Environmental Management Act No.19 of 2017

In accordance with the Environmental Management Act (EMA) 19 of 2017, a Director's certificate terms and conditions are required prior to the commencement of the construction of an energy production facility. As prescribed under section 24(1) of the EMA, the types of projects for which an ESIA is mandatory are provided in List A as indicated below:

List A (List of projects for which EIA is mandatory)

- Agriculture/aquaculture projects

- Projects in the food and beverage production industry
- Water resources development
- Infrastructure projects
- Waste management projects
- **Energy generation, transmission and storage projects**
    1. Construction or expansion of electrical generating facilities designed to operate at greater than 4 MW or, in the case of hydroelectric generating facilities, where the total head is greater than 20 m or where there is a firm flow of 100 m^3 per second.
    2. Construction of electrical transmission facilities operating at a voltage of 132 kV or greater.
    3. Construction or expansion of oil and gas pipelines longer than 1 km.
    4. Construction or expansion of storage facilities (excluding services station) for oil, gas, petrol or diesel, located within 3 km of commercial, industrial or residential areas and with a storage capacity of 500 000 litres or more
    5. All activities associated with nuclear power development.
- Industrial projects
- Mining and quarrying projects
- Forestry projects
- Land development, housing and human settlement projects
- Remedial flood and erosion control projects
- Tourism development projects
- Projects in proximity to or which have the potential to affect:
- Major policy reforms

As indicated above, the proposed thermal power facility will generate more than 4MW of power and subsequently the project falls within the List A category. For this reason, an in-depth Environmental and Social Impact Assessment (ESIA) is undertaken.

4.3 Guidelines for Environmental Impact Assessments in Malawi

The purpose of these Guidelines for Environmental Impact Assessments in Malawi is to facilitate compliance with Malawi's environmental impact assessment requirements by Government, project developers and the general public. These guidelines were developed to assist with the integration of environmental concerns in national development. The guidelines also prescribe the structure of the EIA Terms of Reference and the ESIA to be submitted for consideration.

4.4 Forestry Act, 1997

The Act makes provision for participatory forestry, forest management, forestry research, forestry education, forest industries, protection and rehabilitation of environmentally fragile areas and international co-operation in forestry and for matters incidental thereto or connected therewith. The Act also notes that no person shall (a) cut, take, fell, destroy, uproot, collect and remove forest

produce from a forest reserve, customary land, public land and protected forest area; (b) cultivate crops, graze livestock, clear land, dig or break up land for any road or for any purpose whatsoever on such area of the forest reserve and protected forest area that may be specified in the licence.

Although no forest produce will be removed as part of the construction or operational phase of the proposed cogeneration power plant, the project will have an indirect positive impact on the current deforestation statistics as the availability of more electricity will result to less wood being required as a fuel for cooking purposes.

4.5 Energy Regulation Act, 2004

The Energy Regulation Act states that no person may establish, operate, carry on or be involved in any manner in an energy undertaking in Malawi, without a licence issued by the Authority. Illovo Sugar Malawi is consulting with the Authority in order to obtain a license as required within the Energy Regulation Act of 2004, for the proposed operation of the cogeneration power plant.

4.6 National Energy Policy, 2018

The goal of this policy is to increase access to affordable, reliable, sustainable, efficient and modern energy for every person in the country. It aims to diversify energy sources, enhance the sector's efficiency, modernise the services and make them more sustainable, improve living standards and equity, and increase access to clean, sustainable and affordable energy for all people.

The proposed Cogeneration Power Plant will be generating sufficient electricity for the operations of the Nchalo Illovo Sugar Estate, while the additional electricity generated will be exported to the national grid. At present, Malawi is mostly dependent on generating electricity by means of hydro power stations. However, this generation is unreliable when faced with drought or floods. The proposed cogeneration powerplant will diversify the energy source as aimed within the National Energy Policy.

4.7 Water Resources Act No. 2 of 2013

In accordance with Section 39 of the Water Resources Act of 2013, no person shall abstract and use water unless it is authorized to undertake such activity. Section 92 of the Water Resources Act of 2013 also states that a person who wishes to discharge effluent shall apply to the Authority for a discharge permit.

As noted in Section 3, Table 3-1, Illovo Sugar, Nchalo Estate, is in possession of a permit for the discharge of effluent as well as various permits/licenses for the abstraction of surface and groundwater.

It is not proposed that the operation of the Cogeneration Plant would have any significant change in the volume of water to be used or effluent to be discharged and therefore, water use and effluent discharge will be in accordance with the existing permits/licenses issued for Illovo Sugar, Nchalo Estate.

4.8 Water Policy Act, 2005

The National Water Policy as reflected in its new title is meant to address all aspects of water including resource management, development and service delivery. The Policy, among other issues, aims at:

- Achieving sustainable and integrated water resources management and development that make water readily available and equitably accessible by all Malawians in pursuit of their socio-economic development and for environmental sustenance;
- To ensure water of acceptable quality for all the needs in Malawi;
- Achieving sustainable provision of water supply and sanitation services that are equitably accessible and used by individuals and entrepreneurs for socio-economic development at affordable cost;
- Promoting efficient and effective utilization, conservation and protection of water resources for sustainable agriculture and irrigation, fisheries, navigation, eco-tourism, forestry, hydropower and disaster management and environmental protection;
- Undertaking the rehabilitation, upgrading, extension and construction of water infrastructure;
- Promoting international cooperation in the management of trans-boundary and cross boundary waters without compromising the country's sovereignty, security and territorial integrity;
- Dealing with challenges facing water resources management which include the need to adopt Integrated Water Resources Management (IWRM) Principles, the need to conform to current regional and international agreements and protocols on shared water resources, catchment protection and management, and water resources monitoring;
- Promoting the participation of the private sector in water resources development, management and service delivery;
- Strengthen and building capacity in the water sector; and
- Clarifying the roles of the Ministry for Water Affairs and other stakeholders in the water sector.

The water use for the Cogeneration Power Plant and water quality following treatment must therefore be compliant with the Water Policy Act to ensure conservation and protection of the water resources.

4.9 National Climate Change Management Policy, 2016

The National Climate Change Management Policy is a key instrument for managing climate change in the country of Malawi. The Policy provides strategic direction for Malawi's priorities for climate change interventions and outlines an institutional framework for the application and implementation

of adaptation, mitigation, technology transfer and capacity building measures. The objective of this Act is to contribute towards the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous human-induced interference with the climate system within a timeframe that enables social, economic and environmental development to proceed in a sustainable manner. This proposed Cogeneration Power Plant will reduce the current air emissions which is currently adding to the greenhouse gas concentrations which will add to the objective of this Act.

4.10 Malawi Standard Emission Limits

MS 737-1:2021 Malawi Standard Emission Limits – Emissions from Stationary Sources specifies maximum allowable limits for particulate matter and other common air pollutants in gaseous emissions from stationary sources. The standard also suggests the mechanisms for reduction or removal of the pollutants.

4.11 Malawi National Land Policy, 2002

The goal of the National Land Policy in Malawi is to ensure tenure security and equitable access to land, to facilitate the attainment of social harmony and broad based social and economic development through optimum and ecologically balanced use of land and land-based resources.

The proposed cogeneration power plant is proposed on land which is already used by Illovo Sugar for agricultural and industrial purposes. No additional land will be required for the purposes of this project and therefore the Malawi National Land Policy of 2002 is not applicable to this project.

4.12 National Sanitation Policy, 2006

The purpose and aim of the National Sanitation Policy are to answer the needs outlined above and to do something more. It is to provide a vehicle to transform the hygiene and sanitation situation in Malawi. As the vision points out below, it is to provide both guidelines and an action plan whereby 2020, all the people of Malawi will have access to improved sanitation, safe hygienic behaviour will be the norm and recycling of solid and liquid waste will be widely practiced leading to a better life for all the people of Malawi, through healthier living conditions, a better environment and a new way for sustainable wealth creation.

The proposed project does not add to an improvement in terms of improved sanitation facilities, and therefore the National Sanitation Policy of 2006 is not applicable to the project.

4.13 Public Health Act, 1948 (No. 12 of 1948)

The Act creates the legal framework for the protection of public health in Malawi and for this purpose provides for powers of the administration to regulate and control and animal and food production and handling, food and water supply, sewerage, etc. The Act also provides for the notification of infectious diseases, and the prevention and suppression of such diseases.

The power generation plant will not be using or be producing any food product, and therefore the Act is not applicable to the proposed project.

4.14 Occupational Safety, Health and Welfare Act, 1997 (No. 21 of 1997)

This Act makes provision for the regulation of conditions of employment in workplaces with regard to safety, health and welfare of employees; for the inspection of certain plant and machinery; for the prevention and regulation of accidents occurring to persons employed or authorised to go into the workplace, and for some related matters. It will be imperative for the Cogeneration Power Plant and associated activities to comply with the Occupational Safety, Health and Welfare Act, of 1997.

4.15 Monuments and Relics Act (1990)

The Act makes provision for the conservation, preservation and study of cultural heritage including place of distinctive natural beauty and of sites, buildings and objects of archaeological, palaeontological, geological, anthropological, ethnological, historical, prehistorical and other interests. The Act also provides for the procedure to be followed in relation to the discovery, excavation, removal, sale, exportation and importation of monuments, relics and collections of cultural heritage.

As the project site has already been disturbed, it is unlikely that any relics of cultural significance would be found within the proposed area, however palaeontological resources could be uncovered during excavation and therefore compliance with the Monuments and Relics Act of 1990, would be relevant for the protection of cultural and/or palaeontological resources.

4.16 National Construction Industry Act, 1996 (No. 19 of 1996)

This act makes provision for the regulation, development, and promotion of the local construction industry. Construction activities will have to comply with the National Construction Industry Act, of 1996 which states that 30% of the construction on site must be delivered by a local company, and 51% of the professional consultants will also have to be local. During the construction of the Cogeneration Power Plant, compliance with the National Construction Industry Act, 1996 (No. 19 of 1996) will be ensured.

4.17 Malawi Vision 2063

The 2063 Malawi Vision states that it aims to become an inclusively wealthy and self-reliant nation by 2063 and includes goals such as:

- No poverty
- Zero hunger
- Good health and well-being
- Quality education
- Gender equality
- Clean water and sanitation
- Affordable and clean energy
- Decent work and economic growth
- Industry, innovation and infrastructure
- Reduced inequalities
- Sustainable cities and communities
- Responsible consumption and production
- Climate action
- Life below water
- Life on land
- Peace, justice, and strong institutions
- Partnerships for the goals

The proposed cogeneration power plant will aid in supplying additional, much needed electricity to ESCOM who would be in a position to distribute the electricity for the country to grow economically. The increase in the availability of electricity will not only aid in economic growth, which would lead to decent work and reduced inequalities, but also assist in protecting life on earth, as increase electricity supply would lead to a decrease in deforestation as less wood would be required for cooking purposes.

4.18 Gender Equality Act, 2014

The Gender Equality Act in Malawi was drafted to begin to redress the gender inequalities present in Malawian society. Gender inequalities affect us all and are all too often present in all our communities. It is the responsibility of all Malawi citizens to implement the GEA in our schools, homes and communities. The emphasis of the GEA is on improving the lives of girls and women. This resource highlights key areas within the Act that are relevant to young people and should be seen as a positive step to benefit Malawian society as a whole.

During the construction and operational phases of the project, the project developers and contractors should provide job opportunities to woman, where feasible and possible, to assist in improving the lives of woman as stated within the Gender Equality Act of 2014.

4.19 HIV and Aids Act, 2018

According to the Act, the State shall respect, protect, and promote human rights as the cornerstones of an effective response to the country's HIV and AIDS situation. The Act also makes provision for the prevention and management of HIV and AIDS, provides for the rights and obligations of the persons living with HIV or affected by HIV and AIDS, and provides for the establishment of the National AIDS Commission.

During the project, measures must be taken to ensure the prevention and management of HIV and AIDS and it must be ensured that there is no discrimination against people living with HIV and AIDS.

4.20 Malawi National Irrigation Policy, 2016

Malawi National Irrigation Policy is a cross-sectoral policy designed to contribute to sustainable national economic growth and development through enhanced irrigated agriculture production and productivity. The National Irrigation Policy (NIP, 2016) aims at addressing critical issues affecting the irrigation sector that include spatial and temporal water shortages; customary land tenure disputes; and poor operation and maintenance of infrastructure. The NIP attempts to provide solutions to these challenges by addressing three priority areas of sustainable irrigation development, management and capacity development.

Although the proposed project does not include the irrigation of sugarcane, the sugarcane is irrigated, and the by-product of the sugarcane is required for the efficient generation of electricity. The National Irrigation Policy is therefore indirectly applicable and must be taken into consideration by exercising sustainable irrigation practises.

4.21 National Education Policy, 2016

The NEP is designed to respond to the Malawi Growth and Development Strategy and various related national, regional and international policies and protocols on education. The policy recognizes that Early Childhood Development (ECD) and Early Childhood Education (ECE), primary and secondary education are critical foundations to further education. It further recognizes the importance of inclusion of special needs education, out-of-school youth education (complementary basic education) and adult literacy in the education sector. The NEP attempts to define the provision of quality education in a holistic manner through expanded access and equity, improved quality and relevance, and improved governance and management.

Although, the proposed cogeneration power plant will not have a direct impact on education within Malawi, the increase in electricity capacity will result to more schools becoming electrified, improving the quality of education and facilities which could be provided.

4.22 IFC Performance Standards on Environmental and Social Sustainability (2012)

IFC's Sustainability Framework articulates the Corporation's strategic commitment to sustainable development and is an integral part of IFC's approach to risk management. The Sustainability Framework comprises IFC's Policy and Performance Standards on Environmental and Social Sustainability, and IFC's Access to Information Policy. The Performance Standards are directed towards clients, providing guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and disclosure obligations of the client in relation to project-level activities. The IFC sustainability Framework comprise of eight Performance Standards:

Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts Performance Standard

Performance Standard 1 establishes the importance of:

a. integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects;
b. effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and
c. the client's management of environmental and social performance throughout the life of the project

Performance Standard 2: Labour and Working Conditions Performance Standard

Performance Standard 2 recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers. For any business, the workforce is a valuable asset, and a sound worker-management relationship is a key ingredient in the sustainability of a company. The objective of this performance standard includes:

a) To promote the fair treatment;
b) Non-discrimination, and equal opportunity of workers;
c) To establish, maintain, and improve the worker-management relationship;
d) To promote compliance with national employment and labour laws;
e) To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain;
f) To promote safe and healthy working conditions, and the health of workers.
g) To avoid the use of forced labour.

Performance Standard 3: Resource Efficiency and Pollution Prevention Performance Standard

Performance Standard 3 recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels. This Performance Standard outlines a project-level approach to resource efficiency and pollution prevention and control

in line with internationally disseminated technologies and practices. In addition, this Performance Standard promotes the ability of private sector companies to adopt such technologies and practices as far as their use is feasible in the context of a project that relies on commercially available skills and resources.

Performance Standard 4: Community Health, Safety, and Security Performance Standard

Performance Standard 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities. The objective of this performance standard includes:

a) To anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances; and
b) To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

Performance Standard 5: Land Acquisition and Involuntary Resettlement Performance Standard

Performance Standard 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or other means of livelihood) as a result of project-related land acquisition and/or restrictions on land use. The objectives of this performance standard are:

a) To avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs;
b) To avoid forced eviction;
c) To anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected;
d) To improve, or restore, the livelihoods and standards of living of displaced persons; and
e) To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources Performance Standard

Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. This Performance Standard addresses how clients can sustainably manage and mitigate impacts on biodiversity and ecosystem services throughout the project's lifecycle

a) To protect and conserve biodiversity;
b) To maintain the benefits from ecosystem services; and

c) To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

Performance Standard 7: Indigenous Peoples Performance Standard

Performance Standard 7 recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to, and interests in, lands and natural and cultural resources, and may restrict their ability to participate in and benefit from development. The objectives of this Performance Standard include:

a) To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples;
b) To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts;
c) To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner;
d) To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's life-cycle;
e) To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the circumstances described in this Performance Standard are present.

Performance Standard 8: Cultural Heritage

Performance Standard 8 recognizes the importance of cultural heritage for current and future generations. The objective of this Performance Standard includes the following:

a) To protect cultural heritage from the adverse impacts of project activities and support its preservation; and
b) To promote the equitable sharing of benefits from the use of cultural heritage.

Although all eight IFC Performance Standards are noted above, it must be noted that Performance Standard 5, 6, 7 and 8 will not be applicable to this project as no community or individual will be resettled, no natural vegetation will be cleared, no indigenous people will be affected, and there will be no impact on any cultural heritage.

4.23 IFC Industry Sector Guidelines (2016)

The Environmental Health and Safety (EHS) Guidelines for Thermal Power Plants include information relevant to combustion processes fuelled by gaseous, liquid and solid fossil fuels and biomass and designed to deliver electrical or mechanical power, steam, heat or any combination of these. The EHS applies to boilers in new and existing facilities and therefore the proposed project must be in compliance with the IFC Industry Sector Guidelines of 2016 which notes the following:

- Industry-Specific Impacts and Management;
- Performance Indicators and Monitoring;
- Description of Industry Activities;
- Environmental Assessment Guidance for Thermal Power Projects

5. NEED AND DESIRABILITY

Malawi is among the least electrified countries in the world with only 7–12 % of the population connected to the grid while the rural electrification rate remains below 2%. Inadequate energy supply is one of the major problems confronting Malawi and limiting its social, economic and industrial development. The national utility Energy Supply Corporation of Malawi (ESCOM) needs to ration power supply by regular load-shedding as the maximum installed capacity of 351MW cannot feed an estimated energy demand of about 400MW. Due to Malawi's high dependency on hydro-power (almost 98% of the electricity is generated from the Shire River) the generation capacity went down to below 200MW after storm Freddy hit in 2022.

In terms of Greenhouse Gas Emissions (GHG), it is noted that the energy sector is accounting for almost three quarters of human-caused greenhouse gas emissions, and for this reason shifts to clean, renewable sources are critical to solving the climate crisis. Energy is therefore now a priority in many countries' climate action plans.

Rural populations are almost entirely dependent on biofuels. Since grid connections and gas fuels are not affordable to most, a huge number of the rural families are left with no choice but to rely on firewood and charcoal for cooking. This puts excessive pressure on the already fast depleting forests, leading to environmental degradation and deforestation. However, as trees are part of the natural water cycle, these interruptions eventually have a direct impact on the water levels, hence on electricity generation.

According to the *Journal of Energy in Southern Africa, Vol 26, No 2 of May 2015 John L Taulo, Kenneth Joseph Gondwe and Adoniya Ben Sebitosi,* the contribution of renewable energy sources is only 0.3%, which is very low in comparison to other countries. Sugar cane is a major commercially grown agricultural crop in the vast majority of countries in Africa. It is one of the plants having the highest bioconversion efficiency of capture of sunlight through photosynthesis and is able to fix around 55 tonnes of dry matter per hectare of land under this crop on annually renewable basis. Annual average production of sugarcane in Malawi is estimated at 2.5 million tons/year leaving behind over 950 000 tons bagasse which is a significant renewable power source for electricity generation. There are two sugar mills in Malawi having potential to generate 62 Mwe of electricity but currently only 18 Mwe has been utilised. This proposed cogeneration facility will add a portion of the identified potential (79 GWh/year) to the electricity grid in Malawi.

The proposed Cogeneration Power Plant will also have a number of benefits for the Malawian national power grid such as:

- Offering high availability, base-load quality for export;
- Produces and exports power during the high demand season for the national grid;
- Provides high rotating power, resulting to strong static and dynamic stability to the national grid;
- Diversifies the National Grid energy mix (hydro and solar power);

- It is 100% renewable

In terms of the economy, the proposed project represents Foreign Direct Investment (FDI) with its associated multiplier effect on the local economy. The construction of the Cogeneration Power Plant will take approximately two years and will provide an estimated 500 temporary job opportunities, further benefiting the local communities. In accordance with the NCIC, of 1996, and to ensure compliance thereof, local companies will be engaged during the construction process. The investment will also send a positive signal to others contemplating FDI into Malawi.

There are also significant positive benefits to increased power generation when it is renewable. These positive benefits include:

- Compliance with the Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021), as well as the International Finance Corporation (IFC) Standards;
- Increased capacity utilisation in the economy;
- Creating additional jobs and improved tax collections can be expected if power cuts through insufficient or intermittent power supply are reduced.
- Utilisation of modern technologies will improve the ISM's employees' skills, helping to retain high skills in country.
- In turn, potential greater rural electrification can have the benefit of reduced environmental degradation and its associated costs as people convert from charcoal to electricity.
- Sugarcane in the Shire Valley is not viable without irrigation. For this reason, increased power generation will be beneficial to the Nchalo Estate as well as possible Outgrowers, as irrigation would be uninterrupted.

In terms of the health and safety of the operation, the proposed Cogeneration Power Plant is also much needed as the existing boilers were constructed in 1965, consisting of old technology referred to as Dutch oven. The "oven" is stacked with bagasse and then lit on fire. There are steel pipes to recover the energy to produce steam. The flue gas is then rejected into the atmosphere without any filter, having an impact on air quality.

With this old technology, the oven would have to be fed with new bagasse, however, the ash cannot be removed. For this reason, combustion would have to be stopped once a week in order to open the chamber to extract the ash. Please refer to Figure 5-1.

FIGURE 5-1: IMAGE OF BOTTOM ASH BEING EXTRACTED FROM THE COMBUSTION CHAMBER

The extraction of the bottom ash from the combustion chamber is classified as a high risk as working conditions are:

- hot,
- dusty,
- and within a confined space

Illovo Sugar Malawi mitigate the above risks by means of the following:

- providing appropriate Personal Protection Equipment
- set up specific maintenance tasks
- ISM have experienced, skilled people and processes to operate boilers and turbines
- Protection corridor

By changing the existing boilers to modern technologies with automated deashing of the boilers, unsafe conditions would be avoided completely.

In addition to the current high safety risk with the deashing of the combustion chambers, high pressure 32 bars and 17 bars are distributed along the site for:

- Mechanical driving some boiler feed water pumps;

- Mechanical drive (steam turbine) the de-watering mills (3). They are squeezing the bagasse to separate the juice (high sugar content) from the bagasse; as well as
- Mechanical drive (steam turbine) for the front-end shredder (element crushing the cane).

With the implementation of the new Cogeneration Power Plant, the above operations would be electrified to avoid high pressure steam in places least expected. The objective is to limit the high-pressure steam pipes to a very limited area into the powerhouse. As a consequence, the hazard related to the high pressure is contained into a much more limited area.

6. PUBLIC PARTICIPATION PROCESS

Section 5 of the **Environment Management Act No.19 of 2017**, states the following in terms of public consultation:

(1) For the purpose of ensuring effective public participation, enforcement of rights and duties created under this Act, the Authority shall promote the right of every person to –

(a) Access environmental information and lead agencies, private sector and non-governmental organisations shall have a duty to provide such information in a timely manner;

(b) Participate in environmental decision-making processes directly or through representative bodies and mechanisms for effective, direct and indirect public participation shall be created by lead agencies; and

(c) Be afforded an adequate and effective administrative or judicial remedy for any harmful or adverse effect resulting from acts or omissions affecting the environment.

(2) The Authority shall establish guidelines and, where necessary recommend promulgation of regulations for ensuring the realisation and implementation of the provisions of subsection (1).

(3) No derogation from the rights and duties provided for in subsection (1) shall be permissible unless the same is necessary in a free, accountable and democratic society and in accordance with the Constitution.

The ESIA Process is undertaken in accordance with the EIA Guidelines of Malawi which was developed in 1997. These guidelines are not very specific in terms of the public participation process which must be undertaken, however as the project will need to comply with the IFC Standards, it is required that meaningful consultations with relevant stakeholders including affected groups and other interested parties are undertaken. The public consultation process was therefore undertaken in compliance with the IFC Performance Standards. The IFC Standards emphasizes Stakeholder Engagement and Information with five steps for interactive consultation, namely: (1) To plan ahead; (2) To consult using basic principles of good practise; (3) To incorporate feedback; (4) To document the process and results of consultation; and (5) To report back.

6.1 Stakeholder Identification and Analysis

During a project, various stakeholders and interested and affected parties were identified to provide valuable input to maximize benefits and reduce negative consequences. The areas directly adjacent to the project site and Illovo Sugar Factory is used for sugar cane farming while staff houses are located to the west of the project site. All the surrounding property is owned by Illovo Sugar Nchalo. A large portion of the people residing in Nchalo is also employed by Illovo Sugar. The project

stakeholders were categorized as: (a) Project Affected Parties (individual or groups who are affected or likely to be affected by the project): Communities impacted by project activities. (b) Interested Parties (individual or groups who may have an interest in the project): District Councils; National Authorities; Government Ministries, Departments and Agencies; NGO, CBOs, etc.

The Stakeholder Register contains details related to the Identified stakeholders, but not limited to:

a. Identification Information: Organization, Name and Surname, method of consultation
b. Stakeholder Characterization: Stance (opposed, moderately opposed, neutral, moderately supportive, supporting) and current dialogue level with the Project (no contact, reactive information, proactive information occasional direct contacts, regular direct contacts, privileged relationship/active partnership);

Table 6-1 below notes the stakeholders, departments, interested and affected parties identified during the process:

TABLE 6-1: STAKEHOLDER, DEPARTMENTAL AND I&AP LIST

DEPARTMENTAL / INSTITUTIONS				
ORGANISATION	**NAME AND SURNAME**	**CONTACT DETAILS**	**METHOD OF CONSULTATION**	**STAKEHOLDER CHARACTERISATION**
Department of Economic Planning and Development	Mr. Thokozire Ngwira	+265882730502 **mepd@globe.net**	Email	No feedback has yet been received
Malawi Environmental Protection Agency (MEPA)	Patrick Nyirenda	+265 881 919 563 **mediusnyirenda@gmail.com**	Email	No feedback has yet been received
Directorate of Health and Social Services	Dr. Stalin Zimkanda	+265888528579 **szimkanda@yahoo.com**	Email	No feedback has yet been received
Ministry of Finance		+2651 789 355 **finance@malawi.gov.mw**	Email	No feedback has yet been received
National Construction Industry Council (NCIC)	Mr. George Chapotera	+265 887 829 505 **george.chapotera@ncic.mw**	Email	No feedback has yet been received
ESCOM	Mr. Sinosi Maliano *Director of Planning and Development*	+265 882158109 **smaliano@escom.mw** **bkanjala@escom.mw**	Email	No feedback has yet been received
Malawi Energy Regulatory Authority (MERA)	Mr. Patrick Kadewa	+265 1774103 **pkadewa@mera.mw**	Email	No feedback has yet been received

Ministry of Natural Resources, energy and Mining	Mphatso Chikoti	+265 999 629 581 +265 888854 195 **mphatsosamuel@gmail.com**	Email	No feedback has yet been received
National Water Resources Authority	Mr. O.K.K. Mwamsamali *Executive Director*	+265 999 110 437 **nwrasec@gmail.com**	Email	No feedback has yet been received
Malawi Bureau of Standards	Mr. Rex Moyo	+2651870017 **rmoyo@mbsmw.org**	Email	No feedback has yet been received
Leadership for Environment and Development	Prof. Sosten Chiotha	+265 991144448 +265 881144448 **schiotha@gmail.com**	Email	No feedback has yet been received
Chikhwawa District Environmental Representatives	Elina Mkandawire	+265 995107234 **Elina.mkandawire@yahoo.com**	Email and consultation	During consultation, their support to the project was noted
National Local Government Finance Committee Chikhwawa District	Paul W. Chipeta	**pchipeta@nlgfc.gov.mw** **paulwchipeta1@gmail.com**	Email	No feedback has yet been received
Ministry of Agriculture	Don Ghambi	+265 883509286 **mwaichimuna1@gmail.com**	Email	No feedback has yet been received
Department of Climate Change and Meteorological Services	Lucy Mtilatila	+2651 822 014 **lmtilatila@metmalawi.gov.mw** **lmtilatila@gmail.com**	Email	No feedback has yet been received

Ministry of Labour Skills and Innovation	*To be confirmed*	+2651 773 773 **labour@labour.gov.mw**	Email	No feedback has yet been received
Ministry of Labour, Regional Inspector	Schubert Zgambo Lungulera	Mobile: +265(0)884480876 +265(0)999029633 **schubertz@yahoo.com**	Email	No feedback has yet been received
Southern Region Water Board	Tisungana Kapalamula	**tisungane-kapalamula@srwb.mw** **tisukapalamula81@gmail.com**	Email	No feedback has yet been received
National Water Resources Authority	Tonney Nyasulu	+265 993 837 950 **thnyasulu@gmail.com**	Email	No feedback has yet been received
Department of Water Resources (central level)	*Lyson Mseu*	+265 997315278 **mseulaison@gmail.com**	Email	No feedback has yet been received
Ward Councillor	Mwayiwawo Dowe	+265 999638873	Consultation meeting	During consultation, their support to the project was noted
Community Leaders	Paramount Chief Lundu	+265 888627503	Consultation meeting	During consultation, their support to the project was noted
Religious Leader	Wilson Kachenje	+265 881238639 **wilsonkachenje@gmail.com**	Consultation meeting	During consultation, their support to the project was noted
Local Administrator for Kasinthula	Mr. James Chonde	+265 8883366455 **jameschonde@gmail.com**	Consultation meeting	During consultation, their support to the project was noted
Local Administrator for Phata	Mr. Bakali	+265 998375851	Meeting with Mr. Bakali still to be held	No feedback has yet been received
Local Administrator for Kaombe	Mr. Chinzamba	+265 88 609 5758	Consultation meeting	During consultation, their support to the project was noted

NGO Regulatory Authority	Mr. Patrick Mwale	+265 993707252 pmwale@ngora.mw	Email	No feedback has yet been received
NGO – Jhpiego Health	Daniel Pindani	+265 996597466 info@jhpiego.org	Email	No feedback has yet been received
NGO – CHREAA	Temwa Mhango	+265 882728907 temwamhango8@gmail.com	Email	No feedback has yet been received
NGO – Malawi Voices	John Alufandika	+265 995264702 voicesteam185@gmail.com	Email	No feedback has yet been received
NGO – Eagles Malawi	Victor Mughogho	+265 1879023 vmughogho@eaglesmw.org	Email	No feedback has yet been received
NGO – Development Initiative Network	Anderson Frey Billiat	+265991043004. dinmalawi@gmail.com	Email	No feedback has yet been received
Centre for Environmental Policy and Advocacy (CEPA)	Alfred Kambwiri	+265 212 700 104 info@cepa.org.mw	Email	No feedback has yet been received
Wildlife and Environmental Society of Malawi (national and district)		+265 212 843 502 wesmhq@wesm.mw	Email	No feedback has yet been received
Department of National Parks and Wildlife	Wisely Kawaye William Mgoola Jester Kaunga-Nyirenda	+265 886177271 +265 888353993 wmgoola@yahoo.co.uk jkaunganyirenda@gmail.com	Email	No feedback has yet been received

	Patricio Ndadzela	patricion@african-parks.org		
Mpatamanga Hydroelectric plant	Charlotte Bisley Patricia Nayeja	charlotte-externe.bisley@edf.fr patnayeja@gmail.com	Email	No feedback has yet been received
Shire Valley Transformation Project	Daulos Mauambeta	+265 888914540 ddcmauambeta@gmail.com	Email	No feedback has yet been received
Presscane Limited		+265 1896517 Cchilangwe@presscorp.com	Email	No feedback has yet been received
Local Growers		chvchavi@yahoo.co.uk cchavi.svcgt@kasinthula.mw	Email	No feedback has yet been received
Unitrans Malawi (Cane Haulage)		danie.meyer@unitrans.africa	Email	No feedback has yet been received
Garda World – Security		francis.arena@garda.com Gani.Kanchiputu@garda.com	Email	No feedback has yet been received
Farming and Engineering Services		+265 1812070 landpreparedmin@fesmw.com	Email	No feedback has yet been received
Illovo Sugar Nchalo – Factory	Victor Chirambo	Vchirambo@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Agricultural Department	Jaco Burger	Jburger@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Human Resource Department	Joyce Katengeza	Jkatengeza@illovo.co.za	Email	In support of the project

Illovo Sugar Nchalo – Agricultural Department	Simba Mapfumo	Smapfumo@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Factory	Ignatius Phiri	Iphiri@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Environment, Health and Safety	Stella Mdyanyama	Smdyanyama@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Environment, Health and Safety	Thoko Chakwantha	Tchakwantha@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Warehouse	Smart Sikelo	Ssikelo@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Factory	Kinford Nzutha	Knzutha@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Optimization	Evans Mautsahuku	Emautsahuku@illovo.co.za	Email	In support of the project
Illovo Sugar Nchalo – Estate Support	Steve De La Harpe	Sdelaharpe@illovo.co.za	Email	In support of the project

Appropriate consultation techniques, and culturally appropriate consultation methods were used to engage the respective parties and stakeholders. The techniques used and which will continue to be used for the remainder of consultations to be undertaken are as follows:

- Correspondences (email and telephone);
- One-on-one meetings;
- Formal meetings;
- Public meetings;
- Focus group meetings;
- Information boards;
- Media (newspaper, community radio);

6.2 Summary of initial stakeholder engagement

During the scoping phase, consultation was undertaken with Stakeholders and Interested and Affected Parties (I&AP's), by means of the following:

- Distribution of the Draft Scoping Report to Stakeholders, Departments and I&AP's on 9 March 2023. The Draft Scoping Report was initially made available for a 30-day commenting period, however, following the natural disaster caused by Cyclone Freddy, a decision was taken to extend the public review and comment period to 24 April 2023, in order to provide I&AP's with more time to review the Draft Scoping Report and submit any comments or questions. The Draft Scoping Report, with the executive summary of the report being in Chichewa, was made available by means of the following:
    - Hard copy of the Draft Scoping Report was placed at the reception of Illovo Sugar Ncahlo;
    - An electronic copy of the Draft Scoping Report was distributed to all parties who had an email address.

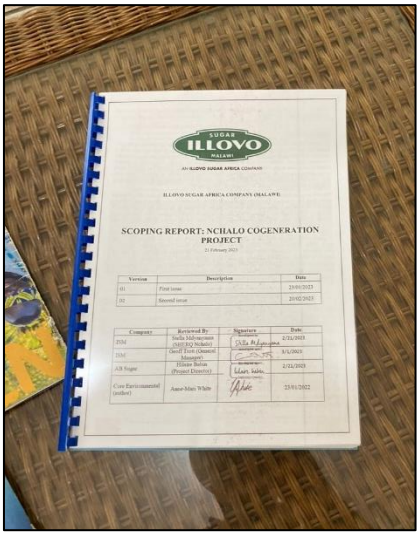

FIGURE 6-1: PROOF OF SCOPING REPORT HARD COPY MADE AVAILABLE FOR PUBLIC REVIEW AT NCHALO ILLOVO SUGAR RECEPTION

- Stakeholders and Interested and Affected Parties were made aware of the availability of the Draft Scoping Report by means of the following:
    - Electronic letter to all Departments, Stakeholders and I&AP's with email addresses (Please find proof of notification attached as Appendix B);
    - Site Notice boards in the local language of Chichewa, was placed on site (at the entrance of Illovo Sugar Nchalo, as well as the notification board of Illovo Sugar);
    - Radio Advert in the local language of Chichewa was broadcasted on Capital Radio, Malawi, running for three weeks, providing information on the availability of the Draft Scoping Report for public review. This notice included a short description of the project, contained information about where a copy of the Draft Scoping Report could be obtained for review, described the process of submitting any comments and/or questions and included contact information of the environmental consultant who could be contacted if any clarification is required (Find attached email confirmation of radio advert placed).

FIGURE 6-2: SITE NOTICES PLACED TO INFORM THE COMMUNITY ABOUT THE PROJECT AND THE AVAILABILITY OF THE SCOPING REPORT

- Engagement with the Chikwawa District Council to discuss the proposed project and current ESIA process being undertaken. Meeting was held on 29 March 2023, at the Chikwawa District Council.
- Meeting with the respective Traditional Leaders, Religious Leader and Ward Councillor of the Nchalo area on 29 March 2023.
- Meeting with the Besta Womans Group on 29 March 2023, within the village located approximately 2km north-east of the Nchalo Illovo Sugar Factory.
- Meeting with Chief Lundu at his residence in Nchalo on 30 March 2023.

Following the meetings and consultations undertaken, it was evident that all four groups or individuals consulted, appreciated the fact that the project will be generating additional electricity, however, they all requested that the local surrounding community be the first to benefit from this additional electricity generation. A summary of the issues raised, and comments made are described below while the full minutes of the meetings undertaken are attached as Appendix B.

Chikwawa District Council Meeting

The meeting was attended by approximately 30 people representing various departments within the Chikwawa District (environment, land, forestry, fisheries, meteorology, agriculture, irrigation and trade). As all attendees confirmed that English is understood by all, the meeting was conducted in English and translation was provided if required. The minutes of the meeting and section where these concerns or comments are addressed, is included with the ESIA document, however some main concerns or comments noted from the attendees during the meeting is noted below:

- The chairperson, Ms. Elina Mkandawire thanked Nchalo Illovo Sugar for presenting the project to the stakeholders and moving to a more sustainable approach.
- Quantifiable results of the Air Quality Impact Assessment and Noise Impact Assessment undertaken for this project will be appreciated.
- The local community should be the first to benefit from the additional electricity generation and if electricity is not provided free of charge, vulnerable communities will most likely not benefit from the additional electricity generation.
- Engagement of communities: Clarification was requested as to the communities involved and providing input for the project as additional electricity will be exported to the national grid for distribution. It was confirmed that the stakeholder database consists of various national, district and local departments, the traditional leaders and religious leaders of the Nchalo area, NGO's, subcontractors as well as the Paramount Chief Lundu who is the head of all village Chief's within the southern section of Malawi.

To summarize, the project is supported by the District Council and more correspondence and communication will be submitted following the review of the ESIA Report.

Traditional, Religious Leaders and Ward Councilor

A meeting was also held with the Traditional Leaders, Religious Leader and Ward Councilor of the surrounding area in Nchalo. The main concerns and comments noted in the meeting included the following:

- The generation of electricity is currently dependent on Hydro Power Stations and the generation is impacted severely by floods and drought. The implementation of this electricity generation is therefore welcomed and appreciated.
- The local surrounding communities are impacted severely by the lack of electricity and therefore, through ESCOM, the surrounding community should be the first in line of benefitting from the additional electricity to be generated.

Besta Village Woman's Group

A consultation session was also held with a woman's group residing within the adjacent Best Village and their main comments and concerns are noted below:

- The woman's group is welcoming the project as they were very concerned about the amount of emissions being emitted into the atmosphere and they are of the opinion that the current air emissions are impacting the rainfall of the area as more drought has been experienced within the specific area compared to other regions.
- They expressed their concern about the high noise levels generated by the factory.
- The additional electricity generation is welcomed as the community will benefit from this generation, enhancing community development.
- The woman's group is appreciating the fact that they have been contacted to provide input into the proposed project.
- They welcome the fact that Illovo is growing as Illovo is their only source of assistance when their crops are washed away.

Paramount Chief Lundu

A one-on-one meeting was also held with the Paramount Chief Lundu to discuss the project proposed and the following inputs and comments were made:

Paramount Chief Lundu is appreciating the fact that more electricity will be generated as their current dependence on Hydropower is problematic during drought and flood events.

- The Chief is hoping that this additional electricity generation will make a significant difference in the current power cuts experienced.

- He is also suggesting that the surrounding community must be the first to benefit from the additional electricity generation.

6.3 Public Consultation and Disclosure Programme

The Social and Environmental Impact Assessment for the Illovo Sugar Cogeneration Power Plant will continue with stakeholder engagement during the remainder of the project cycle to ensure that every stakeholder is aware of the project's planned activities, and to ensure compliance with the IFC Standards for stakeholder engagement. Table 6-2 outlines the remainder of the stakeholder engagement to be undertaken. The purpose of the engagement plan for this project is to:

- Consult stakeholders on the proposed project design, anticipated environmental and social risks and impacts, mitigation measures, and environmental and social risk management instruments;
- Provide regular information on the implementation progress and feedback to stakeholders and any other emerging issues throughout the project cycle.

TABLE 6-2: STAKEHOLDER ENGAGEMENT PLAN

No.	Project Phase	Method of engagement	Objective	Targeted Stakeholders
1.	Social and Environmental Impact (ESIA) Phase	Distribution of the Social and Environmental Impact Report to all identified Stakeholders and Interested and Affected Parties. (By email and printing hard copies for review at a public place)	Obtain comments and inputs from Stakeholders and I&AP's	All identified Stakeholders and Interested and Affected Parties
		Placing an advert in the local newspaper (English),	Advertisement of the availability of the ESIA for review and comment	Residents of Nchalo
		Placement of a radio advert on the local radio station (Chichewa)	Advertisement of the availability of the ESIA Report for review and comment	Residents of Nchalo
		Public Meeting	Providing details of the proposed project to members of the community and other Stakeholders present	Community members of Nchalo

6.4 Grievance Redress Mechanism

Projects which result to environmental and social impacts, can expect grievances to be raised and how a business respond to such grievances can have a significant implication on business performance. Having a good overall community engagement process in place and providing access to information on a regular basis can substantially help to prevent grievances from arising in the first place, or from escalating to a level that can potentially undermine business performance.

Grievance procedures should exist throughout all phases of the project lifetime (planning, construction, commissioning, closure and decommissioning). The purpose of the Grievance Redress Mechanism would be to address any issues arising from community members, by means of ensuring a transparent and fair process whereby people's concerns will be heard and addressed. Raising concerns must therefore be an easily accessible procedure and/or process.

The principles of a good Grievance Redress Mechanism System include the following:

- Proportionality: Designing the Grievance Redress Mechanism according to the scale and adverse impact on the affected communities;
- Cultural appropriateness: Designing the Grievance Redress Mechanism taking into account culturally appropriate ways of handling community concerns;
- Accessibility: A clear and understandable mechanism that is accessible to all segments of the affected communities at no cost;
- Transparency and accountability to all stakeholders;
- Appropriate protection: A mechanism that prevents retribution and does not impede access to other remedies;

The process involved for grievance management is a five-step process which includes the following:

Step 1: Publicizing the Grievance Management Procedures:

During this process, the Grievance Management Procedure is made public to inform all affected communities of the methods of lodging a grievance. The information to be included within this publication includes the following:

- What project-level mechanisms are (and are not) capable of delivering and what benefits complainants can receive from using the company grievance mechanism, as opposed to other resolution mechanisms;
- Who can raise complaints (affected communities);
- Where, when, and how community members can file complaints;
- Who is responsible for receiving and responding to complaints, and any external parties that can take complaints from communities;
- What sort of response complainants can expect from the company, including timing of response;
- What other rights and protection are guaranteed.

Step 2: Receiving and Keeping Track of Grievances:

Once communities are aware of the mechanism and access it to raise grievances, the company needs to process them. Processing includes: 1) collecting grievances; 2) recording grievances as they come in; 3) registering them in a central place; and 4) tracking them throughout the processing cycle to reflect their status and important details.

Step 3: Reviewing and Investigating Grievances:

For a grievance mechanism to work, all complaints should be handled as promptly as possible, depending on the nature and complexity of the matter. All grievances will need to undergo some degree of review and investigation, depending on the type of grievance and clarity of circumstances. Minor, straightforward issues may only need screening before proceeding to the next step whereby information can be provided on the spot. Less clear, more problematic, or repetitive issues, or group complaints may need a more detailed review prior to action. Staff involved in handling grievances may need to seek advice internally, and in some cases turn to outside parties to help in the validation process, especially in cases of damage claims.

Step 4: Developing Resolution Options and Preparing a Response:

Once the grievance is well understood, resolution options can be developed taking into consideration community preferences, project policy, past experience, current issues, and potential outcomes. General approaches to grievance resolution may include proposing a solution:

i. unilaterally (the company proposes a solution);
ii. bilaterally (the company and the complainant reach a resolution through discussion or negotiation);
iii. through a third party (either informally or formally through mediation); or
iv. through traditional and customary practices.

Regardless of the outcome, a response should be provided to all complainants. Responses can be either oral or written, depending on whether the grievance was received orally or in writing.

Step 5: Monitoring, Reporting, and Evaluating a Grievance Mechanism

Monitoring and reporting can be tools for measuring the effectiveness of the grievance mechanism and the efficient use of resources, and for determining broad trends and recurring problems so they can be resolved proactively before they become points of contention. Depending on the extent of project impacts and the volume of grievances, monitoring measures can be as simple as tracking the number of grievances received and resolved, or as complex as involving independent third-party evaluations. It is important for the project to adapt the mechanism to correct inefficiencies. The final objective of monitoring is to ensure that the design and implementation of the grievance mechanism adequately respond to the stakeholders' needs in a cost-effective manner.

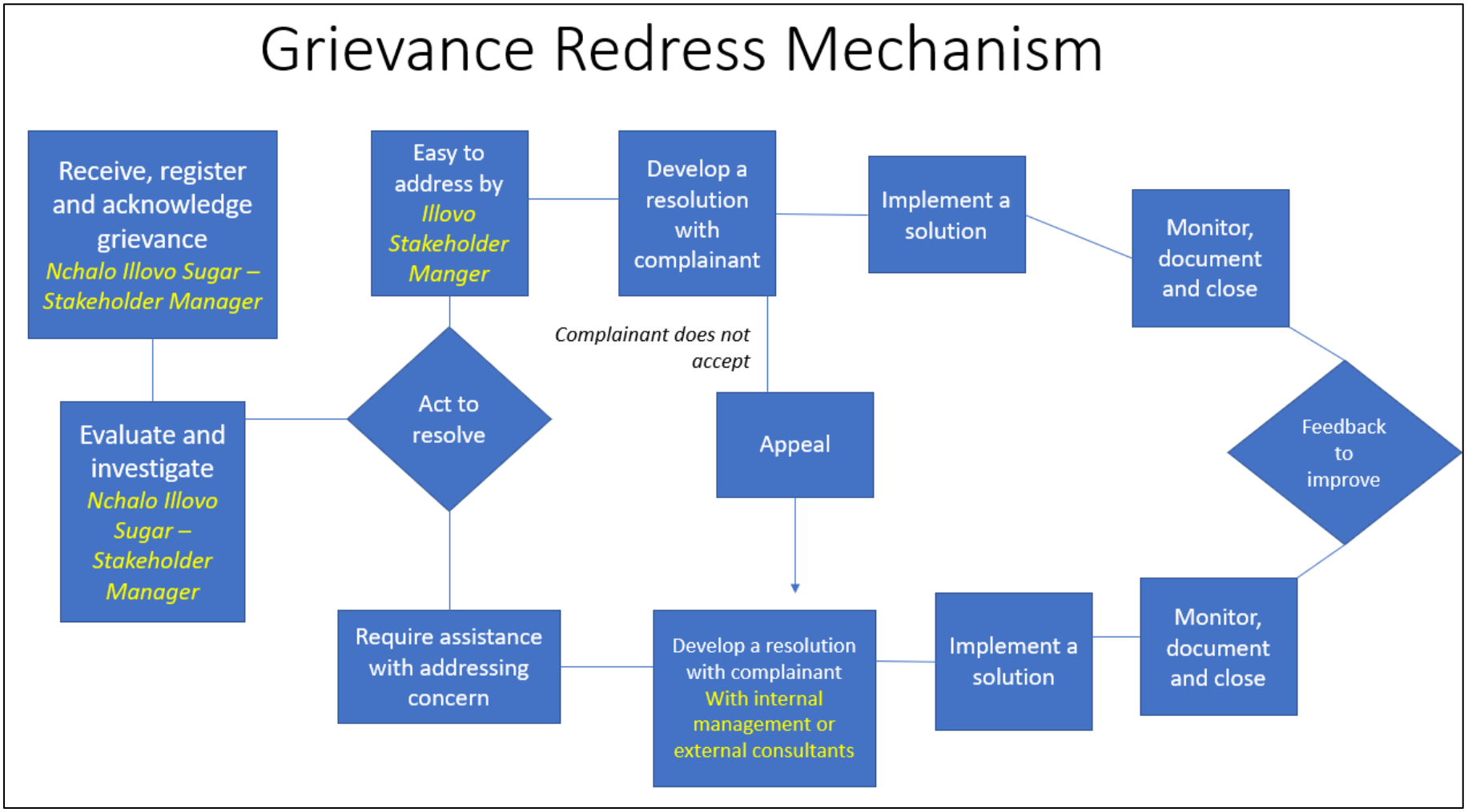

FIGURE 6-3: GRIEVANCE REDRESS MECHANISM PROCESS DESCRIPTION

7. CONSIDERATION OF ALTERNATIVES

The ESIA process requires the developer to identify and investigate/assess feasible and reasonable alternatives. The project alternatives range from the location where the activity is proposed, type of activity to be undertaken, design the of activity, technology to be used in the activity, to the option of not implementing the activity (No-Go Alternative).

