Comments on Tosaco Energy Block 1 Exploration Right issued to

Tosaco Energy (Pty) Ltd (PASA Reference: 12/3/362)

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In preparing these comments, we have reviewed scientific literature on the physiological, behavioural and ecological impacts of seismic survey activities on marine wildlife. The body of peer-reviewed scientific literature on seismic surveys has grown over the last few decades in response to significant concerns about the impacts of these seismic surveys on the marine environment. Although scientists may debate the nature, magnitude and reach (distance away from the source of seismic blasts) of negative impacts of seismic surveys on marine fauna, the overwhelming majority of the multitude of peer-reviewed published scientific studies (over 538 studies on ocean noise, where the majority found negative effects on marine mammals, and/or adverse impacts on fish and invertebrates) demonstrate that harm is caused or is the most likely scenario. This is a tangible cause for concern and warrants a precautionary approach. The issue at hand is not whether harm will be caused but rather what the magnitude of that harm will be, and whether measures that would prevent or effectively mitigate this harm are in place and effective.

In this report we provide a summary as well as more detailed discussion of our findings from the available information and studies on the impacts of seismic activities on marine wildlife, both globally as well as specifically relevant to the survey area (the west coast of South Africa) and time of year (December to May) specified in the EIAR associated with the exploration right (including 2D/3D seismic survey) granted to Tosaco Ltd for Tosaco Energy Block 1. A list of relevant publications is provided at the end of this document for reference.

Having reviewed the available information we conclude that seismic surveys do cause harm to both species and ecosystems, and that significant direct harm to individual animals and harm to populations of endangered species is the most likely scenario in the case of this authorised seismic survey on the west coast of South Africa. Of specific concern is the impact on humpback whales and southern right whales which are still frequenting the west coast over this period, and the impact on critically endangered (leatherback) turtles (migration routes in the area), the critically endangered African Penguin (changes in foraging behaviour and impacts on fitness) and the Cape fur seal (and consideration of added stress in light of current mass die-offs). We conclude that this seismic survey is inadvisable due to the presence of these species in the area, the increasing anthropogenic pressures,

and the inability of the prescribed mitigation measures preventing harm to individuals/populations. We disagree with the findings of the Marine Specialist Report that impacts on all species both physiological and behavioural will be very low, because the mitigation mechanisms specified are not fully effective in preventing harm. Furthermore, recent literature provides credible concern about ecosystem/food-chain impacts of seismic surveys, which may, in turn, have impact on fisheries, the severity and localisation of which will depend on coincidences with spawning and juvenile recruitment events.

It is our opinion that the seismic survey should not have been authorised, and we recommend that further studies on the impacts of seismic activities in the South African context are carried out *in situ* before proceeding with further seismic surveys of this nature.

Summary of Findings

- Based on peer-reviewed scientific literature, it is clear that physical damage to marine animals, including soft tissue trauma damage, embolisms, damage to organs used in balance and orientation, concussions, haemorrhaging, decompression sickness and both temporary and permanent threshold shifts to hearing ability have been directly linked to the kind and level of sound emitted during this nature of seismic surveys.
- There is plausible evidence to suggest that seismic survey activity is likely to affect the conservation status and recovery of populations of vulnerable and threatened species including (IUCN Red listed species such as humpback and southern right whales), because sound and the ability to hear and interpret sound is critical for many species to reproduce (both vocalisations on breeding grounds and communications across large distances for mate detection). Therefore, it must be assumed that interference in sound perception or utilisation for communication (temporarily or permanently) has the potential to impact a species at the population level.
- Some species have been shown and documented to display physiological stress responses and behavioural changes to seismic activities, such as moving away rapidly, diving or remaining still. These responses are likely to increase their energy consumption and energy costs, reduce their time to forage, and/or affect their vulnerability to predation, thus having negative impacts on the survival of individuals (especially young or compromised animals) as well as the overall population growth and survival of a species (especially for threatened species that are already at risk of extinction).
- The impacts of seismic activities are most well studied for marine mammals, and evidence suggests that there are distinct avoidance responses such as leaving the area or ceasing to

undertake everyday activities such as feeding in preferred areas. This is likely to negatively impact the "fitness" of an affected animal.