7.1 Alternatives in terms of type of activity to be undertaken

The scope of the replacement of the boilers were assessed to reduce the cost of the solution. While the three very old boilers dated 1965, could not be upgraded safely to improve the emissions levels and ensure compliance in terms of the Ambient Air Quality Standards and Emission Limits (MS 737-1:2021), boiler 4 and 5 could have been upgraded to comply with the new emissions levels. A value engineering assessment was performed followed by a risks analysis to determine which of the two following solutions were the most beneficial:

a) a decommissioning of all boilers on site and a complete replacement thereof; or
b) a partial replacement where the two retained boilers will be upgraded.

Solution (b) would result to the continuation of the massive maintenance costs on the retained boilers for the following 20 years to reduce the possibility of leaks. To construct and install safer equipment, environmentally friendly assets, and reduce future maintenance costs, the project team decided to validate the complete replacement of all existing boilers. But, if the Power Purchase Agreement to export power to the grid with ESCOM is not signed, the Illovo Sugar Malawi might opt for solution b, as Nchalo Illovo Sugar was given until 2026 to ensure that the emissions emitted into the air, is within the thresholds included within the Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021). For this reason, the option of only upgrading the existing boilers exist, however, no additional electricity will be generated for export is solution b is implemented.

7.2 Location Alternatives

In order for the Cogeneration Power Plant to be feasible, the Power Plant would have to be within a close proximity to the existing Nchalo Illovo Sugar Factory. For this reason, the project location alternatives are restricted to an available area within and/or near the Sugar Factory footprint. The available space within the footprint and immediate surrounding area of the Sugar Factory is limited and therefore no other location alternatives could be investigated. More options were available in terms of the layout of the proposed Cogeneration Power Plant within a specific location of the Nchalo Illovo Sugar Factory.

7.3 Layout Alternatives

Two different layout alternatives were identified for the proposed project. For both alternatives, the Boiler House, Powerhouse, Cooling Tower and associated structures and infrastructures are proposed within the footprint of the existing Illovo Sugar Factory, while the location for the bagasse storage area are proposed either towards the north of the existing Illovo Sugar Factory (Layout Alternative 1) or towards the west of the existing Illovo Sugar Factory (Layout Alternative 2). These proposed alternatives are described below:

Layout Alternative 1 (Preferred Option):

With this layout alternative, the Boiler, Powerhouse and Cooling Tower is proposed near the existing boilers, within the existing bagasse storage area and scrap yard. It is proposed that the bagasse yard be extended north of the service road, on the area currently used for the cultivation of sugarcane. The bagasse will be transported by means of conveyor and an overhead conveyor will be constructed to traverse the service road without impacting the flow of traffic.

The area required for the proposed Cogeneration Power Plant is approximately 35 000m^2, excluding the area to be established for the bagasse storage yard. The bagasse storage yard will require an additional 25 000m^2 for the effective storing of sufficient fuel. The area available as per the location proposed, is sufficient for the construction of the Cogeneration Power Plant, with the bagasse storage yard extended to the north of the existing Sugar Factory.

One of the environmental impacts associated with the storage and transportation of bagasse, includes air pollution with the generation of small dust particles being transported off site during windy conditions. By locating the bagasse storage area north of the existing Illovo Sugar Factory, residential houses are located further from the proposed bagasse storage area and the impact on the surrounding community/employees are minimised when compared to Layout Alternative 2.

FIGURE 7-1: DESKTOP LEVEL LAYOUT PLANT FOR PROPOSED LAYOUT ALTERNATIVE 1 (PREFERRED ALTERNATIVE)

In terms of safety and security within the Cogeneration Power Plant, the proposed location would still enable the owner to fence off the area to ensure controlled access for authorised personnel.

Layout Alternative 2:

With this layout alternative, the area proposed for the Boiler, Powerhouse and Cooling Tower, is located at the same location as proposed for Layout Alternative 1. The bagasse storage yard is however proposed to the west of the existing Illovo Sugar Factory, adjacent to the residential area of Illovo Sugar. It is also proposed that the bagasse will be transported by means of conveyor and an overhead conveyor to avoid any impact on traffic flow.

As with Layout Alternative 1, the area required for the proposed Cogeneration Power Plant is approximately 35 000m^2, with the bagasse storage yard which will require an additional 25 000m^2 for the effective storing of sufficient fuel.

With this proposed layout alternative, the bagasse storage yard will be located less than 100m from the nearest residential house and as mentioned, one of the environmental impacts associated with the storage of bagasse, is the generation of dust which will affect nearby residents during windy conditions. Another risk to consider is the spontaneous combustion of bagasse piles. The safety risk is therefore higher when the bagasse storage piles are located closer to residents.

FIGURE 7-2: DESKTOP LEVEL LAYOUT PLANT FOR PROPOSED LAYOUT ALTERNATIVE 2

For these reasons provided above, Layout Alternative 1 is identified as the preferred layout alternative for the Cogeneration Power Plant.

7.4 Technology Alternatives

In terms of technology alternatives, the possibility of constructing a solar farm to produce additional power was also assessed. This technology would have matched the irrigation load. This alternative however, faced various difficulties such as:

i. Power grid instability is created in Malawi due to over commitment of solar technology and for this reason, ESCOM did not authorize the option of constructing a solar farm to create additional power;
ii. While the solar technology will not result to any pollutants emitted, boilers will still be required for the sugar mill. The existing boilers would still have to be replaced.

Due to permitting constraints, the option of constructing a solar facility was not retained.

7.5 Design Alternatives

The design specifications adopted for the Cogeneration Power Plant was also assessed between:

- low pressure boilers (32 bars and 45 bars); and
- high pressure boilers (67, 82 or 105 bars).

A risks analysis was performed along with a costing review of the different solutions, and it was found that due to the fact that the sugar mill requires steam for operational purposes, the optimum solution for the Nchalo Illovo Cogeneration Power Plant is the construction of one 67 bar boilers.

7.6 No-Go Alternative

The No-Go Alternative would be to not establish and construct the 32MW Cogeneration Power Plant at the Nchalo Illovo Sugar Factory, which would result in the following:

- The air emissions emanating from the existing boilers will continue to be Non-Compliant with Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021), as well as the International Finance Corporation (IFC) Standards;
- The continuous non-compliance of the pollutants emitted from the existing boilers would have a negative impact on climate change;
- No additional electricity will be generated and be available for export to the National Grid. ESCOM would therefore loose the potential of 79GWh/yr which would have been available for export; and
- Potential direct and indirect job opportunities will be lost.

8. DESCRIPTION OF THE AFFECTED ENVIRONMENT

8.1 Topography

The town of Nchalo and surrounding areas including the Nchalo Illovo Sugar Factory where the Cogeneration Power Plant is proposed, is relatively flat at approximately 70m above mean sea level (amsl). The topography changes significantly where the Thyolo Mountain range is located approximately 13km toward the north-east of the project site, with an elevation peaking at 1400m amsl. Higher altitudes are also noted towards the north-west of Nchalo, towards Lengwe National Park.

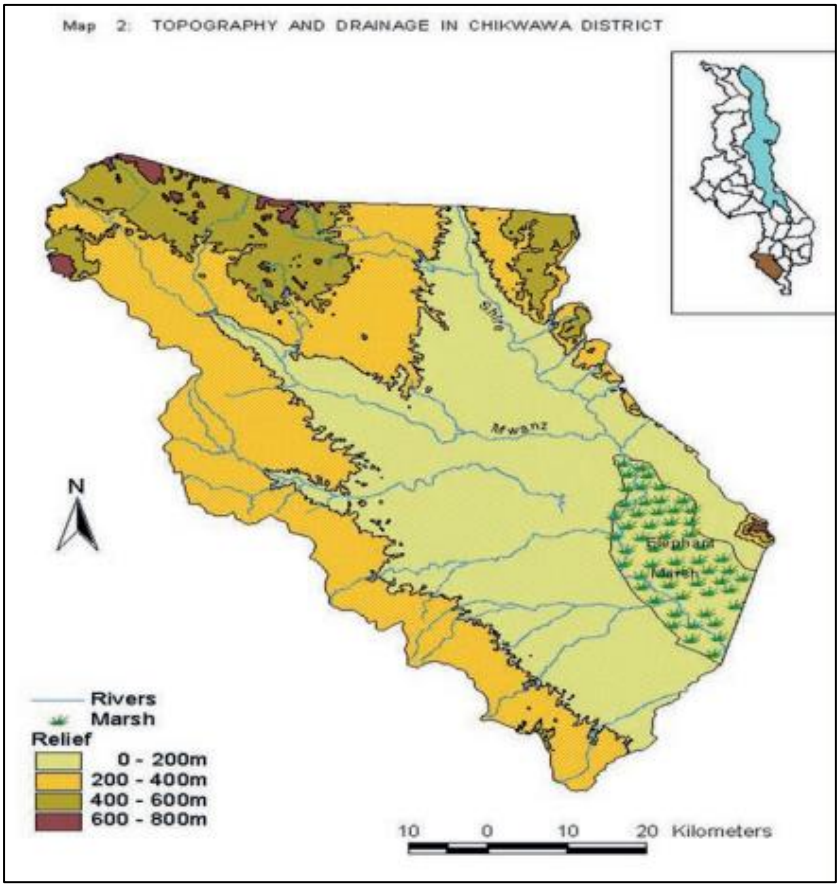

FIGURE 8-1: TOPOGRAPHY MAP OF THE CHIKWAWA DISTRICT (NCHALO FALLING WITHIN THE 0M-200M CATEGORY)
** Map source: Chikwawa District Council Socio-Economic Profile 2017 – 2022*

The area proposed for the development of the Cogeneration Power Plant is located within the existing Nchalo Illovo Sugar Factory. This area, as well as the surrounding area proposed for the storage of bagasse, is flat with an average area elevation of 72 meters above mean sea level (AMSL).

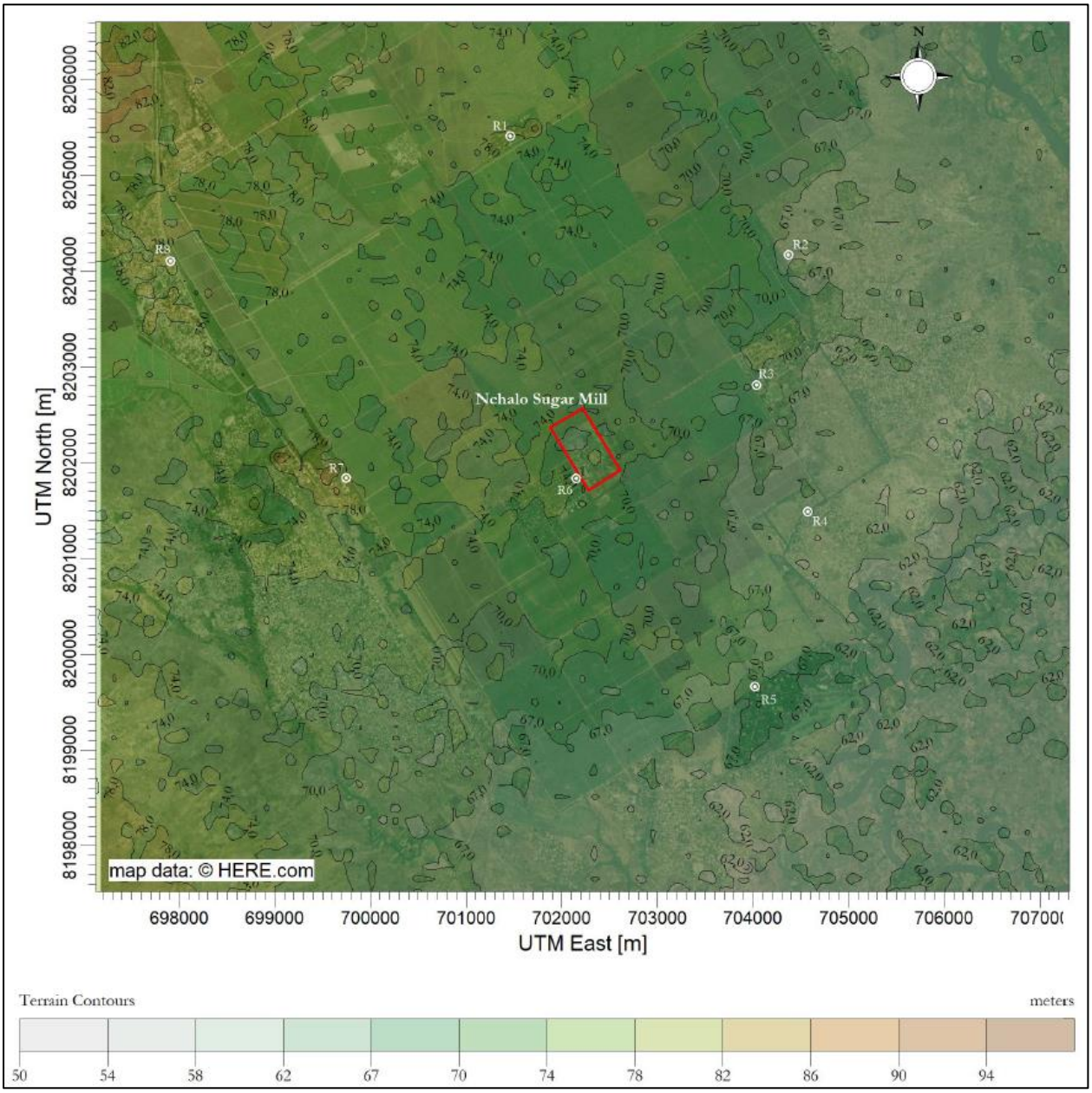

FIGURE 8-2: NCHALO SUGAR MILL TERRAIN ELEVATIONS

8.2 Geology and Soils

The geological formations of Malawi may be considered in three main divisions:

The pre-Cambrian or Basement Complex, the Karroo System and the post-Karroo formations. Basement complex rocks of pre-cambrian age, consisting of greisses and granulite underlie most of the hills and uplands of Chikwawa. Sedimentary rocks of the Karoo system (grits, sandstones, shales and mudstones) and Mesozoic basalts are found in the Shire Valley Uplands in the West. This is the area that forms part of the Great African Rift Valley. These rocks are rich in minerals, and it would be a potential area for mineral exploration. A wide variety of soils have developed

in Chikwawa District that varies from area to area according to different types of sediments and rocks. The soils are deep, medium to fine textured, brown to very dark grey in colour. The soils have a drainage which varies from good to very poor. From Figure 15 below, it is noted that the project area is located within an area characterised by sandy loam soils which is ideal for crop production.

Sandy loam soils which are present on site are characterised as a mix of sand and clay. These soils are capable of quickly draining excess water but cannot hold significant amounts of water or nutrients for plants. Loam is the best soil type for construction due to its ideal combination of silt, sand, and clay. It combines the best of all their qualities into the ideal balance for supporting a foundation. Loam generally does not shift, expand, or shrink drastically and handles the presence of water very well. Sandy soils has a light and loose structure and as it drains water easily, it can easily be used for construction purposes.

As other structures have been constructed within the footprint of the Nchalo Sugar Factory with no development constraints in terms of geology and soils, it is not expected that the geology and soils would have any impact on the construction of the proposed Cogeneration Power Plant.

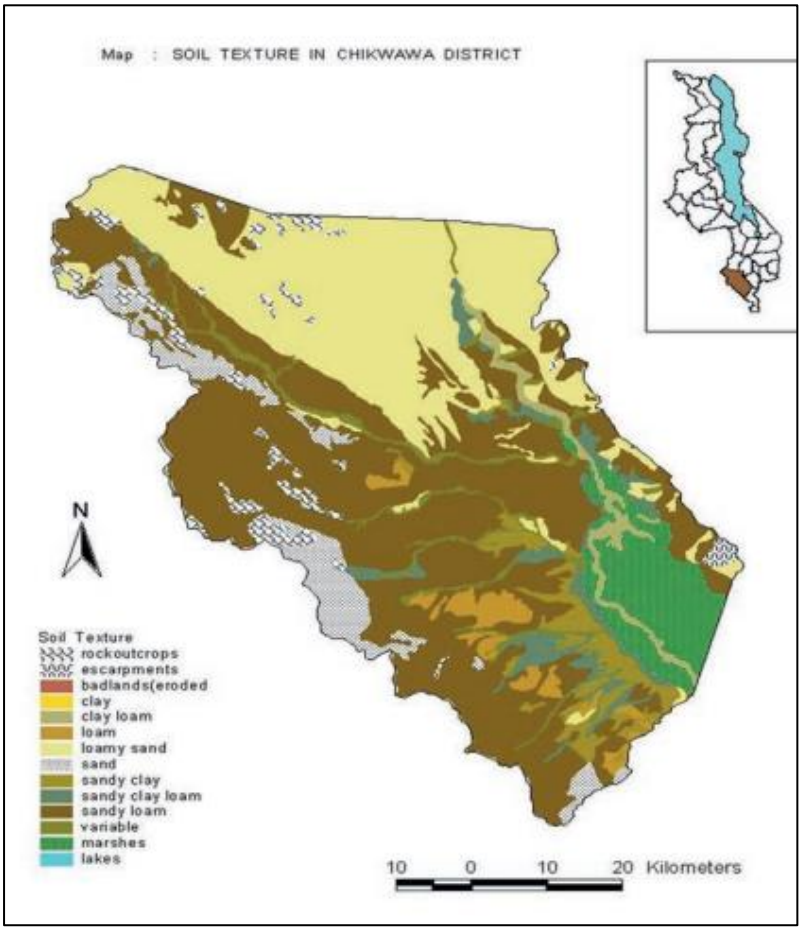

FIGURE 8-3: SOIL TEXTURE AND CLASSIFICATION WITHIN CHIKWAWA DISTRICT
** Map source: Chikwawa District Council Socio-Economic Profile 2017 – 2022*

8.3 Climate

The climate of the region is largely influenced by the northward and southward seasonal migration and intensity of the Inter-Tropical Convergence Zone (ITCZ), a low pressure belt within the Congo basin caused by tropical high pressure belts over both the Indian and Atlantic Oceans and the Congo Air Boundary (CAB), that is controlled by sea surface temperature (SST) anomalies such as the Indian Ocean Dipole (IZOD) and El Niño/Southern Oscillation (ENSO) system (World Bank Group, 2021).

As noted within the topography and elevation of the town of Nchalo, the area is approximately 70m amsl, which means that lower altitude results to higher temperatures with very humid conditions being experienced within the project area. The climate is categorised as a tropical wet and dry or savanna climate. Temperature affects the formation, action, and interactions of pollutants in various ways (Kupchella & Hyland, 1993). Chemical reaction rates tend to increase with temperature and the warmer the air, the more water it can hold and hence the higher the humidity. Temperature also provides an indication of the rate of development and dissipation of the mixing layer as well as determining the effect of plume buoyancy; the larger the temperature difference between the plume and ambient air, the higher the plume is able to rise.

The highest temperatures are experienced between the months of September to December with averages ranging between 21^0C and 36^0C. These high temperatures could have a direct influence on the risks associated with heat stress. Lower temperatures are experienced between the months of May to July, with averages ranging between 15^0C and 28^0C. Between September to November, dry dust laden winds at approximately 9km/h are experienced.

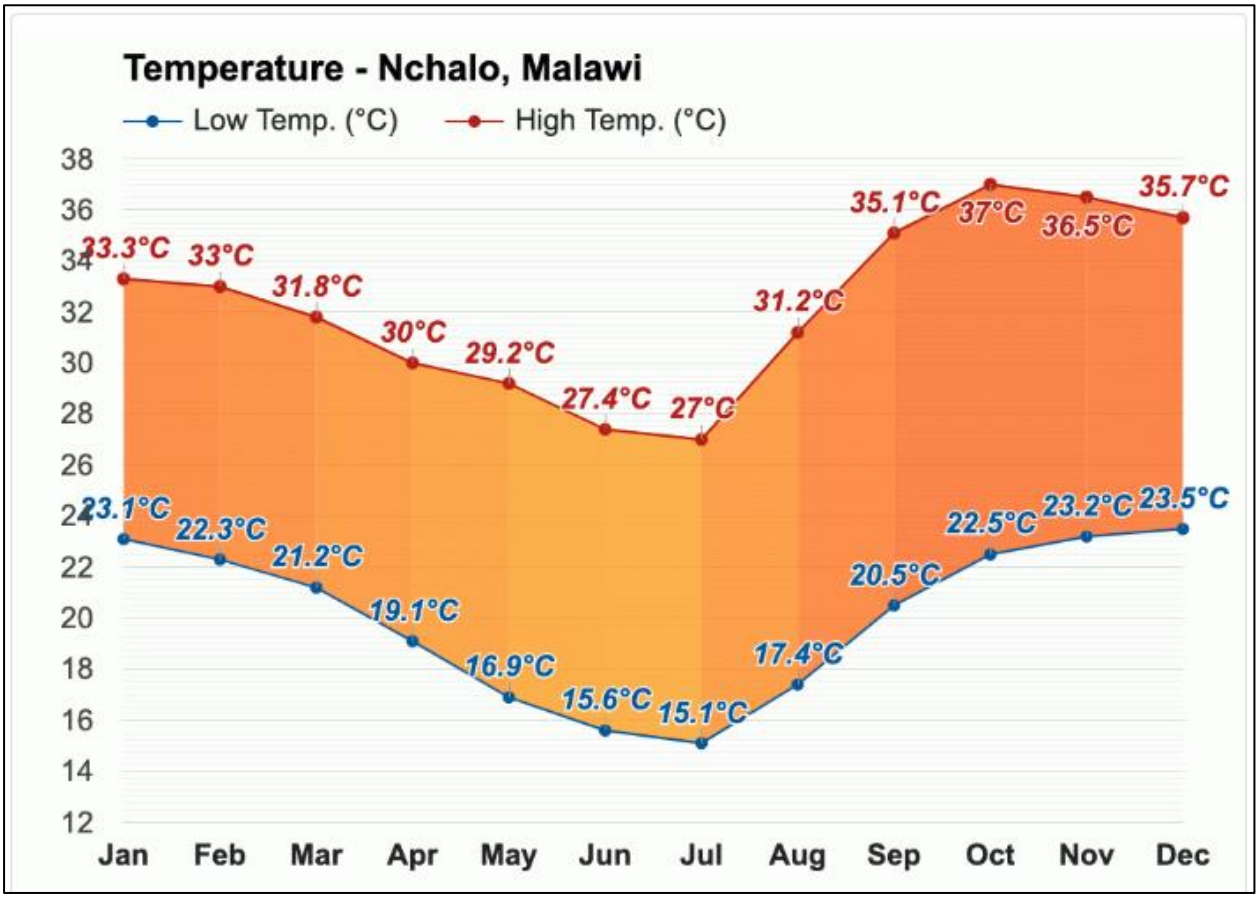

FIGURE 8-4: AVERAGE MONTHLY TEMPERATURES FOR NCHALO, MALAWI
(Source: https://www.weather-atlas.com/en/malawi/nchalo-climate#temperature)

Precipitation cleanses the air by washing out particles suspended in the atmosphere (Kupchella & Hyland, 1993). It is calculated that precipitation accounts for about 80-90% of the mass of particles removed from the atmosphere (CEPA/FPAC Working Group, 1999).

Malawi's rainfall is variable depending on altitude and ranges from 600 mm for the rift valley floors to 1600 mm per annum for the mountainous areas. Local differences in rainfall are caused by complex topography causing deflections of moisture-bearing winds that are responsible for precipitation and rain-shadow effects in various terrains (World Bank Group, 2021). The Chikwawa District generally experiences variable rainfall ranging from about 170 mm to 968 mm.

Rainfall within the area is experienced mostly between November and April, with the most rainfall occurring during the month of January. Precipitation for Nchalo is measured at approximately 430mm per annum.

During construction, the high rainfall expected during the month of January and February must be incorporated into the project schedule. Total annual evapotranspiration averages around 2,000mm with high monthly rates in the dry season from September to December, and lower rates from June to July. Evapotranspiration far exceeds rainfall even during the rainy season, except in January

and February. Precipitation in the Shire Basin is characterized by torrential downpours of high intensities.

The zone is occasionally traversed by residual tropical cyclones. Over the last two decades, the Basin has experienced significant changes in weather patterns. The basin experienced severe droughts in 1991/92; 1993/94 and 1994/95. In addition, the basin is prone to extreme flooding events, such as the severe flash flooding of 2001/2 and 2014/15. More flooding was experienced at the Nchalo factory during the month of March 2020 as well as March 2023, caused by Cyclone Freddy.

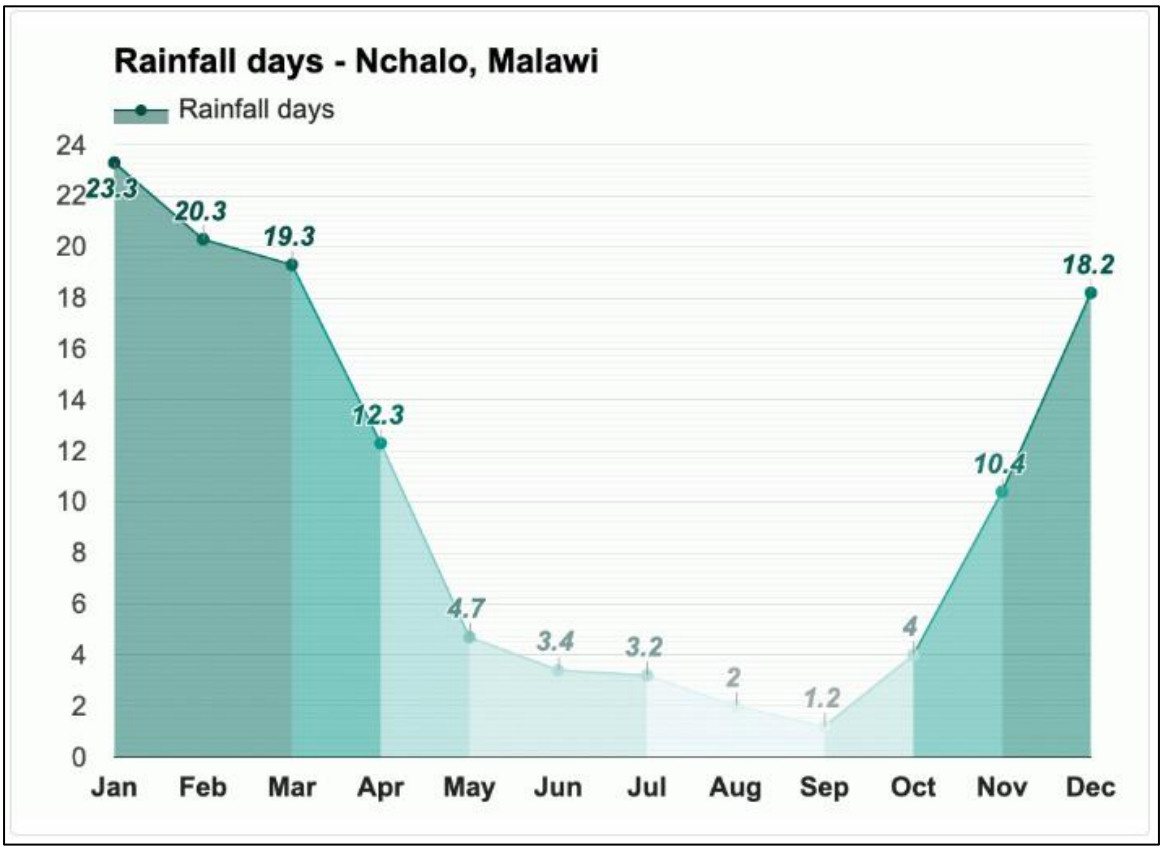

FIGURE 8-5: AVERAGE ANNUAL RAINFALL FOR NCHALO, MALAWI
(Source: https://www.weather-atlas.com/en/malawi/nchalo-climate#temperature)

Wind direction and speed is also an aspect to consider when boilers are operational as flue gas will be emitted from the stacks and transported in the same wind direction. Winds from the south-eastern sector (61.62%) were mostly reported for the study area. Strong winds above 5.7m/s were the exception (2.9%) and wind speeds were most often light between 0.5 and 2.1 m/s 43.3%. Moderate winds between 2.1 and 3.6 m/s were recorded 31.8% and brisk winds, between 3.6 and 5.7m/s 17.3%. Lights winds below 0.5 m/s were recorded 4.9% of the time.

Wind roses consist of 16 spokes which represents the direction from which the winds blew during the period under review. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction

categories. The value given in the centre of the circle describes the frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s.

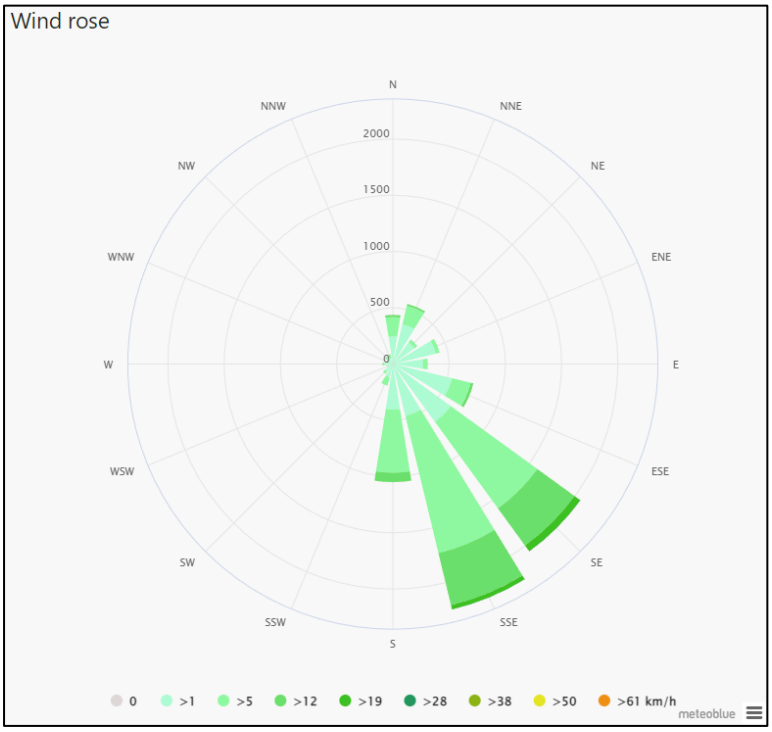

FIGURE 8-6: NCHALO WIND ROSE FOR THE PERIOD 1992 – 2022

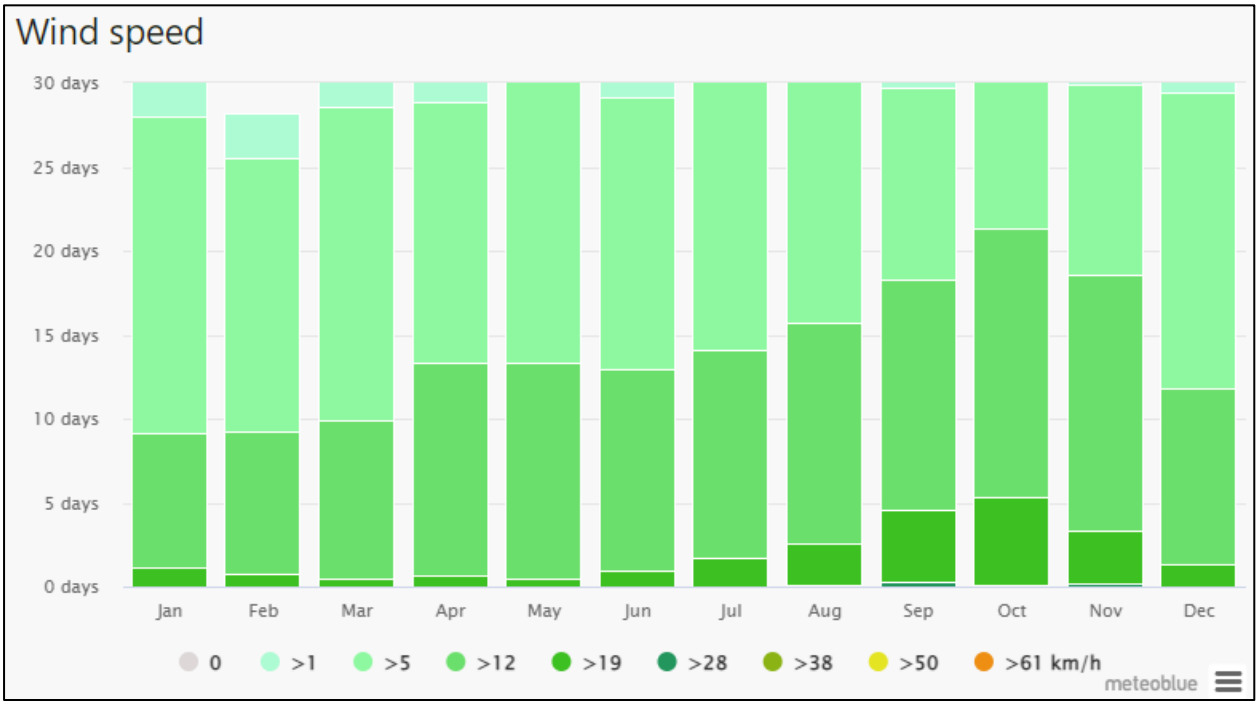

FIGURE 8-7: NCHALO AVERAGE WIND SPEED FOR THE PERIOD 1992 – 2022

Period, diurnal, and seasonal wind roses for the period 1 January to 31 December 2022 are presented in Figure 8-8 to Figure 8-15.

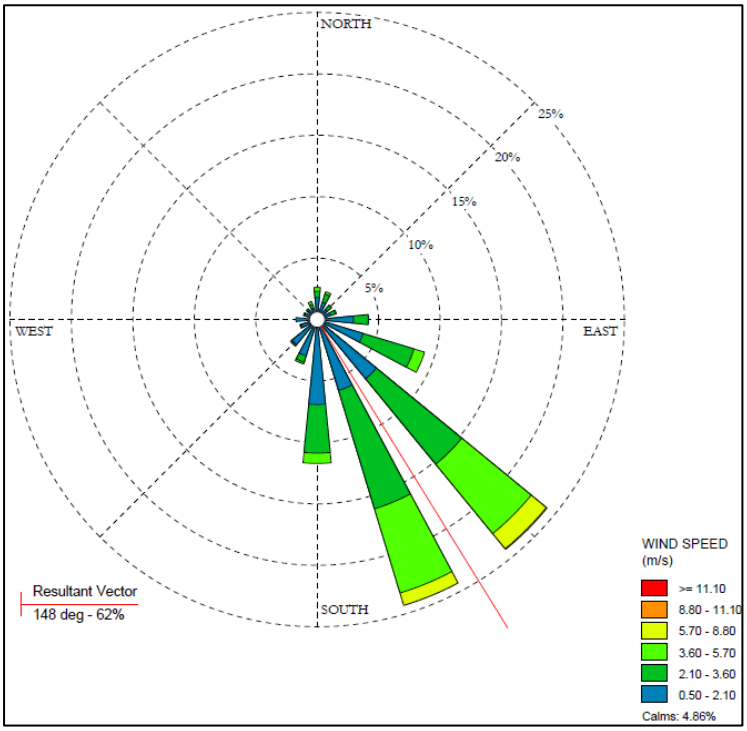

FIGURE 8-8: PERIOD WIND ROSE

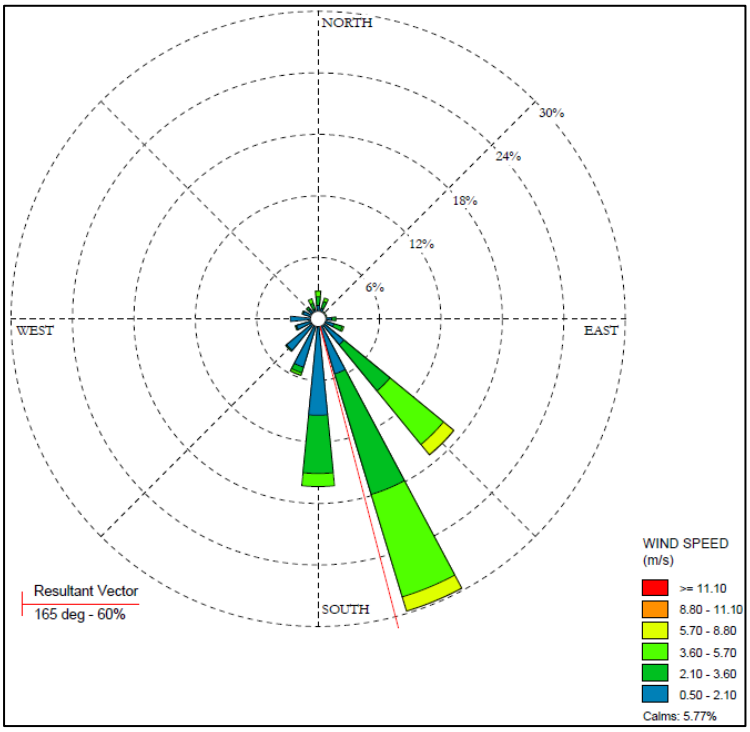

FIGURE 8-9: DAY-TIME WIND ROSE

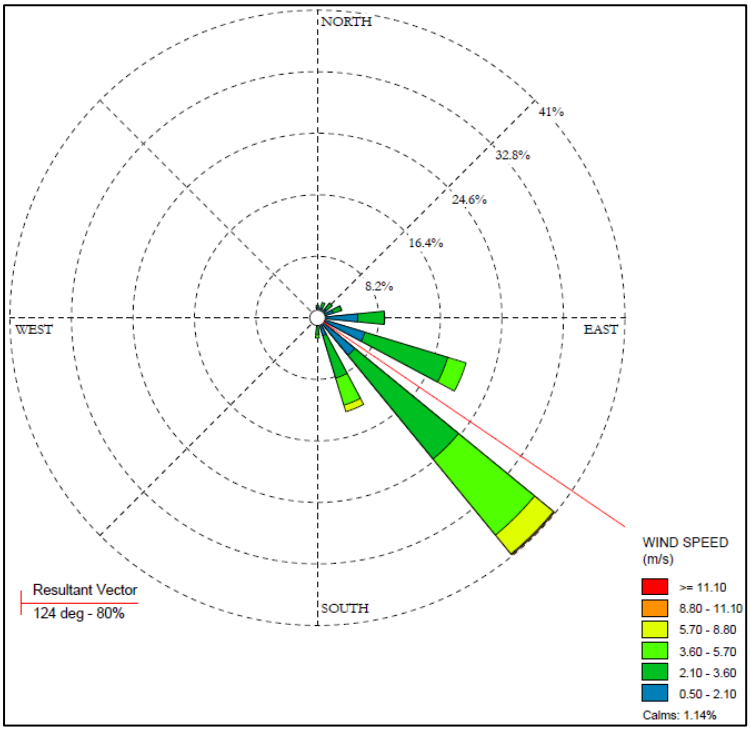

FIGURE 8-10: EVENING WIND ROSE

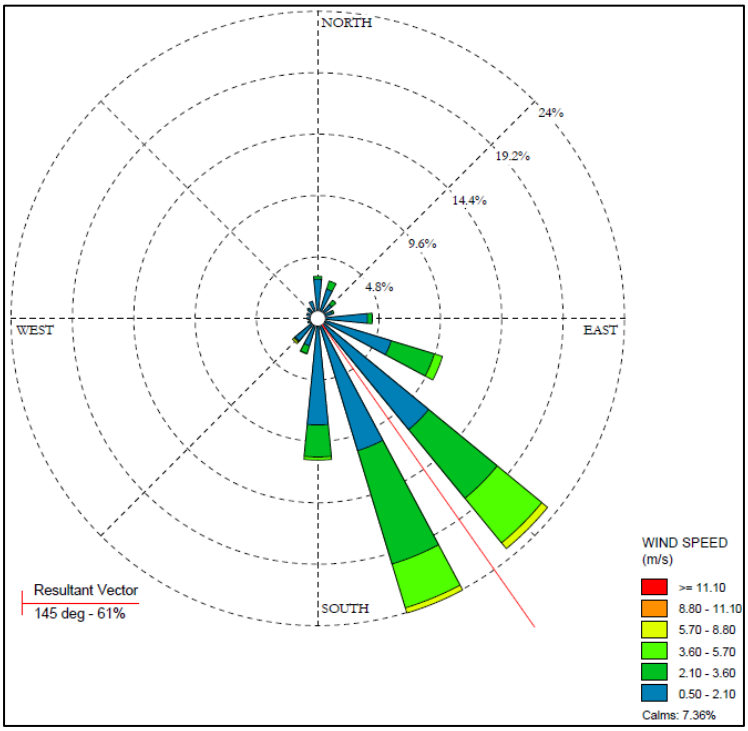

FIGURE 8-11: NIGHT-TIME WIND ROSE

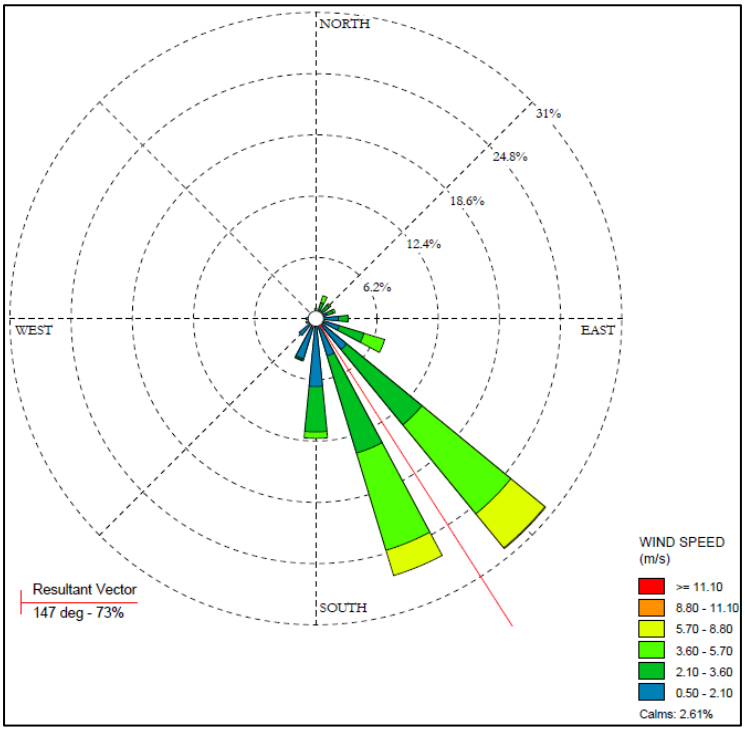

FIGURE 8-12: SPRING WIND ROSE

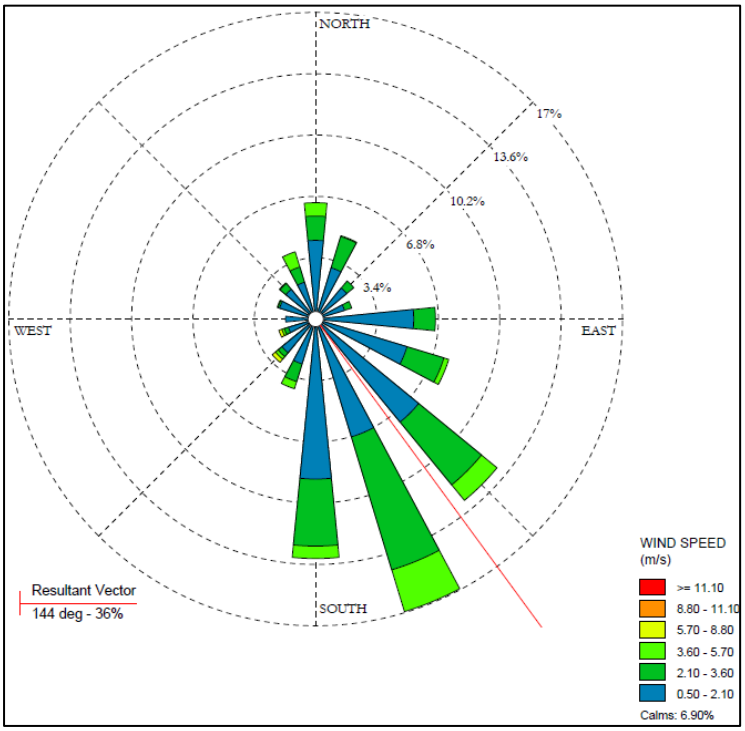

FIGURE 8-13: SUMMER WIND ROSE

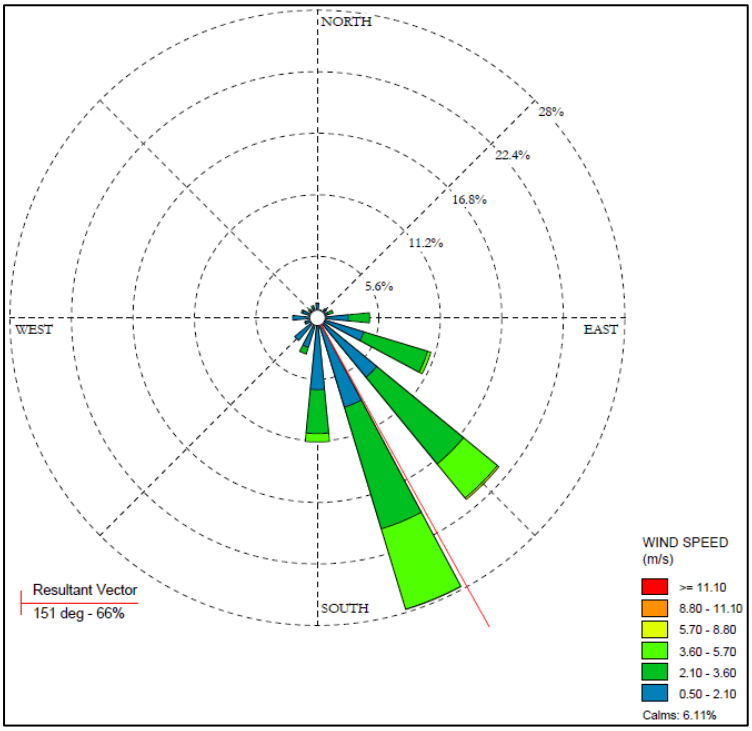

FIGURE 8-14: AUTUMN WIND ROSE

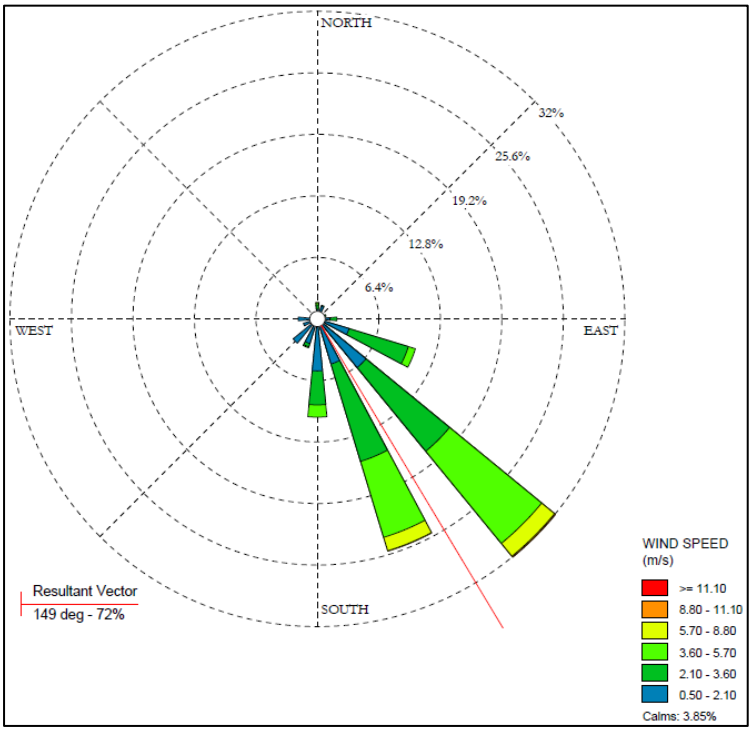

FIGURE 8-15: WINTER WIND ROSE

8.4 Ambient Air

Air pollution in Malawi is recognized as one of the key environmental issues. Out of nine key issues it is ranked eighth on priority issues. Typical pollutants include particulates (including soot, fly ash and aerosols), sulphur oxides (SO_x), oxides of nitrogen (NO_x), carbon monoxide (CO), carbon dioxide (CO_2), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), methane (CH_4), ammonia (NH_3), hydrogen chloride (HCl), hydrogen sulphide (H_2S), ozone (O_3) and other photochemical oxidants (as secondary pollutants) and various trace elements. Organic compounds released include formaldehyde, benzene, poly-aromatic hydrocarbons, PCBs and dioxins and furans.

The inventories and studies show that air quality in Malawi is still good, but future anticipated air quality problems are a cause for worry as air quality has an impact on human health, global climate change and ozone depletion. Trends in consumption of ozone depleting substances (ODS) show a remarkable drive towards total reduction. The cutting down of forests for firewood due to lack of access to electricity is reducing the purification capacity of vegetation for pollutants such as CO_2 which results to the accumulation of such particles and gasses in the atmosphere which increases the likely hazard to human health and threatens the ecosystem integrity.

The monitoring of air quality includes the measurement of specific pollutants, such as particulate matter, carbon monoxide, sulphur dioxide and nitrogen dioxide. Atmospheric particulate matter (PM) is microscopic solid or liquid matter suspended in the air. Sources of particulate matter can be natural or anthropogenic. Of greatest concern to public health are the particles small enough to be inhaled into the deepest parts of the lung. These particles are less than 10 microns in diameter and are defined as PM10. They are a mixture of materials that can include smoke, soot, dust, salt, acids, and metals. Particulate matter also forms when gases emitted from motor vehicles and industry undergo chemical reactions in the atmosphere. PM10 includes fine particulate matter defined as PM2.5, which are fine particles with a diameter of 2.5 μm or less. At the Nchalo Illovo Sugar Factory, another aspect which could impact air quality is the generation of dust from the bagasse storage area. With the increase of the bagasse storage area, dust generation from the extended bagasse storage area will have to be assessed. The biggest impact of particulate air pollution on public health is understood to be from long-term exposure to PM2.5.

Sulphur dioxide (SO_2) is a gas, which is invisible and has a nasty, sharp smell. It reacts easily with other substances to form harmful compounds, such as sulfuric acid, sulphurous acid and sulphate particles. Short-term exposures to SO_2 can harm the human respiratory system and make breathing difficult. SO_2 can also contribute to acid rain which can harm sensitive ecosystems.

Nitrogen dioxide (NO_2) is a reddish-brown gas that has a characteristic sharp, biting odour and is a prominent air pollutant. The major source of nitrogen dioxide is the burning of fossil fuels: coal, oil and gas. Most of the nitrogen dioxide in cities comes from motor vehicle exhaust. Nitrogen dioxide is an important air pollutant because it contributes to the formation of ozone, which can have significant impacts on human health.

Carbon monoxide is a product of incomplete combustion of fossil fuels. It is predominantly formed in internal combustion engines of motor vehicles, but the combustion of any carbon-based material can release CO. Chemical reactions in the atmosphere may also lead to the formation of CO by the oxidation of other carbon-based gases such as methane. Decomposition of organic material within soils can also result in the release of CO. Natural ambient concentrations of CO range between 0.06 and 0.14 mg/m^3. In urban environments, mean concentrations over eight hours are usually less than 20 mg/m^3, and one-hour peak levels are usually less than $60mg/m^3$. Highest concentrations are usually measured near major roads, as vehicles are the major source of CO.

Volatile Organic Compounds are compounds that have a high vapour pressure at ordinary, room-temperature conditions. It is noted that some organic compounds have little or no known direct human health effects, while others are extremely toxic and/or carcinogenic. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anaemia, in occupationally exposed humans. Reproductive effects have been reported in women exposed by inhalation to high levels of benzene, and adverse effects on the developing foetus have been observed in animal tests (US-EPA, 2001).

Nchalo Illovo Sugar Estate was issued a licence for the release of gaseous emissions in accordance with the Environmental Management Act Chapter 60:02. This licence requires the Licensee, Nchalo Illovo Sugar Estate, to comply with specific conditions contained within the license. Due to the fact that the existing boilers are too old to be retrofitted to comply with the revised emission standards, the Nchalo Illovo Sugar team is implementing a complete replacement of the boilers. This plan was submitted to MEPA and at the moment, the Nchalo Sugar Mill Factory run with a derogation to operate, subject to the implementation of the exposed plan. The Malawi Environmental Protection Authority (MEPA) granted Nchalo Sugar Mill until 2026 to ensure compliance with the local gaseous emission standards and more specifically the new emission standards issued (MS 737-2021).

For ambient air quality, an Ambient Air Quality Monitoring Survey was conducted at Nchalo Sugar Mill from 21 October to 20 November 2021 to determine ambient air quality within the Nchalo Sugar Estate and surrounding areas. Eight dust deposition monitoring stations were strategically located within the Nchalo Sugar Mill and surrounding estate, orientated within the predominant wind vectors with the locations of potential emission sources, residential zones and the natural topography in mind.

The dust deposition monitoring locations are indicated in Figure 8-16, while the results are included in Table 8-1. The ambient air quality monitoring results for SO_2, NO_2, O_3, HF, Pb and VOCs are included in Table 8-2.

FIGURE 8-16: NCHALO SUGAR MILL DUST DEPOSITION MONITORING LOCATIONS

TABLE 8-1: NCHALO SUGAR MILL DUST DEPOSITION MONITORING RESULTS

Unit ID	Location	GPS Coordinates	Dustfall Rate, D (mg/m²/day)[1]	Measured Concentration
15867-1	Unitrans	16°15'24.52"S 34°53'33.95"E	600 < D < 1200 – Non-residential Area	**1344,23**
15867-2	Staff Car Parking Lot	16°15'16.78"S 34°53'42.54"E		303.32
15867-3	Warehouse Yard	16°15'3.77"S 34°53'29.61"E		**2263.82**
15867-4	Irrigation Workshop	16°15'13.18"S 34°53'28.97"E		**1811.20**
15867-5	Factory Village – Water Treatment Plant	16°15'22.56"S 34°53'15.27"E	D < 600 – Residential Area	414.48
15867-6	Kalulu Water Treatment Plant	16°14'42.56"S 34°54'33.97"E		514.70
15867-7	Estate Maintenance	16°15'32.02"S 34°52'17.02"E		160.50
15867-8	Area 2 – Pump House	16°13'42.87"S 34°52'43.81"E		524.72

Notes:

mg/m²/day : milligram dust deposited on a horizontal area of one square meter in a period of 24-hours.
1 : South African National Dust Control Regulations was published (Notice 827 of 2013).
2 : Dust deposition for the monitoring period measured in accordance with ASTM D1739: 1998. Colours correspond to the coding used below, i.e. dust deposition rates indicated in blue indicate

conformance to the standard and red indicates that the standard has been contravened.

Monitoring stations MP1 Unitrans, MP3 Warehouse Yard and MP4 Irrigation Workshop returned results that exceeded the non-residential dust deposition standard. The remaining monitoring stations all reported results below the related standards.

TABLE 8-2: NCHALO SUGAR MILL AMBIENT AIR QUALITY MONITORING RESULTS

Chemical Compound	Sample Number[1]					Malawi AQS[2] µg/m³	Evaluation
	A19450-1	A19450-2	A19450-3	A19450-4	A19450-6		
Sulphur Dioxide – SO_2	0.049	0.058	0.528	0.053	0.032	150 µg/m³ 24 hours	**Compliant Results**
Nitrogen Dioxide – NO_2	1.240	0.877	4.216	1.367	0.545	110 µg/m³ 24 hours	
Ozone – O_3	14.18	17.22	11.93	14.40	12,95	120 µg/m³ 8 hours	
Hydrogen Fluoride (HF)	< 0.007	< 0.007	< 0.007	< 0.007	0.073	3 µg/m³ 24 hours	
Lead - Pb	BDL	BDL	BDL	BDL	BDL	0.5 µg/m³ 12 months	
Volatile Organic Compounds (VOCs) – 1 Hour Average Concentrations							
Pentane	-	-	-	-	0,015	-	**Compliant Results**
Ethanol	< 0.001	< 0.001	0.005	< 0.001	-	-	
Ethyl acetate	< 0.001	< 0.001	0.009	0.003	-	-	
Benzene	0.001	0.001	0.002	0.001	0,008	50 µg/m³ 1 hour	
Toluene	0.001	0.001	0.001	0.002	0,006	-	
Ethyl benzene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.004	-	
Xylene	< 0.001	< 0.001	< 0.001	< 0.001	< 0.004	-	
n-Decane	0.001	0.001	0.001	0.002	-	-	
White Spirits	-	-	-	-	0,061	-	

All the samplers for VOCs, SO_2, NO_2, HF and O_3 returned compliant results when compared with the Malawian Ambient Air Quality Standards (MS 737:2011). Similarly, compliant results were also returned for the active sampling of Pb.

8.5 Surface and Ground Water Resources

Aquatic ecosystems constitute about 22% of the total surface area of Malawi and are characterised into four major types of ecosystems, namely, lakes, rivers, small water bodies and other wetlands.

Water bodies within the district are highly affected by pollution as a result of human activities such as waste disposal, agricultural activities, deforestation which leads to siltation and eventually the drying up of the watercourse. The Shire River is located approximately 6km to the east of the project site. The Shire River is of great importance economically and environmentally. Its hydroelectric schemes generate 98% of Malawi's electricity. It has extensive fisheries and wildlife conservation areas and provides freshwater for agricultural irrigation, industrial production and domestic use. It has been described as the development engine of Malawi's economic growth.

The Shire River Catchment, which originates at Lake Malawi at Samama, has a catchment area of 18, 945km2. It flows approximately 410km south and south east where it meets the Zambezi River at Ziu in Mozambique. This makes the Shire River the largest river in Malawi. The Basin represents about 16% of Malawi's total geographical area and is shared with Mozambique. It is one of 13 sub-basins that comprise the Zambezi River Basin. The Shire River flows through parts of Mozambique before joining the Zambezi River, which then flows into the Indian Ocean. The catchment is divided into upper, middle and lower sections.

Prior to flowing into the Zambezi River, the Elephant Marsh forms a flood plain which lies at the southern tip of Malawi. The Marsh is difficult to define as it varies from season to season and year to year, however, the Elephant Marsh has been quoted to be between 400km^2 – 1200km^2 in size. The northern margin of the Elephant Marsh is more described as a semi-permanent marshland and as depicted from Figure 8-16 below, this area is located adjacent and east of the Nchalo Sugar Estate.

The Shire River carries high sediment loads into the top (north) of the Elephant Marsh. This sediment originates from the heavily deforested and degraded catchment in the upper Shire Valley. The trapping of the sediments in the top of the Elephant Marsh, together with the predicted climate change which includes more severe storms, increases the possibility of floods occurring within the area. In 2020 as well as March 2023, Malawi experienced heavy rainfall and some recreational facilities within the Nchalo Estate (Nchalo Sports Club), located adjacent to the Shire River, was affected by the flooding. The Illovo Sugar Factory, where the Cogeneration Power Plant is also proposed, is located approximately 2.7km north-west of the Shire River and is relatively flat. Due to the relatively high-water table, water infiltrates at a slower rate which adds to the possibility of flooding on relatively flat areas.

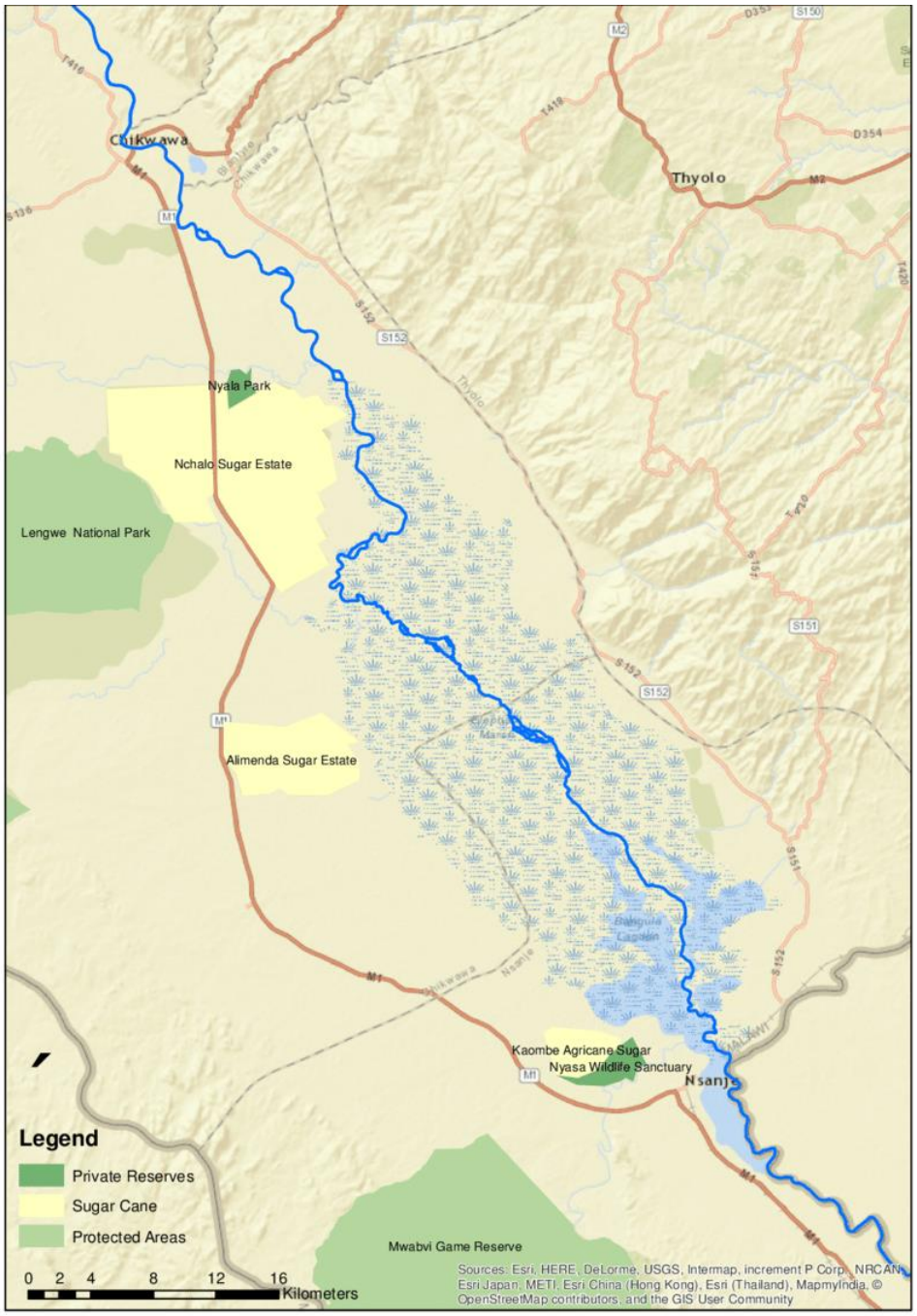

FIGURE 8-17: SHIRE RIVER AND ELEPHANT MARSH IN RELATION TO THE NCHALO SUGAR ESTATE

(Reference: https://www.researchgate.net/figure/Lower-Shire-valley-showing-the-Elephant-Marsh-and-nearby-conservation-areas-and-sugar_fig16_304579483)

In terms of groundwater within the area, as stated above, the groundwater table is relatively shallow and fluctuating seasonally between 1m – 5m. The dominant domestic water supply source for rural areas in the Shire River Basin is groundwater. The dominant aquifer type is low yielding. However, there is the high yielding alluvial aquifer of the lakeshore plains and the Lower Shire Valley. However, based on a 'fitness for purpose' assessment conducted by the Government of

Malawi in 2011, groundwater is available for most uses except large-scale arable agriculture in most aquifer areas. In other areas this includes commercial and mining purposes in the Shire River Basin.

Pollution of surface and groundwater is an issue of growing concern. There is a trend towards water quality degradation owing to the discharge of untreated effluent from domestic and industrial waste, which is compounded by inadequate waste management in the upper Shire Basin. The basin faces increased siltation, sedimentation, agrochemicals, and general and point source pollution. With increasing population pressure and growing industrialisation, the increasing disposal of effluent will increasingly impact negatively on water quality. The Lower shire Valley, in particular, is prone to groundwater contamination. As noted above, the temperatures within the lower Shire Valley and area surrounding Ncahlo, are amongst the highest in Malawi which also mean that very high evaporation rates are experienced. The high evaporation rates diminish the value of the limited rainfall available. As a result, the negative water balance may lead to an accumulation of salts in the soil profile which leads to a high salt content in groundwater.

Groundwater will however not be used for the proposed project, nor will it be affected as effluent ("blow-down) water from the boilers, will be treated by the existing oxidation pond, prior to being used for irrigation purposes.

8.6 Noise Pollution

Nchalo Illovo Sugar Estate is a factory/industry with various noise generating sources within the factory as well as surrounding area. Typical activities generating noise associated with the existing sugar plant includes the following:

- Sugarcane trucks (or tractor with wagons) arriving at the processing plant where they are weighted before the sugarcane are offloaded (trucks idling, general noise);
- Trucks delivering other raw materials (e.g., lime) and collecting products (sugar syrup, ash, mud and scum);
- The shredding of the sugar cane, with the shredded pieces conveyed to a pre-extraction mill (electric motor, gearbox);
- First extraction juice is pumped to the mixed juice tank (mill, pump);
- Sugarcane pressings are conveyed to a diffuser where it hot water is used to extract remaining sugar from the pressings (general noise). Liquid is pumped to the mixed juice tank (pump);
- Sugarcane pressings from the diffuser is send to a dewatering mill with the supernatant pumped to the mixed juice tank (mill, pump) where lime is added to assist with the clarification of the juice. Bagasse is conveyed to the boiler;
- Clarified juice is concentrated in an evaporator to obtain the sugar syrup;
- Mud from the clarifier is pressed to obtain sucrose rich water and mud cake (motor, impulsive sounds);

- Bagasse is burned in the boiler to generate steam and heat used in the process (intake fans, exhaust flue); and
- Steam is used for the generation of electricity (steam turbine in generator building) and low-value heat in the process (heat exchangers – steam venting).

There have been a few studies focusing on the noise levels in sugar mills, with measurements done by Munir (2012) measuring levels ranging between 85 – 112 dBA. Macey (1978) defined common sources of noises in a sugar mill as: preparation equipment, mill-drive gearboxes, hydraulic pumps, high-pressure fans, boiler feed pumps, steam valves, steam vents and leaks, vacuum-breaking valves, compressors, vacuum pumps, centrifuges, pneumatic tools, workshop and maintenance operations. Some of these noises are highly variable and can include:

- Sugarcane delivery and offloading. Noise levels are high and frequently have impulsive components to them;
- Cane preparation (chopping) just before the shredders (also a source of significant noise), caused by pieces of cane being fling onto the inside of the enclosure. The shredder is also moved by a high-pressure turbine creating noises with a significant acoustic energy in the higher frequencies (the proposed future changes will remove the turbines and change this to electrical motors);
- Roller mills driven by high pressure turbines operating at high speeds generating a loud piercing noise (the proposed future changes will remove the turbines and change this to electrical motors);
- Forced air blowers at the boiler house, air cooling fans and exhaust stacks;
- Noises generated at the generator building from steam turbines and generators, forced oil cooling fans and pumps (future changes in the sugar process will remove the high-pressure steam network, including the vents);
- The atmospheric venting of steam from main exhaust lines, boiler safety valves, leaks and other small vents (future changes in the sugar process will remove the high-pressure steam network, including the vents);
- Noises from various pumps, motors, compressors and exhaust of vacuum pumps; and,
- Noises generated by various mobile heavy equipment utilized in material handling and movement of other equipment.

FIGURE 8-18: CONCEPTUAL NOISE GENERATING ACTIVITIES AND EQUIPMENT OF THE EXISTING SCENARIO

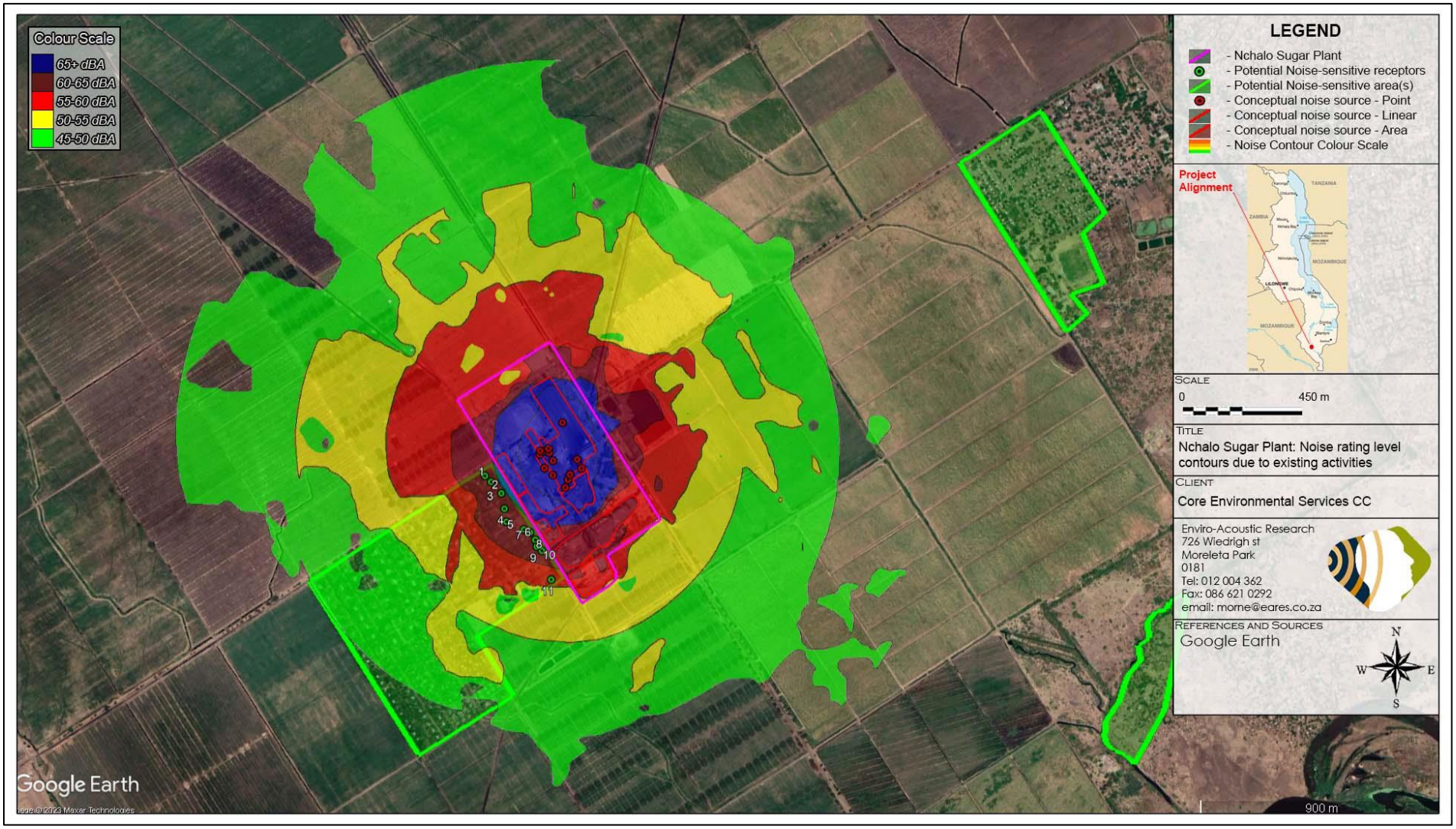

FIGURE 8-19: POTENTIAL NOISE RATING CONTOURS - EXISTING SCENARIO

Noise level monitoring was undertaken for the Nchalo Illovo Sugar Estate during 2018 and 2021 at various areas/locations within the factory and it was found that most areas within the factory were classified as having a moderate to significant risk of noise induced hearing loss, with levels exceeding 65dBA. The risk was however found to be lower within the packaging area and warehouse. Considering the noise levels measured onsite, existing noise levels were very high, typical of an industrial project area.

Exposure to noise in a work environment causes a number of physiological and psychological responses. Noise could have the following effects:

- Annoyance and speech interference;
- Interference with concentration and though processes;
- Loss of productivity;
- Sleep disturbance;
- Fatigue and aggression;
- Increasing heart rate and blood pressure;

A Noise Assessment was also undertaken as part of the ESIA process for the Cogeneration Power Plant, to determine and identify whether the proposed new Cogeneration Power Plant would have any additional impact on the current noise levels of the Nchalo Illovo Sugar Estate and surrounding area. The results of the assessment is described in Section 9.2 of the Draft ESIA Report.

8.7 Biodiversity

Terrestrial biodiversity comprises of terrestrial ecosystems, habitats and the species within them. Terrestrial ecosystems are described based on specific biomes and vegetation types. The project area falls within the Montane Grassland and Shrubland Biome within the ecoregion classified as the South Malawi Montane Forest-Grassland Mosaic which is noted as being Critically Endangered. The only Protected Area within a close proximity to the project site is the Lengwe National Park which is located approximately 12km north-west of the Nchalo Illovo Sugar Factory. The Chikwawa District is facing numerous environmental problems which adds to the impact on the biodiversity of the area. Some of these problems include deforestation due to energy demand, brick making, drying of rivers, and cultivation along riverbanks. These activities all add to the current loss of biodiversity.

The project area has already been transformed as it is proposed to be located within the footprint of the existing Nchalo Sugar Factory. The 11kV powerline is also proposed along the existing 11kV powerline route of which the area is currently being utilised for agricultural purposes up to where the 11kV powerline connects with the existing substation.

The proposed Cogeneration Power Plant and 11kV powerline will therefore have no impact on terrestrial or aquatic biodiversity, as the proposed project areas have already been modified.

FIGURE 8-20: EXISTING HIGH VOLTAGE LINE ALONGSIDE THE ACCESS ROAD OF CANE FIELD TO BE STRENGTHEN TO BE ABLE TO EXPORT POWER

The Nchalo Illovo Sugar Estate however plays an important role to enhance the improve the environment by rolling out projects which mitigates the impact on biodiversity. One of these projects are the indigenous vegetation nursery which are used for various initiatives on and off the estate for the rehabilitation of indigenous forests and the protection of riverbanks.

8.8 Socio-Economic Environment

8.8.1 Population

Nchalo is noted as one of Chikwawa District's headquarters with a total of approximately 15 300 people residing within the immediate area. The majority of the approximately 564 000 people within the Chikwawa District, resides within rural areas. From the Chikwawa District Physical Development Plan, of August 2020, it is noted that there has been a substantial increase in population size within the Chikwawa district over the past 30 years, however, this increase follows the same growth pattern as noted for the entire country of Malawi. An annual percentage growth rate of 2.5% is expected, which implies that a population of approximately 972 000 people is expected to reside within the Chikwawa District by 2040.

The Chikwawa District is sparsely populated compared to Malawi and Southern Region of Malawi in absolute terms, however, there has been a steady increase in population densities within the Chikwawa District. The Chikwawa District is also faced with high fertility rates and early marriages. According to the 2008 Malawi Population and Housing Census fertility Report projection for 2017, it is indicated that each woman in the district would bear an average of 6.2 children for the duration of her reproductive life. The geographical characteristic of the district

makes any increase in population worrisome as habitable land in the district is very limited with large areas of the land within the district taken up by estates, mountains, protected areas as well as floodplains. Illovo Sugar Nchalo covers 4% of the total district land area which adds to approximately 19 000Ha (including external growers).

In terms of the age structure, it is noted that 54.3% of the total population is below the age of 19 of which 49.3% is below the age of 18. This implies that 54.3% of the total population within the district is an economic burden on the economic active group. (Please refer to Figure 8-20 below). The district experiences issues of child labour within the informal labour group which refers mostly to people who are self-employed. Much of child labour is practised where children are sent to sell goods. It was also found that most employers in the small and medium sized enterprises, pay below the minimum wage and due to limited resources being available within the labour department, employer are taking advantage of the fact that the statutory minimum wage is not enforced.

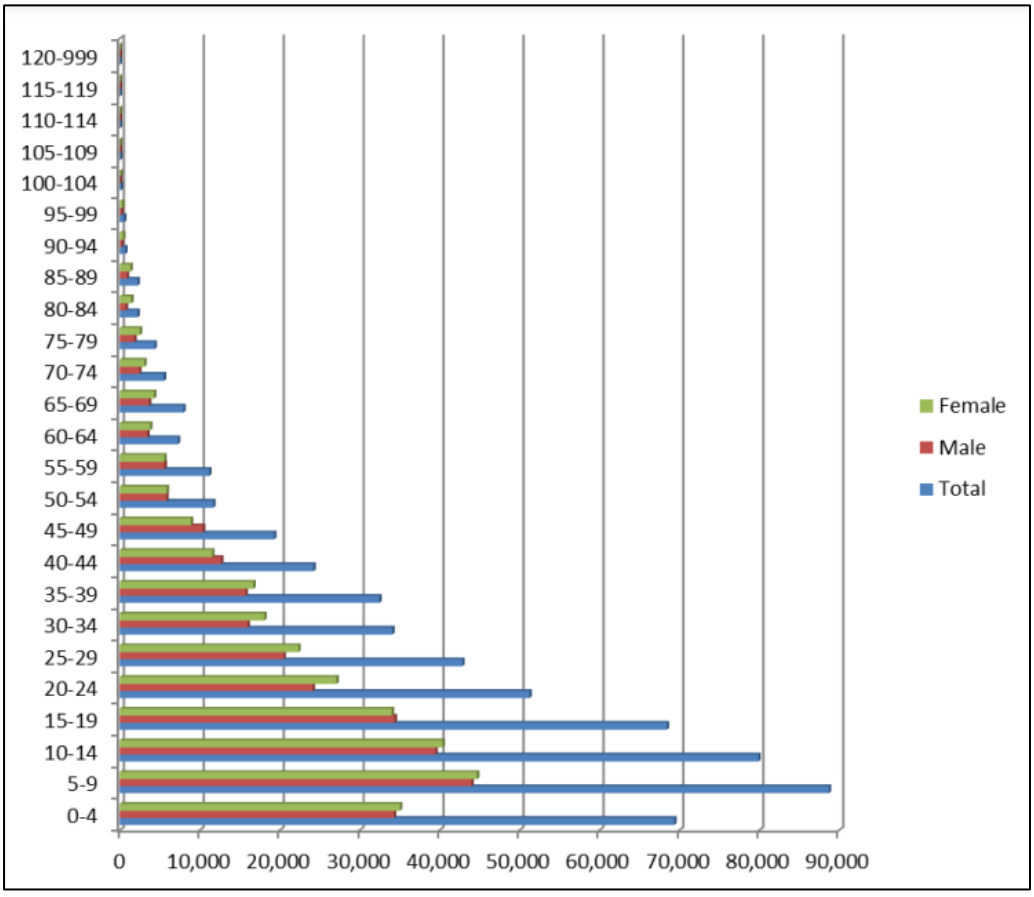

FIGURE 8-21: 2018 POPULATION AND HOUSING CENSUS FOR CHIKWAWA DISTRICT

(Source: https://svtp.gov.mw/wp-content/uploads/2021/01/CHIKWAWA-DISTRICT-PHYSICAL-DEVELOPMENT-PLAN-APPROVED-VERSION.pdf)

8.8.2 Employment and Education

In Malawi, more than two-thirds of the population lives in extreme poverty and rely on small-scale farming for their livelihoods. The poor cultivates approximately 0.5Ha which does not fulfil their daily requirements and is therefore also dependent on purchasing food. Most of their income is generated from crop sales which is limited, and therefore results in the increased sale of firewood as an energy source. Malawi also has one of the youngest populations in the world with 43% of the people under the age of 15 and therefore not economically active.

In terms of literacy, 67% of people living within Malawi was found to be literate. Adult literacy is the percentage of people ages 15 and above who can both read and write with understanding a short simple statement about their everyday life. It is noted that the literacy rate is worse among older adults and men were found to be more literate than woman. In Malawi, primary education is the highest level of education most people will achieve. The Chikwawa district has 143 preschools, 197 government primary schools and 46 government secondary schools. There are several schools in Nchalo. These include private schools where company employees' dependants pay subsidised fees, and the rest are government schools. However, some company employees prefer to send their children to schools further from Nchalo.

Agriculture is the mainstay of the economy, contributing close to a third of the country's GDP and employing approximately 70% of the workforce. Illovo Sugar Malawi has two factories within the country, namely Nchalo within the southern region as well as Dwangwa within the central region of the country. Within Chikwawa District, Nchalo Illovo Sugar Estate occupies the largest land used for agricultural purposes within the Chikwawa. This also results to Nchalo Illovo Sugar Estate being the largest employer within the district with approximately 3000 employees. Illovo Sugar also provides accommodation for all permanent staff members.

8.8.3 Infrastructure, Services and Facilities

- Roads

The road from Blantyre to Nchalo is in good shape and is classified as a main road. Recent floods in 2022 washed away some sections of the road, however, these sections have been re-established.

Within Chikwawa District, there are two manufacturing companies of which frequent movement of cargo is experienced on the main roads. These companies include Illovo Sugar and Presscane. Presscane is a company which specialises in the production of Ethanol of which the raw materials required are, coal and molasses. Molasses is supplied by Illovo and delivered to Presscane by tankers.

The roads from the Nchalo Illovo Sugar main gate up to the Nchalo sugar mill (approximately 4 km inland) are all privately owned by Illovo Sugar. These roads are used by employees of Illovo

Sugar and also by trucks delivering cane or any other goods to the factory. These roads can accommodate heavy moving vehicles.

- Housing

Malawi has approximately 4.8 million housing units of which 58% are sub-standard homes comprising of mud walls and grass thatched roof. Most of these families live with little hope of being able to afford better housing. To meet the current demand for housing within Malawi, approximately 21 000 new housing units must be constructed for the next 10 years.

Illovo however, provides housing for most of their direct employees.

- Sanitation and Waste Management

As of 2015, only 42% of Malawian rural households had access to basic sanitation services. Consequently, in 2018 there were 9.9 million people in Malawi who did not use basic sanitation. Combined with poor transportation infrastructure, this lack of local sanitation facilities places strain on rural communities. Communities that do not have secure access to water, predominantly rural communities, are reliant on local sanitation facilities to stay clean and healthy. Thus, without such facilities, the risks of experiences the consequences of poor sanitation increase dramatically.

Within the Nchalo Illovo Sugar Estate, access to potable water and proper sanitation facilities are however provided.

In terms of waste generation and disposal, the most common waste management practice in Malawi is reuse. Reuse practices in Malawian households are diverse: most waste items get reused multiple times before being discarded. Research has shown that the overwhelming motivator for reusing items is economic incentive, because it is cheaper to reuse a product than to buy a new one that does the same function. Electricity

Malawi is one of the least electrified countries globally, with 42% of the urban and only 4% of the rural population connected to electricity. Primary energy supplies of the country consist of hydropower, biomass, petroleum products, coal and other renewable energy sources. In terms of energy supply, the Malawi Energy Policy indicates that approximately 85% of energy comes from biomass largely exploited in a non-sustainable manner which is mainly leading to deforestation at the moment.

The Nchalo Illovo Sugar factory is however well serviced with electricity, which is currently being generated by the burning of bagasse. This supply of electricity is however not sufficient and therefore electricity is also being supplied by ESCOM.

Associated with the construction of the Cogeneration Power Plant is the replacement of the 11kV powerline that will run along the existing alignment which currently runs along the dirt road towards the substation.

The proposed structures and infrastructure will enable Ncahlo Illovo Sugar Factory to become completely self-sufficient as the Cogeneration Power Plant will generate sufficient electricity for the operation of the Nchalo Sugar Estate, with the remainder of the electricity generated being exported to the national grid.

- Water

Within Malawi, approximately 76% of Malawi's households have access to drinking water, however distribution among districts and between urban and rural areas, is uneven. In rural areas, approximately 37% of households spend 30 minutes or more to fetch drinking water in comparison to 13% in urban areas. Poor sanitation and hygiene are the major contributors to the burden of disease and child survival and having limited access to water adds to the level of sanitation.

Within the Nchalo Illovo Sugar Estate and in accordance with the licences issued for surface water abstraction (SL 3/2008, SL 656/1979, SL 393/1973, SL 4/2008), water used in the estate is pumped from the Shire River, filtered and treated in-house to be used for domestic, irrigation and industrial purposes.

8.8.4 Health Care

- Hospitals and Clinic

Nchalo is serviced by a private hospital, known as the Saint Montfort Hospital, located to the west of the Nchalo Illovo Sugar Estate.

ISM also has a clinic which provides health care for its employees and surrounding communities. The hospital also provides occupational health and safety services for ISM employees. Such services are also provided for surrounding businesses at cost. The Nchalo Sugar Hospital provides Employee Assistance Programs for health issues including HIV/AIDS, TB, diabetes, hypertension, malaria etc.

There are currently three satellite clinics located in Nchalo Sugar Sections to provide convenient health care for company employees and their dependants in order to attend to immediate requirements since the hospital is far away from certain villages.

- Occupational Health

ISM has a functional occupational health program which monitors employees' health against workplace exposures. This is done through medical examination programs for occupational health which include pre-employment, periodic and exit medical examinations. These medicals entail a full physical medical examination, urinalysis, vision screening, lung function and audiometric testing for all seasonal and permanent employees depending on the type of job and the workplace exposures/risks for the job.

Heat stress and exposure to particulates are some of the main health and safety impacts currently experienced with the existing boilers. The proposed Cogeneration Power Plant, with improved boiler technology will have a significant positive impact on both of these health and safety risks on employees as well as the surrounding community.

8.8.5 Vulnerable Groups

Malawi, and specifically Nchalo has various vulnerable groups which are to be considered within the ESIA for the proposed Cogeneration Power Plant. These vulnerable groups include the following:

- Subsistence dependent households:

Poverty rates in Malawi is high with 51% living below the national poverty line, being dependent on subsistence farming for survival. These groups are heavy reliant on rainfed agriculture and therefore heavily affected by climate shocks such as drought or flooding. These households have little to no source of income.

- Woman and children

It is often women who require social protection interventions, as they are disproportionately vulnerable due to lack of capital, high wage differentials and gendered work norms, bearing the responsibility for childcare, and exclusion from basic services. Women and children are among the most vulnerable populations in the world, suffering the most from illness, poverty, and disparity. Women are also more likely to live in poverty than men and commonly have less schooling, decision-making power, and access to finance. Woman and children are also the groups mostly affected by family violence.

- Female headed households

Female headed households are highly vulnerable and experience many problems such as low income, widespread economic problems, mental, neurological and physical disorders and isolation.

- Elderly

Certain problems common in old age creates vulnerability. These include, decreased strength, poor tolerance of physical activity. Functional limitations and decreased sensory awareness. These problems also affect the elderly in being able to provide for themselves.

- Youth

Youth tend to get involved in high-risk behaviours making themselves susceptible to criminal offences, accidents, physical injuries, emotional trauma and medical problems. Young people are

more vulnerable than adults to sexual, physical and verbal abuse because they are less able to prevent or stop such manifestations of power.

- Mentally and physically disabled

People with disabilities, like other marginalized groups, are particularly vulnerable to violence and abuse in the home or in public places. Certain disabilities, particularly physical disabilities, may decrease their ability to physically defend themselves and escape from abuse. Other disabilities can limit a person's ability to understand and recognise potential signs of abuse.

9. SUMMARY OF SPECIALIST ASSESSMENTS UNDERTAKEN

To adequately describe and assess the potential environmental and social impacts associated with the project, a number of specialist studies were undertaken as part of the ESIA. These studies focused on the project area as well as other areas affected by the proposed project. A summary of the findings of the specialists' assessments are provided below.

9.1 Air Quality Impact Assessment

9.1.1 Introduction

An Air Quality Impact Assessment was undertaken by EHRCON (Pty) Ltd to assess the air quality impact associated with the newly proposed Cogeneration Project at the Nchalo Sugar Mill of Illovo Sugar Africa in Malawi. As noted, the existing equipment installed and currently being operated is not efficient and the emission levels are non-compliant with the new Malawian Ambient Air Quality Standards and Emission Limits (MS 737-1:2021).

The proposed project will replace the existing inefficient equipment and install a technologically advanced equipment as per the project description noted in Section 2 of this ESIA document.

The objectives of the air quality impact study were to describe the ambient emissions from the newly proposed Nchalo Cogeneration Project and to assess the impact on the health of the receiving community. The findings of the study are aimed at providing Illovo Sugar Africa (Malawi), the Environmental Affairs Department of Malawi and other stakeholders with scientific data required in terms of present and future air quality management systems.

The Air Quality Impact Assessment considered a review of the relevant health legislation, and ambient air quality guidelines and standards. The legal context, policies and regulations applicable to air quality limits and management have been included in Section 4 of the Draft ESIA Report. An evaluation of the potential for human health and environmental impacts, centred on comparisons of modelled pollutant concentrations with relevant guidelines and standards was

performed. An assessment of the contribution and outcome of the process on the current air quality, completed the study.

9.1.2 Emission Inventory

Construction

Heavy construction is a source of dust emissions that may have substantial temporary impact on local air quality. Building and road construction are two examples of construction activities with high emissions potential. Dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A large portion of the emissions result from equipment traffic over temporary roads at the construction site.

Sugar Cane Processing Emissions

Fugitive dust is generated by cane handling operations at the sugar mill.

Particulate matter (PM) and volatile organic compounds (VOC) are the primary pollutants emitted from the sugarcane processing industry. Potential emission sources include evaporators, clarifier, vacuum pans, sugar handling and packaging, bulk loadout operations, and boilers. Potential sources of PM emissions include sugar packaging operations. The evaporators, clarifier and vacuum pans are a potential source of VOC emissions.

Bagasse Stockpiling Emissions

Large scale sugarcane bagasse storage in uncovered stockpiles has the potential to result in hazards associated with nuisance dust and spontaneous combustion.

Smaller bagasse fibres called ‘pith’ are liberated during the process of sugarcane shredding and milling. On a dry, water insoluble basis, the resulting bagasse consists of about 30–40% pith and fibre bundles. The smaller pith fibres are more likely to become and remain airborne during typical bagasse stockpiling operations than other bagasse fibres.

Cogeneration Power Plant Emissions

The most significant pollutant emitted by bagasse-fired boilers is particulate matter, caused by the turbulent movement of combustion gases with respect to the burning bagasse and resultant ash. Emissions of sulphur dioxide (SO_2) and nitrogen oxides (NOx) are lower than conventional fossil fuels due to the characteristically low levels of sulphur and nitrogen associated with bagasse.

Auxiliary fuels (typically fuel oil or natural gas) may be used during startup of the boiler or when the moisture content of the bagasse is too high to support combustion; if fuel oil is used during these periods, SO_2 and NOx emissions will increase. Soil characteristics such as particle size can affect the magnitude of particulate matter (PM) emissions from the boiler. Cane that is improperly washed or incorrectly prepared can also influence the bagasse ash content. Upsets in combustion

conditions can cause increased emissions of carbon monoxide (CO) and unburned organics, typically measured as volatile organic compounds (VOCs) and total organic compounds (TOCs).

Vehicle Transport Emissions

When a vehicle travels on an unpaved road, the force of the wheels on the road surface causes pulverisation of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

9.1.3 Pollution Sources and Receptors

The outdoor sources of air pollution resulting from human activities comprise three broad categories.

Stationary sources can be subdivided into; rural area sources, e.g. agriculture, mining and quarrying and industrial point and area sources, e.g. manufacturing of chemicals, non-metallic mineral products, basic metal industries and power generation.