- The only existing field study in South Africa (that we have been able to find) on the impacts of seismic activities in our waters is illuminating in this regard. It presents clear evidence that the endangered, endemic African penguins avoided preferred feeding sites when a seismic survey was active nearby. This is particularly of concern for a species that has had a 70% decrease in numbers over the past decade, is stressed by prey depletion creating a greater demand for them to forage further afield, and for which the prospect of extinction is significant.
- The phenomenon of energy-cost (from stress and avoidance behaviour) is of particular concern for some of the species expected to be encountered in the survey area in question, particularly the humpback whales and southern right whales who are at risk of the airgun noise affecting their behaviour or interfering with the communication between mother and calf. Any impact on their energy reserves could impact on their condition (weight-loss and physiological condition) and affect the survival of the animals during a vulnerable time (especially for lactating mothers and their calves) on their long migration to feeding grounds in Antarctica.
- Research has demonstrated significant mortality in zooplankton up to 1.2 km from a seismic survey array. Zooplankton forms the base of many important food webs in the marine environment. Depletion of zooplankton could thus have an impact on food for their predators (such as fish) as well as impact fish eggs and larvae (Ichthyoplankton) with potential local impacts on species important in fisheries. This damage to zooplankton over 1km away from the survey array raises concern that a 500m buffer for other animals that are unable to move away from the sound, is far too small to ensure that damage is not inflicted (even if they were able to evade it).
- The impact on fish assemblages is difficult to interpret, due to multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. A global review of the effect of seismic activities on fish and invertebrates acknowledged the limits of the current research due to experimental designs used or due to the focus on single species during investigations. A key concern is a lack of research focused on confounding effects and multiple stressors, therefore potential impacts of seismic surveys that have been previously identified may be reflective of underestimation or overestimation and would depend on the type of interaction (synergistic, additive, or antagonistic).
- In South Africa, since October 2021, thousands of dead and/or dying Cape fur seals (*Arctocephalus pusillus pusillus*), have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. It is of concern that although the cape fur seal population within

South Africa is relatively healthy, they too are under pressure from various anthropogenic pressures. Additional stress from seismic activity at this time is inadvisable.

- While "Soft starts" as mitigation for seismic impacts are likely to reduce the impact for highly mobile large animals, this is unlikely to be adequate for the many species that are prevalent in the area over the austral summer months and are unable to avoid the array or leave the area due to their lower mobility, such as smaller turtles, penguins, invertebrates, some fish species and zooplankton.
- The finding of observer efficiency (from a scientific monitoring study conducted during the 2018/19 and 2019/2020 seasons on the humpback whales on the east coast) suggests that even with trained observers up to 44% of humpback whales in an area went undetected. This casts doubt on the effectiveness and success of Marine Mammal Observer (MMO) sightings of the largest species (humpbacks) as a mitigation measure, indicating that it is most likely that whales go undetected. Furthermore, the detection rate for smaller species, such as dolphins, seals, turtles and flightless birds (penguins), would be expected to be much lower, obviating the effectiveness of visual observations to prevent harm to these species.
- Also of concern, is that the efficacy of Marine Mammal Observers (MMO) is likely to be low due to the nature of the offshore marine environment in the survey area (frequent high swells and winds affecting surface visibility), putting species that are missed by MMO's and PAM operators at extreme risk, particularly at night or during adverse weather conditions.
- Furthermore, the reliance on Observers to do visual sightings to supplement the PAM monitoring during the day, as a mandated mitigation measure, necessitates that we question the acceptability of continuing with survey activities at night. If the visual observations are useful (perhaps sighting large animals around 65% of the time) in addition to PAM, then it is unreasonable to rely on PAM alone at night. It is our opinion that surveys should not occur between sunset and sunrise each day if a real attempt for maximum avoidance of cetaceans is the objective of this mitigation measure.
- It is of our opinion that the proposed seismic survey activities are highly likely to both disturb and have an adverse effect on Marine Protected Areas (MPA) and Critical Biodiversity Areas (CBA). It should be noted that the MPA in question, the Orange Shelf MPA, provides key feeding grounds for the endangered Atlantic Yellow-nosed Albatross, the near-threatened Black-browed Albatross and the critically endangered Tristan Albatross.

Global context – impacts of seismic surveys on marine wildlife

Despite seismic surveys having been undertaken for decades in South African waters, together with the knowledge that some impact to marine fauna does indeed occur[1], there remains very little scientific research on the effects of seismic surveys, and in addition there are no legislated guidelines for seismic surveys in South African waters (Purdon 2018). Globally, seismic surveys' environmental impacts and consequences are slightly better documented, although not uniform in results or widely accepted within all sectors. The primary mitigation measures for seismic surveys in South Africa include soft-starts, which is a gradual and systematic increase in power of the airgun array undertaken to warn and drive mobile marine species, such as cetaceans (whales and dolphins), seals, flightless birds and turtles away from the sound source before the full-power airgun blasts begin, thus attempting to minimise the negative effects of the airgun blasting activity. Various studies contest this assumption (McCauley et al. 2000; Weilgart 2013; Dunlop et al. 2016) and have revealed a growing concern for animals that are unable to avoid or out-swim the airgun arrays.