Community sources i.e., heating of homes and buildings, municipal waste and sewage sludge incinerators, fireplaces, cooking facilities, laundry services and cleaning plants.

Mobile sources include sources such as combustion-engine vehicles, e.g. light duty petrol-powered cars, light and heavy-duty diesel-powered vehicles, motorcycles, aircraft and line sources such as fugitive emissions from vehicle traffic.

Nchalo Sugar Mill Receptors

Sensitive receptors were selected on the basis of proximity to the project and the closest receptors in the eight main wind directions were included. Receptors mainly comprised villages and commercial establishments up to a distance of 5 km from the operations. Table 9-3 and Figure 9-1 provides a summary of the closest receptors associated with the Nchalo Sugar Mill.

TABLE 9-1: NCHALO SUGAR MILL RECEPTORS

Description	Direction from Operations	Distance from Operations
R1 – Illovo Village: Bonksville Lat -16.223842°, Lon 34.885164°	North-west (346°)	3.45 kilometres
R2 – Ndirande Village Lat -16.235463°, Lon 34.912778°	North-east (45°)	2.94 kilometres
R3 – Illovo Village: Kalulu Lat -16.248315°, Lon 34.910145°	East (71°)	1.93 kilometres
R4 – Materekera Village Lat -16.259380°, Lon 34.914480°	South-east (104°)	2.37 kilometres
R5 – Illovo Village: Riverside Lat -16.276053°, Lon 34.908606°	South (146°)	2.96 kilometres
R6 – Illovo Factory Village Lat -16.255679°, Lon 34.891111°	South (226°)	0.28 kilometres
R7 – Nchalo Village Lat -16.256250°, Lon 34.869286°	South (264°)	2.56 kilometres
R8 – Pangilesi Village Lat -16.238353°, Lon 34.852901°	North-west (292°)	4.63 kilometres

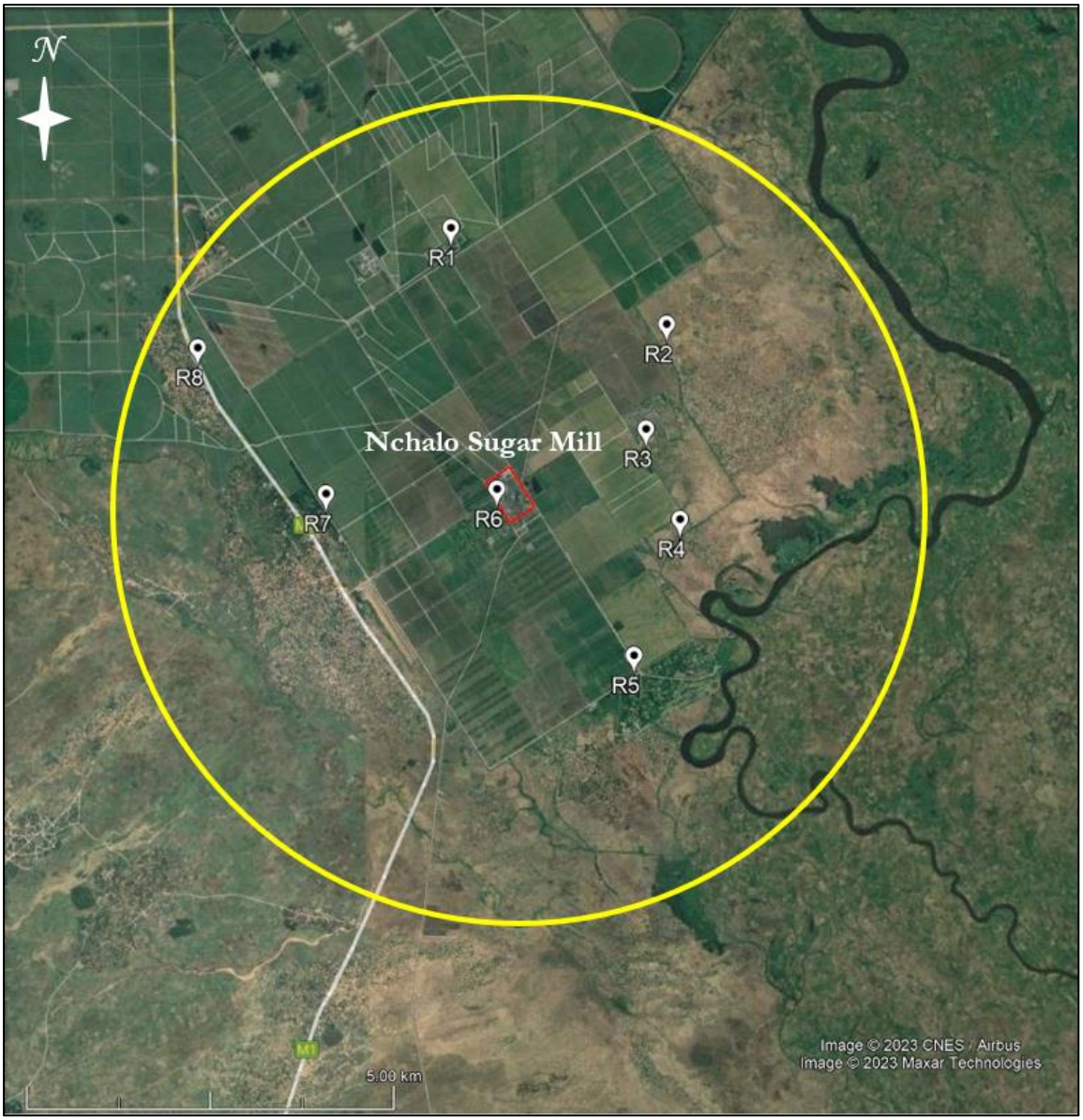

FIGURE 9-1: NCHALO SUGAR MILL (RED POLYGON), RECEPTORS AND STUDY AREA (YELLOW CIRCLE)

9.1.4 Assessment of Air Quality Impact

Dispersion results–for current - and future operations following replacement of the existing cogeneration process at Nchalo Sugar Mill are presented for the following scenarios:

- Daily and annual average total suspended particulates (TSP)
- Daily and annual average PM_{10} concentrations
- Annual average $PM_{2.5}$ concentrations
- Daily average nitrogen dioxide concentrations

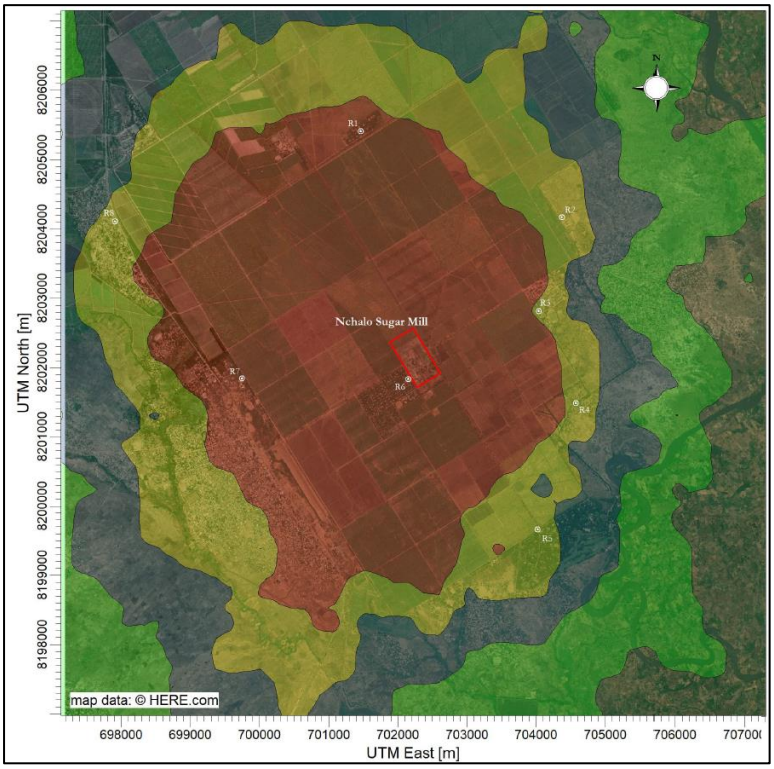

FIGURE 9-2: CURRENT DAILY AVERAGE TSP CONCENTRATION

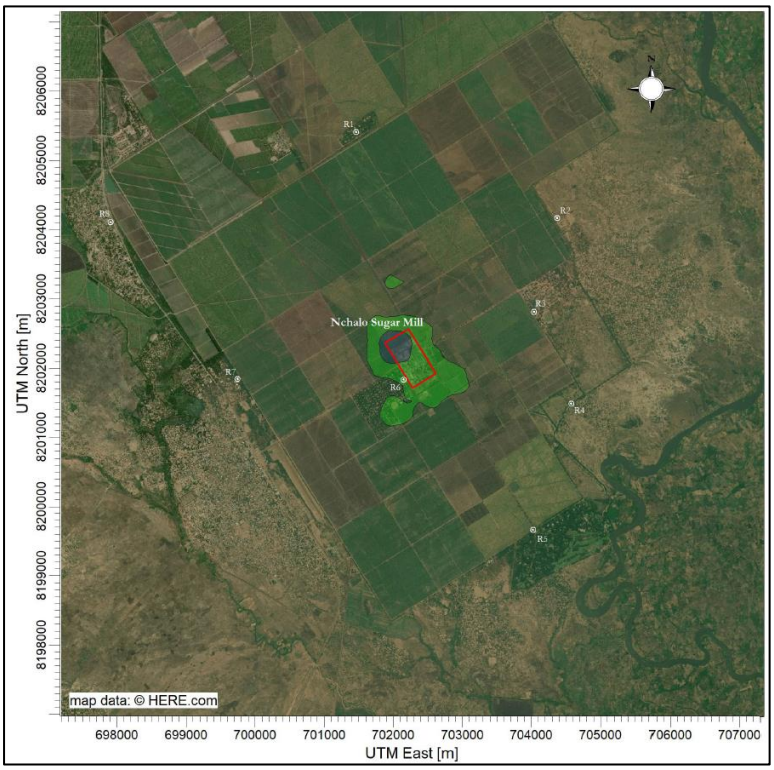

FIGURE 9-3: FUTURE DAILY AVERAGE TSP CONCENTRATION

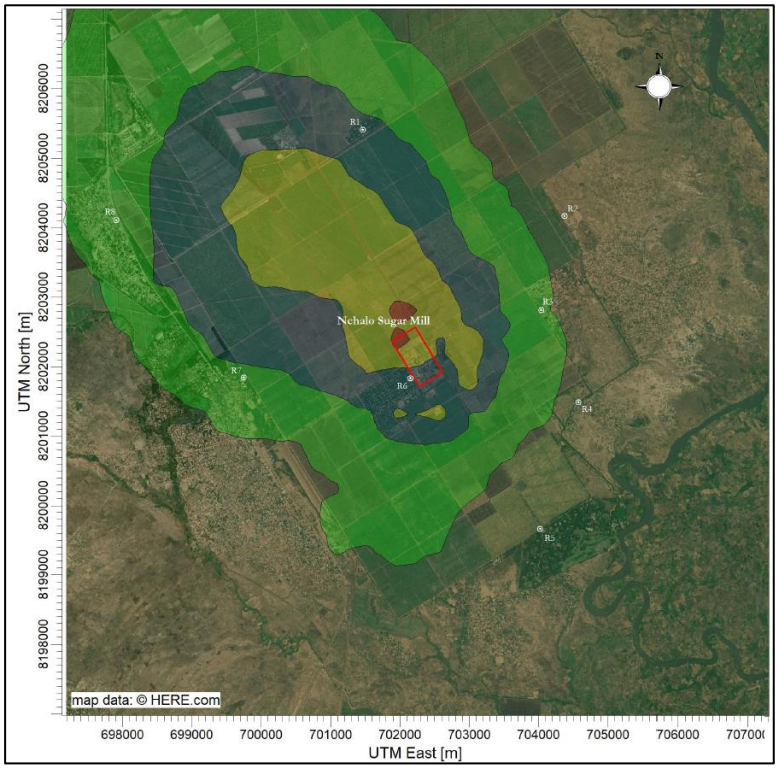

FIGURE 9-4: CURRENT ANNUAL AVERAGE TSP CONCENTRATION

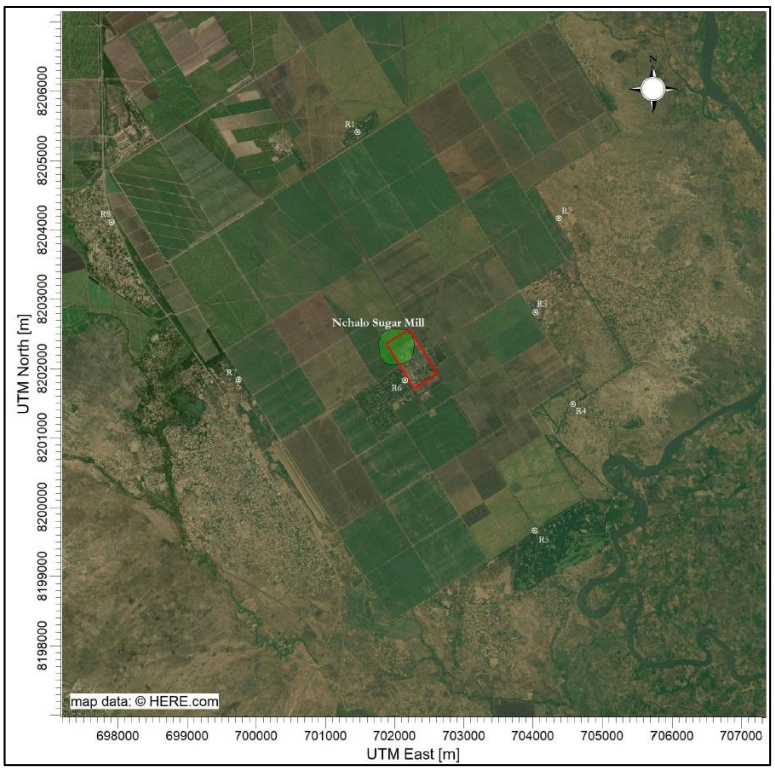

FIGURE 9-5: FUTURE ANNUAL AVERAGE TSP CONCENTRATION

Current daily average TSP concentrations (Figure 9-2) probably exceed the 230 µg/m^3 standard up to a distance of 4km beyond the process boundary. The impact area includes the closest

residential receivers north and west of the mill, including Illovo Village Bonksville (R1), Illovo Factory Village (R6) and Nchalo Village (R7). Annual average TSP concentrations (Figure 9-3) may exceed the standard in an isolated area up to 400m beyond the northern boundary. TSP concentrations at the Illovo Factory Village (R6) located on the Nchalo Plantation currently range between 25 and 50% of the standard and between 10 and 25% at the surrounding communities.

Daily and annual average TSP concentrations are expected to reduce by as much as 83% following commissioning of the new cogeneration plant. No contraventions of the TSP standard are expected anywhere in the study area. TSP concentrations at the Illovo Factory Village (R6) will probably range between 10 and 25% of the daily standard and below 10% for the annual standard.

Fugitive emissions account for less than 18% of the total site particulate emissions at present and controlled emissions, 82%. The improvements brough about by the new cogeneration plant will probably result in the contribution of fugitive sources increasing to almost 57% and controlled emissions reducing to about 43% of the site total emissions in the future.

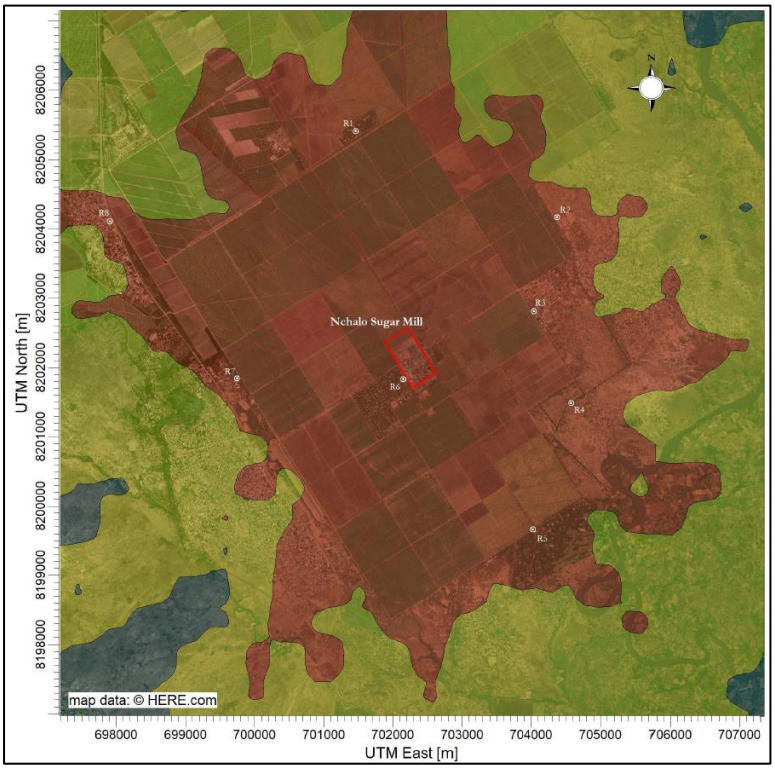

FIGURE 9-6: CURRENT DAILY AVERAGE PM_{10} CONCENTRATION

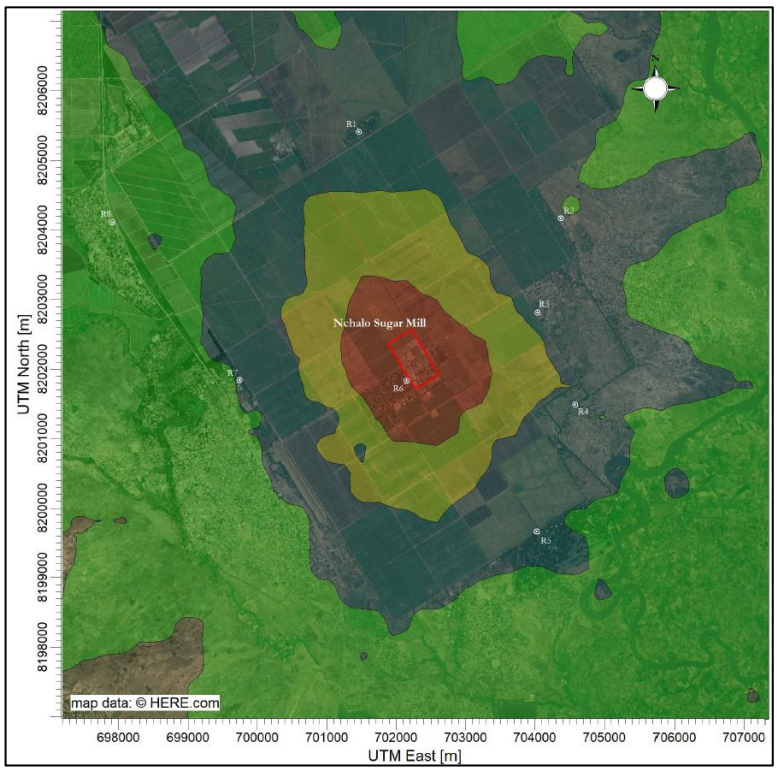

FIGURE 9-7: FUTURE DAILY AVERAGE PM_{10} CONCENTRATION

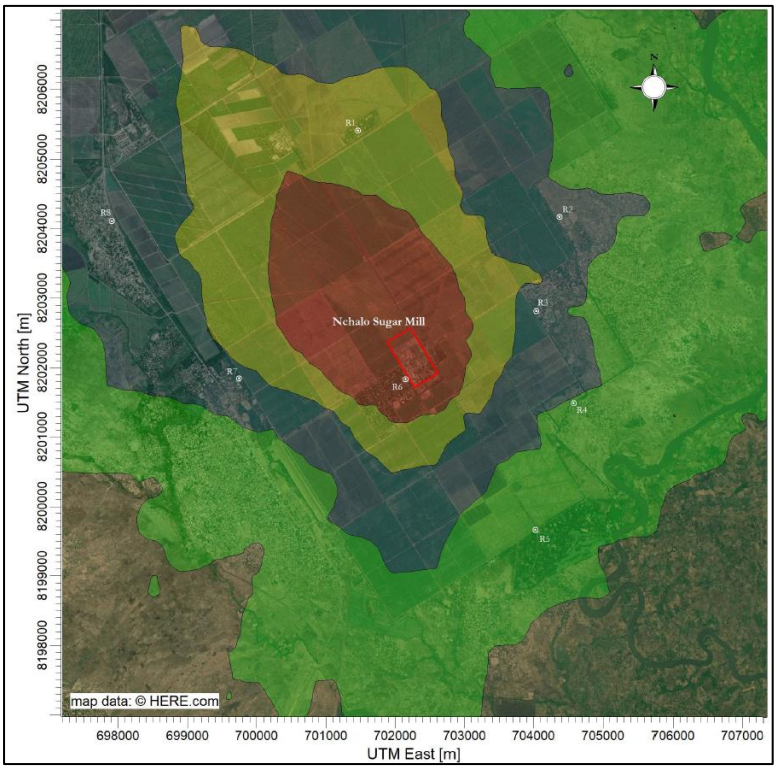

FIGURE 9-8: CURRENT ANNUAL AVERAGE PM10 CONCENTRATION

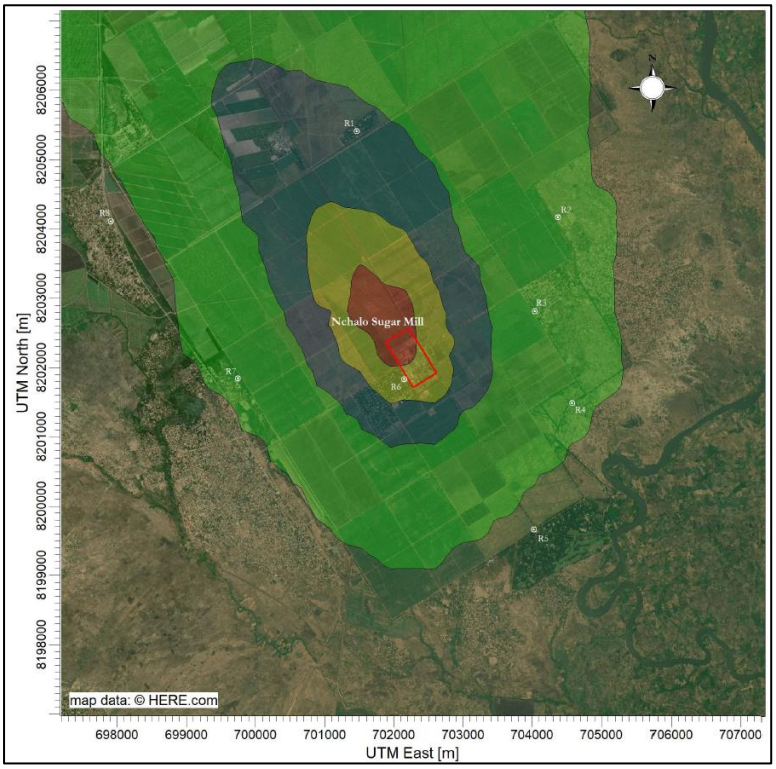

FIGURE 9-10: FUTURE ANNUAL PM_{10} CONCENTRATION

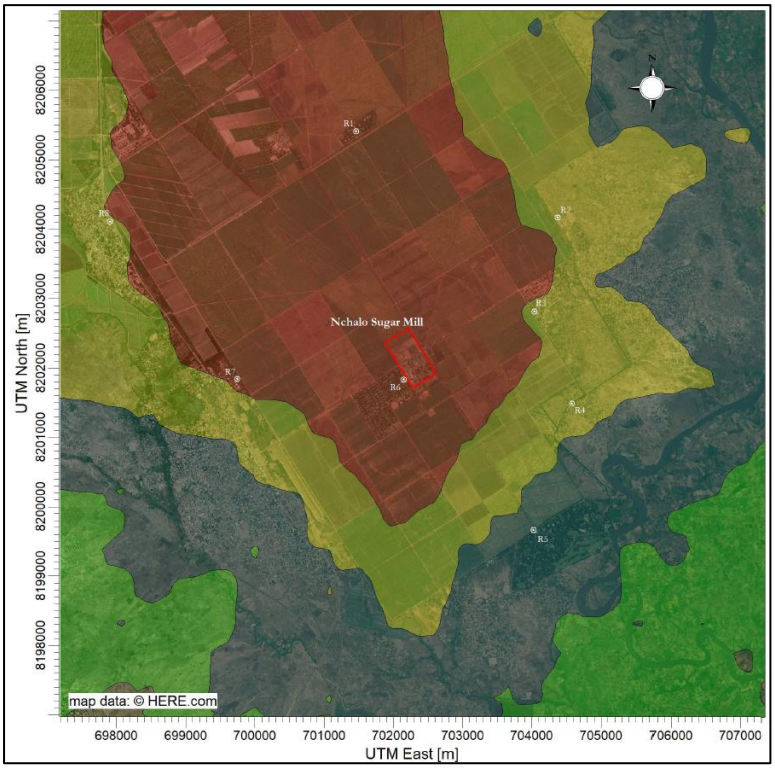

FIGURE 9-11: CURRENT ANNUAL $PM_{2.5}$ CONCENTRATION

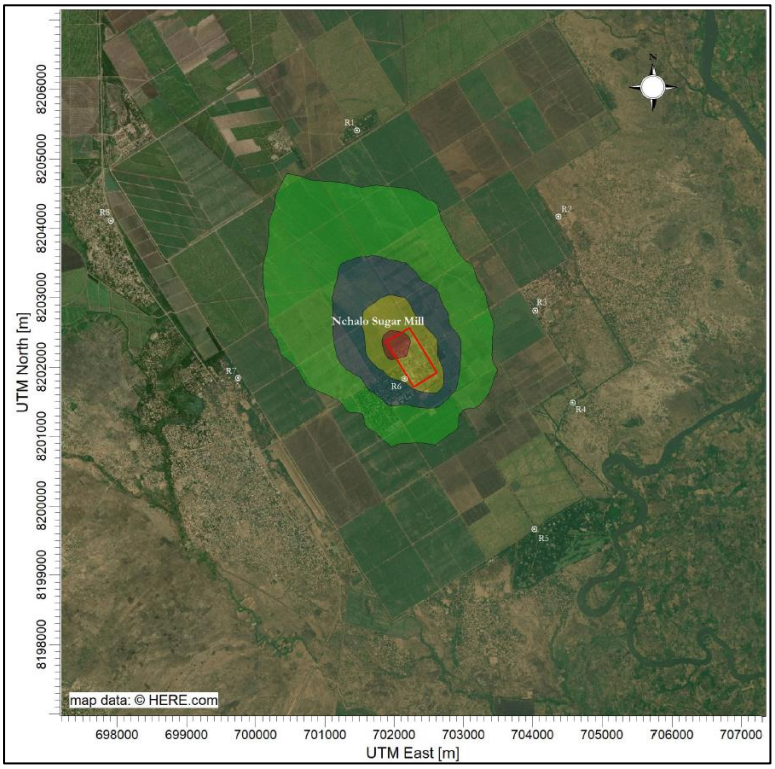

FIGURE 9-12: FUTURE ANNUAL AVERAGE $PM_{2.5}$ CONCENTRATION

At present, $PM_{10/2.5}$ concentrations probably exceed the respective daily limits over an area of almost 20 square kilometres surrounding the mill. The impact area includes all the closest receivers, Illovo Village Bonksville (R1), Ndirande Village (R2), Illovo Village Kalulu (R3), Materekera Village (R4), Illovo Village Riverside (R5), Illovo Factory Village (R6), Nchalo Village (R7) and Pangilesi Village (R8). Annual contraventions are most likely downwind of the mill, towards the north west, but also includes the closest receivers east and west, Illovo Village Bonksville (R1), Illovo Factory Village (R6) and Nchalo Village (R7).

Notwithstanding the fact that the planned improvement project will most likely reduce the $PM_{10/2.5}$ impact by as much as 90%, contraventions of the daily and annual standards remain likely at the Illovo Factory Village (R6). This is due to the incremental contribution of fugitive sources on the site, not influenced by the planned improvement project.

FIGURE 9-13: CURRENT DAILY AVERAGE NITROGEN DIOXIDE CONCENTRATION

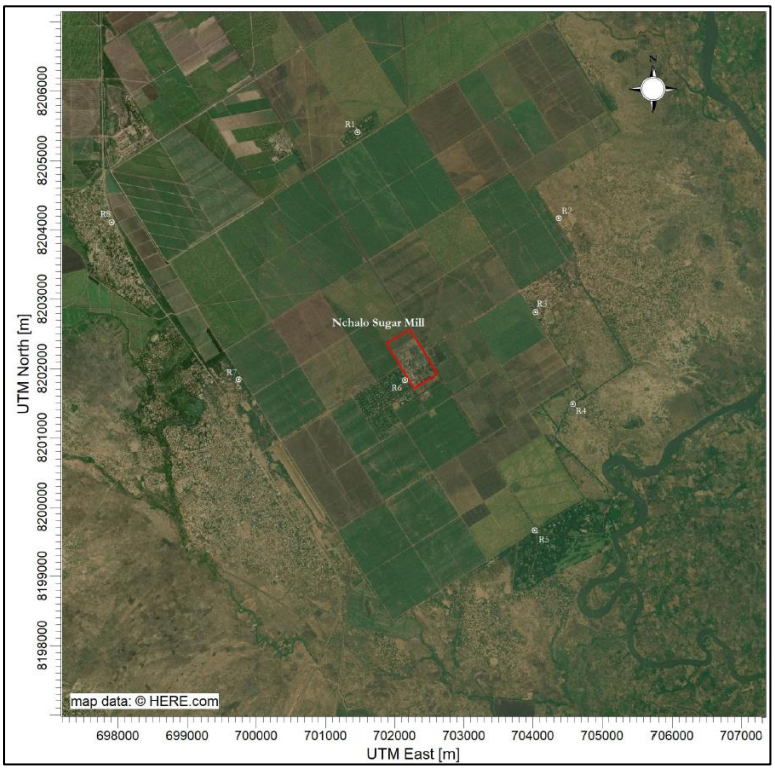

FIGURE 9-14: FUTURE DAILY AVERAGE NITROGEN DIOXIDE CONCENTRATION

Hourly, daily and annual simulations were performed for nitrogen dioxide, carbon monoxide and total volatile organic compounds (TVOCs).

Current nitrogen dioxide concentrations may exceed 25% of the 110 µg/m^3 standard, onsite and immediately northwest of the site. These, slightly elevated concentrations, will most likely not be present after the improvement project.

All other predictions yielded results below 5% the relevant ambient air quality standards for all reference periods.

From the impact significance analysis for the Nchalo Sugar Mill the following observations can be made:

The negative impact of particulate pollutants is currently minor at all the closest receivers identified during the study. The new cogeneration process will reduce the particulate impact to negligible at all the receivers, except at the Illovo Factory Village (R6) directly bordering the mill towards the southwest. Industry standard emission control techniques and administrative measures should be supplemented with engineering measures to maintain the residual impact to lowest possible levels. These measures should specifically focus on fugitive dust sources following the installation of the new cogeneration plant.

The negative impact of gaseous pollutants presently, and in the future, is negligible at the closest receivers identified. Current industry standard techniques and administrative control measures should be maintained to ensure the residual impact at the nearest sensitive receivers remains at current background levels.

9.1.6 Mitigation Measures

According to SANS 1929:2009 the concentrations of specific pollutants within an area shall be evaluated against the following thresholds to determine applicable assessment methods:

- Upper assessment threshold, i.e. the 99th percentile pollutant levels represent a pollutant value exceeding 70% of a limit value (considering limit values for all periods which have been used to derive averages).
- Lower assessment threshold, i.e. the 99th percentile pollutant levels represent a pollutant value below 50% of all limit values (considering limit values for all periods which have been used to derive averages).

Provision should be made for three air pollutant concentration assessment methods, based on the classification pollutant concentrations relative to the upper and lower assessment thresholds. These methods are:

- Mandatory monitoring, which may be supplemented by modeling techniques to provide an adequate level of information on ambient air quality. This method should be implemented where the upper assessment threshold for a specific pollutant is exceeded.
- A combination of measurement and modeling techniques should be implemented in areas and for pollutants for which concentrations are between the upper and lower assessment thresholds.

- The sole use of modelling or objective estimation techniques is permissible for pollutant concentrations below the lower assessment threshold.

The classification to determine applicable assessment methods should be based on air pollutant concentrations recorded during the previous five years where data is available.

In view of the predicted ambient pollutant concentrations resulting from emissions from the Nchalo Sugar Mill, the installation of at four fence-line and three residential dust deposition gauges are recommended. The fence-line monitors should be located downwind of the operations. The proposed monitoring locations are indicated in Figure 9-15 and described in Table 9-2.

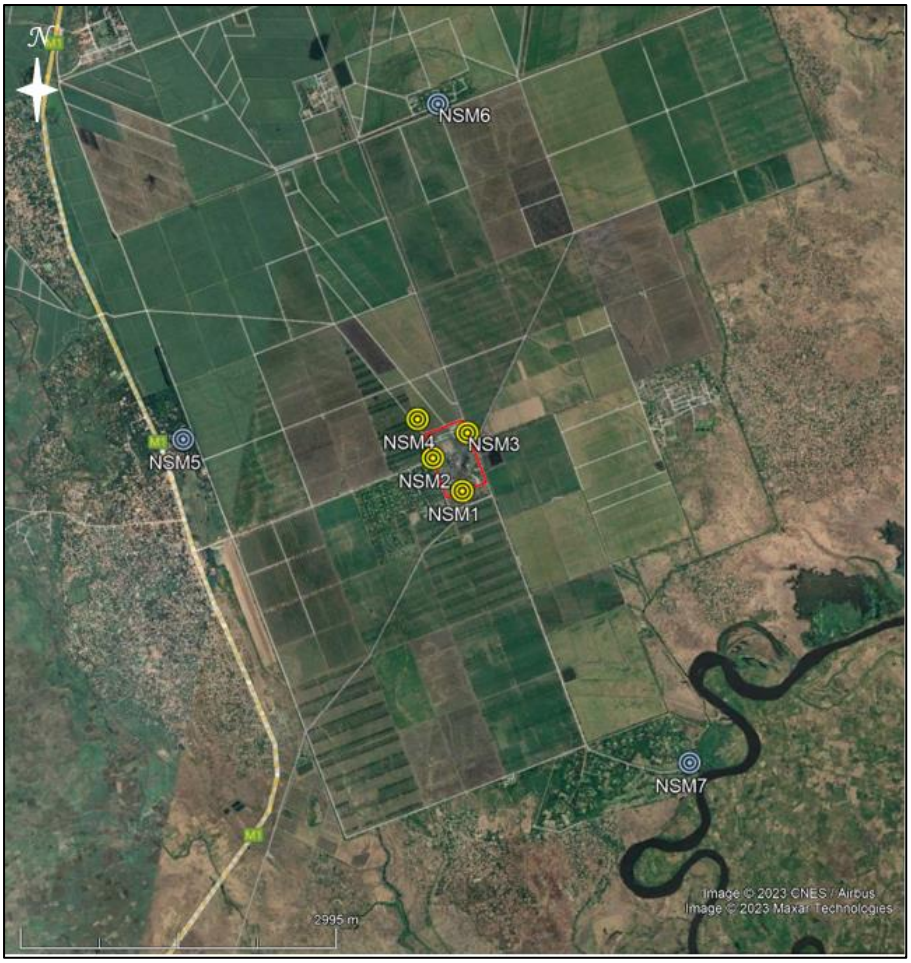

FIGURE 9-15: NCHALO SUGAR MILL PROPOSED MONITORING LOCATIONS

TABLE 9-2: NCHALO SUGAR MILL MONITORING MATRIX COORDINATES

Monitoring Station	Coordinates	Action	Classification
NSM1 Sugarcane Receiving Gate	lat -16.256136° lon 34.894034°	New gauge	**Fence-line Non -residential**
NSM2 Water Treatment Plant	lat -16.253883° lon 34.890882°	New gauge	**Fence-line Non -residential**
NSM3 Product Dispatch Gate	lat -16.251169° lon 34.893418°	New gauge	**Fence-line Non -residential**
NSM4 Bagasse Storage Area	lat -16.250895° lon 34.888830°	New gauge	**Fence-line Non -residential**
NSM5 St Montfort Hospital	lat -16.256654° lon 34.868788°	New gauge	**Receptor Residential**
NSM6 Illovo Village: Bonksville	lat -16.224139° lon 34.884896°	New gauge	**Receptor Residential**
NSM7 Nchalo Sport Club	lat -16.274945° lon 34.918757°	New gauge	**Receptor Residential**

The project will have to comply with the most stringent standards as noted within the Malawian Ambient Air Quality Standards (MS 737:2021), WHO Air Quality Guidelines (2021) and IFC Environmental, Health and Safety Guidelines (2008).

The related ambient air quality standards and guidelines are noted in Table 9-5 below. Table 9-6 contains the related stationary source emission limits.

TABLE 9-3: AMBIENT AIR QUALITY STANDARDS AND GUIDELINES

Pollutant	Average Time	Malawi Air Quality Standards	WHO Air Quality Guidelines[1]
Nitrogen dioxide (NO_2) mg/m^3	1 hour	290	-
	24 hours	110	**25**
	1 year	-	**10**
Sulphur dioxide (SO_2) mg/m^3	1 hour	350	-
	24 hours	150	**40**
	1 year	50	-
Total suspended particles (TSP) mg/m^3	24 hours	230	-
	1 year	90	-
Particulate matter (PM_{10}) mg/m^3	1 hour	300	-
	24 hours	150	**45**
	1 year	50	**15**
Particulate matter ($PM_{2.5}$) mg/m^3	24 hours	25	**15**
	1 year	8	**5**

Notes:
Values in **BOLD** indicate most stringent standards.
mg/m^3 : Milligram per cubic meter air.

TABLE 9-4: STATIONARY SOURCE EMISSION LIMITS

Substance or Mixture of Substance	Plant Status	Malawi Standard Emission Limits Solid [illegible] Maximum Allowable Limit (mg/Nm^3) [illegible] All installation with design capacity equal to or greater than 50MW heat input per	Airshed Status	IFC Environmental, Health and Safety [illegible] mg/Nm^3 Nm^3 is at 1 Atmospheric [illegible] Solid Fuels (Plant > 50 MWth to < 600 MWth)
Particulate Matter	New	50	NDA	**50**
	Existing	100	DA	**30**
Oxides of Nitrogen, NOx (expressed as NO_2)	New	750	NDA	**510 or up to 1100 if volatile matter of fuel <10%**
	Existing	1100	DA	**200**
Sulphur Dioxide (SO_2)	New	**500**	NDA	900 -1500
	Existing	3500	DA	**400**

Notes:
Values in **BOLD** indicate most stringent standards.
mg/Nm^3 : Milligram per cubic meter air.
NDA : Non-degraded airshed.
DA : Degraded airshed (poor air quality).
Airshed should be considered as being degraded if nationally legislated air quality standards are exceeded or, in their absence, if WHO Air Quality Guidelines are exceeded significantly.

9.2 Noise Impact Assessment

9.2.1 Introduction

A Noise Impact Assessment was undertaken by Enviro-Acoustic Research (EAREA) cc, to determine the potential noise impact on the surrounding environment caused by the proposed cogeneration project. Noise can be defined as "unwanted sound", and an audible acoustic energy that adversely affects the physiological and/or psychological well-being of people, or which disturbs or impairs the convenience or peace of any person.

Noise does not need to be loud to be considered “disturbing”. One can refer to a dripping tap in the quiet of the night, or the irritating “thump-thump” of the music from a neighbouring house at night when one would like to sleep.

Severity of the annoyance depends on factors such as:

- Background sound levels, and the background sound levels the receptor is used to;
- The manner in which the receptor can control the noise (helplessness);
- The time, unpredictability, frequency distribution, duration, and intensity of the noise;
- The physiological state of the receptor; and
- The attitude of the receptor about the emitter (noise source).

9.2.2 Legal Context, Policies and Guidelines

The Constitution of the Republic of Malawi, 1995, is the supreme law of the country. The Constitution recognises that responsible environmental management can make an important contribution towards achieving sustainable development, improved standards of living, and conservation of natural resources (SADC, 2012). The Constitution states that the environment of Malawi should be managed in order to (SADC, 2012):

- Prevent the degradation of the environment;
- Provide a healthy living and working environment for the people;
- Accord full recognition of the rights of future generations by means of environmental protection; and
- Conserve and enhance biological diversity.

No noise standards could be located for Malawi covering environmental acoustics. For this reason, the legal context used for the assessment of the noise impact includes the Equator Principles and IFC: General EHS Guidelines – Environmental Noise Management.

Equator Principles

The Equator Principles (EPs) are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Equator Principles Financial Institutions (EPFIs) commit to not providing loans to projects where the borrower will not or is unable to comply with their respective social and environmental policies and procedures that implement the EPs. The participating banks chose to model the Equator Principles on the environmental standards of the World Bank (1999) and the social policies of the International Finance Corporation (IFC).

IFC: General EHS Guidelines – Environmental Noise Management

These guidelines are applicable to noise created beyond the property boundaries of a development that conforms to the Equator Principle.

It states that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at source.

It goes as far as to propose methods for the prevention and control of noise emissions to ensure compliance with the Noise Level Guidelines as stipulated in Table 9-5 below:

TABLE 9-5: NOISE LEVEL GUIDELINES IN ACCORDANCE WITH THE IFC STANDARDS

Receptor type	One hour L_{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Night-time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

9.2.3 Potential Noise Sources during Operation

The following sound power emission levels were used for modelling the proposed noise impact on the surrounding environment:

TABLE 9-6: EQUIPMENT LIST AND SOUND POWER EMISSION LEVELS USED FOR MODELLING

Equipment	Sound power level, dB re1 pW, in octave band, Hz							SPL
Centre frequency	63	125	250	500	1000	2000	4000	(dBA)
Construction and WTG equipment and activities								
Air compressor	59.0	73.0	83.0	88.0	89.0	86.0	81.0	92.6
Air Inlet Filter Housing	106	97	82	72	88	69	75	89.9
Air Inlet Filter Housing Duct	104	103	92	86	100	85	86	100.7
Bag house - Sugar plant	119.6	114.0	111.9	109.5	106.7	104.6	100.8	112.3
Boiler building - Sugar plant	122.7	119.5	116.7	115.8	112.8	110.2	105.6	118.1
Boiler Feed Water Pumps	95	93	87	88	97	95	91	100.5
Coal crushing plant (50 k tons/hr)	110.6	111.2	110.9	111.2	110.8	107.0	100.6	114.5
Coal Pulverisers	99.0	99.0	95.0	93.0	90.0	89.0	84.0	96.0
Condenser (Air Cooled)	109	106	102	96	95	95	97	102.7
Conveyor belt (± 70 tons / hr)	71.0	72.7	74.5	77.9	84.5	78.6	71.9	86.3
Cooling fans	115.8	115.1	113.4	110.3	106.0	101.2	96.1	111.8
Cooling Water Condensers (Forced)	102.0	104.0	106.0	100.0	96.0	94.0	92.0	103.0
Cooling Water Fan Array	94	92	91	91	89	88	86	94.7
Cyclone (dewatering)	64.0	77.0	90.0	101.0	104.0	104.0	101.0	109.0
Dryer - Gas Generator	108.0	107.0	105.0	102.0	99.0	96.0	93.0	104.6
Dryer Stack	98.0	104.0	101.0	100.0	98.0	91.0	88.0	102.0
Exhaust Fans	112.9	93.5	90.2	82.9	72.7	81.8	80.6	90.6
Exhaust Stack UHN	131.0	114.0	102.0	100.0	95.0	95.0	95.0	107.6
FEL - Bell L1806C	109.0	106.7	107.3	97.9	95.8	92.5	87.6	102.7
Furnace fans 1	106.8	105.8	117.0	114.3	110.1	103.5	94.7	115.2
General noise	95.0	100.0	103.0	105.0	105.0	100.0	100.0	108.8
Generator building - Sugar plant	118.9	113.2	110.1	109.7	108.2	108.1	106.6	114.4
Intake Fans	105.0	103.0	98.0	89.0	77.0	81.0	95.0	97.7
Lube Oil Coolers URC	98.0	100.0	101.0	96.0	92.0	90.0	88.0	98.8
Mill building (Sugar)	109.2	113.8	111.1	106.8	106.1	100.2	93.0	110.1
Pumps (Cavity, slurry, VSD, etc)	80.0	81.0	83.0	83.0	86.0	83.0	79.0	89.5
Road Truck average	90.0	101.0	102.0	105.0	105.0	104.0	99.0	109.6
Steam Turbine Condenser	108.0	108.0	107.0	102.0	100.0	97.0	92.0	105.4
Substation	67.0	81.0	84.0	81.0	74.0	61.0	48.0	80.9
Sugar Mill - Factory (as point source)	129.2	128.0	122.7	122.0	119.4	115.2	111.6	120.3
Water Cooling Fans	110.8	98.4	97.2	96.7	94.7	93.4	91.1	100.4
Area noise sources (dBA/m² re 1 pW)								
General noise (sugar factory)	95.0	100.0	103.0	105.0	105.0	100.0	100.0	67.0
General noise (workshops)	95.0	100.0	103.0	105.0	105.0	100.0	100.0	55.0
General noise (bagasse area)	95.0	100.0	103.0	105.0	105.0	100.0	100.0	55.0

Although it is difficult to include the noise model, it is noted that the proposed changes involved the following:

- Steam turbines will be removed from an old building, with the old building never designed to minimize noise emission levels. The older steam turbines casings also have a reduced noise reduction efficiency. This benefit however is difficult to model without accurate sound power emission levels, with this assessment considering a potential reduction of 3 dBA;

- The new turbines will be installed within a generator building with restricted access, fitted with acoustic doors. The turbines and piping will also be fitted with acoustic and thermal insulation. This could have a significant influence on the reduction of noise emission levels but difficult to model without sound power emission characteristics of the new equipment and generator building. This assessment only considers a potential reduction of 5 dBA, though in reality this reduction could be significantly higher;

- It is envisaged to remove the steam shredders and prime movers as part of the project. Existing high-pressure equipment are without noise protection and the changes will also reduce future noise levels. Without sound power emission levels of the replacement equipment this is difficult to assess, and this evaluation did not consider this potential improvement.

9.2.4 Noise Criteria of Concern

The criteria used in this noise assessment report were drawn from the criteria for the description and assessment of environmental impacts considering the guidelines from the World Health Organization.

There are a number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in noise levels:* People or communities often react to an increase in the ambient noise level they are used to, which is caused by a new source of noise.
- Absolute or total noise levels: Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g. 65 dBA. Anything above this level will be considered unacceptable.

Figure 9-16 provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. If Δ is the increase in sound level, the following criteria are of relevance:

- **$\Delta \leq 3$ dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level would not be noticeable.
- **$3 < \Delta \leq 5$ dBA:** An increase of between 3 dBA and 5 dBA will elicit 'little' community response with 'sporadic complaints'. People will just be able to notice a change in the sound character in the area.
- **$5 < \Delta \leq 15$ dBA:** An increase of between 5 dBA and 15 dBA will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

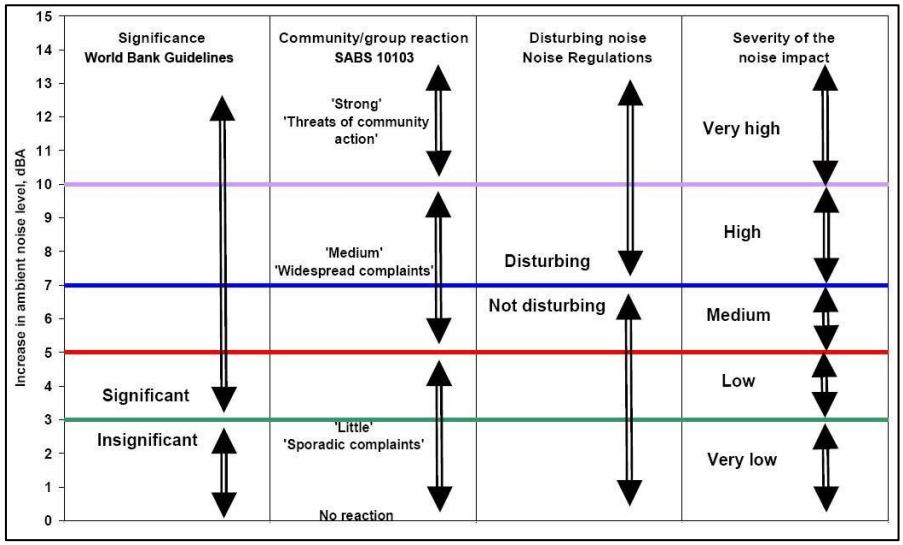

FIGURE 9-16: CRITERIA TO ASSESS THE SIGNIFICANCE OF IMPACTS STEMMING FROM NOISE

9.2.5 Noise Impact Assessment Results

Noise measurements were undertaken at 10 locations within the existing Nchalo sugar operation for the existing operation and is depicted by Figure 9-17 below.

The existing noise level ratings are indicated in Figure 9-17 below and it shows that surrounding areas approximately 100m from the are currently experiencing noise levels of between 55-60 dBA. The noise receptor affected most by this noise level of the existing operation, is the staff accommodation of Illovo Sugar, located directly adjacent and west of the existing site.

Two noise models were developed considering the proposed operational activities. One noise model for proposed layout alternative 1 and one noise model for proposed layout alternative 2 as described in Section 7.3. Figure 9-18 illustrates the noise rating level contours for layout alternative 1 while Figure 9-19 illustrated the noise rating level contours for layout alternative 2. However, the bagasse storage area is not a high noise generating area and therefore the noise model for both layout alternative 1 and 2 is similar.

FIGURE 9-16: CONCEPTUAL NOISE GENERATING ACTIVITIES AND EQUIPMENT – EXISTING SCENARIO

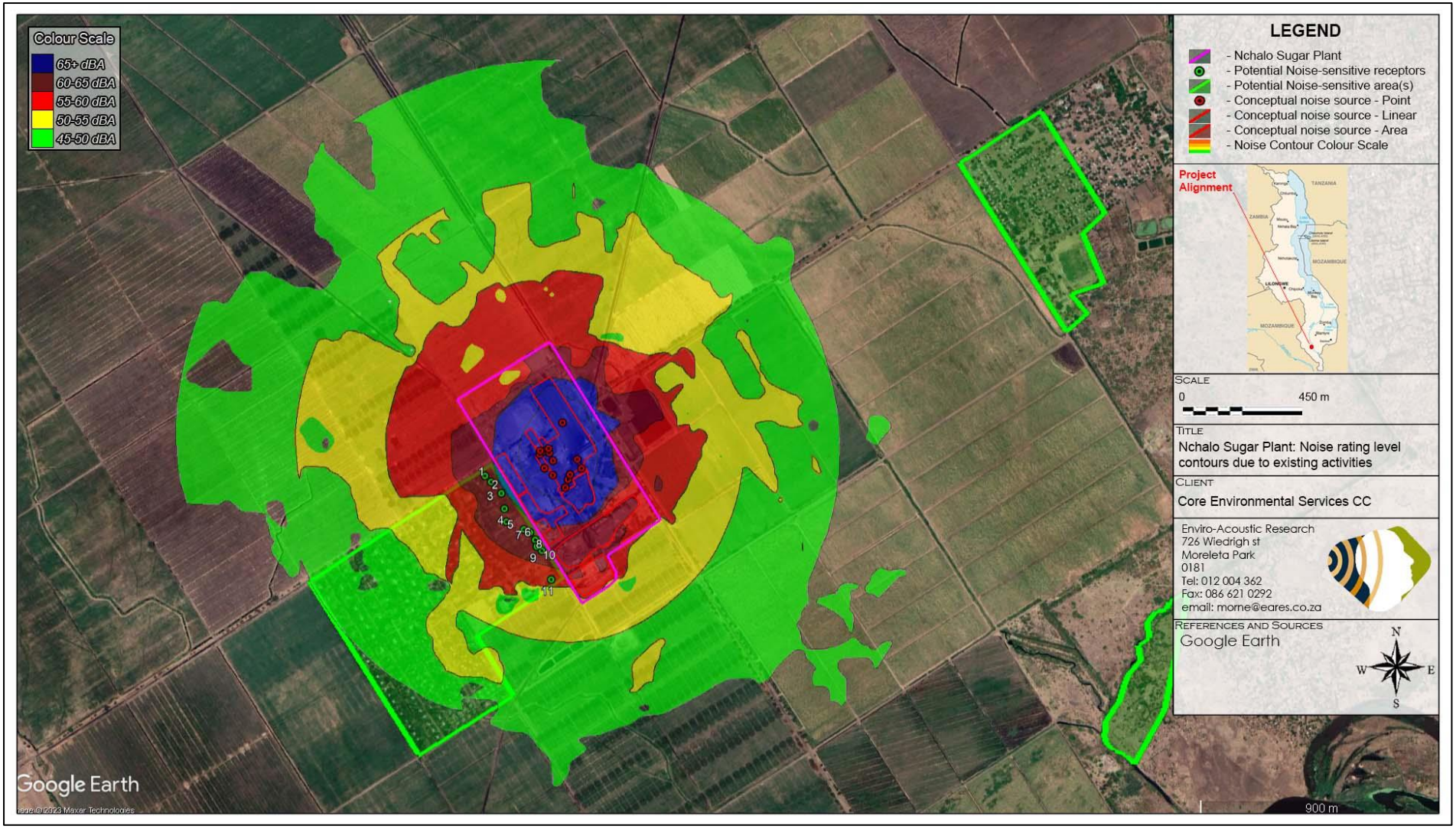

FIGURE 9-17: POTENTIAL NOISE RATING LEVEL CONTOURS – EXISTING SCENARIO

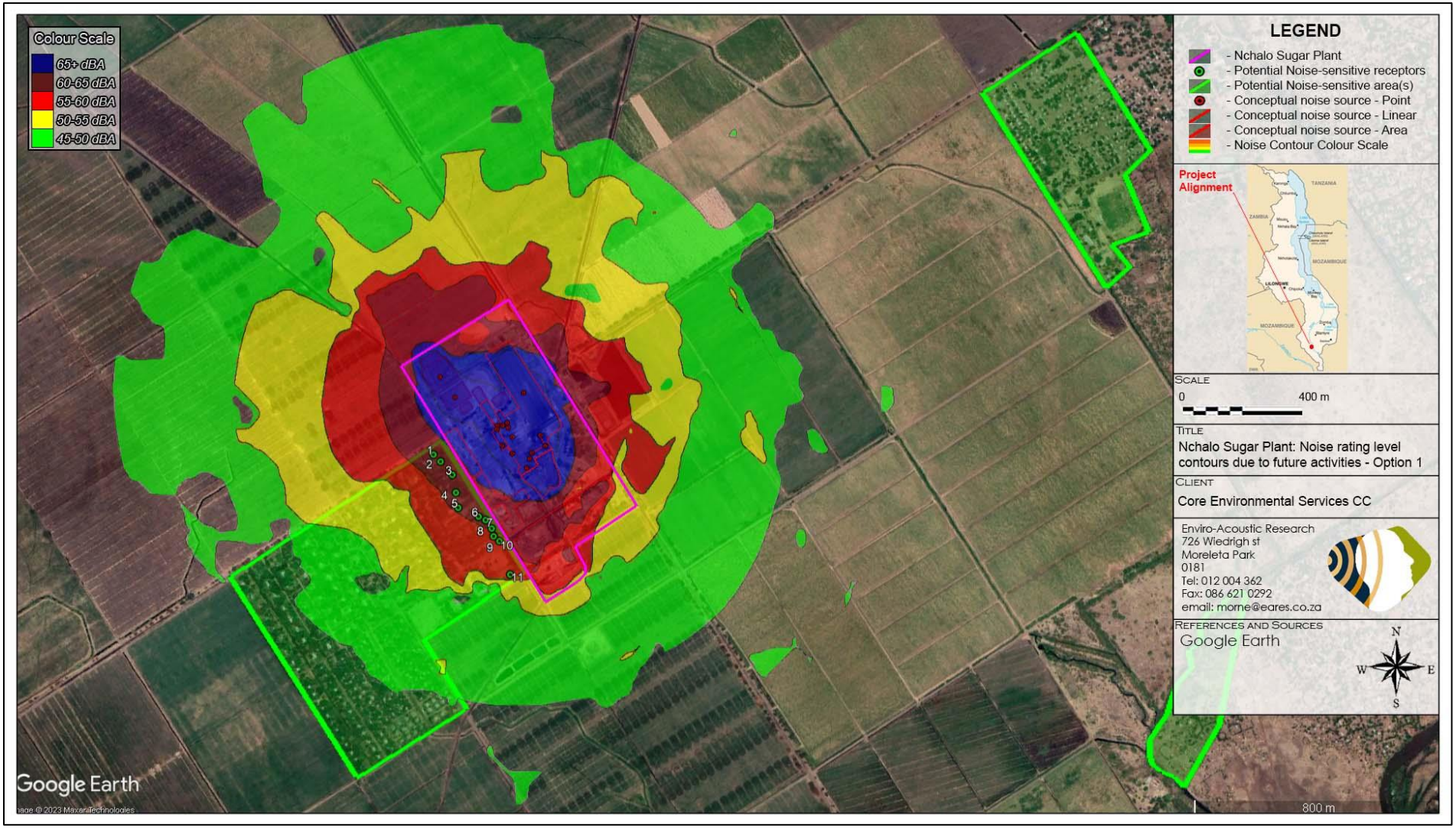

FIGURE 9-18: POTENTIAL NOISE RATING LEVEL CONTOURS – OPERATIONAL ACTIVITIES (LAYOUT ALTERNATIVE 1)

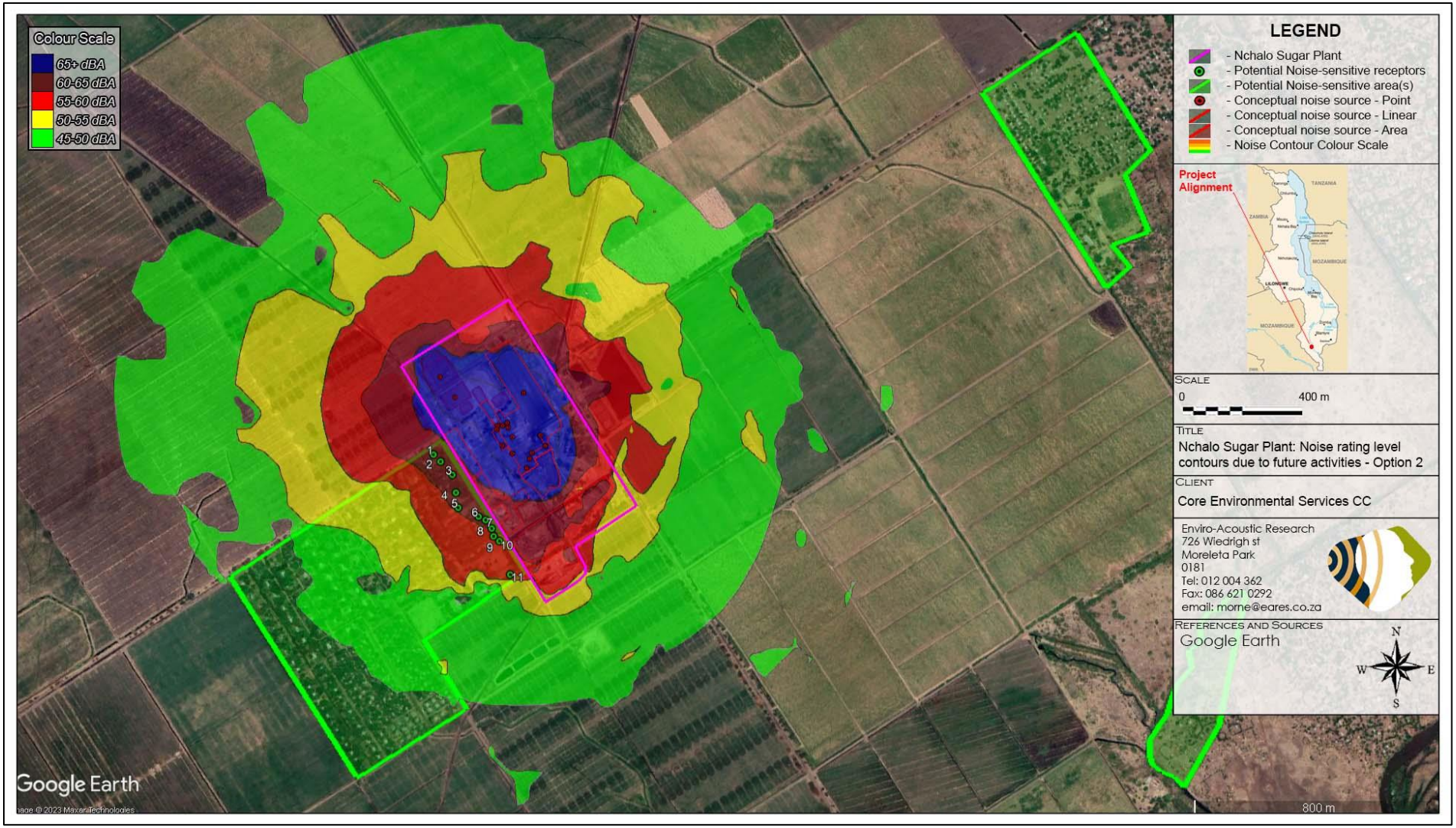

FIGURE 9-19: POTENTIAL NOISE RATING LEVEL CONTOURS – OPERATIONAL ACTIVITIES (LAYOUT ALTERNATIVE 2)

The potential noise level contours associated with Nchalo Sugar operation expanding as per layout alternative 1 (Section 2.3), assessed the noise impact to be of low significance during daytime and due to the high noise levels the Illovo Sugar Nchalo Residents are exposed to at night, the impact was rated to be of medium significance during night time.

The significance of the noise impact associated with proposed layout alternative 2, illustrates the same assessment ratings as with layout alternative 1, with the daytime impact rated as being of low significance, while the night-time impact to be of medium significance.

It was therefore determined that the potential noise impact would be of medium significance for both alternatives for night-time activities. While the magnitude of the noise impacts associated with the expansions is minor, the medium significance is mainly due to high noise levels raising the probability of annoyance with the project, especially at night. It should be noted that NSR in the Nchalo residential estate area may have a higher threshold to the elevated noise levels,

9.2.6 Mitigation Measures

The developer must know that community involvement needs to continue throughout the project. Annoyance is a complicated psychological phenomenon, as with many industrial operations, expressed annoyance with sound can reflect an overall annoyance with the project, rather than a rational reaction to the sound itself. At all stages surrounding receptors should be informed about the project, providing them with factual information without setting unrealistic expectations.

Noise control can broadly be divided into technical and management measures. Technical measures include:

- The selection of different equipment or process (feasible during the planning phase),
- The changing of a process methodology (possible during the construction or operational phase if feasible),
- The design and implementation of certain control measures such as enclosing, silencing, isolation, damping or barriers,
- Use of acoustical masking equipment,
- The implementation of acoustic shielding at the dwelling of a receptor.

Management measures include:

- The changing of operational localities (if viable), including the relocation of sugar cane delivery routes further from the Nchalo residential areas at night;
- The changing of operational protocols and/or operational hours, minimizing night-time operational activities and/or operational hours;
- The incorporation of noise into the Environmental Awareness Programme and Induction, informing employees and contractors about the potential noise impacts on the community, especially those operating close to, or within the community;
- Potential relocation of people living very close to noise generating activities;

- Ensure a good working relationship between Nchalo Sugar operation and all potentially NSR. The provision of employment to the community will ensure a positive attitude with the activity (decreasing the sensitivity of the receptors);
- Measurement of noise levels to define major noise sources. This data can be used to design an appropriate mitigation measures; and
- The use of sound attenuation in the buildings that will house noise generating equipment (considering the noise level measurements to select the most appropriate mitigation). This may include proper stack and ducting design (boiler), the incorporation of sound attenuation lining within any flue stacks, etc.

9.3 Hazard Area Classification

9.3.1 Introduction

Ottalaus (Pty) Ltd was appointed to assist in providing a Hazardous area classification (HAC) report and HAC drawings for Nchalo Cogeneration Power Plant. Ottalaus evaluated all the possible source of release points of flammable products on the following areas proposed for the cogeneration power plant:

- New Boiler Section - Construction of one new modern 200 t/h (tons per hour) / 67 bar boilers
- New Power House
- Bagasse Stock Pile Yard and Bagasse Shed

A site investigation was undertaken by the specialist and all Material Safety Datasheets (MSDS) were obtained in order to sort materials into Flammable and Non-Flammable products. The physical and chemical properties of the flammable products were extracted from the Material Safety Datasheets (MSDS) to determine the gas groups and temperature ratings of the products.

9.3.2 Classification of Flammable Chemicals

Classification of gases and vapours are done according to certain criteria. In short, this criterion is based on ignition energy. As heat is created in for example an electrical circuit the minimum ignition current (MIC) is used to classify the chemical. Another method to classify chemicals is the Maximum Experimental Safe Gap (MESG). MIC and MESG is used to classify the gasses into the groups.

For most gases and vapours, it is sufficient to make only one determination of either Maximum Experimental Safe Gap (MESG) or Minimum Ignition Current (MIC) ratio to classify the gas or vapour.

One determination is adequate when:

- Group IIA: MESG > 0,9 mm, or MIC > 0,9.
- Group IIB: 0,55 mm ≤ MESG ≤ 0,9 mm, or 0,5 ≤ MIC ≤ 0,8.
- Group IIC: MESG < 0,55 mm, or MIC < 0,5.

Determination of both the MESG and MIC ratio is required when:

- for IIA: 0,8 ≤ MIC ≤ 0,9 need to confirm by MESG,
- for IIB: 0,45 ≤ MIC ≤ 0,5 need to confirm by MESG,
- for IIC: 0,5 ≤ MESG ≤ 0,55 need to confirm by MIC.

9.3.3 Findings of the Hazardous Area Classification

An in-depth investigation was carried out on all the information collected, and the following hazardous area classification applies to the specific areas:

- New boiler section
  Classified as a Non-Hazardous Area (safe).

- New Power House
  a) Battery Charging Bay – 0,5m Zone 1, IIC, T1
  b) Power House - Non-hazardous (safe) area
  c) Diesel Storage Tank
     - All filler points will be surrounded by a 0.100 m zone 1, IIB, T3 radii.
     - Ullage space inside the diesel tanks will be classified as a zone 0, IIB, T3.
     - All vent points will be surrounded by a 2 m zone 1, IIB, T3 radii, with a zone 2, IIB, T3 down to ground.
     - Bunded area up to height of the bund wall will be classified as non-hazardous.
  d) Offloading to diesel storage tanks
     - Area surrounding the truck offloading point will be classified as a 1 m zone 1, IIB, T3 radii.
     - During offloading, 4 m x 1 m from truck offloading point will be classified as a zone 2, IIB, T3 radii.
  e) Bagasse Stockpile Yard and Bagasse Shed
     - Stock Pile Yard - Non-hazardous (safe) area, but a Fire Hazard -
     - Shed – Non-hazardous (safe) area - If an efficient housekeeping programme is followed
  f) Conveyors
     - Non-hazardous (safe) area however the fire risk remains.

9.3.4 Conclusion and Recommendations

During the execution of the HAC investigation, it was found that the implementation of the new Cogeneration Power Plant will significantly reduce the explosion and other associated hazardous risks in the plant, due to, but not limited to, the following improved design and operating conditions of the new boiler section:

- Existing boilers are very old and do not meet the emission standards. There are no measures that can be applied to the old boilers to reduce the emissions to meet the standards. In terms of explosion risk, the reduction/elimination of any gas release is always beneficial for a plant. Reduction of any gas emissions is directly related to a decrease in the possibility of the formation of an explosive atmosphere in the plant.

- Existing boilers are not insulated, resulting in high outside skin temperature and high dust content in the air. Higher temperature and dust content in the air therefore leads to higher explosion risks. By replacing existing boilers with a single boiler, with a 60°C skin temperature at maximum, the possibility of the formation of an explosive atmosphere is drastically reduced.

- Bagasse conveyor belts will be covered to avoid dust suspension or dust clouds. However, the sides of the conveyor belts will remain open.

- By electrification of shredders and the removal of all existing turbines, the high-pressure steam (above 3 bars) in the sugar process will be removed completely. The high pressure will be contained in a very limited space. Therefore, by reducing the risk of explosion from pressurised vessels are massively limited. Furthermore, by reducing the explosion risk area, possible classified areas will also be reduced, leading to a direct reduction in costs in terms of explosion protected equipment, permit conditions, training, etc.

- Current boilers are very hot from the outside because the furnace is made of bricks with no external skin insulation. The new boilers will be "insulated", which results in a further decrease in explosion risk. Sources of ignition in various cases are likely to be caused by burning, grinding or welding activities or potential hot surfaces that have the potential to increase the temperature of a flammable substance above its flash point. By reducing/eliminating any hot surfaces in the plant, potential sources of release points are reduced. In addition to the decrease in explosion risk, the insulation of the boilers reduces the hazardous risk on employees currently working in extreme heat conditions within the boiler section of the plant.

- The current boilers require "manual deashing". Because the boilers are very hot, this is a hazard to employees. The new proposed power plant is proposing automated deashing, which will reduce the health risk, and bring a further decrease in the plant temperature.

During the plant visit, several areas, outside the current scope of work, were identified as potentially hazardous areas. Classification of areas adjacent to Project Solomon equipment may result in a change in the current classification.

Areas identified as potentially hazardous areas:

- Packing Station
- Sugar Warehouse
- Oil Store
- Paint Store
- Chemical Store
- Afrox Area

Static is a major source of ignition. It is therefore recommended that an earthing and bonding system be corrected. Care should be taken to earth the point where the highest possibility of a flammable environment is first. The second connection may then spark at the point of least possibility of flammable environment. The rest of the installation should be correctly earthed and bonded using the IEC standards as a reference. The COC procedure should cover the earthing installation testing.

All equipment shall be selected and installed as per the zone classification of the area in which it is installed. It is essential that equipment is maintained to a high standard i.e. at least up to the OEM and IA certificate specifications and to assure that this is maintained in a routine, controlled and safe manner. Particular attention should be provided to any replacement parts and other system products for example glands and IS loops etc.

The HAC drawings must be available and displayed at all control rooms and maintenance plants. This is very important to enable the employee to correctly identify the classified areas as per the HAC drawings. A sign at all entrances should state that the area contains classified zones and that no smoking, arcs, sparks or hot surfaces etc. are allowed.

It is recommended that all personnel working in the hazardous area be educated and declared competent to work in the area. This competency must be kept up to date due to changes in legislation and standards for example. This is a requirement as per legislation.

9.4 Socio-Economic Impact Assessment

9.4.1 Introduction

A Socio-Economic Impact Assessment was undertaken by E&D Consulting Services to determine the socio-economic impact of the proposed cogeneration power plant on the surrounding as well a regional socio-economic environment.

It is noted that during the construction phase, approximately 200 skilled and unskilled individuals will be appointed to undertake the construction activities of the cogeneration power plant with associated structures and infrastructure. Operationally, the project will result to additional electricity generation which will be exported to ESCOM for further distribution throughout the country of Malawi. In addition to this, Nchalo Illovo Sugar will be able to generate all their energy requirements and therefore the Nchalo Estate will no longer be dependent on ECSOM to supply any electricity to the Estate. The electricity currently distributed to Nchalo Sugar Estate will therefore be available for other operations in Malawi, positively impacting the socio-economic environment.

The Socio-Economic Impact Assessment therefore investigated all possible positive and negative impacts associated with the construction and operational phase of the proposed project.

9.4.2 Description of the surrounding socio-economic environment

The southern regions of Malawi are predominantly rural, with poverty levels generally higher than the national average. The population surrounding the Nchalo Estate has generally low levels of development, education, health and literacy and is largely reliant on subsistence agriculture, informal labour, piece jobs, small household businesses and natural resource harvesting.

According to the Environmental and Social Red Flag Review Report for AB Sugar (Illovo) Malawi, written by IBIS in November 2022, it was found that:

- There is a 30% employment rate in households in Illovo's footprint;
- The communities have a high exposure to economic and environmental shocks and do not have many options for coping with these shocks;
- These communities have very low food security;
- The average total net income for households around the Estate was calculated to be MWK350,418 (equivalent to R6044 / US$ 341) per year.

These households within the surrounding communities are vulnerable to climate change induced weather events and have low economic resilience. 44% of households surveyed listed negative gift income as one of their income sources.

Impoverishment in the receiving community occurs despite Illovo being one of Malawi's biggest employers. Approximately 6440 individuals receive some form of employment at its Nchalo Estate, either as permanent, seasonal or casual workers, or as contractors with temporary or fixed term contracts. Approximately 1695 of these being in the Industrial (Mill and Powerplant) section.

In addition, there are approximately 30 contractors contracted to work on the industrial side of the mill. These contractors employ approximately 1692 people.

Currently, 2314 Nchalo Estate employees are housed on the Estate across 10 different villages. The other 2793 employees receive a live-out allowance and either rent or own houses outside the Estate.

Illovo has robust national and internationally aligned company policies and procedures in place for procurement, staff training and development as well as a Redundancy Policy. Illovo also conducts various Corporate Social Responsibility projects and campaigns within the surrounding communities.

9.4.3 Assessment Methodology

E&D's approach to this assessment included the following:

- Reviewing all background project information and source documents.
- Undertaking a two-day site visit to the project area to inspect the existing powerplant, the sugar mill and Nchalo Estate and surrounding community areas.
- Undertaking key informant interviews with respective Illovo Sugar staff
- Reviewing Illovo's existing HR procedures, reports undertaken for Illovo Malawi, as well as published research papers and other government information, for relevant information related to the surrounding socio-economic environment and context.
- Stakeholder engagement was also undertaken by the public participation teams by means of physical meetings with the following stakeholders and/or individuals representing the larger community on 29 and 30 March 2023:
    - Chikwawa District Council.
    - Various Traditional Leaders, Religious Leader and Ward Councillor of the area.
    - Bester Village Woman's Group.
    - Paramount Chief Lundu.

9.4.4 Identification of Socio-Economic Impacts

E&D undertook an assessment of the proposed project and identified the following socio-economic issues and impacts.

Downstream benefits from economic investment into the local Nchalo region

This project will involve a workforce of approximately 200 workers, involved in the project over a two-year period. Some of these will be local labourers whilst the project may also provide opportunities for other small businesses, such as those in transport, accommodation rental and food retailers.

It is expected that a large portion of the infrastructure and expertise necessary during the construction of this project will need to be brought into the country. The project team will however use local companies as much as possible to perform the installation work using their local technical skill. Doing so, the company will comply with the legal requirement to ensure that 30% of the work is allocated to local contractors and 51% of the of the professional consultants on available skills in country. On top of this local content, there will be opportunities for other downstream economic benefits as a result of Illovo's proposed investment into the region. These include local employment opportunities, local services and accommodation opportunities and other small business opportunities.

The retiring and removal of the old infrastructure may present another potential opportunity worth exploring. If any decommissioned materials can be re-used by local small businesses, providing these materials to them for free or at low cost, may help to promote other local downstream economic opportunities. The alternative being to simply appoint a contractor to transport all material directly to a scrap yard or waste site in Blantyre.

During operation, this project will have significant economic benefits for the wider Malawian economy in terms of the additional supply of reliable electricity into the national grid. This economic benefit will indirectly contribute to increasing economic and employment opportunities within Malawi. Design options are being considered that will allow alternative biomass products such as bamboo, to also be converted into power, which would help to diversify local household income and activities.

Benefits of additional renewable generation capacity for Malawi

Malawi is one of the least electrified counties in the world and has the lowest average population access to electricity in Sub-Saharan Africa. Almost 80% of the population relies on wood for cooking. Wood and charcoal for fuel accounts for 88% of the country's energy requirements, leading to multiple other negative environmental impacts which includes deforestation, increased siltation of rivers, as well as indoor air pollution, resulting to health impacts, especially for vulnerable communities.

By helping to improve electricity supply and reliability, this project will make positive contributions towards other socio-economic and health issues that affect many in Malawi. These contributions include the following:

- The improved reliability of electricity will enable many small businesses reliant on electricity, such as welders, mechanical workshops and irrigation farmers, just to name a few, to improve their productivity and economic activity.
- The allocation and loss of primarily women's productive time to the task of collecting firewood, will also decrease as the availability of electricity in the country improves. This will enable women to allocate this time to other more productive economic activities or child-care duties, both which lead to long-term economic growth and improvement.
- The contribution will aid in diversifying energy supply and reducing dependence on imported fuels and use of diesel generators.

- Any contribution to help reduce the use of wood for cooking, will also be a contribution to reducing deforestation. Using electricity for cooking purposes will reduce incidences indoor air pollution which results to various respiratory and lung diseases for families who regularly use wood as a fuel or energy source for indoor cooking.

This project will therefore make a significant positive national contribution both in terms of the megawatts generated as well as helping to diversify the national generation capacity with a technology that also provides a stable and valuable baseload contribution.

In addition, given the increased efficiencies and the reduction in emissions, there will be a reduction in greenhouse gas emissions within the footprint of the Nchalo sugar Estate by more than 25,000 tons of equivalent CO_2 per year.

Changes to existing employment

This project entails decommissioning an outdated powerplant with five old boilers and replacing it with a new powerplant with one modern boiler. There will be a higher level of automation with the installation of the new powerplant equipment.

There may be some job and role changes required within the industrial part of the Nchalo operation, whilst recognizing that a large part of the industrial section activities will be unchanged i.e., the cane milling operation.

Some of the job changes and roles will result in the existing employees being trained and up-skilled so they can operate the cogeneration power plant. This is a positive impact as this will help the growth and development of their career as well as provide the employees with an opportunity to possibly earn a higher salary, thereby improving their current livelihood conditions.

Most employees have dependents and any loss in work opportunity or income can have a wider negative impact within the local community. The proposed cogeneration power plant will however not result in any significant changes in terms of employment. There may be a few lower level workers within the power plant that may need to be redeployed into the sugar mill for an equivalent job. Some of these may be sub-contractors or seasonal employees.

Importantly, Illovo has a robust Redundancy Policy in place and is aiming to ensure that no individual will be made redundant by this project but will rather be retrained and redeployed to a new role within alternative sections of the Nchalo Estate operation if they cannot be accommodated in the powerplant section.

Construction related risks to surrounding community

The influx of many outside short-term contractors and workers into a relatively poor community can result in various negative short and long-term impacts. Potential impacts and risks were identified to include:

- An increase in road accidents because of increased construction traffic.

- An increase in negative coping strategies, dropping out of school and an increase in HIV and AIDS within the community.
- A lack of available local accommodation to absorb temporary demand.
- An increase in local prices and pressure on existing services.

Various mitigation measures and strategies to address these issues have been recommended within the report.

Operational health and disturbance impact upon resident employees and surrounding communities

The current working condition with the existing boilers entails high risk work as the existing boilers must be deashed manually. Employees responsible for the deashing work in very hot conditions and within confined spaces to clear the ash from these boilers. By removing the existing boilers and replacing them with an automated and insulated system, there will be a significant improvement on the health and safety of such employees.

The existing boilers are also emitting pollutants into the atmosphere which exceed the limits noted within the Malawian Ambient Air Quality Standards and Emission Limits. These pollutants have an impact on the surrounding air quality. The replacement of these boilers with new technologically advanced boilers will ensure that the pollutants emitted into the atmosphere are reduced, as filtering systems will ensure that all heavy metals are caught before the emissions are released into the surrounding atmosphere. The replacement of the existing boilers with the new boilers will therefore improve the existing surrounding air quality.

A larger bagasse stockpile yard will be established for the operation of the new cogeneration power plant. If unmitigated, these bagasse stockpiles could have an impact on the air quality and health of employees and nearby individuals as small particles could be inhaled. Particulate matter sampling and quality testing will be done as per the air quality licensing requirements.

9.4.5 Socio-Economic Impact Statement

In conclusion, the proposed Cogeneration Power Plant will have a largely positive long-term impact on the local Nchalo area whilst also making a valuable contribution, through power generation, to the country of Malawi.

The assessment of impacts identified in terms of the socio-economic environment concluded the following:

TABLE 9-7: SUMMARY OF SOCIO-ECONOMIC IMPACT ASSESSMENT

Activity	Impact / Risk	Significance Without mitigation	Significance With mitigation
Downstream benefit from economic investment	Local downstream economic benefits during construction (including removal of old infrastructure)	Low (+)	Medium (+)
	Benefit of additional renewable generation of electricity	Neutral *	High (+)
	National downstream economic benefits arising from improved electricity supply during operation	Neutral *	Medium (+)
Benefits of additional renewable electricity generation in Malawi	Climatic and environmental benefits arising from improved electricity supply during operation	Neutral *	Medium (+)
	Contribution towards improving the socio-economic and health living standards in Malawi.	High (-) *	High (+)
Changes to existing employment	New skills and opportunities for employee's and contactors within the new powerplant.	Medium	High (+)
	Contract loss, employment loss and negative socio-economic impact upon small Contractors and their unprotected employees	Low (-)	Very Low (-)
	Employment loss and negative socio-economic impact upon Illovo employees made redundant	Low (-)	Neutral (-)
Construction related risks to surrounding communities	Increased construction traffic road accidents.	Low (-)	Very Low (+)
	Increase in negative coping strategies, school dropouts, HIV and AIDS	Medium (-)	Low (-)
	Lack of available local accommodation to absorb temporary demand	Medium (-)	Low (-)
	Increase in local prices and pressure on services	Low (-)	Very Low (-)
Operational health and disturbance impact on surrounding environment	Possible health and safety impact on workers from the replacement of the old boilers with an automated system	High (-) *	High (+)
	Possible health and safety impact on surrounding community with the improvement of air emissions emitted (especially reduction in heavy metals)	High (-) *	High (+)
	Possible health and air quality impacts from increased bagasse storage – **Layout 1**	Medium (-)	Low (-)
	Possible health and air quality impacts from increased bagasse storage – **Layout 2**	High (-)	Medium (-)

Activity	Impact / Risk	Significance Without mitigation	Significance With mitigation
	Noise and lighting disturbance to surrounding residents – **Layout 1**	Low (-)	Very Low (-)
	Noise and lighting disturbance to surrounding residents – **Layout 2**	Medium (-)	Low (-)

** The without mitigation option here is based on Illovo simply upgrading the powerplant to the minimum level required to address the plant's power needs only.*

9.4.6 Mitigation Measures

The following recommendations and mitigation measures should be considered:

- Illovo should develop a 'Local Procurement, Skills Development and Business Opportunities' plan that focusses on ways to maximise all feasible downstream economic benefits that could arise from this project during the construction phase. This plan should have the following focus areas:
  - An investigation into all possible downstream economic opportunities, direct and indirect, that may result from the project and early upfront training and awareness campaigns to help prepare local businesses and individuals to help them take maximum advantage of potential opportunities.
  - A formalised process through which all sub-contractors will be able to hire local unskilled labour and/or support local Nchalo formal and informal businesses and entrepreneurs.
- Create and promote local biomass production opportunities to help diversify local income sources and opportunities.
- Nchalo Illovo should maximize the opportunity to re-train and re-allocate existing employees during the construction phase in preparation for the operational phase.
- Illovo should put in place a 'Human Resource Action Plan' in line with its existing labour and redundancy policies as early as possible to help phase in any job changes, employment opportunities and any reduction in numbers over time. This plan can then be updated as more accurate data becomes available.
- Illovo should put together a strategy that includes providing open and free business skills and entrepreneurial training sessions to help any who may lose any work or income opportunities.
- Illovo should prepare a 'Road Safety Management and Mitigation Plan' that identifies peak traffic times during the construction period, high risk accident areas and road signage or other options, school and community safety awareness campaigns and reporting mechanisms to put in place during the construction phase. This Plan must also include mechanisms for community members to report bad driving incidences.
- Illovo must increase and run suitable awareness campaigns on negative coping strategies, HIV and AIDs both within the community and at local schools prior to construction starting. E&D recommends that Illovo consider establishing a partnership during the construction period with a National or Local NGOs who focuses on these issues, who will be able to run the campaigns,

set up monitoring mechanisms with teachers for example to identify those at risk of dropping out of school, and to provide counselling services available to assist any vulnerable school pupils and individuals needing support or guidance.

- Illovo should prepare an 'Influx Management Plan' that will anticipate likely accommodation demand during the construction period and accommodation options on-site and off-site to minimise socio-economic risks and planned settlement.
- Illovo to consult and work with the relevant Local Authorities, stakeholders and if feasible local accommodation facility providers, to ensure temporary accommodation demand increases are suitably managed.
- Illovo should consult and work with the relevant Local Authorities and Business stakeholders to identify possible risks in terms of increased demand for local services, natural resources and an increase in prices. This Influx Management Plan should include implementing a suitable strategy to monitor any price changes during construction and ways to address areas of concern.
- Illovo should implement small-business training opportunities for existing local businesses to help increase competition and business preparation in advance of construction, to both increase local downstream economic opportunities and to help increase competition and mitigate any supply and demand price increases.

10. METHODOLOGY OF ASSESSING THE SIGNIFICANCE OF IMPACTS

This section outlines the method which will be used for assessing the significance of the potential environmental impacts during the construction/establishment, and operational phases.

For each impact, the EXTENT (spatial scale), MAGNITUDE and DURATION (time scale) would be described, as shown in Table 10-1. These criteria are then used to determine the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the Report represents the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.

The following tables show the scale used to assess these variables and defines each of the rating categories.

TABLE 10-1: ASSESSMENT CRITERIA FOR THE EVALUATION OF IMPACTS

Criteria	Category	Description
Extent or spatial influence of impact	**Regional**	Beyond a 30km radius of the candidate site.
	Local	Within a 30km radius of the candidate site.
	Site-specific	On site or within 100 m of the candidate site.
Magnitude of impact (at the indicated spatial scale)	**High**	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact	**Long-term**	More than 10 years after construction
	Medium-term	Up to 5 years after construction
	Construction-term	Up to 3 years

The SIGNIFICANCE of an impact is derived by taking into account magnitude, duration and extent of each impact. The criteria employed in arriving at the different significance ratings is shown in Table 10-2.

TABLE 10-2: DEFINITION OF SIGNIFICANCE RATINGS

Significance ratings	Level of criteria required
High	• High magnitude with a regional extent and long-term duration • High magnitude with either a regional extent and medium-term duration or a local extent and long-term duration • Medium magnitude with a regional extent and long-term duration
Medium	• High magnitude with a local extent and medium-term duration • High magnitude with a regional extent and construction period or a site-specific extent and long-term duration • High magnitude with either a local extent and construction period duration or a site-specific extent and medium-term duration • Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long-term duration
Low	• High magnitude with a site-specific extent and construction period duration • Medium magnitude with a site-specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long-term duration
Very low	• Low magnitude with a site-specific extent and construction period duration • Very low magnitude with any combination of extent and duration except regional and long term
Neutral	• Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the PROBABILITY and CONFIDENCE of this impact are determined using the rating systems outlined in Table 10-3 and Table 10-4. The significance of an impact should always be considered in concert with the probability of that impact occurring. Lastly, the REVERSIBILITY of the impact is estimated using the rating system outlined in Table 10-5.

TABLE 10-3: DEFINITION OF PROBABILITY RATINGS

Probability ratings	Criteria
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

TABLE 10-4: DEFINITION OF CONFIDENCE RATINGS

Confidence ratings	Criteria
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

TABLE 10-5: DEFINITION OF REVERSIBILITY RATINGS

Reversibility ratings	Criteria
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause of the impact is removed.

11. ASSESSMENT OF IMPACTS DURING CONSTRUCTION, OPERATIONAL AND DECOMMISSIONING PHASE

The biophysical, social and economic environment will be impacted during the construction, operation and decommissioning phases of the cogeneration power plant. For this reason, the impacts are assessed for all three phases of the development as noted below:

11.1 Assessment of impacts during Construction

The construction of the cogeneration power plant is likely to result in the following environmental and socio-economic impacts:

- Impact on soil (soil erosion and soil contamination);
- Impact on air quality (generation of dust);
- Noise generation;
- Impact on traffic flow;
- Impact on water resources;
- Impact on biodiversity;
- Waste generation
- Impact on climate change;
- Impact on health and safety of workers and surrounding land users;
- Socio-economic impact

11.1.1 Impact on Soil

Soil is a fundamental and irreplaceable natural resource. Its key functions include providing food and raw materials, supporting wildlife and regulating the flow of water. Poor understanding of soil management during the construction process has led to soil compaction and valuable topsoil being sent to landfill.

Erosion

During construction, soil is disturbed, and heavy machinery is used for this purpose. The disturbance of soil leads to the increased possibility of erosion occurring and is therefore often a serious problem. Although it is noted that the area proposed for the cogeneration power plant is on areas which have already been disturbed and is within the Nchalo Illovo Sugar Factory, the area proposed for the construction camp, powerline and bagasse yard is currently used for agricultural purposes and therefore, when the sugarcane is removed for the purposes of construction, soil is disturbed, increasing the possibility of soil erosion.

The proposed project area is relatively flat, which reduces the velocity of storm water runoff during storm events. The magnitude of the impact on soil caused by erosion is therefore medium. The impact however of short duration, and site specific and for this reason the impact is regarded to be of low significance prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact can be further reduced to be of very low significance.

The cumulative impact can be defined as changes to the environment caused by the combined impact of past, present and future human activities and natural processes. The larger section of the proposed project area is already being used for industrial purposes and therefore, during construction, it is not expected that there would be any significant cumulative impact on soil erosion.

TABLE 11-1: IMPACT ON SOIL CAUSED BY EROSION

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Soil erosion [NEGATIVE]	**Medium**	**Site Specific**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Soil erosion [NEGATIVE]	**Zero**	**Site Specific**	**Short-term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) Drainage on site must be managed and velocity of storm water runoff must be reduced; b) Create diversions to assist drainage on site, on areas which show signs of erosion. c) Reduction of the velocity of storm water can be accomplished by making use of sandbags; d) Avoid soil compaction on areas where structures are not to be placed; Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

Soil Contamination:

Machinery and materials used during the construction phase could also have an impact on soil as the machinery contains fuel and oils which could leak, causing soil to become polluted. Structures will also be erected by means of using cement. The use of cement affects the pH of soil, increasing

the pH to high alkaline levels. This increase in pH reduces the solubility of the minerals in the soil making it less available for plants to absorb.

Soil pollution could notably alter natural functions of soil and therefore the impact is of medium magnitude. If soil becomes polluted, the natural resource will forever be lost as the polluted soil will be disposed of. The polluted soil would therefore be irreversible. As the impact is associated with the construction phase, the impact is of short-term duration, and site specific. The impact is therefore assessed to be of low significance prior to the implementation of mitigation measures.

Cumulatively, the project area is being used for industrial purposes and for this reason, there is a possibility that soil is polluted during the operational phase of the current activities. Placing even more machinery on site which hazardous substances like fuel and oil and adding more activities, would increase the possibility of soil becoming polluted. The magnitude is however low, of site-specific extent and short-term duration and therefore the cumulative impact is of very low significance.

TABLE 11-2: IMPACT ON SOIL CAUSED BY SOIL CONTAMINATION

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Soil contamination [NEGATIVE]	**Medium**	**Site Specific**	**Short term**	**Probable**	**Sure**	**Irreversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Soil contamination [NEGATIVE]	**Low**	**Site Specific**	**Long term**	**Probable**	**Sure**	**Irreversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) All hazardous substances such as oil and fuel, must be stored within a bunded and lined area and should oil or fuel be handled, handling must be undertaken on a lined surface; b) Drip trays must be used on all machinery standing on site; c) Machinery used on site must be in good working order; Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.1.2 Impact on Air Quality (Dust)

At any construction site, you may find metal, wood, concrete, sand, sheetrock, and plastics. Because of the various materials being used, the unhealthy dust emissions from a construction site can be full of numerous particles. Typical dust from a construction site includes silica dust, which is created when working with materials that contain silica, including concrete and sandstone. Dust will also come from lower-toxicity materials, such as gypsum, limestone, dolomite, and marble. Even more dust is generated when high-energy tools such as grinders and cut-off saws are used of such materials.

The movement of heavy machinery on site associated with the vegetation (sugarcane) clearance, disturbance of soil and windy conditions, would also result to the generation of dust during the construction phase of the proposed cogeneration power plant.

All of the dust generated during the construction phase of the project could have a negative impact on construction workers and directly adjacent land users, causing health and lung problems. Inhalable particles often get trapped in the nose, mouth and upper respiratory tract, and therefore the inhalation of such particles can be associated with respiratory disorders such as asthma, tracheitis, pneumonia, allergic rhinitis and silicosis.

The impact of dust on workers and surrounding land users are assessed in Table 11-3 below. As social functions could be notably altered, the impact is rated to be of medium magnitude. The impact is of short duration and of local extent as the impact could affect people adjacent to the construction site (100m or more from the site). For this reason, the impact is assessed to be of medium significance prior to the implementation of mitigation measures.

From a cumulative perspective, dust is currently being generated from the operational activities at the sugar factory as well as the existing bagasse handling. Construction activities will add to these current impacts and therefor the impact is also assessed to be of medium significance.

TABLE 11-3: IMPACT ON AIR QUALITY

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Air quality [NEGATIVE]	**Medium**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULAITVE IMPACT						
Air quality [NEGATIVE]	**Medium**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**

IMPACT RATING PRIOR TO MITIGATION	IMPACT RATING AFTER MITIGATION
Medium	**Low**
PROPOSED MITIGATION MEASURES	
a) The project site must be sprayed with water to reduce the excessive generation of dust during construction; b) The construction site should also be fenced with shade cloth to act as a barrier for wind, which transports dust off site. c) Construction workers using grinding machinery must make use of the correct PPE, and dust masks to prevent inhalation of small particles. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.	