Animals use sound critical to their life cycles (Jasny et al. 2005) in three ways, by actively producing sound (Tyack 1981), by listening to sounds emitted by other living organisms (Clark et al. 2009; Van Opzeeland 2010) and taking cues from physical or non-living factors producing sounds, contributing to the ambient background noise, such as wind, waves, swell, bubbles, currents, turbulence, earthquakes, rainfall, ice cracking or breaking (Hildebrand 2005). Many marine animals produce sound for communication, reproduction, aggression, defence mechanisms, antagonistic interactions, courtship, group coordination, orientation, navigation, and prey identification (Hildebrand 2005). They rely on producing a sound that is heard while hearing a sound and interpreting the sound for their survival.

Various physical responses to acoustic disturbance have been documented, with physical responses including soft tissue damage (Balcom and Claridge 2001), embolisms (Dolman and Simmonds 2005), damage to organs used in balance (André et al. 2011), concussions in penguins (Cooper 1982), haemorrhaging (Evans et al. 2001) and decompression sickness (Fernández et al. 2005). Hearing impairment in the form of Temporary Threshold Shift (TTS) or Permanent Threshold Shift (PTS) has also been reported (Hildebrand 2005). Threshold shift refers to an increase in the minimum sound level required for an animal to hear a sound. A TTS is followed by successful recovery to normal hearing thresholds after a given period of time in the absence of that sound, while PTS is when the sensory

[1] https://jncc.gov.uk/our-work/marine-mammals-and-noise-mitigation: “to reduce the risk of deliberate injury to marine mammals”.

hair cells in the inner ear are permanently damaged and lost making recovery impossible (Weilgart 2013).

Stress caused by disturbance is associated with a change in body chemistry (Jasny et al. 2005) and can be equally disruptive as physical damage. Stress has implications on sexual maturation, inhibits growth, reproduction and general survival ability (Pickering 1992; McCormick 1999; Consten et al. 2001). Perceptual effects can occur when there is an interference of sounds of interest to a specific animal but are being drowned out or masked by anthropogenic noise. The impact of this in the long term could have implications on breeding populations, thus on reproduction within a population (Erbe 2001). Many animals may have the ability to counteract this and make minor changes to their vocalisations and behaviour; however, these modifications may come at a cost in terms of energy expenditure (Tyack 2008) and are likely to reduce breeding productivity of the population. This is of particular concern for species that are threatened.

Behavioural responses to noise are dependent on various factors, such as age, sex, presence of offspring, location and an individual animals' previous encounter with a specific sound or noise. Behavioural responses may include modification of vocal behaviour, displacement from important habitats, and other subtle responses, including increased breathing rates, change in dive duration, time spent at the surface, rapid or erratic movements (Bowles et al. 1994; Lesage et al. 1999; Williams et al. 2002; Hastie et al. 2003; Ng and Leung 2003; Aguilar de Soto et al. 2006). These all with potentially high energetic costs (Williams et al. 2006; Koper and Plön 2012).

Most scientific research on the impacts of seismic surveys has been conducted on cetaceans, and as a result, most mitigation measures are to protect these animals. In South Africa, this is no different. However, it is becoming more and more evident that mitigation measures are not adequate (Weilgart 2013). In the Gulf of Mexico, it was recorded that ~250 male fin whales appeared to stop singing for several weeks to months during a seismic survey. These animals resumed singing within hours or days after the survey ended (IWC 2007). The assumption is that male fin whales use vocalisations for reproduction by finding and attracting mates (Croll et al. 2002); it can only be assumed that such an effect would be biologically significant (Weilgart 2013). In addition to this, a blue whale ceased calling in the presence of a seismic survey at 10 km away (Macdonald et al. 1995). Conversely, a different group of blue whales appeared to have the opposite reaction. They changed their vocalisations (De Lorio et al. 2010) by calling consistently more on days when the seismic surveys were actively ongoing,

suggesting that seismic survey noise interfered with important signals used in their social interactions and feeding (De Lorio et al. 2010).

Other reactions to seismic airguns can be subtle or hard to detect (Weilgart 2013) and it has been found that Sperm whales in the Gulf of Mexico did not appear to avoid a seismic airgun survey area but reduced their swimming effort and their tendency to reduce foraging effort (Miller et al. 2009). It has also been documented that as a result of changes in behaviour, the result could be lower reproductive rates and have negative consequences for the population (Miller et al. 2009). In comparison, bowhead whales showed no avoidance or change in vocalisations in the area of seismic surveys; however, their dive duration was shorter (Richardson et al. 1986). In Brazil, a reduction in cetacean species diversity during 2000 and 2001 was noted with the increased occurrence of seismic surveys in the area being implicated in the possible cause of these animals vacating the area (Parente et al. 2007). In other areas, marine mammals have been recorded to avoid seismic noise by leaving an area (Castellote et al. 2012; Weir 2008; Stone and Tasker 2006). The long-term impacts of various changes in behaviour are largely unknown but potentially impact their ability to feed and/or reproduce as in some species, these life-history stages are site or habitat-specific.