11.1.3 Noise Generation

During construction, sources of noise pollution include loud machinery, heavy moving vehicles, raised voices and physical work such as hammering, drilling or digging. The gathering of construction workers at the contractor's camp could also result to an increase in noise after working hours for the employees residing in the adjacent, existing factory residences. Long term excessive noise could result to the loss of hearing and could also cause high blood pressure, heart disease, sleep disturbances and stress. Excessive noise could also affect the surrounding land users ability to undertake daily activities.

A noise impact assessment was undertaken as part of the ESIA for the proposed cogeneration power plant and noise level monitoring is also undertaken at the factory every two years. The results of the noise level monitoring undertaken for the existing factory, indicated that the noise levels of the project area are indicative of noise levels measured for an industrial area and by implication, noise generated within the factory area is relatively high (above 65dBA in most areas within the factory).

With this noise level used as a baseline for the current noise generated on site, it is not expected that the noise generated during the construction phase of the project would be significant as the project is already taking place within a noisy/industrial area. The closest receptors are construction workers, Illovo Sugar employees working within the factory boundary, and Illovo Sugar workers residing directly adjacent and west of the existing factory and proposed site. The magnitude of the impact is therefore low and rated to be of low significance prior to the implementation of mitigation measures.

Cumulatively, due to the existing noise levels within the perimeter of the factory, it is expected that the generation of noise during construction would only slightly alter the social functions of workers and the surrounding community and therefore, the cumulative impact is also of low magnitude and assessed to be of low significance prior to the implementation of mitigation measures.

TABLE 11-4: IMPACT OF NOISE GENERATION

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Noise generation [NEGATIVE]	**Low**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Noise generation [NEGATIVE]	**Low**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) Choose appropriate construction equipment for the job and ensure that all equipment is functional before use; b) Make use of low noise machinery. c) Limit the amount of time a worker spends near the source of noise; d) Provide quiet areas where workers can find relief during breaks. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.1.4 Impact on traffic flow

During construction, there are various aspects to be considered in terms of traffic flow associated with the construction of a proposed project. These aspects include the following:

- Heavy moving vehicles will travel to and from the site on a daily basis, in addition to the existing sugarcane delivery trucks making use of the gravel road to access the factory.
- In addition to the impact on site, delivery vehicles will also mostly be travelling along the main road between Blantyre and Nchalo to deliver materials to the construction site. With the proposed construction activity within Nchalo, it is expected that traffic flow and volumes would increase during the construction period.
- Pedestrians/workers on the construction site will be moving within the site perimeter and if specific areas are not allocated for pedestrian access and walkways, the flow of traffic within a construction site could be affected as pedestrians having right of way, would slow down the flow of traffic accessing the site.

In terms of the delivery of sugarcane to the factory, it is noted that the drop-off of the sugarcane is at the most southern boundary of the factory, while the cogeneration power plant is proposed along the northern boundary of the factory. There are two entrances from the M1 to the Nchalo Illovo Sugar Estate and both entrances are operational. For this reason, options exist for the construction traffic to be split from the heavy moving vehicles delivering sugarcane to the factory. (Refer to Figure 11-1 below)

The M1 is a single lane, two-way directional road which is the main road between Blantyre and Nchalo, which most heavy moving vehicles and/or delivery vehicles and construction personnel will be travelling to get to the Nchalo Illovo Sugar Factory where the project is proposed. This additional expected volume of traffic would place pressure on the existing M1 single lane roadway and recent floods caused by Cyclone Freddy, damaged some of this road infrastructure. This aspect will place even more pressure on the M1 with the additional traffic expected as a result of the construction activities.

FIGURE 11-1: ACCESS POINTS TO THE NCHALO ILLOVO SUGAR ESTATE

Within the construction site perimeter, pedestrians and workers will be moving in and around the construction site to execute the construction of the cogeneration power plant. If no site planning is undertaken to allocate areas and walkways for pedestrians and allocate areas for delivery vehicles, traffic flow on site could be negatively impacted.

Taking the above into consideration, the flow of traffic could notably alter the social functions and process and for this reason the magnitude of the impact is regarded to be medium. As the impact extend beyond the 30km radius of the site, the impact is of regional extent. Due to the impact

being assessed during the construction phase only, the impact is of short-term duration and is reversible when the construction period ceases. As noted in Table 11-5 below, the impact is therefore assessed to be of medium significance prior to the implementation of mitigation measures.

At present, delivery trucks travel to and from the Nchalo Illovo Sugar Factory by means of using the main road (M1) and then through the access gate to the Nchalo Illovo Sugar Estate. In addition to the cane delivery trucks, the residents of Nchalo are primarily making use of the M1 for transport on a daily basis. By adding the traffic expected during the construction phase of the development, the cumulative impact has been assessed to be of medium magnitude, and due to its local extent and short duration, the impact has been assessed to be of low significance.

TABLE 11-5: IMPACT ON TRAFFIC FLOW

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Traffic flow [NEGATIVE]	**Medium**	**Regional**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULATIVE IMPACT						
Traffic flow [NEGATIVE]	**Medium**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) Speed limits must be imposed, and all contractors and workers must adhere to such limits; b) Construction site planning must incorporate and separate vehicle and pedestrian access points; c) Pedestrian walkways must be demarcated on site; d) To improve the flow of traffic on-site, one-way traffic is proposed with different entrance and exit points. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.1.5 Impact on water resources

As noted within the project area description, there are no water resources within a close proximity to the proposed site. The nearest water resource is the Shire River, located approximately 2km

south-east of the proposed project site. The possibility of water resources being polluted during the construction phase is therefore unlikely.

The impact on water resources to be assessed during the construction phase, would be the efficient use of water during construction to ensure that the natural resource is protected preventing the depletion of the natural resource.

During construction, water is used for a variety of functions which includes worker hydration, concrete batching, grouting, and dust suppression. According to water license issued for abstraction from the Shire River (License Number: SL656/1979), 1 156 464 m^3 per day is authorised to be used for industrial, domestic and irrigation purposes. At present, the water used for industrial purposes on a daily basis, equates to approximately 50 000m^3. According to the license issued and water abstraction measurements, sufficient water is available for the construction of the proposed cogeneration power plant, however, inefficient water use would have an impact on the water resource.

It is not expected that the impact on water resources would alter natural and/or social functions and/or processes and therefore the magnitude is rated as low. Water use has an impact on downstream water users and therefore the impact is of regional extent, however, due to the short duration of the impact during the construction phase, the impact is of low significance. As for the cumulative impact during construction, it is noted that 200 construction workers would have a daily requirement of approximately 20 000 litres per day (20m^3). In addition to the water already being used for the operational activities, water will also be required during the construction of the project and therefore the cumulative impact during construction would have a notable impact on natural functions/processes and therefore the magnitude is medium. For this reason, the impact is rated to be of medium significance prior to the implementation of mitigation measures.

TABLE 11-6: IMPACT ON WATER RESOURCE

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Impact on water resource [NEGATIVE]	**Low**	**Regional**	**Short term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Impact on water resource [NEGATIVE]	**Medium**	**Regional**	**Short term**	**Probable**	**Sure**	**Reversible**

IMPACT RATING PRIOR TO MITIGATION	IMPACT RATING AFTER MITIGATION
Medium	**Low**
PROPOSED MITIGATION MEASURES	
a) Ensure that there are no leaking taps on site and ensure all hoses have auto shut off nozzles; b) Use water sparingly; Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.	

11.1.6 Impact on Biodiversity

As noted within the project area description, there are no natural vegetation on site to be removed as part of the construction phase of the project. The cogeneration power plant is proposed within the existing Nchalo Illovo Factory footprint, with additional areas for the bagasse storage yard, proposed directly adjacent and north of the existing power plant, which is currently used for the cultivation of sugarcane. The alignment proposed for the 11kV powerline is also located on area currently used for the cultivation of sugarcane. For this reason, the only vegetation to be affected, would be the sugarcane cultivated for Illovo Sugar.

The only impact during the construction phase of the project, which could have an impact on biodiversity, would be the spreading of alien invasive plant species. During construction, materials are normally imported from various areas. Such materials could contain seeds of alien invasive species and during construction, such plant species establishes on site and start spreading if not managed and mitigated. The negative impact of spreading of alien invasive species could slightly alter natural functions and therefore the impact is of low magnitude. The impact is however of site-specific extent and of short duration and for this reason the impact has been assessed to be of very low significance. The proper management of this impact would result to the impact being neutral.

From a cumulative perspective, all surrounding areas have already been transformed and the activity will not result to any additional clearance of natural vegetation. The cumulative impact on biodiversity is therefore neutral.

TABLE 11-7: IMPACT ON BIODIVERSITY

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Impact on biodiversity **[NEGATIVE]**	**Low**	**Site Specific**	**Short term**	**Probable**	**Certain**	**Reversible**

IMPACT RATING PRIOR TO MITIGATION				IMPACT RATING AFTER MITIGATION		
Very Low				**Neutral**		
CUMULATIVE IMPACT						
Impact on biodiversity **[NEGATIVE]**	**Low**	**Site Specific**	**Short term**	**Probable**	**Certain**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) The management of alien invasive species must be undertaken in accordance with the Illovo Sugar Environmental Management System specifically drafted to mitigate impacts on biodiversity; b) The contractor shall establish an alien invasive species management programme for the construction phase of the project and measures contained therein must be adhered to.						

11.1.7 Waste generation during construction

During construction, different types of waste is generated. Such waste include:

- Domestic waste from the construction camp;
- Construction waste (containing cement, wood, steel, tiles, etc.);
- Hazardous waste from oil, fuel and other chemicals; and
- Sewage from temporary sanitation facilities provided during the construction phase.

Improper storage and disposal and management of all four of these waste streams generated during construction, will have a negative impact on the subject and surrounding environment.

Illovo Sugar Africa has an Environmental Waste Management System (EWMS) in place and Nchalo Illovo Sugar, a site-specific Waste Management Plan (WMP) in addition to the EWMS, which is used as the operational tool for the storage and disposal of waste. The appointed contractor will have to comply with both the EWMS as well as the site-specific Waste Management Plan for Nchalo Illovo Sugar, to ensure appropriate and effective storage and disposal of waste in accordance with national and local regulations. The WMP makes reference to the disposal methods for solid and hazardous waste, however, this WMP does not address construction waste or sewage from temporary sanitation facilities.

The EWSM promotes the management of waste in accordance with the waste hierarchy for the prevention, re-use, recycling, treatment and disposal of waste.

If all streams of waste are not managed in accordance with the EWMS and WMP, the magnitude of the impact would be medium, as natural functions would be notably altered. As the waste to be disposed of, will have to be disposed of at a registered landfill site, the impact is not restricted to the site only, but also to the landfill site which must accommodate this additional waste and for this reason the impact is of local extent. As per the assessment below, the impact has been assessed to be of medium significance prior to the implementation of mitigation measures.

Cumulatively, the additional waste during the construction phase will add to the waste currently generated during the operational phase. As approximately 200 construction workers will be added to the site during this period, and additional construction waste would be generated, the cumulative impact of waste generation during construction is of high magnitude. The impact is of local extent as waste will have to be transported to a waste disposal facility, however, the impact is of short duration. For this reason, the cumulative impact is of medium significance.

TABLE 11-8: WASTE GENERATION

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Waste generation [NEGATIVE]	**Medium**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULATIVE IMPACT						
Waste generation [NEGATIVE]	**High**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						
a) Ensure that there are sufficient sealable waste bins on the construction site and contractor's camp; b) Designate a specific area for construction waste during construction and ensure that this is removed when storage capacity is reached; c) A registered third-party contractor must be appointed to collect sewage from the temporary toilet facilities on a regular basis; d) All hazardous and domestic waste must be stored and removed as stipulated with the existing EWMS and WMP. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.1.8 Impact on Climate Change

Construction activities contributes significantly to climate change as building materials such as concrete, aluminium and steel are directly responsible for large quantities of CO_2 emissions. When aluminium is converted to pure metal, the production process accounts for a significant amount of carbon emissions. The energy and heat used in the manufacturing process, come from fossil fuels and the use of fossil fuels means that the average CO_2 emissions from steel production, is about 1.85 tonnes CO_2 per one tonne of steel produced.

CO_2 emissions within the atmosphere are normally increased when vegetation is removed and the opportunity for CO_2 absorption is minimised. However, vegetation removal during the construction phase would be limited to approximately 3Ha of sugarcane and for this reason the impact would be insignificant.

As concrete and steel would be manufactured for the purposes of the cogeneration power plant, the magnitude of the impact of climate change during construction would be low as natural functions and/or processes could be slightly altered. As climate change affects a larger area, the extent of the impact is regional with a medium-term duration. The impact is therefore assessed to be of medium significance prior to the implementation of mitigation measures.

Other activities such as deforestation is currently adding to the impact of climate change experienced within Malawi. In addition to this, various large construction projects will be commenced with within the following three years, which results to more concrete and steel manufacturing. From a cumulative impact perspective, the magnitude of the impact is of medium magnitude, and therefore of medium significance prior to the implementation of mitigation measures.

TABLE 11-9: CLIMATE CHANGE

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Climate change [NEGATIVE]	**Low**	**Regional**	**Medium term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Climate change [NEGATIVE]	**Medium**	**Regional**	**Medium term**	**Probable**	**Sure**	**Reversible**

IMPACT RATING PRIOR TO MITIGATION	IMPACT RATING AFTER MITIGATION
Medium	**Low**
PROPOSED MITIGATION MEASURES	
a) Construction materials must be recycled if possible, to reduce the requirement for the production of new materials; b) Removal of vegetation must be restricted to the footprint of the required site. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.	

11.1.9 Impact on Health and Safety

During the construction phase, the health and safety of construction workers as well as the surrounding community members must be assessed and addressed in order to reduce the health and safety impact of the project.

During construction, construction personnel are working with heavy moving machinery, working on heights, working in confined spaces, working with hazardous substances, and working in extreme heat conditions. Another aspect to be considered is road safety of construction workers and drivers delivering materials to the construction site. This aspect could also impact innocent road users is any accident is to occur. All these activities are associated with a health and safety risk as these activities could lead to serious health conditions and injuries and in worst case scenarios, it could result to the loss of life. Nchalo Illovo Sugar has a Safety, Health, Environment, Risk and Quality (SHERQ) Policy which promotes a culture of "zero harm" in order to protect, as far as reasonably practicable, the health, safety and well-being of its people, surrounding community and the environment around Nchalo. During construction, compliance with the Safety, Health, Environment, Risk and Quality Policy will be a requirement to aim to protect the health, safety and well-being of workers and the surrounding community.

For community members, the influx of construction workers can provoke higher rates of violence, injury, alcohol and drug consumption and sexually transmitted diseases in the local population. The influx of construction workers could also result to a spike in pregnancies and especially teenage girls. All of these impacts can negatively impact the long-term livelihood potential of the local resident population, particularly teenage girls, as girls would then tend to drop out of school due to early pregnancy. During the construction period, teenage girls are particularly vulnerable and will require targeted attention.

Overcrowded or camp-based living conditions can significantly alter existing levels of communicable diseases including respiratory problems, diarrheal and vector-borne diseases, and tuberculosis, which also increases the risks of disease being introduced and spreading through host communities. This, in turn, strains public resources and affects overall service capacity for local residents' health needs.

The health and safety impact during construction could notably change the social functions and/or processes and therefore the impact is of medium magnitude. As the impact would mostly be restricted to the site and the surrounding community of Nchalo, the impact is of local extent. As some of the impacts results to diseases which could have a medium to long term effect, the extent of the impact is rated as being long term.

Cumulatively, more workers are being added to the footprint of the existing sugar factory and this increases the possibility of injury occurring and diseases being spread. For this reason, the magnitude of the cumulative impact is medium as it could have a notable change to the social environment. The significance of the impact is also assessed to be of medium significance prior to the implementation of mitigation measures.

TABLE 11-10: HEALTH AND SAFETY

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Health and Safety [NEGATIVE]	**Medium**	**Local**	**Long term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULATIVE IMPACT						
Health and Safety [NEGATIVE]	**Medium**	**Local**	**Long term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						
a) Construction workers must ensure that all work is undertaken with the correct PPE; b) All contractors must comply with the SHE Specification drafted for Nchalo Estate; c) All contractors must adhere to the Health and Safety Plan issued for to the contractor and drafted specifically for the cogeneration power plant; d) Illovo will prepare a Road Safety Management and Mitigation Plan that identifies peak traffic times during the construction period, high risk accident areas and road signage or other options, school and community safety awareness campaigns and reporting mechanisms to put in place during the construction phase; e) Illovo must increase and run suitable awareness campaigns on negative coping strategies, HIV and AIDs both within the community and at local schools prior to construction starting; f) Illovo should prepare an 'Influx Management Plan' to identify any health and safety risks on the surrounding community with the influx of construction workers, and to compile measures to effectively mitigate such impacts.						

Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

11.1.10 Socio-Economic Impact

Positive Socio-economic impact

During construction, Illovo Sugar Malawi will comply with the National Construction Industry Act 19 of 1999, which states that 30% of the construction on site must be delivered by a local company, and 51% of the professional consultants will also have to be local. It is expected that the contractor will bring as many as 200 workers to the construction site. During construction, 'n minimum of 200 families will therefore be positively impacted with the job opportunities created and income to be received to support these families.

Due to the 200 workers which will be brought to the construction site, there will therefore be an influx of minimum 200 people to the town of Nchalo during the construction phase. Local entrepreneurs could therefore also use this opportunity to increase their revenue by supplying the basic necessities to the local construction workers.

Besides the direct positive impact on local labour and local entrepreneurs, for some supplies, the contractor will also make use of local suppliers to supply the required services, if the products are in compliance with the required standards. The positive impact on local suppliers could therefore be of regional extent.

The positive socio-economic aspect could have a notable impact on social processes and environments and therefore the impact is rated to be of medium magnitude. The impact is however only of short duration due to the construction phase aspect of the development and therefore the impact is of medium significance. Measures are included within the Environmental and Social Management Plan to ensure that the local community benefits from the construction, however, due to the short extent of the positive impact, the impact will remain to be of medium significance following the implementation of mitigation measures.

It is also expected that the construction phase of the Shire Valley Transformation and Irrigation Program and the Mpatamanga Hydroelectric Power Station will be undertaken during the same period as the construction activities for the Nchalo Cogeneration Power Plant. These construction projects are all proposed within the southern area of Malawi (within the 100km radius of Blantyre). Cumulatively, these construction activities would result to an impact of high (+) magnitude, which is of regional extent and medium-term duration. The significance of the cumulative is therefore high (+).

TABLE 11-11: POSITIVE SOCIO-ECONOMIC IMPACT

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Socio-economic [POSITVE]	**Medium**	**Regional**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium (+)				**Medium (+)**		
CUMULATIVE IMPACT						
Socio-economic [POSITVE]	**Medium**	**Regional**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
High (+)				**High (+)**		
PROPOSED MITIGATION MEASURES						
a) Illovo should implement small-business training opportunities for existing local businesses to help increase competition and business preparation in advance of construction, to both increase local downstream economic opportunities and to help increase competition and mitigate any supply and demand price increases Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

Negative Socio-Economic Impact

As noted within the Health and Safety impact, the influx of additional construction workers into the area, can result in a spike in pregnancies. This could have a negative impact on the long-term livelihood potential of the local resident population, particularly teenage girls. Considering that 44% of the households in the area already apparently engage in negative coping strategies, the likelihood of an increase in the number of teenage girls falling pregnant, dropping out of school, and the spread of HIV, is high.

Another negative socio-economic impact during construction would be the possible lack of available local accommodation to absorb the temporary demand. Construction activities can result in a spike in the demand for temporary accommodation near Nchalo and insufficient planning and monitoring could result to unplanned increase of temporary shack or other accommodation into areas not designated or suitable for residential use.

Besides the pressure on demand for temporary accommodation facilities, construction projects and an influx of employed individuals to an area can result in a significant increase in demand for food

and other resources such as water supply and fuelwood. A lot of this added resource pressure can fall predominately upon women, particularly those most vulnerable. Increased pressure on local services and resources, such as water, or wood supplies for fuel, can also add to the challenges experienced by poorer households. This demand may also be exacerbated by the in-migration of jobseekers or traders into Nchalo during the construction period.

A spike in demand and subsequent price increases, can increase the social and financial pressure on the vulnerable households surrounding the estate. These are difficult indirect impacts to address, as in some respects they can also present potential economic opportunities for the surrounding community, whilst increasing the pressure upon vulnerable households.

Developing local supply chains in advance can help reduce reliance on external suppliers and reduce the risk of price inflation. This can be done by identifying local suppliers and encouraging them to participate in the construction project and/or to prepare for an increase in demand. This can also help increase local competition.

As the negative socio-economic impact could have a notable impact on the surrounding social environment, the impact is rated to be of medium magnitude. The impact does however extend beyond the boundaries of the site and is therefore of local extent. As some of these impacts could result to pregnancies which would cause teenage girls to drop out of school and have an impact on their livelihood, the impact is of long-term duration and therefore the socio-economic impact has been assessed to be of medium significance prior to the implementation of mitigation measures.

As noted with the positive socio-economic impact, it is also expected that the construction phase of the Shire Valley Transformation and Irrigation Program and the Mpatamanga Hydroelectric Power Station will be undertaken during the same period as the construction activities for the Nchalo Cogeneration Power Plant. Cumulatively, this will result to a very large influx of construction workers which could result to negative socio-economic impacts of high significance. The impact is of regional extent and long-term duration and therefore of high significance.

TABLE 11-12: NEGATIVE SOCIO-ECONOMIC IMPACT

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Socio-economic impact [NEGATIVE]	**Medium**	**Local**	**Long term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		

CUMULATIVE IMPACT						
Socio-economic impact [NEGATIVE]	**Medium**	**Local**	**Long term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
High				**Medium**		

PROPOSED MITIGATION MEASURES

a) Illovo must increase and run suitable awareness campaigns on negative coping strategies, HIV and AIDs both within the community and at local schools prior to construction starting;
b) Illovo consider establishing a partnership during the construction period with a National or Local NGOs who focuses on these issues, who will be able to run the campaigns, set up monitoring mechanisms with teachers for example to identify those at risk of dropping out of school, and to provide counselling services available to assist any vulnerable school pupils and individuals needing support or guidance;
c) Illovo should prepare an 'Influx Management Plan' that will anticipate likely accommodation demand during the construction period and accommodation options on-site and off-site to minimise socio-economic risks and planned settlement;
d) Illovo should consult and work with the relevant Local Authorities and Business stakeholders to identify possible risks in terms of increased demand for local services, natural resources and an increase in prices. This plan should include implementing a suitable strategy to monitor any price changes during construction and ways to address areas of concern.
e) Illovo should implement small-business training opportunities for existing local businesses to help increase competition and business preparation in advance of construction, to both increase local downstream economic opportunities and to help increase competition and mitigate any supply and demand price increases

Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

11.2 Assessment of Impacts During Operation

The operation of the cogeneration power plant is likely to result in the following environmental and socio-economic impacts:

- Impact on soil (soil erosion and soil contamination);
- Impact on air quality;
- Noise generation;
- Impact on water resources;
- Impact on biodiversity;
- Impact on existing land use;
- Waste generation;
- Climate change impacts;
- Impact on health and safety of workers and surrounding land users;
- Socio-economic impact

11.2.1 Impact on Soil

Erosion

During operation, areas within the cogeneration power plant will be built up and surfaces and/or paved. Paving and surfacing of an area, increases the velocity of storm water during a storm event and should proper storm water management measures not be implemented within the cogeneration power plant area, storm events could lead to erosion of the adjacent surrounding property, as storm water, with an increased velocity, is discharged to the surrounding property.

The proposed project area is relatively flat, which could result to water not draining from site at an acceptable velocity. The design of the site and storm water management would therefore be important during operation.

As the project site is relatively flat, natural processes on the subject property and surrounding area, would only slightly be altered by the possibility of erosion occurring. The magnitude of the impact on soil caused by erosion during operation is therefore low. Erosion protection measures can be implemented on site and the immediate surrounding area if erosion is noticed during operation and therefore the impact is noted to be of short duration, and site specific. For this reason, the impact is assessed to be of low significance prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact can be further reduced to be of very low significance. The significance of the erosion impact for both proposed layout alternatives is the same and therefore only one assessment table is provided below for both layout alternatives.

At present the largest portion of the site has already been transformed with industrial activities taking place on site. With the largest portion of the site already impacted, it is unlikely that the additional structures and infrastructure would have a significant cumulative impact and therefore the impact has also been assessed to be of low significance.

TABLE 11-13: OPERATIONAL IMPACT ON SOIL CAUSED BY EROSION (BOTH LAYOUT ALTERNATIVES)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Soil erosion [NEGATIVE]	**Low**	**Site Specific**	**Short term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Soil erosion [NEGATIVE]	**Low**	**Site Specific**	**Short term**	**Unlikely**	**Sure**	**Reversible**

IMPACT RATING PRIOR TO MITIGATION	IMPACT RATING AFTER MITIGATION
Low	**Very Low**
PROPOSED MITIGATION MEASURES	
a) Drainage on site must be managed and velocity of storm water runoff must be reduced; b) Storm water on site must be managed in accordance with a storm water management plan; c) All drains on site must be kept clear of debris to ensure storm water flows and drains freely; d) Areas where soil erosion is noticed, must be attended to immediately and permanent structures must be placed to ensure that erosion is mitigated. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.	

Soil Contamination:

During operation, the site will still be operating with machinery which contain fuel and oil which could leak, causing soil to become polluted. Once soils have become polluted, it can no longer be used and will have to be disposed of. This impact will therefore be permanently impacted.

Soil pollution could notably alter natural functions of soil and therefore the impact is of medium magnitude. Due to the permanent nature of the cogeneration power plant, and the fact that contaminated soil would be permanently lost, the impact is of long-term duration, and site specific.

The impact was assessed taking the magnitude, extent, duration, probability and confidence into consideration. The impact table below assessed the impact on soil caused by soil contamination, to be of medium significance prior to the implementation of mitigation measures. The significance of the impact for both proposed layout alternatives is the same and therefore only one assessment table is provided below for both layout alternatives.

Cumulatively, the addition of the cogeneration power plant would not result to such a significant change as the current power generation operation will be replaced with the new cogeneration power plant. The cumulative impact is therefore neutral.

TABLE 11-14: OPERATIONAL IMPACT ON CAUSED BY CONTAMINATION (BOTH LAYOUT ALTERNATIVES)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Soil contamination **[NEGATIVE]**	**Medium**	**Site Specific**	**Long term**	**Probable**	**Sure**	**Irreversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		

CUMULATIVE IMPACT						
Soil contamination **[NEGATIVE]**	**Zero**	**Site Specific**	**Long term**	**Probable**	**Sure**	**Irreversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) All hazardous substances such as oil and fuel, must be stored within a bunded and lined area and should oil or fuel be handled, handling must be undertaken on a lined surface; b) Drip trays must be used on all machinery standing on site; c) Machinery used on site must be in good working order; Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.2.2 Impact on Air Quality

Air pollution occurs countrywide in Malawi. Composition of air in all areas is a combination of dust, gases and car exhaust fumes that affects the air quality in both urban and rural settings. The large volumes of vehicles in cities contribute significant amounts of carbon monoxide, carbon dioxide, volatile organic compounds and secondary pollutants to the poor quality of air. Smoke and haze especially in the rural areas are other pollutants experienced in Malawi due to bushfires, burning of tires, biomass burning and dust.

Factors affecting air quality within the Nchalo Sugar Estate, include dust from roads, current emissions from the existing boiler, surrounding deforestation, wildfires and fires for cooking purposes.

A total pollutant emission rate of 20 575.17 gram per second was calculated for the current operations, of which carbon dioxide accounts for 98.03% of the pollution load, particulates 1.62% and other gaseous pollutants, 0.35%. The existing power generation process currently accounts for 99.91% of the total pollution load.

An Air Quality Impact Assessment was undertaken to determine the impact on air quality associated with the proposed cogeneration power plant, by removing the existing old boilers and replacing it with a new technologically advanced unit as described in Section 2 of the Draft ESIA Report. The results of the Air Quality Impact Assessment Report are summarized within Section 9.1 of the Draft ESIA, and an assessment of the emission levels associated with the existing and future operations were undertaken for daily and annual average total suspended particulates (TSP), daily and annual average PM_{10} concentrations, annual average $PM_{2.5}$ concentrations and daily average nitrogen dioxide concentrations.

Total Suspended Particulates (TSP)

The assessment concluded that daily and annual average TSP concentrations are expected to reduce by as much as 83% following commissioning of the new cogeneration plant. No contraventions of the TSP standard are expected anywhere in the study area. Fugitive emissions account for less than 18% of the total site particulate emissions at present and controlled emissions, 82%. The improvements brough about by the new cogeneration plant will probably result in the contribution of fugitive sources increasing to almost 57% and controlled emissions reducing to about 43% of the site total emissions in the future.

$PM_{10/2.5}$

At present, $PM_{10/2.5}$ concentrations probably exceed the respective daily limits over an area of almost 20 square kilometres surrounding the mill. Notwithstanding the fact that the planned improvement project will most likely reduce the $PM_{10/2.5}$ impact by as much as 90%, contraventions of the daily and annual standards remain likely at the Illovo Factory Village, located adjacent and west of the existing sugar factory. This is due to the incremental contribution of fugitive sources on the site, not influenced by the planned improvement project.

Hazardous and Other Gaseous Pollutants

Hourly, daily and annual simulations were performed for nitrogen dioxide, carbon monoxide and total volatile organic compounds (TVOCs).

Current nitrogen dioxide concentrations may exceed 25% of the 110 $\mu g/m^3$ standard, onsite and immediately northwest of the site. These, slightly elevated concentrations, will most likely not be present after the improvement project.

All other predictions yielded results below 5% of the relevant ambient air quality standards for all reference periods.

Significance analysis

The negative impact of particulate pollutants is currently minor at all the closest receivers identified during the study. The new cogeneration process will reduce the $PM_{10/2.5}$ impact by as much as 90%, however, contravention of the daily and annual standards remains likely at the Illovo Factory Village directly bordering the mill towards the southwest.

The negative impact of gaseous pollutants presently, and in the future, is negligible at the closest receivers identified.

Following commissioning of the new cogeneration plant, the total pollutant emission rate will decrease by more than 48% to 10 599.30 gram per second. CO_2 will remain the pollutant of concern, at more than 98% of the pollution load. Particulate emission will decrease to 0.43% of the total pollution load and the minor gaseous pollutants will remain mostly unchanged.

Although the proposed changes to the power generation infrastructure will be positive with the pollutants being emitted being reduced, pollutants will still be emitted into the atmosphere during the operational phase of the power generation unit. Due to the new infrastructure and technology, pollutants emitted will be significantly lower than what is currently being emitted and will also be compliant with the local Ambient Air Quality Standards (MS 737:2011). Subsequently, the magnitude of the impact is low. As the impact will extend beyond the boundary of the site, the extent of the impact is local and of long-term duration.

From a cumulative impact perspective, existing air emissions from the surrounding environment must be taken into account. As mentioned, air emissions within the surrounding environment are currently resulting from dust dispersion, and fires used for cooking purposes. The impact is further exacerbated by deforestation as CO_2 absorption is reduced with the reduction of trees. As the existing air quality impact is negative and of high magnitude, the positive impact of the reduction of the pollutants emitted from the boilers when compared with the existing boilers, will improve the current situation and bring some balance to the negative impact. The cumulative impact will therefore be of low magnitude, of local extent and long-term duration.

TABLE 11-15: IMPACT ON AIR QUALITY (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Air quality [NEGATIVE]	**Low**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Air quality [NEGATIVE]	**Medium**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						
a) Community involvement must continue throughout the lifetime of the project; b) Nchalo Illovo Sugar must implement a line of communication where complaints can be lodged; c) Industry standard emission control techniques and administrative measures should be supplemented with engineering measures to maintain the residual impact to lowest possible levels. These measures should specifically focus on fugitive dust sources following the installation of the new cogeneration plant. d) Current industry standard techniques and administrative control measures should be maintained to ensure the residual impact at the nearest sensitive receivers remains at current background levels. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.2.3 Impact of Noise Generation

Noise level monitoring of the existing Nchalo Illovo Sugar Factory is undertaken on a bi-annual basis. These monitoring reports indicated that the current baseline noise levels are quite significant with levels mostly exceeding 85dBA within most areas of the existing factory.

A Noise Impact Assessment was also specifically undertaken for the cogeneration power plant and Section 9.1 of the ESIA summarized the assessment undertaken for this project. The most excessive noise sources expected from the new cogeneration power plant includes the following:

- Boiler feed water pumps;
- Cooling fans;
- Cooling water condensers;
- Steam turbine condensers;
- Heavy moving vehicles;

It is noted that the new cogeneration power plant will bring forth the following changes to the existing power generation unit which has an impact on the noise being generated:

- Steam turbines will be removed from the old building. The old building was never designed to minimize noise emission levels. The older steam turbines casings also have a reduced noise reduction efficiency. The assessment is estimating that this change would result to a potential noise reduction of 3 dBA;
- The new turbines will be installed within a generator building with restricted access, fitted with acoustic doors. The turbines and piping will also be fitted with acoustic and thermal insulation. This could have a significant influence on the reduction of noise emission levels and considers a potential reduction of 5 dBA, though in reality this reduction could be significantly higher;
- It is also envisaged to remove the steam shredders and prime movers as part of the project. The existing high-pressure equipment are without noise protection and these changes will further reduce future noise levels. However, without sound power emission levels of the new equipment, it is difficult to assess the potential improvement.

The Noise Impact Assessment also noted that there were numerous residential dwellings associated with the Nchalo sugar Estate, of which a significant noise impact can be expected from residences within 200m from the project site. Noises from industrial impacts could be high up to a distance of 500m from the project infrastructure while industrial projects could be audible at a distance of 1km from the project site.

During the scoping phase, two layout alternatives were identified, as noted in Section 7. Layout alternative 1 proposes the bagasse storage yard directly adjacent and north of the existing sugar factory footprint, while layout alternative 2 proposes the bagasse storage yard directly adjacent and west of the existing sugar factory. It must be noted that the bagasse storage yard is not an area

generating significant noise and as the high noise generating equipment remains at the same for both alternatives, the significance of the noise impact for both alternatives are the same.

Considering the conceptual scenarios evaluated within the Noise Impact Assessment, the development of the co-generation project will result in a slight reduction in noise levels, with this assessment defining the magnitude of the noise impact for both layout alternatives, to be minor/low.

However, due to existing high noise levels, this assessment assumes a probable (daytime) to definite (night-time) probability of annoyance with the project, though it must be noted that the high noise levels are associated with the existing sugar processes and equipment, as well as the proximity of potential noise-sensitive receptors adjacent to the sugar operation. The cumulative impact of both layout alternatives is therefore of medium magnitude during the day and high magnitude during the night. The cumulative noise impact is therefore noted to be of medium significance during the day and high significance during the night, when the noise generation for the sugar processing operation is also taken into consideration. As most of the noise sources to be generated are from the existing sugar processing plant, measures will have to be taken to reduce this impact, however, this would form part of an exercise to be undertaken by Nchalo Illovo and does not form part of this scope for the cogeneration power plant.

The impact of noise generated for daytime and night-time is noted in Table 11-16 and Table 11-17 below.

TABLE 11-16: NOISE IMPACT DURING DAY-TIME (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Noise generation [NEGATIVE]	**Low**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very low**		
CUMULATIVE IMPACT						
Noise generation [NEGATIVE]	**Medium**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Medium**		

PROPOSED MITIGATION MEASURES
a) Community involvement must continue throughout the lifetime of the project; b) Nchalo Illovo Sugar must implement a line of communication where complaints can be lodged; c) Technical measures could include: The selection of different equipment or processes; changing a process methodology; design and implementation of certain control measures such as enclosing; silencing; isolation; damping or barriers; use of acoustical masking equipment; implementation of acoustic shielding at the dwelling of a receptor. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

TABLE 11-17: NOISE IMPACT DURING NIGHT-TIME (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Noise generation [NEGATIVE]	**Medium**	**Local**	**Long-term**	**Definite**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULATIVE IMPACT						
Noise generation [NEGATIVE]	**High**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
High				**Medium**		
PROPOSED MITIGATION MEASURES						
a) Community involvement must continue throughout the lifetime of the project; b) Nchalo Illovo Sugar must implement a line of communication where complaints can be lodged; c) Technical measures could include: The selection of different equipment or processes; changing a process methodology; design and implementation of certain control measures such as enclosing; silencing; isolation; damping or barriers; use of acoustical masking equipment; implementation of acoustic shielding at the dwelling of a receptor. d) As part of another process, Nchalo Illovo Sugar should investigate the measures which could be taken to reduce the existing noise generation from the sugar manufacturing operation. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.2.4 Impact on Water Resources

Water will be used for the proposed cogeneration power plant for boiler blowdown and general cleaning purposes. At present, approximately 750 000m^3 of water per month is used for the factory. The total volume of water used only for the existing power generation operation is unfortunately not available, however, when comparing the designs of the old and new power generation units, it is noted that the new power generation unit will be using significantly less water than the existing unit, approximately 14,1m^3 per hour, which equates to only 10 150m^3 of water per month. Which is approximately 2% of the water used by the factory on a monthly basis. As the volume of water used for the existing power generation facility is not specifically available, it is difficult to assess the impact of water use during operation. It is however noted that the water used during operation, for this purpose, is insignificant compared to the total volume of water used for the sugar processing plant and therefore this impact is not further assessed in detail.

Water used for blow down and general cleaning purposes is diverted to the new effluent pond located directly west and adjacent to the warehouse within the perimeter of the sugar factory. Following treatment, water is used for irrigation purposes on the existing sugar can fields. According to the design of the new effluent treatment pond, it is expected that the quality of the treated effluent will be in accordance with the following values:

TABLE 11-18: QUALITY OF TREATED EFFLUENT OF THE NEW EFFLUENT TREATMENT POND

QUALITY OF TREATED EFFLUENT	
Variable	**Value**
Temperature raise	+3 Degrees
pH	6.0 – 9.0
BOD5	30.0 mg/L (Max)
TSS	5.0 mg/L (Max)
Oil and Grease	10 mg/L
Dissolved Solids	2000

Should the quality of the treated effluent not meet the above standards, it is possible that ground and surface water resources could become polluted with irrigation water with unacceptable standards draining towards these water bodies. The impact could slightly alter natural functions and processes and therefore the magnitude of the impact is low. The impact is unlikely to occur and noted to be of local extent and medium-term duration. The significance of the impact is therefore assessed to be of low significance prior to the implementation of mitigation measures. There is no change to this assessment with the two different layout alternatives investigated and therefore only one assessment table is provided which would be applicable for both layout alternatives.

Cumulatively, it is noted that treated effluent is currently being used for irrigation purposes following the treatment from the existing effluent pond. As the same conditions would apply for the new effluent treatment pond as with the existing effluent treatment pond, the cumulative impact

would not be significant on ground and surface water resources and therefore the impact is of low significance.

TABLE 11-19: IMPACT ON WATER RESOURCES FOR BOTH LAYOUT ALTERNATIVES (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Water resource pollution [NEGATIVE]	**Low**	**Local**	**Medium-term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Water pollution [NEGATIVE]	**Low**	**Local**	**Medium-term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) Treated effluent must be tested monthly to ensure treated effluent meets the required national and local standards; b) The effluent treatment pond must be regularly maintained to ensure effective treatment of effluent. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.2.5 Impact on Biodiversity

The project area itself has already been disturbed where the area proposed for the cogeneration power plant is within the existing factory footprint, while the area proposed for the extension of the bagasse yard, is the existing sugarcane fields adjacent to the project site. No natural vegetation will therefore require clearance for the purposes of the cogeneration project. However, during operation, disturbed areas lead to the increased possibility of alien invasive plant species establishing and spreading to adjacent areas is not managed properly. Nchalo Illovo Sugar Estate is however managing the site in accordance with the Illovo Sugar Environmental Management System Group Guideline for biodiversity and therefore the alien plant species infestation and spreading is managed accordingly.

Due to the current alien invasive species management procedures in place, natural functions will be negligibly altered and therefore the impact is of very low magnitude. The impact is also of site-specific extent and long-term duration which resulted in the very low significance of the impact.

The cumulative impact is also of very low significance as alien invasive species on site is managed and the presence thereof is very limited as such species are eradicated as soon as it establishes on site. There is no change to this assessment with the two different layout alternatives investigated and therefore only one assessment table is provided which would be applicable for both layout alternatives.

TABLE 11-20: NEGATIVE IMPACT ON BIODIVERSITY (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Biodiversity [NEGATIVE]	**Very Low**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Very Low				**Very Low**		
CUMULATIVE IMPACT						
Biodiversity [NEGATIVE]	**Very Low**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Very Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) Illovo Sugar should continue to adhere to the Illovo Sugar Environmental Management Standard drafted to mitigate impacts on biodiversity. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

The current lack of affordable electricity is resulting in deforestation as residents require wood for cooking and fuel purposes. The increased electricity capacity generated, would therefore result to less deforestation, as increased electricity capacity implies that more electricity would be available to be distributed to the residents of Malawi through ESCOM. The focus is however placed on affordability, and it is noted that a large percentage of residents will still not be able to afford electricity provided by ESCOM, even if there is an increased generating capacity. This positive impact will therefore only slightly alter the natural processes and functions and is therefore

of low magnitude. The additional electricity generated is provided to ESCOM and therefore the extent of the impact is regional in nature and for as long as the project is operational (long-term). The likelihood of the positive impact occurring is probable and for this reason, the positive impact on biodiversity is assessed to be of medium (+) significance. Mitigation measures are proposed to enhance the positive impact and ensure that the positive impact is not reduced.

Cumulatively, it was also previously noted that other power generation projects and power saving projects are currently in the planning process and is proposed to be implemented during the same time as the Illovo Sugar cogeneration power project. This will result to more electricity availability for the country of Malawi, having a further positive impact on the current deforestation rate. Once again, focus is placed on the affordability of electricity. However, it is expected that industries and businesses would benefit most from the additional electricity capacity, resulting to an increase in revenue, impacting job creation and availability which would positively impact the local communities. The positive financial impact on the local communities would increase the possibility of the local community to afford electricity, thereby reducing the need for wood as their only fuel source. Cumulatively, the impact would therefore be of medium magnitude, regional extent and long-term duration. The impact is therefore of medium significance (+).

TABLE 11-21: IMPACT ON BIODIVERSITY (POSITIVE)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Biodiversity [POSITVE]	**Low**	**Regional**	**Long term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium (+)				**Medium (+)**		
CUMULATIVE IMPACT						
Biodiversity [POSITVE]	**Medium**	**Regional**	**Long term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
High (+)				**High (+)**		
PROPOSED MITIGATION MEASURES						
a) All activities must be undertaken in accordance with the Illovo Environmental Management System – Biodiversity Group Level Guideline.						

b) Nchalo Illovo has an indigenous tree nursery which are used for various initiatives on and off the estates e.g. rehabilitation of indigenous forests and the protection of river banks. This initiative must continue throughout the lifetime of the cogeneration power project.

Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

11.2.6 Impact on Existing Land Use

As mentioned in the project description, the proposed project site where the cogeneration power plant is proposed is currently within the existing sugar factory footprint currently utilized for industrial purposes. Approximately 2.5Ha will however be required in addition to the existing footprint, for the purposes of the extended bagasse storage yard and a powerline of approximately 6km will be constructed on existing agricultural land. The area proposed for this extension for both layout alternatives is currently used for the cultivation of sugarcane and therefore the impact on existing land use for both layout alternatives is the same and only one assessment table is provided below.

Approximately 2.5Ha of cultivated land would be transformed for industrial purposes and due to the adjacent industrial activities, it is unlikely that any other land use except industrial or agricultural would be suitable on the approximately 2.5Ha area. The impact on the small agricultural area to be affected, is of low magnitude as no other land uses would be compatible on the proposed area, due to the existing industrial activities. The impact is therefore of very low significance.

Looking at the total area under cultivation in Nchalo (16 029Ha), the loss of approximately 2.5Ha of agricultural land, is seen as having an insignificant impact on natural or social processes and/or functions. The cumulative impact is therefore also of very low magnitude, specific and of long-term duration and is therefore assessed to be of very low significance.

TABLE 11-22: IMPACT ON EXISTING LAND USE (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Land use [NEGATIVE]	**Very Low**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Very Low				**Very Low**		
CUMULATIVE IMPACT						
Land use [NEGATIVE]	**Very Low**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**

IMPACT RATING PRIOR TO MITIGATION	IMPACT RATING AFTER MITIGATION
Very Low	**Very Low**
PROPOSED MITIGATION MEASURES	
a) The transformation of the extended area must be kept to the footprint required for the bagasse storage yard. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.	

11.2.7 Impact of Waste Generated

During operation, there are various waste streams generated as a result of the cogeneration power plant. Such waste includes the following:

Bottom Ash:

A by-product or waste which is currently re-used, is the ash resulting from the burning of the bagasse within the boiler. This is known a bottom ash which is removed from the equipment and used as a fertilizer on the existing agricultural areas.

The process with the new cogeneration power plant will remain the same, with bottom ash being used as a fertilizer on existing agricultural lands. The IFC Guideline for Converting Biomass to Energy, 2017, also noted that biomass ash could contain high concentrations of cadmium, lead or zinc. If these high concentrations infiltrate the soil, it could have a negative impact on soil fertility impacting agricultural production. Should bottom ash contain high concentrations of these metals, natural processes would be notably altered and for this reason the impact is of medium magnitude. The impact is site-specific to the area where the bottom ash is applied and long term and for this reason the impact of bottom ash with high concentrations of heavy metals, is assessed to be of medium significance prior to the implementation of mitigation measures.

Illovo Sugar currently has an Ash Disposal and Management Plan in place to ensure the safe application, temporary dumping, and permanent storage of bottom ash. The recycling of the bottom ash must be undertaken in accordance with the Ash Disposal and Management Plan and according to the IFC Guideline, it must be ensured that concentrations of heavy metals within the bottom ash, is low. If the measures contained within the Ash Disposal Management Plan is adhered to the impact could be mitigated to be actually having a positive impact of medium significance, as a waste is re-used as a fertiliser and not being disposed of at a waste disposal site.

Cumulatively, it is not expected that there would be any change to the current impact as the bottom ash currently generated will be replaced with the bottom ash to be generated by the new cogeneration power plant. The cumulative impact is therefore neutral.

The impact associated with bottom ash will remain the same for both layout alternatives and therefore only one assessment table is provided.

TABLE 11-23: IMPACT OF BOTTOM ASH (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Waste: Bottom ash [NEGATIVE]	**Medium**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium (-)				**Medium (+)**		
CUMULATIVE IMPACT						
Waste: Bottom ash [NEGATIVE]	**Zero**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) Current measures included within the Ash Disposal Management Plant must continue to be complied with; b) Sampling and testing of bottom ash must be undertaken on a quarterly basis. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

Domestic/Solid Waste:

Domestic waste is currently generated at present with the current sugar factory operation. Some domestic/solid waste is reused and/or recycled. Such waste includes scrap metals, plastics and paper. Metals which can't be reused, and scrap plastics are normally sold for recycling purposes. Other domestic waste which cannot be recycled or reused, is transported to the nearest landfill site in Nchalo.

The magnitude of the impact is medium, as it could result to a notable change in environmental and social processes and functions. As waste must be disposed of off site or transported to other facilities which could disposed of specific waste, the impact is of local extent, and long-term duration. The impact is therefore of medium significance prior to the implementation of mitigation measures.

Form a cumulative impact perspective, the domestic waste generated and associated with the cogeneration power plant, is not much different from what is currently being generated and as the process will remain the same, only with newer technology, and no additional staff members are expected to be appointed during the operational phase, it is unlikely that there will be any change in the domestic waste generated. The magnitude of the impact is therefore zero, with a site-specific extent and long-term duration. The cumulative impact associated with the generation of solid waste for the cogeneration power plant, is therefore neutral if the recycling/reuse of such materials are undertaken in accordance with all applicable national and local regulations as well as the site-specific Waste Management Plan drafted for Illovo Sugar Nchalo. The impact associated with domestic waste generation and disposal is the same for both layout alternatives and therefore only one assessment table is provided as below.

TABLE 11-24: IMPACT OF DOMESTIC WASTE (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Waste: Domestic [NEGATIVE]	**Medium**	**Local**	**Long-term**	**Unlikely**	**Certain**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULATIVE IMPACT						
Waste: Domestic [NEGATIVE]	**Zero**	**Local**	**Long-term**	**Unlikely**	**Certain**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						

a) Removal of domestic waste must be undertaken as per the Nchalo Illovo Sugar Waste Management Plan and Environmental Management System for waste management;
b) Solid waste must be recycled and reused as far as possible and if this is not possible, it must be disposed of at the nearest landfill site, with the approval for the District Council and in accordance with the national and local regulations.

Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

Hazardous Waste:

Hazardous waste generated during operation of the cogeneration power plant includes substances such as fuel, oil, herbicides and pesticides.

Any spillages of such waste could result to the pollution of the project area, causing a hazardous environment for workers and the surrounding environment. Fuel or oil spillages requires immediate attention as the area would need to be rehabilitated. Soil will have to be removed from the area affected and be disposed of and treated as hazardous waste. The magnitude of the impact is medium as it could notably affect environmental processes. The impact is site-specific and of long-term duration. For this reason, the impact is of medium significance prior to the implementation of mitigation measures. As the new cogeneration power plant is not expected to generate more hazardous waste than what is currently being generated with the existing electricity generation process, the magnitude of the cumulative impact is zero, with a site-specific extent and long-term duration. For this reason, the cumulative impact of hazardous waste is neutral.

All hazardous waste management will be undertaken in accordance with the site-specific Waste Management Plan drafted for Illovo Sugar Nchalo. The impact has therefore been assessed to be neutral.

TABLE 11-25: IMPACT OF HAZARDOUS WASTE (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Waste: Hazardous (Oil and fuel) [NEGATIVE]	**Medium**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULATIVE IMPACT						
Waste: Hazardous (Oil and fuel) [NEGATIVE]	**Zero**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		

PROPOSED MITIGATION MEASURES
a) Hazardous waste must be handled and disposed of in accordance with the Environmental Management System drafted for Waste Management, Hazardous Waste Management as well as the site-specific Nchalo Illovo Sugar Waste Management Plan. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

Fly ash can also be regarded as a hazardous waste if high levels of heavy metals are found within the fly ash. If the heavy metal content within the fly ash is high, it is not suitable for being recycled and used as a fertilizer on the existing agricultural land.

At present, with the existing boilers and power generation equipment, fly ash is emitted from the stack as there is no filter capturing the fly ash before being emitted. The entire site is therefore impacted by small black dust particles polluting the site. The current impact is therefore of high magnitude and significance.

The new cogeneration power plant will be constructed with abatement equipment which will capture the fly ash before the pollutants are emitted into the atmosphere. The new cogeneration power plant will therefore improve the current situation resulting from the emission of fly ash and due to the significant positive change on environmental and social processes, the impact is of low magnitude. If the abatement equipment is not functioning properly, the fly ash could affect adjacent communities and therefore the impact is of local extent and long-term duration. However, with the new equipment to be installed, the possibility of the impact occurring, is low. The impact has therefore been assessed to be of low significance. For the disposal of fly ash, it must be noted that fly ash will have to be removed from the abatement equipment and landfilled in accordance with national and local regulations.

From a cumulative perspective, no other fly ash is generated within the proximity of the site and for this reason the impact is of zero magnitude and therefore of neutral significance.

TABLE 11-26: IMPACT OF FLY ASH (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Waste: Hazardous (Fly ash) **[NEGATIVE]**	**Low**	**Local**	**Long-term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULAITVE IMPACT						

Waste: Hazardous (Fly ash) **[NEGATIVE]**	**Zero**	**Local**	**Long-term**	**Definite**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) Hazardous waste must be handled and disposed of in accordance with the Environmental Management System drafted for Waste Management as well as the site-specific Nchalo Illovo Sugar Waste Management Plan. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

Wastewater:

Wastewater from the power plant is known as "blow-down" water which is water that is drained from the cooling equipment to remove mineral build up. Blow down water could possibly contain high Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and high temperatures. The proposed power generation facility proposes the blow-down water to be diverted to the new effluent treatment plant where the water will be treated by means of stabilising organic material through natural processes involving sunlight, water, nutrients, algae, atmospheric oxygen, and bacterial action. Treated effluent is then used for irrigation purposes. The effluent treatment process and limits which will have to be complied with is noted in Section 2.3 above. If the treated effluent does not meet the required standards before it is used for irrigation, it could have a notable impact on environmental processes and for this reason the impact is regarded to be of medium magnitude. The impact would extend beyond the boundaries of the site and could have a medium-term impact if corrective measures are not taken to address these impacts as soon as possible. The impact has therefore been assessed to be of medium significance prior to the implementation of mitigation measures.

It is not expected that the effluent to be generated with the new cogeneration power plant, would exceed the existing effluent generation and therefore the cumulative impact is of zero magnitude and neutral significance.

TABLE 11-27: IMPACT OF EFFLUENT (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Waste: Effluent [NEGATIVE]	**Medium**	**Local**	**Medium-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULATIVE IMPACT						
Waste: Effluent [NEGATIVE]	**Zero**	**Local**	**Medium-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) Treated effluent must be sampled and tested monthly to ensure compliance with the local and national regulations and licenses issued; Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

Medical Waste:

Some first-aid waste could be expected from the boiler house and at present, such waste is placed within a sealable container and transported to the clinic for disposal. If such waste is not disposal of properly, the impact could be of medium magnitude, and due to the long-term impact, of medium significance.

The collection and disposal of medical waste process will however remain the same and it is not expected that the quantity of such waste will increase with the new cogeneration power plant. The cumulative impact is therefore neutral if existing protocols and measures are followed in accordance with national and local regulations and the site-specific Waste Management Plan draft for Illovo Sugar Nchalo.

TABLE 11-28: IMPACT OF MEDICAL WASTE (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Waste: Medical **[NEGATIVE]**	**Medium**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULATIVE IMPACT						
Waste: Medical **[NEGATIVE]**	**Medium**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) Medical waste must be handled and disposed of in accordance with the Environmental Management System drafted for Waste Management as well as the site-specific Nchalo Illovo Sugar Waste Management Plan. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.2.8 Impact on Climate Change

With the energy sector accounting for almost three quarters of human-caused greenhouse gas emissions, shifts to clean, renewable sources are critical to solving the climate crisis. Bioenergy is a unique type of renewable electricity. Unlike solar, wind, and hydropower, generating power from biomass emits greenhouse gases and pollutants into the air. When biomass is burned for electricity generation, it releases carbon dioxide into the atmosphere. However, sources of biomass, such as agricultural crops, also capture carbon dioxide during the process of photosynthesis. If sugarcane absorb as much carbon dioxide as they emitted during the biomass combustion process, then the carbon cycle remains in balance. The renewable nature of biomass therefore results to the burning of biomass to be a carbon-neutral source of electricity.

For this reason, the magnitude of greenhouse gas emissions is zero, with the significance of the impact assessed to be neutral during operation. As this impact is assessed to be neutral, the cumulative impact is also neutral.

TABLE 11-29: IMPACT ON CLIMATE CHANGE (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Climate Change [NEGATIVE]	**Zero**	**Regional**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
CUMULATIVE IMPACT						
Climate change [NEGATIVE]	**Zero**	**Site Specific**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
b) As the impact is neutral, no mitigation measures are proposed.						

11.2.9 Impact on Health and Safety during operation

As discussed within the report, the existing power generating equipment is a health and safety hazard and for this reason, it is currently of high magnitude with a negative impact of high significance.

The new cogeneration power plant will however significantly improve the health and safety of workers and surrounding environment due to the improved design and operating conditions of the new boiler section. The following changes to the design and operating conditions are noted:

a) Existing boilers are very old and do not meet the emission standards. There are no measures that can be applied to the old boilers to reduce the emissions to meet the standards. In terms of explosion risk, the reduction/elimination of any gas release is always beneficial for a plant. Reduction of any gas emissions is directly related to a decrease in the possibility of the formation of an explosive atmosphere in the plant.
b) Existing boilers are not insulated, resulting in high outside skin temperature and high dust content in the air. Higher temperature and dust content in the air therefore leads to higher explosion risks. By replacing existing boilers with a single boiler, with a 60°C skin

temperature at maximum, the possibility of the formation of an explosive atmosphere is drastically reduced.

c) Bagasse conveyor belts will be covered to avoid dust suspension or dust clouds.
d) By electrification of shredders and the removal of all existing turbines, the high-pressure steam (above 3 bars) in the sugar process will be removed completely. The high pressure will be contained in a very limited space. As a consequence, by reducing the risk of explosion from pressurized vessels, are massively limited.
e) Current boilers are very hot from the outside because the furnace is made of bricks with no external skin insulation. The new boilers will be "insulated", which results in a further decrease in explosion risk. Sources of ignition in various cases are likely to be caused by burning, grinding or welding activities or potential hot surfaces that have the potential to increase the temperature of a flammable substance above its flash point. By reducing/eliminating any hot surfaces in the plant, potential sources of release points are reduced. In addition to the decrease in explosion risk, the insulation of the boilers reduces the hazardous risk on employees currently working in extreme heat conditions within the boiler section of the plant.
f) The current boilers require "manual deashing". Because the boilers are very hot, this is a hazard to employees. The new proposed power plant is proposing automated deashing, which will reduce the health risk, and bring a further decrease in the plant temperature.
g) Emissions currently emitted by the existing equipment are non-compliant. There is no abatement equipment on the stacks, capturing particulate matter and fine particulate matter before it is emitted into the atmosphere. Exposure to such concentrations could result in numerous health impacts such as asthma, bronchitis, high blood pressure etc. The new advanced design of the proposed cogeneration power plant proposes abatement equipment which will significantly reduce pollutants emitted into the atmosphere, and specifically particulate matter affect the health of workers and the surrounding environment.

All of the above changes will therefore result to the existing negative impact of high significance, being reduced to an impact of low magnitude. Within the operation of the power plant, some health and safety risks will still be present, however, this risk is significantly reduced by the new proposed structures and infrastructure. The impact is therefore regarded to be of low magnitude, local extent and long duration, for as long as the project continues. The project is therefore assessed to be of low significance.

Cumulatively, it is noted that the proposed power plant will be within the footprint of the existing sugar factory, and the improvement in terms of the health and safety impact must therefore also consider the health and safety of the sugar factory when assessing the cumulative impact.

The health and safety of the new cogeneration power plant will significantly improve the current health and safety impacts, however taking the existing industrial environment into consideration, it is noted that the possibility of injuries and health issues are still probable if no measures are taken to reduce the possibility of the impact occurring. With the proposed new cogeneration power plant, the magnitude of the cumulative impacts reduced from high to medium and subsequently

the cumulative impact is assessed to be of medium significance prior to the implementation of mitigation measures. It must be noted that the cumulative impact without the implementation of the cogeneration power plant, would have resulted to an impact of high significance.

The health and safety impacts for both layout alternatives would remain the same and therefore only one assessment table is provided below:

TABLE 11-30: HEALTH AND SAFETY IMPACT (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Health and Safety [NEGATIVE]	**Low**	**Local**	**Long-term**	**Definite**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Health and Safety [NEGATIVE]	**Medium (-)**	**Local**	**Long-term**	**Definite**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium (-)				**Low (-)**		
PROPOSED MITIGATION MEASURES						
a) Maintenance of equipment must be undertaken on a continuous basis; b) Danger signs must be placed on all areas where any risk has been identified; c) Health and safety of the site must be undertaken in accordance with the Health and Safety Plan specifically drafted for the project; d) Health and safety of the site must be undertaken in accordance with the IFC: Environmental Health and Safety Guidelines. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

For the operation of the new cogeneration power plant, a larger bagasse storage yard will be required. The larger bagasse storage yard also results in more bagasse being stored until it is used as a fuel for the boiler. The storage of bagasse, could have the following impacts:

- Generation of dust during handling of bagasse and this impact is increased during windy conditions. The inhalation of this bagasse dust could result to breathing issues and lung diseases; and

- Storage of large quantities of bagasse could result in spontaneous combustion.

Two layout alternatives were proposed for the cogeneration plant, with the bagasse storage area for layout alternative 1 located directly north and adjacent to the existing footprint of the sugar factory, while the bagasse storage area for layout alternative 2 is located west and directly adjacent to the existing sugar factory. The bagasse storage yard proposed within layout alternative 2 is proposed directly adjacent to the Nchalo Illovo Sugar staff accommodation, while the bagasse storage yard for layout alternative 1 is located further from any residents or employee households. Although the possibility of combustion remains the same for both layout alternative 1 and 2, the health impacts associated with the generation of dust within the bagasse storage area, have been assessed for both layout alternative 1 and 2.

For layout alternative 1 (bagasse storage area located north of the existing sugar factory), the staff accommodation is located further from the project area and therefore the impact might only result to a slight change in social and environmental processes and/or functions. For this reason, the impact is of low magnitude. It is also noted that the wind direction is predominantly in a north-western direction, therefore during windy conditions, bagasse dust will be airborne and transported in a northernly direction, which is currently characterized by agricultural land. Without any mitigation measures and during such windy conditions, the impact will extend beyond the boundary of the site. The impact is also noted to be of long-term duration (for the duration of the project). Based on the magnitude, extent and duration of the impact, the impact has been assessed to be of low significance.

Cumulatively, the project must also consider dust from other sources such as the vehicular movement on dirt roads. With the prevailing wind conditions coming from a south-easterly direction and the dirt road located directly adjacent and east of the proposed bagasse storage yard for layout alternative 1, it is expected that generated dust would most likely have a larger impact on the north-western area of the project site, currently used for cultivation purposes. The magnitude of the impact is therefore low, with a local extent and long-term duration and therefore the impact has also been assessed to be of low significance.

TABLE 11-31: HEALTH AND SAFETY IMPACT ASSOCIATE WITH BAGASSE STORAGE AREA (LAYOUT ALTERNATIVE 1)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Health and Safety: Bagasse storage area (Alternative 1) [NEGATIVE]	**Low**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
CUMULATIVE IMPACT						
Health and Safety: Bagasse storage area (Alternative 1) [NEGATIVE]	**Low**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) The covering of the bagasse stockpiles is recommended to reduce water ingress, provide a barrier against oxygen which could favour combustion conditions, protect external sources of ignition, and to minimise dust generation during handling of the bagasse; b) Firefighting equipment must be on site and be within close proximity to the bagasse storage yard to fight any possible fires as soon as possible. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

For layout alternative 2, the bagasse storage area is proposed directly adjacent and west of the existing sugar factory and directly adjacent and north of the staff accommodation facilities for Nchalo Illovo Sugar. Bagasse dust generation would therefore notably alter the social and environmental processes and/or functions and therefore the impact is of medium magnitude. The impact is also rated to be of local extent and long-term duration and therefore the impact is rated to be of medium significance prior to the implementation of mitigation measures.

From a cumulative impact perspective and taking into account dust generated from heavy moving vehicles travelling on that road, the cumulative impact of the bagasse storage area as proposed in

layout alternative 2, is also of medium magnitude and assessed to be of medium significance prior to the implementation of mitigation measures.

TABLE 11-32: HEALTH AND SAFETY IMPACT ASSOCIATE WITH BAGASSE STORAGE AREA (LAYOUT ALTERNATIVE 2)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Health and Safety: Bagasse storage area (Alternative 2) **[NEGATIVE]**	**Medium**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
CUMULAITVE IMPACT						
Health and Safety: Bagasse storage area (Alternative 2) **[NEGATIVE]**	**Medium**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						
a) The covering of the bagasse stockpiles is recommended to reduce water ingress, provide a barrier against oxygen which could favour combustion conditions, protect external sources of ignition, and to minimise dust generation during handling of the bagasse; b) Firefighting equipment must be on site and be within close proximity to the bagasse storage yard to fight any possible fires as soon as possible. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.2.10 Socio-Economic Impact

Additional electricity capacity

Malawi has the lowest average population access to electricity in Sub-Saharan Africa and lacks sufficient and reliable supply of energy. The additional power generated by this project, which

uses a high inertia, rotating power generation process, will add both generation capacity and stability to the national grid.

Malawi's current generation capacity is largely dependent on hydropower which is susceptible to drought, climate change and siltation. The current energy supply in Malawi is critically stressed due to the aging nature of these hydropower plants and as a result of both droughts and recent floods, substantial losses of electricity generation was experienced (between 18% - 22%). The increased provision of electricity will have significant positive impacts with production as irrigation of fields would be more consistent. The provision of electricity will also make an indirect contribution by supporting other small business sectors that require more stable electricity to develop. Thereby improving the economic environment and opportunities for business growth.

By helping to improve electricity supply and reliability, this project will make positive contributions towards other socio-economic issues that affect many in Malawi. These contributions include the following:

- The improved reliability of electricity will enable many small businesses reliant on electricity, such as welders, mechanical workshops and irrigation farmers, just to name a few, to improve their productivity and economic activity.
- The allocation and loss of primarily women's productive time to the task of collecting firewood, will also decrease as the availability of electricity in the country improves. This will enable women to allocate this time to other more productive economic activities or child-care duties, both which lead to long-term economic growth and improvement.
- The contribution will aid in diversifying energy supply and reducing dependence on imported fuels and use of diesel generators.

This project will therefore make a significant positive national contribution both in terms of the megawatts generated as well as helping to diversify the national generation capacity with a technology that also provides a stable and valuable baseload contribution.

During the stakeholder engagement process, a concern was noted that the local surrounding community be the first to benefit from the additional electricity generation. Nchalo Illovo is however not responsible for the distribution of the additional electricity generation as all additional electricity will be exported to ESCOM for distribution and it will be distributed according to their prerogative. The electrical tariff is also determined by ESCOM and Illovo Sugar Malawi would unfortunately not have any input to the determination of the tariff. Illovo and ESCOM are however exploring a grid infrastructure to run the district in isolation when the ESCOM grid is down. Therefore, the local communities will still be connected when other generating power stations of ESCOM are not producing power. This would have a direct positive impact to local communities.

As the larger population within Malawi lives in poverty, the positive impact on surrounding community members, will however be dependent on the affordability of the electricity. Social processes could be notably impacted and therefore the impact is of medium (+) magnitude. As

electricity is exported to ESCOM who will be responsible for distributing electricity to areas within Malawi, the extent of the positive impact is regional and also of long-term duration. The impact has therefore been assessed to have a positive impact of high significance.

When considering the cumulative impact, other proposed power generating or power saving projects such as the Mpatamanga Hydroelectric Power Station (power generating) and the Shire Valley Transformation and Irrigation Program (SVTP) (power saving) is also considered. The SVTP is a project which entails the construction of a gravity fed channel to supply water to the lower lying areas of Malawi, which will result to a significant reduction in electricity use as water for irrigation purposes will no longer have to be pumped from the Shire River. The Mpatamanga Hydroelectric Power Station will be producing 350MW of power for Malawi. In addition to this it must be noted that Nchalo Illovo Sugar will be generating sufficient electricity for their energy requirements and will therefore no longer be dependent on ESCOM to supply any portion of electricity for their demands. The electricity, which is currently allocated to Nchalo Illovo Sugar Estate, will no longer be required and can therefore be used for other operations in Malawi. Considering this, the cumulative impact is therefore of high magnitude, resulting to an impact having positive impact of high significance.

TABLE 11-33: SOCIO-ECONOMIC IMPACT – ADDITIONAL ELECTRICITY CAPACITY (DURING OPERATION)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Socio-economic: Additional electricity capacity **[POSITIVE]**	**Medium (+)**	**Regional**	**Long-term**	**Definite**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
High (+)				**High (+)**		
CUMULATIVE IMPACT						
Socio-economic: Additional electricity capacity **[POSITIVE]**	**Medium (+)**	**Regional**	**Long-term**	**Definite**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
High (+)				**High (+)**		

PROPOSED MITIGATION MEASURES
a) As the impact is positive, no mitigation measures are required. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

Changes to existing employment

This project entails decommissioning an outdated powerplant with five old boilers and replacing it with a new powerplant with one modern boiler. There will be a higher level of automation with the installation of the new powerplant equipment. There may be some job and role changes required within the industrial part of the Nchalo operation, whilst recognizing that a large part of the industrial section activities will be unchanged i.e., the cane milling operation.

Some of the job changes and roles will result in the existing employees being trained and up-skilled so they can operate the cogeneration power plant. This is a positive impact as this will help the growth and development of their career as well as provide the employees with an opportunity to possibly earn a higher salary, thereby improving their current livelihood conditions.

Most employees have dependents and any loss in work opportunity or income can have a wider negative impact upon larger numbers in the community. The proposed cogeneration power plant will however not result in any significant changes in terms of employment. There may be a few lower-level workers within the power plant that may need to be redeployed into the sugar mill for an equivalent job. Some of these may be sub-contractors or seasonal employees.

Importantly, Illovo has a robust Redundancy Policy in place and is aiming to ensure that no individual will be made redundant by this project but will rather be retrained and redeployed to a new role within alternative sections of the Nchalo Estate operation if they cannot be accommodated in the powerplant section. If Illovo Sugar does not comply with the Redundancy Policy, and another position within Illovo Sugar is not found for employees which positions have been made redundant, some positions might be affected. However, such positions would be limited to less than three and therefore the magnitude of the impact is low. The impact prior to the implementation of mitigation measures were assessed to be of low significance. However, should the Redundancy Policy be complied with, none of the less than employees would be affected, as other positions within Illovo Sugar will be provided to such employees. As for the cumulative impacts, seeing that the impact is neutral, the magnitude of the cumulative impact is zero, also resulting to a neutral impact.

TABLE 11-34: IMPACT OF EMPLOYMENT LOSS (ILLOVO STAFF MEMBERS)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Socio-economic: Employment loss **[NEGATIVE]**	**Low**	**Local**	**Medium-term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Neutral**		
CUMULATIVE IMPACT						
Socio-economic: Employment loss **[NEGATIVE]**	**Low**	**Local**	**Medium-term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) The Redundancy Policy of Illovo Sugar must be taken into consideration and be adhered to if any employees are to be affected by the new cogeneration power plant operation. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

The upskilling and training of some of the employees to operate the new cogeneration power plant, will have a positive socio-economic impact. As the number of such employees to receive the required training is limited, the positive impact is of medium magnitude and significance.

Cumulatively, the upskilling and training of some of the employees will have a positive impact on the livelihood of the employees affected as the training would positively impact their careers and have an additional downstream positive effect on their families. The cumulative impact is also of medium magnitude and assessed to be of medium significance.

TABLE 11-35: SOCIO-ECONOMIC IMPACT – TRAINING OF STAFF MEMBERS

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Socio-economic: Upskilling and training of staff **[POSITIVE]**	**Medium (+)**	**Local**	**Long-term**	**Definite**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium (+)				**Medium (+)**		
CUMULATIVE IMPACT						
Socio-economic: Upskilling and training of staff **[POSITIVE]**	**Medium (+)**	**Local**	**Long-term**	**Definite**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium (+)				**Medium (+)**		
PROPOSED MITIGATION MEASURES						
a) As the impact is positive, no mitigation measures are required. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

It is likely in this rural area, particularly in the case of long-term contractors, that most of their work will be primarily with Illovo. Nchalo Illovo indicated that there would not be any job losses for any long-term sub-contractors or their staff. For this reason, the magnitude of the impact is zero, with the significance of the impact being assessed as neutral. As the impact is neutral, the magnitude of the cumulative impact is also zero.

TABLE 11-36: IMPACT OF EMPLOYMENT LOSS FOR LONG-TERM CONTRACTORS

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Employment loss: Long-term contractors **[NEGATIVE]**	**Zero**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
CUMULATIVE IMPACT						
Employment loss: Long-term contractors **[NEGATIVE]**	**Zero**	**Local**	**Long-term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Neutral				**Neutral**		
PROPOSED MITIGATION MEASURES						
a) As the impact is neutral, no mitigation measures are proposed, however, Illovo Sugar must ensure continuous engagement with their contractors during all phases of the project and should any activity affect any of the long-term contractors, communication with such contractors will be imperative and agreements must be made between the respective parties. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.3 Assessment of Impacts during Decommissioning

The impacts assessed for the decommissioning phase are related to the decommissioning of the cogeneration power plant, if or when operation of the plant should cease, and decommissioning of the structures would be required.

Should the operation of the power plant cease and decommissioning would be required, a construction team will once again establish a construction camp site for the duration of the decommissioning phase and subsequently the following environmental and socio-economic aspects could be impacted:

- Soil (soil erosion and soil contamination);

- Air quality (generation of dust);
- Noise generation;
- Traffic flow;
- Water resources;
- Waste generation
- Impact on health and safety of workers and surrounding land users;
- Socio-economic impact

As it is unclear if/or when the cogeneration power plant will be decommissioned, the assessment of cumulative impacts is not possible as the aspects which should be considered during the period of decommissioning is not known. For this reason, cumulative impacts are not assessed for the decommissioning phase.

11.3.1 Impact on Soil

Erosion

During decommissioning soil would be disturbed, and heavy machinery is used for this purpose. As per the assessment of the impact during the construction phase in Section 11.1.1, the disturbance of soil leads to the increased possibility of erosion occurring and is therefore often a serious problem.

The proposed project area is relatively flat, which reduces the velocity of storm water runoff during storm events. The magnitude of the impact on soil caused by erosion is therefore medium. The impact however of short duration, and site specific and for this reason the impact is regarded to be of low significance prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact can be further reduced to be of very low significance.

TABLE 11-37: IMPACT ON SOIL CAUSED BY EROSION (DECOMMISSIONING)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Soil erosion [NEGATIVE]	**Medium**	**Site Specific**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) Drainage on site must be managed and velocity of storm water runoff must be reduced; b) Create diversions to assist drainage on site, on areas which show signs of erosion. c) Reduction of the velocity of storm water can be accomplished by making use of sandbags; Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

Soil Contamination:

Machinery and materials used during the construction phase could also have an impact on soil as the machinery contains fuel and oils which could leak, causing soil to become polluted. Soil pollution could notably alter natural functions of soil and therefore the impact is of medium magnitude. If soil becomes polluted, the natural resource will forever be lost as the polluted soil will be disposed of. The polluted soil would therefore be irreversible. As the impact is associated with the decommissioning phase, the impact is of short-term duration, and site specific. The impact is therefore assessed to be of low significance prior to the implementation of mitigation measures.

TABLE 11-38: IMPACT ON SOIL CAUSED BY SOIL CONTAMINATION (DECOMMISSIONING)

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Soil contamination [NEGATIVE]	**Medium**	**Site Specific**	**Short term**	**Probable**	**Sure**	**Irreversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) All hazardous substances such as oil and fuel, must be stored within a bunded and lined area and should oil or fuel be handled, handling must be undertaken on a lined surface; b) Drip trays must be used on all machinery standing on site; c) Machinery used on site must be in good working order; Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.3.2 Impact on Air Quality (Dust)

Workers don't necessarily have to be building something for there to be a risk of dust exposure. All of the dust generated during the decommissioning phase of the project could have a negative impact on construction workers and directly adjacent land users, causing health and lung problems. Inhalable particles often get trapped in the nose, mouth and upper respiratory tract, and therefore the inhalation of such particles can be associated with respiratory disorders such as asthma, tracheitis, pneumonia, allergic rhinitis and silicosis.

The impact of dust on workers and surrounding land users are assessed in Table 11-38 below. As social functions could be notably altered, the impact is rated to be of medium magnitude. The impact is of short duration and of local extent as the impact could affect people adjacent to the

cogeneration power plant site (100m or more from the site). For this reason, the impact is assessed to be of medium significance prior to the implementation of mitigation measures.

TABLE 11-39: IMPACT ON AIR QUALITY

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Air quality [NEGATIVE]	**Medium**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						
a) The project site must be sprayed with water to reduce the excessive generation of dust during construction; b) The site should also be fenced with shade cloth to act as a barrier for wind, which transports dust off site. c) Construction workers using griding machinery must make use of the correct PPE, and dust masks to prevent inhalation of small particles. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.1.3 Noise Generation

During the decommissioning phase, sources of noise pollution include loud machinery, heavy moving vehicles, raised voices and physical work such as hammering, drilling or digging. Excessive noise could also affect the surrounding land users ability to undertake daily activities.

The closest receptors are construction workers, Illovo Sugar employees working within the factory boundary, and Illovo Sugar workers residing directly adjacent and west of the existing factory and proposed site. As the decommissioning noise impact would be similar to the noise impacts associated with the construction phase, the magnitude of the impact is also low and rated to be of low significance prior to the implementation of mitigation measures.

TABLE 11-40: IMPACT OF NOISE GENERATION

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Noise generation [NEGATIVE]	**Low**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		

PROPOSED MITIGATION MEASURES
a) Choose appropriate construction equipment for the job and ensure that all equipment is functional before use; b) Make use of low noise machinery. c) Limit the amount of time a worker spends near the source of noise; d) Provide quiet areas where workers can find relief during breaks. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

11.3.4 Impact on traffic flow

During the construction phase impact assessed within Section 11.1.4, the aspects to be considered were discussed in detail. During decommissioning, the same aspects would be applicable as the materials delivered to the site, will now have to be removed from site.

Tas a result of this, the magnitude of the impact is also regarded to be medium, of regional extent and short duration. As noted in Table 11-41 below, the impact is therefore assessed to be of medium significance prior to the implementation of mitigation measures.

TABLE 11-41: IMPACT ON TRAFFIC FLOW

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Traffic flow **[NEGATIVE]**	**Medium**	**Regional**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						
a) Speed limits must be imposed, and all contractors and workers must adhere to such limits; b) Construction site planning must incorporate and separate vehicle and pedestrian access points; c) Pedestrian walkways must be demarcated on site; d) To improve the flow of traffic on-site, one-way traffic is proposed with different entrance and exit points. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.3.5 Impact on water resources

As noted within the project area description, there are no water resources within a close proximity to the proposed site. The nearest water resource is the Shire River, located approximately 2km south-east of the proposed project site. The possibility of water resources being polluted during the construction phase is therefore unlikely.

The impact on water resources to be assessed during the decommissioning phase, would be the efficient use of water to ensure that the natural resource is protected, preventing the depletion of the natural resource.

As noted with the assessment of the impact on water resources during the construction phase, it is not expected that the impact on water resources would alter natural and/or social functions and/or processes and therefore the magnitude is rated as low. As excessive water use has an impact on downstream water users, the impact is of regional extent, however, due to the short duration of the impact during the decommissioning phase, the impact is of low significance.

FIGURE 11-42: IMPACT ON WATER RESOURCE

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Impact on water resource **[NEGATIVE]**	**Low**	**Regional**	**Short term**	**Unlikely**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Low				**Very Low**		
PROPOSED MITIGATION MEASURES						
a) Ensure that there are no leaking taps on site and ensure all hoses have auto shut off nozzles; b) Use water sparingly; Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.3.6 Waste generation during decommissioning

During decommissioning, different types of waste is generated. Such waste include:

- Domestic waste from the construction camp;
- Construction waste and large infrastructure (containing cement, wood, steel, tiles, etc.);
- Hazardous waste from oil, fuel and other chemicals; and
- Sewage from temporary sanitation facilities provided during the construction phase.

Improper storage and disposal and management of all four of these waste streams generated during decommissioning, will have a negative impact on the subject and surrounding environment.

During the decommissioning phase, some structures can be repurposed, or recycled when sold to other parties. However, if waste can't be recycled, or repurposed, waste will have to be removed and disposed of. If all streams of waste are not managed properly and in accordance with existing policies and regulations, the magnitude of the impact would be medium, as natural functions would be notably altered. As the waste to be disposed of, will have to be disposed of at a registered

landfill site, the impact is not restricted to the site only, but also to the landfill site which must accommodate this additional waste and for this reason the impact is of local extent. As per the assessment below, the impact has been assessed to be of medium significance prior to the implementation of mitigation measures.

FIGURE 11-43: WASTE GENERATION AND DISPOSAL DURING DECOMMISSIONING

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Waste generation [NEGATIVE]	**Medium**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						
a) Ensure that there are sufficient sealable waste bins on the construction site and contractor's camp; b) Designate a specific area for construction waste during construction and ensure that this is removed when storage capacity is reached; c) A registered third-party contractor must be appointed to collect sewage from the temporary toilet facilities on a regular basis; d) All hazardous and domestic waste must be stored and removed as stipulated with the existing EWMS and WMP. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.3.7 Impact on Health and Safety

During the decommissioning phase, the health and safety of construction workers as well as the surrounding community members must be assessed and addressed in order to reduce the health and safety impact of the project.

During this phase, construction personnel are working with heavy moving machinery, working on heights, working in confined spaces, working with hazardous substances, and working in extreme heat conditions. Another aspect to be considered is road safety of construction workers and drivers removing materials and equipment from the site. This aspect could also impact innocent road users if any accident is to occur. All these activities are associated with a health and safety risk as these activities could lead to serious health conditions and injuries.

The impacts associated with the decommissioning phase is similar to the health and safety impacts assessed during the construction phase as the same activities will apply, expect structures will be removed instead of being constructed.

The health and safety impact are of medium magnitude, local extent and medium to long-term duration, the impact is assessed to be of medium significance prior to the implementation of mitigation measures.

FIGURE 11-44: HEALTH AND SAFETY

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Health and Safety **[NEGATIVE]**	**Medium**	**Local**	**Long term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						
a) Construction workers must ensure that all work is undertaken with the correct PPE; b) All contractors must comply with the SHE Specification drafted for Nchalo Estate; c) All contractors must adhere to the Health and Safety Plan issued for to the contractor and drafted specifically for the cogeneration power plant; d) Illovo will prepare a Road Safety Management and Mitigation Plan that identifies peak traffic times during the construction period, high risk accident areas and road signage or other options, school and community safety awareness campaigns and reporting mechanisms to put in place during the construction phase; e) Illovo must increase and run suitable awareness campaigns on negative coping strategies, HIV and AIDs both within the community and at local schools prior to construction starting; f) Illovo should prepare an 'Influx Management Plan' to identify any health and safety risks on the surrounding community with the influx of construction workers, and to compile measures to effectively mitigate such impacts. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

11.3.8 Socio-Economic Impact

Positive Socio-economic impact

As with the construction process, during decommissioning, Illovo Sugar Malawi will comply with the National Construction Industry Act 19 of 1999, which states that 30% of the construction on site must be delivered by a local company, and 51% of the professional consultants will also have to be local.

As decommissioning is not planned at this stage, the number of workers to be brought to the area for this phase of the development is unknown. There will however be an influx of people to the town of Nchalo and local entrepreneurs could use this opportunity to increase their revenue by supplying the basic necessities to the local workers.

Besides the direct positive impact on local labour and local entrepreneurs, for some supplies. The positive impact on local suppliers could therefore be of local extent.

The positive socio-economic aspect could have a notable impact on social processes and environments and therefore the impact is rated to be of medium magnitude. The impact is however only of short duration and therefore the impact is of medium significance. Measures are included within the Environmental and Social Management Plan to ensure that the local community benefits from the construction, however, due to the short extent of the positive impact, the impact will remain to be of medium significance following the implementation of mitigation measures.

FIGURE 11-45: POSITIVE SOCIO-ECONOMIC IMPACT

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Socio-economic **[POSITVE]**	**Medium**	**Local**	**Short term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium (+)				**Medium (+)**		
PROPOSED MITIGATION MEASURES						
a) Illovo should implement small-business training opportunities for existing local businesses to help increase competition and business preparation in advance of decommissioning, to both increase local downstream economic opportunities and to help increase competition and mitigate any supply and demand price increases. Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.						

Negative Socio-Economic Impact

The influx of people into the area, can result in a spike in pregnancies. This could have a negative impact on the long-term livelihood potential of the local resident population, particularly teenage girls. The likelihood of an increase in the number of teenage girls falling pregnant, dropping out of school, and the spread of HIV, is high.

Lack of available local accommodation could also negatively affect the socio-economic aspects within the surrounding areas as the requirement for additional accommodation could result to an increase of temporary shack or other accommodation into areas not designated or suitable for residential use.

Besides the pressure on demand for temporary accommodation facilities, an influx of employed individuals to an area can result in a significant increase in demand for food and other resources such as water supply and fuelwood. A lot of this added resource pressure can fall predominately upon women, particularly those most vulnerable. Increased pressure on local services and resources, such as water, or wood supplies for fuel, can also add to the challenges experienced by poorer households. This demand may also be exacerbated by the in-migration of jobseekers or traders into Nchalo during the construction period.

As the negative socio-economic impact could have a notable impact on the surrounding social environment, the impact is rated to be of medium magnitude. The impact does however extend beyond the boundaries of the site and is therefore of local extent. As some of these impacts could result to pregnancies which would cause teenage girls to drop out of school and have an impact on their livelihood, the impact is of long-term duration and therefore the socio-economic impact has been assessed to be of medium significance prior to the implementation of mitigation measures.

FIGURE 11-46: NEGATIVE SOCIO-ECONOMIC IMPACT

IMPACT	MAGNITUDE	EXTENT	DURATION	PROBABILITY	CONFIDENCE	REVERSIBILITY
Socio-economic impact **[NEGATIVE]**	**Medium**	**Local**	**Long term**	**Probable**	**Sure**	**Reversible**
IMPACT RATING PRIOR TO MITIGATION				**IMPACT RATING AFTER MITIGATION**		
Medium				**Low**		
PROPOSED MITIGATION MEASURES						

a) Illovo must increase and run suitable awareness campaigns on negative coping strategies, HIV and AIDs both within the community and at local schools prior to decommissioning starting;
b) Illovo must consider establishing a partnership during the construction period with a National or Local NGOs who focuses on these issues, who will be able to run the campaigns, set up monitoring mechanisms with teachers for example to identify those at risk of dropping out of school, and to provide counselling services available to assist any vulnerable school pupils and individuals needing support or guidance;
c) Illovo should prepare an 'Influx Management Plan' that will anticipate likely accommodation demand during the construction period and accommodation options on-site and off-site to minimise socio-economic risks and planned settlement;
d) Illovo should consult and work with the relevant Local Authorities and Business stakeholders to identify possible risks in terms of increased demand for local services, natural resources and an increase in prices. This plan should include implementing a suitable strategy to monitor any price changes during construction and ways to address areas of concern.
e) Illovo should implement small-business training opportunities for existing local businesses to help increase competition and business preparation in advance of construction, to both increase local downstream economic opportunities and to help increase competition and mitigate any supply and demand price increases

Further recommendations to reduce this impact is included within the Environmental and Social Management Plan.

12. ENVIRONMENTAL IMPACT STATEMENT

A summary of the impacts assessed are provided in the table below:

TABLE 12-1: ENVIRONMENTAL IMPACT STATEMENT

IMPACT	SIGNIFICANCE BEFORE MITIGATION MEASURES	SIGNIFICANCE AFTER MITIGATION MEASURES	CUMULATIVE IMPACT PRIOR TO MITIGATION	CUMULATIVE IMPACT AFTER MITIGATION
Construction Phase				
Soil erosion	Low	Very Low	Neutral	Neutral
Soil contamination	Low	Very Low	Low	Very Low
Dust generation	Medium	Low	Medium	Low
Impact on traffic flow	Medium	Low	Low	Very Low
Impact on water consumption	Low	Very Low	Medium	Low
Spreading of alien invasive species	Very Low	Neutral	Neutral	Neutral
Waste generation	Medium	Low	Medium	Low
Impact on climate change	Low	Very Low	Medium	Low
Impact on health and safety	Medium	Low	Medium	Low
Positive socio-economic impact	Medium (+)	Medium (+)	High (+)	High (+)
Negative socio-economic impact	Medium	Low	High	Medium
Operational Phase				
Soil erosion	Low	Very Low	Low	Very Low

Soil contamination	Medium	Low	Neutral	Neutral
Impact on air quality	Low	Very Low	Medium	Low
Noise generation	Low	Very Low	Medium	Medium
Impact on water resources	Low	Very Low	Low	Very Low
Negative impact on biodiversity	Very Low	Very Low	Very Low	Very Low
Positive impact on biodiversity	Medium (+)	Medium (+)	High (+)	High (+)
Impact of waste generated (bottom ash)	Medium (-)	Medium (+)	Neutral	Neutral
Impact of waste generated (domestic waste)	Medium	Low	Neutral	Neutral
Impact of waste generated (hazardous waste)	Medium	Low	Neutral	Neutral
Impact of waste generated (fly ash)	Low	Very Low	Neutral	Neutral
Impact of waste generated (effluent)	Medium	Low	Neutral	Neutral
Impact of waste generated (medical waste)	Medium	Low	Neutral	Neutral
Impact on climate change	Neutral	Neutral	Neutral	Neutral
Impact on health and safety	Low	Very Low	Medium	Low
Impact on health and safety (Bagasse storage area – layout alternative 1)	Low	Very Low	Low	Very Low
Impact on health and safety (Bagasse storage area – layout alternative 2)	Medium	Low	Medium	Low

Socio-economic impact – additional electricity capacity	High (+)	High (+)	High (+)	High (+)
Socio-economic impact – changes to existing employment	Low	Neutral	Low	Neutral
Socio-economic impact – training of staff members	Medium (+)	Medium (+)	Medium (+)	Medium (+)
Socio-economic impact – impact on long-term contractors	Neutral	Neutral	Neutral	Neutral
Decommissioning Phase				
Soil erosion	Low	Very Low		
Soil contamination	Low	Very Low		
Dust generation	Medium	Low		
Noise generation	Low	Very Low		
Impact on traffic flow	Medium	Low		
Impact on water resources	Medium	Low		
Waste generation during decommissioning	Medium	Low		
Health and Safety	Medium	Low		
Positive socio-economic impact	Medium (+)	Medium (+)		
Negative socio-economic impact	Medium	Low		

13. LENDER REQUIREMENTS (EVALUATION OF IFC PERFORMANCE STANDARDS)

As outlined in Section 4.22, the IFC sustainability Framework comprise of eight Performance Standards.

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts Performance Standard
- Performance Standard 2: Labour and Working Conditions Performance Standard
- Performance Standard 3: Resource Efficiency and Pollution Prevention Performance Standard
- Performance Standard 4: Community Health, Safety, and Security Performance Standard
- Performance Standard 5: Land Acquisition and Involuntary Resettlement Performance Standard
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources Performance Standard
- Performance Standard 7: Indigenous Peoples Performance Standard
- Performance Standard 8: Cultural Heritage

For the construction and operation of the proposed cogeneration power plant, it is noted that Performance Standard 5, 6, 7 and 8 will not be applicable to this project as no community or individual will be resettled, no natural vegetation will be cleared, no indigenous people will be affected, and there will be no impact on any cultural heritage.

TABLE 13-1: LENDER REQUIREMENTS (EVALUATION OF INTERNATIONAL CORPORATION PERFORMANCE STANDARDS AND EQUATOR PRINCIPLES

International Finance Corporation (IFC) Performance Standards (PS)			
Performance Standards	**Section Reference in PS**	**Description of IFC PS Requirements**	**Applicability to PS Requirements**
PS 1 (Assessment and Management of Environmental and Social Risks and Impacts)			
Environmental and Social Assessment and Management System	5	The requirement of this PS notes that a process of environmental and social assessment must be conducted and an ESMS must be maintained appropriate to the nature and scale of the project and commensurate the level of its environmental and social risks and impacts. The ESMS must incorporate the following elements: i. Policy; ii. Identification of risks and impacts; iii. Management programs; iv. Organisational capacity and competency; v. Emergency preparedness and response vi. Stakeholder engagement; and vii. Monitoring and review	The environmental and social impacts for the construction, operation and decommissioning phases of the proposed cogeneration power plant, have been assessed in Section 11 of the ESIA Report. The ESMS elements are assessed in the subsections below.
Policy	6	The client must establish an overarching policy defining the environmental and social objectives and principles that guide the project to achieve sound environmental and social performance. The policy must: i. specify that the project will comply with the applicable laws and regulations of the host country; ii. be consistent with the principles of the Performance Standards;	Illovo sugar Malawi (ISM) already has operational policies and procedures in place which adequately describes objectives and principles in line with local and national laws as well as the Performance standards. The ESMP compiled for this proposed cogeneration power plant will outline the roles

		iii. Include other internationally recognized standards, certification, codes of practice subscribed to; iv. Indicate who within the company will ensure conformance with the policy and be responsible for execution;	and responsibilities between Illovo Sugar and the contractor to ensure conformance with the policy.
Identification of Risks and Impacts	7	The client must establish and maintain a process for identifying the environmental and social risks and impacts of the project in accordance with good international industry practise (GIIP). The client must ensure that risk and impacts are based on recent E&S baseline data at an appropriate level of detail. The process must also consider all relevant environmental and social risks and impacts of the project, including the issues identified in Performance Standards 2 through 8, and those who are likely to be affected by such risks and impacts (including individuals/groups that are considered disadvantaged or vulnerable). The emission of greenhouse gasses must also be considered, as well as risks associated with a changing climate and potential transboundary effects.	The environmental and social impacts were identified and assessed as per the Malawi Environmental Management Act, 2016 (No 19 of 2017) (as amended) as per the Act's screening criteria. The assessment is included in Section 11 of the ESIA Report. The development is proposed on areas which have already been disturbed and no sensitive environments will be affected. The proposed project will also assist in the reduction of greenhouse gas emissions, as the new proposed boilers will be installed with abatement equipment, reducing the emissions emitted into the atmosphere. (Section 11 of the ESIA Report)
	8	Environmental and social risks and impacts must be identified in the context of the project's area of influence. This area of influence encompasses, as appropriate: i. The area likely to be affected by the project, activities and facilities that are a component of the project;	In addition to paragraph 7 above, the environmental and social impact assessment included the identification and assessment of cumulative and indirect impacts as noted within Section 11 of the ESIA Report.

		ii. Unplanned but predictable development caused by the project that may occur later or at a different location; iii. Indirect project impacts on biodiversity or on ecosystem services upon which affected communities' livelihoods are dependent; iv. Associated facilities, which are facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable; v. Cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project.	
	9	Consider risks and impacts resulting from third party involvement (where the client can reasonably exercise control).	During construction, impacts and risks could result from the contractor, however Illovo Sugar is still the entity responsible for the construction and operational phases of the project. All risks have been assessed and is however included within Section 11 of the ESIA Report.
	10	Consider risk and impacts associated with primary supply chains (where the client can reasonably exercise control) defined in PS2 and PS6).	Illovo Sugar Malawi currently has procurement policies in place and all contractors and service providers will be screened as per the company's procurement policies. These policies includes the prohibition of child labour (or forced labour) and encourages the reporting of such breaches. Supply chain risks and impacts will be considered through verification and auditing process of contractors, applying code of conduct, and

			requiring contractors to implement an Employee Relations Policy.
	11	Take cognizance of the findings and conclusions of related plans, studies or assessments that are directly related to the project and its area of influence and the outcome of engagement with Affected Communities.	Although no communities will directly be affected by the project, the leaders of these communities were consulted, and a summary of these meetings held are included in Section 6 of the ESIA Report. Various specialist assessments were also undertaken, and the conclusion and recommendations of these assessments are noted in Section 9 of the ESIA Report. Mitigation measures proposed following these assessments have been included within the ESMP.
	12	Identify individuals and groups directly and differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status and implement differentiated measures to ensure they are not disproportionally impacted or disadvantaged in terms of benefits and opportunities	Not applicable as no disadvantaged groups will be affected by the project.
Management Programmes	13	Establish management programmes that describe mitigation and performance improvement measures and actions that address the identified risks and impacts.	The ESMP for the proposed project has been compiled to mitigate and avoid risks and impacts associated with the construction and operational phases of the project.
	14	Favour impact and risk avoidance over minimisation, and where residual impacts remain, compensate, or offset these, where technically and financially feasible.	

	15	Ensure mitigation and performance measures comply with applicable laws and regulations and meet PS1 to PS8.	The laws and regulations applicable to the performance measures have been included in the ESMP and is included in Section 14 of the ESIA Report.
	16	Establish E&S Action Plans defining desired outcomes as measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of resources and responsibilities for implementation. Plans must recognise the role of third parties and must be responsive to changes in circumstances, unforeseen events and results of monitoring and review.	
Organisational Capacity and Competency	17	Establish, maintain, and strengthen as appropriate an organisational structure that defines roles and responsibilities, authority to implement the Environmental and Social Management System (ESMS). Specific personnel with clear lines of responsibility and authority should be designated. Key social and environmental responsibilities should be well defined and communicated to relevant personnel and the rest of the organisation. Sufficient management sponsorship and human and financial resources will be provided on an ongoing basis to achieve and continuous performance.	Illovo Sugar Malawi currently has an Environmental Management System in place which details the roles and responsibilities of specific personnel who is responsible for the implementation of these measures. External experts will support Illovo Sugar Malawi when required, however, Illovo Sugar's Health, Safety, Environment and Social Performance Groups currently has sufficient capacity to deliver on the performance components of the ESMS.
	18	Personnel with direct responsibility for E&S performance must have the appropriate knowledge, skills, and experience necessary to perform their work, including implementation of the measures and actions in the ESMS and current knowledge of host country regulation and the requirements of PS1 to PS8.	

	19	E&S process must consist of an adequate, accurate, and objective evaluation and presentation, prepared by competent professionals. External experts must assist in the risks and impacts identification process for projects with significant adverse impacts or that are technically complex.	
Emergency Preparedness and Response	20	Establish and maintain an emergency preparedness and response system identifying the following: • Areas where incidents may occur. • Communities and individuals that may be impacted. • Response procedures. • Provision of equipment and resources. • Designation of responsibilities. • Communication (including affected communities) and training to ensure effective response; and • Review and revise activities periodically.	Illovo Sugar Malawi already has an Emergency Preparedness and Response System in place for the current operation, which includes a response mechanism and site response teams. This System will be updated to incorporate the cogeneration power plant and areas where incidents may occur.
	21	Assist potentially affected communities and local government with preparations to enable effective response to emergency situations (if applicable). Where local government agencies have little or no capacity to respond effectively, the Client will play an active role in preparing for and responding to emergencies associated with the project. Document and disclose to Affected Communities and government agencies.	
Monitoring and Review	22	Establish procedures for monitoring and measuring effectiveness of the management programme and compliance with legal/contractual obligations and	The ESMP for the proposed project have ben compiled and included in Section 14 of the ESIA Report. The ESMP includes procedures for

		regulatory requirements. Include representatives from Affected Communities in the monitoring activities (where appropriate). Retain qualified external experts to verify monitoring information.	monitoring compliance with legal obligations, and the use and frequency of audits to verify compliance and progress towards desired outcomes.
	23	Use inspections and audits to verify compliance and progress toward desired outcomes. Document results and corrective and preventative actions implemented and followed up.	
	24	Relay the effectiveness of the ESMS to senior management on a periodic basis. Senior management should take appropriate steps to ensure that the intent of the client's policy is met, the ESMS is being implemented and is effective.	
Stakeholder Engagement	25	Stakeholder engagement planning should include stakeholder analysis and planning, disclosure and dissemination of information, consultation and participation, grievance mechanism, and ongoing reporting to Affected Communities. The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development.	Prior to stakeholder engagement, a Stakeholder Engagement Plan was drafted to identify the stakeholders and the engagement methods to be used. Stakeholders were identified and included in Section 6 of the ESIA Report. The method of consultation is also included within this section of the report.
	26	Clients should identify the range of stakeholders that may be interested in their actions and consider how external communications might facilitate a dialog with all stakeholders	
	27	The client will develop and implement a Stakeholder Engagement Plan that is scaled to the project risks and	

		impacts and development stage and be tailored to the characteristics and interests of the Affected Communities.	
	28	In cases where the exact location of the project is not known, but it is reasonably expected to have significant impacts on local communities, the client will prepare a Stakeholder Engagement Framework, as part of its management program	Not applicable as the location of the project is known
	29	The client will provide Affected Communities with access to relevant information on: i. the purpose, nature, and scale of the project; ii. the duration of proposed project activities; iii. any risks to and potential impacts on such communities and relevant mitigation measures; iv. the envisaged stakeholder engagement process; v. the grievance mechanism.	All information as required is and was included in documentation which were made available for a public review and comment period (Scoping and ESIA Report)
	30	The client will undertake a process of consultation in a manner that provides the Affected Communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them.	Considering the different stakeholders of the project, various methods are used to consult with the respective parties. Such methods include, electronic distribution of information, stakeholder and one on one consultation meetings, printing and placement of site notice information boards, and the availability of the Scoping Report at the Nchalo Illovo Sugar Reception area.
	31	For projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation (ICP) process that will result in the Affected communities' informed participation	
	32Indigenous people - For projects with adverse impacts to Indigenous Peoples, the client is required to engage them in a process of ICP		Not applicable as indigenous people are not affected by the proposed development

	33	Where stakeholder engagement is the responsibility of the host government, the client will collaborate with the responsible government agency, to the extent permitted by the agency, to achieve outcomes that are consistent with the objectives of this Performance Standard.	Not applicable, as stakeholder engagement is undertaken by the client as part of the ESIA process.
	34	The client will implement and maintain a procedure for external communications that includes methods to: i. receive and register external communications from the public; ii. screen and assess the issues raised and determine how to address them; iii. provide, track, and document responses, if any; iv. adjust the management program, as appropriate.	Illovo Sugar has a Grievance Redress Mechanism in place which details the procedure for addressing issues when raised by the public or other stakeholders. The same Grievance Redress Mechanism will be applicable to the Cogeneration Power Plant Project.
	35	Where there are Affected Communities, the client will establish a grievance mechanism to receive and facilitate resolution of Affected Communities' concerns and grievances about the client's environmental and social performance.	
	36	The client will provide periodic reports to the Affected Communities that describe progress with implementation of the project Action Plans on issues that involve ongoing risk to or impacts on Affected Communities and on issues that the consultation process or grievance mechanism have identified as a concern to those Communities.	

PS 2 (Labour and Working Conditions)			
Human Resources Policies and Procedures	8	The client will adopt and implement human resources policies and procedures appropriate to its size and workforce that set out its approach to managing workers consistent with the requirements of this Performance Standard and national law.	Illovo Sugar Malawi currently has Human Resource Policies and Procedures in place, complying with national regulations as well as this PS. Section 8 – 17 is all included within the existing Human Resources Policies and Procedures and therefore these procedures will also be applicable and implemented with the new cogeneration power plant.
	9	The client will provide workers with documented information that is clear and understandable, regarding their rights under national labour and employment law and any applicable collective agreements, including their rights related to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur.	
Working Conditions and Terms of Employment	10	Where the client is a party to a collective bargaining agreement with a workers' organization, such agreement will be respected. Where such agreements do not exist, or do not address working conditions and terms of employment, the client will provide reasonable working conditions and terms of employment	
	11	The client will identify migrant workers and ensure that they are engaged on substantially equivalent terms and conditions to non-migrant workers carrying out similar work.	
	12	Where accommodation services are provided to workers covered by the scope of this Performance Standard, the client will put in place and implement policies on the	

		quality and management of the accommodation and provision of basic services.	
Workers' Organisations	13 - 14	The client must respect workers' rights to join workers organisations and may not restrict workers from developing alternative mechanisms to express their grievances and protect their rights regarding working conditions and terms of employment. The client should not seek to influence or control these mechanisms	
Non-Discrimination and Equal Opportunity	15 - 17	The client will not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The client will take measures to prevent and address harassment, intimidation, and/or exploitation, especially in regard to women. The principles of non-discrimination apply to migrant workers.	

In countries where national law provides for non-discrimination in employment, the client will comply with national law.–			
Retrenchment	18 - 19	Prior to implementing any collective dismissals, the client will carry out an analysis of alternatives to retrenchment. If the analysis does not identify viable alternatives to retrenchment, a retrenchment plan will be developed and implemented to reduce the adverse impacts of retrenchment on workers. The client will comply with all legal and contractual requirements related to notification of public authorities, and provision of information to,	Illovo Sugar Malawi has an existing Redundancy Policy whereby all measures are taken to prevent retrenchment. The operations of the proposed cogeneration power plant will also be undertaken in accordance with this approved Redundancy Policy.

		and consultation with workers and their organizations. The client should ensure that all workers receive notice of dismissal and severance payments mandated by law and collective agreements in a timely manner	
Grievance Mechanism	20	The client will provide a grievance mechanism for workers (and their organizations, where they exist) to raise workplace concerns. The client will inform the workers of the grievance mechanism at the time of recruitment and make it easily accessible to them.	Illovo Sugar Malawi currently has an approved Grievance Handling Procedure which will also be applicable to the new cogeneration power plant operation. The Grievance Mechanism is included in Section 6 of the ESIA Report.
Child Labour	21	The client will not employ children in any manner that is economically exploitative or is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Children under the age of 18 will not be employed in hazardous work. All work of persons under the age of 18 will be subject to an appropriate risk assessment and regular monitoring of health, working conditions, and hours of work.	Illovo Sugar Malawi has policies in place, prohibiting child labour, forced labour or working within unsafe and hazardous environments. The new cogeneration power plant provides a safer environment than that of the existing boilers as the new boilers will be insulated, reducing the current heat stress experienced by workers. This policy will also be applicable to the new cogeneration power plant.
Forced Labour	22	The client will not employ forced labour, which consists of any work or service not voluntarily	

		performed that is exacted from an individual under threat of force or penalty.	
Occupational Health and Safety	23	The client will provide a safe and healthy work environment, considering inherent risks in its particular sector and specific classes of hazards in the client's work areas, including physical, chemical, biological, and radiological hazards, and specific threats to women.	
Workers Engaged b– Third Parties	24 - 26	The client will take commercially reasonable efforts to ascertain that the third parties who engage these workers are reputable and legitimate enterprises and have an appropriate ESMS that will allow them to operate in a manner consistent with the requirements of this Performance Standard. The client will establish policies and procedures for managing and monitoring the performance of such third-party employers in relation to the requirements of this Performance Standard. The client will ensure that contracted workers, have access to a grievance mechanism.	Construction of the new Project Solomon infrastructure, including the transmission lines and powerplant will be undertaken by a non-local EPC contractor, and civil works will be sourced from the local area as much is possible. Illovo Sugar applies a high-level Ethical Audit checklist to its suppliers on an annual basis. The checklist mimics the Fair-Trade assessment and covers a broad number of topics including worker contracts, wages, working hours and overtime, child labour, forced labour, disciplinary and grievance procedure. Illovo therefore takes commercial effort to ascertain that the third parties and contractors are reputable and legitimate enterprises.
Supply Chain	27 - 29	The client will monitor its risks in primary supply chain on an ongoing basis in order to identify any significant changes in its supply chain and if new risks or incidents of child and/or forced labour are	

		identified, the client will take appropriate steps to remedy them. Where remedy is not possible, the client will shift the project's primary supply chain over time to suppliers that can demonstrate that they are complying with this Performance Standard.	The new cogeneration power station project will follow the same policy and procedure for monitoring performance of contractors and third parties.
PS 3 (Resource Efficiency and Pollution Prevention)			
General	4 - 5	During the project life-cycle, the client will consider ambient conditions and apply technically and financially feasible resource efficiency and pollution prevention principles and techniques that are best suited to avoid, or where avoidance is not possible, minimize adverse impacts on human health and the environment. The client will refer to the EHS Guidelines or other internationally recognized sources, as appropriate, when evaluating and selecting resource efficiency and pollution prevention and control techniques for the project.	Mitigation measures as per the EHS Guidelines for the prevention of pollution, is included in the ESMP, Section 14 of the ESIA Report.
Resource Efficiency	6	The client will implement technically and financially feasible and cost-effective measures for improving efficiency in its consumption of energy, water, as well as other resources and material inputs. Such measures will integrate the principles	

		of cleaner production into product design and production processes with the objective of conserving raw materials, energy, and water.	
Greenhouse Gasses	7	In addition to the resource efficiency measures described above, the client will consider alternatives and implement technically and financially feasible and cost-effective options to reduce project-related GHG emissions during the design and operation of the project.	Design measures have been included to reduce the GHG emissions of the project. These measures are noted in the ESMP, Section 14 of the ESIA Report.
	8	For projects that are expected to or currently produce more than 25,000 tonnes of CO2-equivalent annually, the client will quantify direct emissions from the facilities owned or controlled within the physical project boundary, as well as indirect emissions associated with the off-site production of energy used by the project. Quantification of GHG emissions will be conducted by the client annually in accordance with internationally recognized methodologies and good practice	As per the ESMP, annual ambient and point source emission monitoring will be undertaken for the new cogeneration power plant and limits which must be complied with are noted in Table 9-3 and Table 9-4 within the ESIA Report.
Water Consumption	9	When the project is a potentially significant consumer of water, in addition to applying the resource efficiency requirements of this Performance Standard, the client shall adopt measures that avoid or reduce water usage so that the project's water consumption does not have significant adverse impacts on others.	Illovo Sugar Malawi currently has a Group Policy providing measures for reducing water use consumption (ISAPL_Z_G 8.2.5/0.0) Although water consumption will be reduced with the new cogeneration power

			plant, the project will still comply with the water management plan drafted for Illovo Sugar.
Pollution Prevention	10	The client will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release. This applies to the release of pollutants to air, water, and land due to routine, non-routine, and accidental circumstances with the potential for local, regional, and transboundary impacts. To address potential adverse project impacts on existing ambient conditions, the client will consider relevant factors, including, for example: i. existing ambient conditions; ii. the finite assimilative capacity of the environment; iii. existing and future land use; iv. the project's proximity to areas of importance to biodiversity; and v. the potential for cumulative impacts with uncertain and/or irreversible consequences.	The impacts associated with the proposed construction, operation and decommissioning of the cogeneration power plant, has been assessed taking all of the factors into consideration. This assessment is included in Section 11 of the ESIA Report. Measures to reduce the significance of the impacts identified and assessed, are included in the ESMP, Section 14 of the ESIA Report. Illovo Sugar Malawi also has an Environmental Social Management System in place for the prevention of pollution. (ISPL_Z_G 8.2.1/3.0) This Policy will be applicable to the new cogeneration power plant and must be adhered to.
Wastes	12	The client will avoid the generation of hazardous and non-hazardous waste materials. Where waste generation cannot be avoided, the client will reduce the generation of waste, and recover and reuse waste in a manner that is safe for human health and the environment.	Refer to Section 11.1.7, 11.2.7 and 11.3.7 of the ESIA Report, where the impacts associated with the generation and disposal of waste has been assessed. Measures to reduce the impact of waste generation and disposal, have been included in Section 14 (ESMP).

		When hazardous waste disposal is conducted by third parties, the client will use contractors that are reputable and legitimate enterprises licensed by the relevant government regulatory agencies and obtain chain of custody documentation to the final destination.	Illovo Sugar Malawi also has an Environmental Social Management System in place for the management of waste as well as pesticides. (ISPL_Z_G 8.2.8/0.0) This Policy will be applicable to the new cogeneration power plant and must be adhered to.
Hazardous Waste Management	13	The client will avoid or, when avoidance is not possible, minimize and control the release of hazardous materials.	
Pesticide Use and Management	14 - 17	The client will, where appropriate, formulate and implement an integrated pest management (IPM) and/or integrated vector management (IVM) approach targeting economically significant pest infestations and disease vectors of public health significance. When pest management activities include the use of chemical pesticides, the client will select chemical pesticides that are low in human toxicity, that are known to be effective against the target species, and that have minimal effects on non-target species and the environment. The client will not purchase, store, use, manufacture, or trade in products that fall in WHO Recommended Classification of Pesticides by Hazard Class Ia (extremely hazardous); or Ib (highly hazardous); or Class II (moderately hazardous) pesticides unless the project has appropriate controls on manufacture, procurement, or distribution and/or use of these chemicals	

PS 4 (Community Health, Safety, and Security)			
Community, Health and Safety	5	The client will identify health and safety risks to the Affected Communities during the project life-cycle and propose mitigation measures that are commensurate with their nature and magnitude.	The Health and Safety risks throughout the lifetime of the project were identified and assessed in Section 11.1.9, 11.2.9 and 11.3.7 of the ESIA Report and measures were included in the ESMP (Section 14 of the ESIA Report) to reduce the health and safety impacts. Illovo Sugar Malawi also use the IFC Environmental Health and Safety Guidelines as the guideline implemented for the health and safety of the workers and the surrounding community members.
Infrastructure and Equipment Design and Safety	6	The client will design, construct, operate, and decommission the structural elements or components of the project in accordance with GIIP, taking into consideration safety risks to third parties or Affected Communities. For projects that operate moving equipment on public roads and other forms of infrastructure, the client will seek to avoid the occurrence of incidents and injuries to members of the public associated with the operation of such equipment.	
Hazardous Materials Management and Safety	7	The client will avoid or minimize the potential for community exposure to hazardous materials and substances that may be released by the project. Where hazardous materials are part of existing project infrastructure or components, the client will exercise special care when conducting decommissioning activities in order to avoid exposure to the community.	Hazardous materials are currently managed according to the ESMS Hazardous Materials Management ISAPL_Z_G 8.2.6/0.0) drafted for Illovo Sugar Malawi. All hazardous materials associated with the new cogeneration power plant and associated structures and infrastructure, will be managed in accordance with the existing Illovo Sugar Policies and Procedures. Measures to mitigate the impact associated with hazardous materials have been included in the ESMP (Section 14).

Ecosystem Services	8	The project's direct impacts on priority ecosystem services may result in adverse health and safety risks and impacts to Affected Communities. The client will identify those risks and potential impacts on priority ecosystem services that may be exacerbated by climate change. Adverse impacts should be avoided, and if these impacts are unavoidable, the client will implement mitigation measures.	Not applicable. The project will not have a direct impact on any ecosystem services.
Community Exposure to Disease	9	The client will avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases, and communicable diseases that could result from project activities, taking into consideration differentiated exposure to and higher sensitivity of vulnerable groups	The Health and Safety risks throughout the lifetime of the project were identified and assessed in Section 11.1.9, 11.2.9 and 11.3.7 of the ESIA Report and measures were included in the ESMP (Section 14 of the ESIA Report) to reduce the health and safety impacts. Illovo Sugar Malawi also use the IFC Environmental Health and Safety Guidelines as the guideline implemented for the health and safety of the workers and the surrounding community members.
	10	The client will avoid or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labour.	
Emergency Preparedness and Response	11	If local government agencies have little or no capacity to respond effectively, the client will play an active role in preparing for and responding to emergencies associated with the project.	In accordance with the SHERQ Risk and Impact Assessment Group Policy, potential emergency scenarios will be identified and assessed as part of the SHERQ risk and impact assessment process
Security Personnel	12 - 14	During construction, the main construction company will engage a security company to ensure	Due to high level of poverty in Malawi, thieves are common in the sugar mill. As a

		the construction site and the compound are safe from thieves and aggressions.	consequence, the sugar mill has a 24/7 security team controlling the entrance to the estate and then to the factory. The security team account for 500 employees. For safety and security reasons, the new power plant will be fenced and have a dedicated entry with the same security company.

TABLE 13-2: APPLICABILITY TO THE EQUATOR PRINCIPLES

Equator Principles Evaluation		
Equator Principle (EP)	**Description of EP Requirement**	**Applicability to EP Requirements**
Principle 1: Review and Categorisation	The risk of the project is categorized in accordance with internal guidelines based upon the environmental and social screening criteria of the IFC. Projects are classified, relating to social or environmental impacts, in Category A (significant impacts), Category B (limited impacts) and Category C (minimal or no impacts)	The project has not been officially categorised by the Equator Principles Financial Institutions (EPFI's). However, based on assessment of potential impacts of the projects in the Project Brief, they are likely to be classified as Category B project.
Principle 2: Social and Environmental Impact Assessment	For all medium or high-risk projects (Category A and B projects), sponsors complete an Environmental Assessment (full-scale, limited/focused or application in terms of siting, pollution standards, design criteria or construction standards), the preparation of which must meet certain requirements and satisfactorily address key environmental and social issues. Specialised studies may also be required.	A Social and Environmental Impact Assessment was undertaken, and various specialist assessments informed the assessment and significance of the impacts which were assessed. These specialist investigations included, a Socio-Economic Impact Assessment, Air Quality Impact Assessment, Noise Impact Assessment, and Hazardous Area Classification
Principle 3: Applicable Social and Environmental Standards	The Assessment process in both cases should address compliance with relevant host country laws, regulations and permits that pertain to social and environmental matters	Applicable international and local standards and regulations were addressed in Section 4, and environmental limits which must be complied with are included within the ESIA. The Environmental and Social Management Plan (ESMP) have been drafted to effectively mitigate all identified impacts during the construction and operational phase. IFC Performance Standards, Guidance Notes and Industry Specific Guidelines dated January 2012 acts as a guideline on how to identify, avoid, mitigate, and manage risks and impacts

		in a sustainable way. These standards require that all environmental risks and impacts must be managed via an Environmental and Social Management System (ESMS). Illovo Sugar does currently have an Environmental Management System and the existing ESMS might have to be updated to include measures noted in the ESMP (Section14) which is not included in the ESMS.
Principle 4: Action Plan and Management System	For all Category A and Category B Projects, the EPFI will require the client to develop and / or maintain an Environmental and Social Management System (ESMS). EPFIs require the development and maintenance of an Action Plan (AP) to address findings, prioritise mitigation measures, and take corrective actions and monitoring measures.	Illovo Sugar currently has an Environmental and Social Management System in place. The ESMS will be updated to include measures noted within the project specific ESMP,
Principle 5: Consultation and Disclosure	EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process.	Stakeholder Engagement was undertaken as described in Section 6 of the ESIA Report
Principle 6: Grievance Mechanism	The borrower will inform the affected communities about the mechanism during its community engagement process and ensure that the mechanism addresses concerns promptly and transparently, in a culturally appropriate manner, and is readily accessible to all segments of the affected communities.	Illovo Sugar currently has a Grievance Mechanism in place as noted in Section 6.4. This mechanism will be communicated to the communities.

Principle 7: Independent Review	For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower will review the Assessment, affected parties and consultation process documentation to assist EPFI's due diligence, and assess Equator Principles compliance	The ESIA and associated Specialist Studies was undertaken by an independent Environmental and Social Consultant, Core Environmental Services. All documents compiled and submitted was further reviewed by IBIS Consulting, who is responsible for reviewing the project in terms of IFC Standards.
Principle 8: Covenants	Covenants need to be established to ensure compliance with environmental laws and AP, provide periodic report as agreed with EPFIs, and to decommission the project in accordance with an agreed plan.	The ESMP drafted included measures which must be complied with during construction, operation and decommissioning. In accordance with the ESMP drafted, the project activities must be audited, and periodic reports must be compiled for submission. (Section 14 of the ESIA)
Principle 9: Independent Monitoring and Reporting	To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower retain qualified and experienced external experts to verify its monitoring information which would be shared with EPFI's	As per the ESMP, an independent/external environmental and social consultant must be appointed to report on the compliance of the measures implemented as per the ESMP, on an annual basis.
Principle 10: Reporting and Transparency	Each EPFI adopting the Equator Principles commits to report publicly at least annually about its Equator Principles implementation processes and experience, taking into account appropriate confidentiality considerations.	Illovo Sugar will have to submit an annual report about the implementation of the Equator Principles and this report must be available publicly.

14. ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLAN

The previous chapter has presented an analysis and assessment of a wide range of the negative and positive environmental and social impacts from the proposed project. The aim of this chapter is three-fold:

- To recommend an environmental management plan for addressing potential negative impacts.
- To recommend a plan for enhancement measures for some potential positive impacts.
- To recommend an environmental monitoring plan for tracking environmental management plan.

14.1 Roles and Responsibilities

Illovo Sugar Malawi is the project proponent for the proposed cogeneration power plant and is therefore ultimately responsible for the successful implementation of the project. To ensure the successful implementation of the project, various resources will be allocated specific responsibilities during the construction and operational phases of the development.

The responsibilities of the project proponent will include the following:

- Appoint an EPC (Engineering, Procurement and Construction) Contractor who would take all responsibilities to complete the capital project successfully;
- Issue *ad hoc* instructions, corrective action requests, or initiate punitive proceedings where non-compliances are not adequately addressed;
- The EPC Contractor will ultimately report to Illovo Sugar Malawi.

EPC Contractor will be responsible for the following:

- The implementation of all construction related mitigation measures included within the Environmental and Social Management Plan (ESMP);
- Be fully conversant with the ESMP for the project, the conditions therein and all relevant environmental legislation;
- Make financial provisions for the inclusion of an Environmental Monitor as part of the Project Manager's Contract, inclusive of all staff and equipment and resources needed to execute their functions.

The Site Environmental Compliance Officer (SECO) must be appointed by the EPC contractor for the duration of the construction period and be responsible for the following:

- Compilation of daily and weekly checklists;
- Conducting monthly audits and prepare monthly environmental auditing reports;
- Ensure record keeping and environmental administrative tasks are undertaken;

- Ensure implementation and adherence to all environmentally related permits and licenses;
- Responding to incidents on site;
- Environmental Awareness Training in the form of on-site talks and demonstrations. Prior to construction, all contractor teams must be briefed on their obligation towards environmental controls and methodologies in terms of the ESMP. All new employees arriving on site must also undertake such training before commencement of work.

An External Environmental and Social Auditor must be appointed to undertake an annual audit to report on compliance with the ESMP drafted for the Cogeneration Power Plant.

The proposed environmental management plan is presented in tabulated format in Table 14-1. The table has been presented to show clearly the linkages between the predicted negative impacts and recommended mitigation measures, and on the other hand to show the link between recommended mitigation measures, the estimated budget for the activities and stakeholders responsible for implementation. In addition, the plan indicates the suggested period for implementation of the mitigation measures within the project cycle. The estimated budget for mitigation measures is integrated into the construction budget and on the operating costs of the sugar mill. It should be highlighted; however that much of this suggested budget for mitigation measures will be covered within the project activities of the project.

Measures to enhance the positive impacts are tabled in Table 14-2 below.

TABLE 14-1: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (NEGATIVE IMPACTS)

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
1. Impact on Soil						
1.1. Soil Erosion	a) Construction activities must be limited to the footprint of the project area; b) Areas prone to erosion must be monitored and sandbags must be used to reduce the occurrence during the construction phase; c) Areas prone to erosion during the operation phase must be identified and permanent erosion protection structures must be installed to minimise the impact; d) The velocity of stormwater on site must be reduced; e) A stormwater management plant must be drafted and implemented on site; f) During operation, it must be ensured that any stormwater drains or grids are cleared from sediment or vegetation build-up	Construction, operation and decommissioning phases	No budget	Appointed contractor, SECO and Nchalo Illovo Sugar Management	• No erosion is noticed on site during any of the phases; • Possibility of flooding on site is minimised;	• Weekly during construction and decommissioning • Monthly during operation • Annually by External Environmental and Social Auditor

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	which could block these drains and cause flooding					
1.2 Soil Pollution	a) Hazardous substances may only be handled by people trained to handle such materials; b) Obtain Material Safety Data Sheets (MSDS) for all chemicals before use and all materials must be used and handled according to instruction; c) Should there be any spillage of hazardous substances during the construction activities, polluted soil must be removed and be disposed of at a registered hazardous waste disposal facility. Proof of such disposal must be kept on file; d) Drip trays must be placed under all leaking equipment and heavy machinery and must not be allowed to work on site until it has been repaired; e) All contents of drip trays must be collected in one	Construction, operation and decommissioning phases	Part of construction budget	Appointed contractor, SECO, and Nchalo Illovo Sugar Management	• No soil pollution is noticed on site; • All machinery is serviced regularly	• Daily during all phases of development • Must be addressed immediately • Annually by External Environmental and Social Auditor

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	container and be removed from site as hazardous waste; f) All hazardous substances must be stored within a designated area which is bunded; g) Concrete batches must be centralised, and no concrete mixing is allowed on bare soil; h) Any concrete spillages must be cleaned immediately.					
2. Impact on Air Quality						
2.1 Dust generation	a) The project site must be sprayed with water to reduce the excessive generation of dust during construction; b) The construction site should also be fenced with shade cloth to act as a barrier for wind, which transports dust off site. c) Construction workers using grinding machinery must make use of the correct PPE, and dust masks to prevent inhalation of small particles.	Construction and decommissioning phases	No additional cost	Appointed contractor, SECO, and Nchalo Illovo Sugar Management	• Dust on site during construction and decommissioning is minimised to not affect workers and surrounding land users significantly; • No complaints regarding dust are received.	• Monitored quarterly during construction and decommissioning and annually during operation

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
2.2 Pollutants	a) Community involvement must continue throughout the lifetime of the project; b) Nchalo Illovo Sugar continue to use a line of communication where complaints can be lodged; c) Industry standard emission control techniques and administrative measures will be supplemented with engineering measures to maintain the residual impact to lowest possible levels. These measures should specifically focus on fugitive dust sources following the installation of the new cogeneration plant; d) A wet scrubber or an electrostatic filter system will also be installed to further reduce air emissions. e) Current industry standard techniques and administrative control measures should be maintained to ensure the residual impact at the nearest	Operational phase	Part of construction cost	Nchalo Illovo Sugar Management and specifically the environmental manager	Results of air quality monitoring reports comply with the new Malawian Ambient Air Quality Standards (MS 737:2011)	• Annual monitoring /testing during operation • Annually by External Environmental and Social Auditor

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	sensitive receivers remains at current background levels; f) Establish goals and strategies for air quality improvement; g) Establish a comprehensive air quality management and monitoring system and adhere to these specifications; h) Involve and educate people with the purpose of minimising pollution and facilitating the effective participation in air quality governance.					
3. Noise Generation						
3.1 Generation of noise caused by construction and decommissioning activities	a) Choose appropriate construction equipment for the job and ensure that all equipment is functional before use; b) Make use of low noise machinery. c) Limit the amount of time a worker spends near the source of noise;	Construction and decommissioning phase	No cost	Appointed contractor SECO and Nchalo Illovo Sugar Management	• Noise levels are within acceptable standards; • No noise complaints are received from surrounding land users.	Quarterly noise level monitoring during construction and decommissioning

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	d) Provide quiet areas where workers can find relief during breaks; e) Work should only take place during working hours as specified in the Contract Specification; f) It is expected that construction will occur during daylight hours. Should any temporary construction activities need to be undertaken at night-time, which could affect adjacent landowners, such owners must be informed; g) No loud music is allowed on site or the construction camp.					
3.2 Noise generation during the operation of the cogeneration power plant	a) Community involvement must continue throughout the lifetime of the project; b) Nchalo Illovo Sugar must implement a line of communication where complaints can be lodged; c) Technical measures could include: The selection of different equipment or processes; changing a process methodology; design	Operational phase	No cost	Nchalo Illovo Sugar Management and specifically the Environmental Manager	Noise levels generated are within the acceptable limits specified within the Occupational Safety, Health and Welfare Act, 1997.	• Annual noise level monitoring during construction and decommissioning • Annually by External Environmental and Social Auditor

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	and implementation of certain control measures such as enclosing; silencing; isolation; damping or barriers; use of acoustical masking equipment; implementation of acoustic shielding at the dwelling of a receptor.					
4. Traffic						
4.1 Impact on the flow of traffic	a) Speed limits must be imposed, and all contractors and workers must adhere to such limits; b) Construction site planning must incorporate and separate vehicle and pedestrian access points; c) Pedestrian walkways must be demarcated on site; d) To improve the flow of traffic on-site, one-way traffic is proposed with different entrance and exit points. e) If traffic flow during construction and decommissioning disrupts the current traffic flow of	Construction, operation and decommissioning phases	No cost	Appointed contractor, SECO and Nchalo Illovo Sugar Management	Traffic to and from the construction site and the Nchalo Illovo Sugar Factory is uninterrupted.	• Daily monitoring during construction and decommissioning • Annually by External Environmental and Social Auditor

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	heavy moving vehicles transporting sugar cane to the factory, construction traffic must be split form the traffic delivering sugarcane, by means of using the alternative access to the Estate.					
5. Water						
5.1 Groundwater pollution	a) Treated effluent must be tested monthly to ensure treated effluent meets the required national and local standards; b) The effluent treatment pond must be regularly maintained to ensure effective treatment of effluent.	Operational phase		Nchalo Illovo Sugar Management and specifically the environmental manager	Treated effluent meets the required standards as stipulated within the license	• Monthly testing of treated effluent during operation • Annually by External Environmental and Social Auditor
5.2 Water consumption	a) Ensure that there are no leaking taps on site and ensure all hoses have auto shut off nozzles; b) Use water sparingly;	Construction, operation and decommissioning phase	Part of CAPEX and OPEX	Appointed contractor, SECO and Nchalo Illovo Sugar Management	Water consumption is within the limits specified in the existing Water Use Licenses issued for Nchalo Illovo Sugar Estate.	• Monthly monitoring of water consumption during all phases of the development • Annually by External

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
						Environmental and Social Auditor
6. Biodiversity						
6.1 Spreading of alien invasive plant species	a) The use of herbicides and pesticides must be limited as this could affect adjacent farming practises. Mechanical removal is preferred; b) Alien vegetation growing on topsoil stockpiles must be removed throughout the construction phase; c) The management of alien invasive plant species must be undertaken in accordance with the Biodiversity Group Policy drafted for Illovo Sugar.	Construction, operation and decommissioning phase		Appointed contractor, SECO and Nchalo Illovo Sugar Management	No alien invasive plant species on site or the surrounding areas	• Monthly investigation of the project area immediate surrounding area • Annually by External Environmental and Social Auditor
7. Waste						
7.1 Waste generation, storage and disposal	a) Littering on site and the surroundings areas are prohibited; b) Waste must be disposed, as soon as possible and not be allowed to stand on to	Construction, Operation and Decommissioning	Part of construction cost and sugar mill's operating costs	Appointed contractor and Nchalo Illovo Sugar Management, specifically the	All waste is stored and disposed of as per the Illovo Sugar Group Policy on waste management and the	During construction and decommissioning, a daily walkthrough on site to address littering

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	decay, resulting in bad odours and attracting vermin; c) Sufficient refuse bins must be provided along the perimeter of the site; d) Waste must be recycled as much as possible, therefore waste must be split for these purposes; e) Refuse bins must be scavenger proof; f) All waste removed from site must be disposed at the municipal/permitted waste disposal site; g) Temporary storage of construction waste must take place within areas designated by the Contractor's Environmental Control Officer and the Environmental Manager; h) Construction waste may not be stored for periods longer than the time determined by the Environmental Manager;			Environmental Manager	site-specific Waste Management Plan.	• Weekly monitoring of temporary waste storage areas • Monthly monitoring and records of wastes removed and disposed of during construction, operation and decommissioning phases. • Annually by External Environmental and Social Auditor

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	i) All empty cement bags may not be left on site uncontrolled overnight; j) Ensure that solid waste is transported in a manner that will avoid waste spills en-route; k) Chemical toilets must be provided to construction workers. At least 1 toilet per 15 workers. l) A registered third-party contractor must be appointed to collect sewage from the temporary toilet facilities on a regular basis; m) All hazardous and domestic waste must be stored and removed as stipulated with the existing EWMS and WMP. n) Solid waste must be recycled and reused as far as possible and if this is not possible, it must be disposed of at the nearest landfill site, with the approval for the District Council and in accordance					

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	with the national and local regulations. o) The recycling of the bottom ash must be undertaken in accordance with the Ash Disposal and Management Plan and according to the IFC Guideline, it must be ensured that concentrations of heavy metals within the bottom ash, is low. p) Treated effluent must be sampled and tested monthly to ensure compliance with the local and national regulations and licenses issued; q) Medical waste must be handled and disposed of in accordance with the Environmental Management System drafted for Waste Management as well as the site-specific Nchalo Illovo Sugar Waste Management Plan					

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
8. Climate Change						
8.1 Impact on climate change	a) Construction materials must be recycled, if possible, to reduce the requirement to produce new materials; b) Removal of vegetation must be restricted to the footprint of the required site.	Construction phase	Part of construction budget	Appointed contractor, SECO and Nchalo Illovo Sugar Management,	▪ Where possible, construction material is recycled ▪ Removal of vegetative cover (sugarcane) is restricted to the footprint of the site	Monitoring of this impact is limited to as and when mitigation measures are implemented
9. Health and Safety						
9.1 Impact on the health and safety of workers and surrounding land users	a) Construction workers must ensure that all work is undertaken with the correct PPE; b) All contractors must comply with the SHE Specification drafted for Nchalo Estate; c) All contractors must adhere to the Health and Safety Plan issued for to the contractor and drafted specifically for the cogeneration power plant;	Construction, Operation and Decommissioning	Part of construction budget	Appointed contractor, Health and Safety Officer and Nchalo Illovo Sugar Management,	No injuries caused during construction, operational or decommissioning phases	• Daily monitoring during construction, decommissioning and operational phases; • Monthly reporting • Annually by External Environmental and Social Auditor

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	d) Illovo will prepare a Road Safety Management and Mitigation Plan that identifies peak traffic times during the construction period, high risk accident areas and road signage or other options, school and community safety awareness campaigns and reporting mechanisms to put in place during the construction phase; e) Illovo must increase and run suitable awareness campaigns on negative coping strategies, HIV and AIDs both within the community and at local schools prior to construction starting; f) Illovo should prepare an 'Influx Management Plan' to identify any health and safety risks on the surrounding community with the influx of construction workers, and to compile measures to effectively mitigate such					

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	impacts. The Redundancy Policy of Illovo Sugar must be taken into consideration and be adhered to if any employees are to be affected by the new cogeneration power plant operation. g) Maintenance of equipment must be undertaken on a continuous basis; h) Danger signs must be placed on all areas where any risk has been identified; i) Health and safety of the site must be undertaken in accordance with the Health and Safety Plan specifically drafted for the project; j) Health and safety of the site must be undertaken in accordance with the IFC: Environmental Health and Safety Guidelines.					

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
10. Socio-Economic Impact						
10.1 Impact on the socio-economic environment	a) Illovo will increase and run suitable awareness campaigns on negative coping strategies, HIV and AIDs both within the community and at local schools prior to construction starting; b) Illovo will consider establishing a partnership during the construction period with a National or Local NGOs who focuses on these issues, who will be able to run the campaigns, set up monitoring mechanisms with teachers for example to identify those at risk of dropping out of school, and to provide counselling services available to assist any vulnerable school pupils and individuals needing support or guidance; c) Illovo will prepare an 'Influx Management Plan'	Construction, operational and decommissioning phases	Part of the sugar mill operating costs	Appointed contractor, SECO and Nchalo Illovo Sugar Management,	▪ No significant increases in diseases and teenage pregnancies and school dropouts during the construction and decommissioning phases. ▪ No significant price increases during the construction and decommissioning phases	• Specific plans to mitigate the impacts during the construction and decommissioning phase must be drafted prior to these phases and be monitored and reviewed annually • The monitoring during operation would be once off following the training and upskilling of employees • Annually by External Environmental and Social Auditor

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	that will anticipate likely accommodation demand during the construction period and accommodation options on-site and off-site to minimise socio-economic risks and planned settlement; d) Illovo will consult and work with the relevant Local Authorities and Business stakeholders to identify possible risks in terms of increased demand for local services, natural resources and an increase in prices. This plan should include implementing a suitable strategy to monitor any price changes during construction and ways to address areas of concern. e) Illovo will implement small-business training opportunities for existing local businesses to help increase competition and business preparation in advance of construction, to both increase local					

Identified Negative Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
	downstream economic opportunities and to help increase competition and mitigate any supply and demand price increases. f) The Redundancy Policy of Illovo Sugar will be taken into consideration and be adhered to if any employees are to be affected by the new cogeneration power plant operation.					

TABLE 14-2: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (POSITIVE IMPACTS)

Identified Positive Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
1. Biodiversity						
1.1 Reduction in deforestation	a) All activities will be undertaken in accordance with the Illovo Environmental Management System – Biodiversity Group Level Guideline. b) Nchalo Illovo has an indigenous tree nursery which are used for various initiatives on and off the estates e.g. rehabilitation of indigenous forests and the protection of river banks. This initiative must continue throughout the lifetime of the cogeneration power project.	Operation	Part of the sugar mill operating costs	Nchalo Illovo Sugar Management	Indigenous trees are planted along riverbanks and on areas designated to be rehabilitated	Annual monitoring and reporting on the use of the indigenous trees from the Illovo nursery
2. Waste						
2.1 Recycling or reuse of waste	a) Bottom ash from the boilers must be stored and used as fertilizer for the existing agricultural crops;	Operation	Part of construction budget	Nchalo Illovo Sugar Management, and specifically the Environmental Manager	All bottom ash is used as fertiliser on existing agricultural fields;	Monthly monitoring and records of the volume of bottom ash distributed on fields;

Identified Positive Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
3. Health and Safety						
3.1 Improvement in the health and safety of employees and surrounding land users due to the technologically advanced equipment	a) The new equipment must be maintained on a regular basis to ensure a safe working environment for all staff; b) A wet scrubber or an electrostatic filter system will also be installed to further reduce air emissions. These systems will be cleaned and maintained on a regular basis to ensure efficient use thereof; c) The bagasse conveyor belt will be covered to reduce excessive dust from the transportation of the bagasse	Operational phase	Part of construction budget	Nchalo Illovo Sugar Management,	Annual ambient air quality tests and point source emissions are within the new Ambient Air Quality Standards and Emission Limits (MS 737-1:2021)	Annual reporting on the maintenance of power generation equipment

Identified Positive Impacts for mitigation	Recommended mitigation measures	Recommended Period of Implementation	Budget Estimates	Responsible Authority for Implementation of the measures	Recommended Performance Targets on implementation	Monitoring Frequency
4. Socio-economic						
4.1 Positive socio-economic impact *Increase in revenue of local entrepreneurs during construction* *Training of personnel*	a) Illovo should implement small-business training opportunities for existing local businesses to help increase competition and business preparation in advance of construction, to both increase local downstream economic opportunities and to help increase competition and mitigate any supply and demand price increases; b) The Redundancy Policy of Illovo Sugar must be taken into consideration and be adhered to if any employees are to be affected by the new cogeneration power plant operation. This policy makes provision for the training of staff to fulfil other roles within the factory prior to undertaking the last option of retrenchment.	Construction, operation and decommissioning phases	Part of construction budget (EPC cost)	Appointed Contractor, SECO, and Nchalo Illovo Sugar Management	Successful employment of employees working with the more technologically advanced structures and infrastructure;	Once off following the training and upskilling of employees

15. REFERENCES

National Environmental Policy, 2004, Malawi

Environmental Management Act, 2017 (No. 19 of 2017)

Water Resources Ac, 2013 (No. 2 of 2013)

National Climate Change Management Policy, 2016

Occupational Safety, Health and Welfare Act, 1997 (No. 21 of 1997)

Monuments and Relics Act (1990)

Chikwawa District Council Socio Economic Profile, 2017 – 2022

Chikwawa District Physical Development Plan, August 2020

Sustainable Sugarcane Farm Management System, 2019

Deepchand, K. (2005), Sugar Cane Bagasse Energy Cogeneration – Lessons from Mauritius

Taulo, J., Gondwe, K.J., Sebitosi, A.B., (2015) Energy supply in Malawi: Options and Issues

Environmental Affairs Department, Ministry of Natural Resources, Energy and Environment (2010), Malawi Fourth Country Report to the Convention on Biological Diversity (CBD)

Monjerezi, M. (2012), Groundwater Salinity in lower Shire River Valley (Malawi)

*Weather Atlas (**https://www.weather-atlas.com/en/malawi/nchalo-climate#temperature**)*

*AccuWeather (**https://www.accuweather.com/en/mw/nchalo/227425/air-quality-index/227425**)*

*Wilson, H., Mapoma, T., Xie, X., (2013) State of Air Quality in Malawi, (**https://www.scirp.org/html/9-6702019_40195.htm**)*

*Wikipedia, Terrestrial Ecoregions, South Malawi montane forest–grassland mosaic (**https://en.wikipedia.org/wiki/South_Malawi_montane_forest%E2%80%93grassland_mosaic**)*

Rainey, T.J., Hara, I.M.O, Mann, A.P., Bakir, C.H., Plaza, F. (2012), Effect of depicting on the safety and environmental aspects of bagasse stockpiling

*Industrial Water Cooling, News, (13/07/2021), Green power – Co-Generation using bagasse, (**https://iwc.co.za/green-power-co-generation-using-bagasse**)*