South Africa's south and west coasts are host to eight species of beaked whales (Ziphiidae) (Best 2007), including a new species described in 2021 (*Mesoplodon eueu;* Carroll et al. 2021), which are globally recognised as being sensitive to anthropogenic noise, and having raised conservation concerns. New et al. (2013) found that adult female beaked whales could survive but not reproduce in times or areas of lower habitat quality. They may extend the duration of lactation in mediocre conditions to increase their chance of survival, while still reproducing. New et al. (2013) found that some beaked whale species require high-quality habitat to meet their requirements for reproduction and survival. They suggested that even minor, non-lethal disturbances, resulting in changes in behaviour such as displacement from preferred habitats, could impact a population.

McEwen and Wingfield (2003) suggested that all organisms must gather energy for growth and reproduction throughout their life cycle and that organisms must retain reserves for predictable changes such as seasons, and challenges that are less predictable such as disturbance, predation pressure, or social conflict. Often colloquially, this is referred to as the "fitness" of the animal. The accumulated cost in the balance between energy intake and demand is called the 'allostatic load', of physiological and behavioural mechanisms that enable allostasis or adaptation to these changes. McEwen and Wingfield (2003) use the word "allostasis" to signify mechanisms that allow an organism

to regain equilibrium while dealing with external challenges; if energy demand is more than intake, then animals may activate a survival mode that may increase energy available, reduce energy demand, or both, to regain its energy balance. Implications on individuals and populations of this energy imbalance are unknown.

Several studies have reported negative impacts of acoustic signals from airguns on zooplankton (small, aquatic microorganisms living in the water column, including crustaceans, larvae, juvenile fish, juvenile invertebrates, eggs etc.) from more than 10 m away (Kostyuchenko 1972; Kosheleva 1992; Parry *et al.* 2002) with some laboratory experiments on lobster larvae showing no impact at all (Day *et al.* 2016). However, Christian *et al.* (2003), showed retardation in some individuals in the development of snow crab eggs after being exposed to certain sound levels.

The effects of seismic noise on zooplankton were brought under the spotlight when McCauley *et al.* (2017) presented evidence from an *in-situ* study that suggested that seismic surveys cause significant mortality to zooplankton populations. Zooplankton, unlike vertebrates, do not have hearing structures (although they can sense pressure change) and their bodies are generally the same density as the surrounding water, so sudden pressure changes associated with seismic activities were presumed not to cause physical damage (Parry and Gason 2006). McCauley *et al.* (2017) disputed this and has shown zooplankton mortality at distances of up to 1.2 km from the sound source.

Similarly, inconsistent findings occur with fish assemblages. The impacts on fish assemblages are difficult to interpret, because of multiple factors at play including but not limited to the ability of a species to move from an area as well as the receiving habitat. We acknowledge the validity of the results presented by Meekan et al. (2021) which highlights that exposure to an experimental seismic source did not have an impact on the assemblage of tropical demersal fishes found along the northwest shelf of Western Australia. However, it must be noted that the findings have been stated to be applicable only to other habitats with similar physical environments, in particular similar water depths (50 – 70 m), highlighting the need for South African-specific and local research to be undertaken.

A global review of the effect of seismic activities on fish and invertebrates by Carroll et al. (2017) acknowledged the limits of the available research due to experimental design, or to the focus on single species which prevents extrapolation to other regions, other seismic surveys, species, or biological responses. In addition, they highlighted a serious concern, that there was a lack of research focused

on confounding effects and multiple stressors, therefore potential impacts of seismic surveys which had previously been identified may be reflective of under-estimation or over-estimation and would depend on the type of interaction (i.e., synergistic, additive, or antagonistic).

Furthermore, the indirect effects of seismic activity on cetaceans are a concern. It is well known that the productivity and health of the oceans are under-pinned by marine plankton (Raymont 1983; Alcaraz & Calbet 2009). While forming the basis of the food webs, plankton has been implicated in links to climate change via their role in iron fertilisation and carbon sequestration through whales foraging on krill and subsequent defecation (Smetacek and Nicol 2005; Smetacek 2008; Nicol et al. 2010). In 2010, Pershing et al. suggested that over-fishing of large fish and commercial whaling had compromised the ocean's ability to store and sequester carbon, thus contributing to climate change. They indicated that populations of large baleen whales now store 9.1×106 tonnes less carbon than before commercial whaling and that protecting whales (and other large over-exploited species), would be a form of a carbon management scheme. The cascading and knock-on effects of seismic survey impacts between the upper (cetaceans) and lower reaches (plankton) of the food web, as each are being impacted are unknown. McCauley et al. (2017) noted that the ramifications of compromised larval recruitment could be massive for higher predators and for ocean health as a whole. While traditional feeding grounds for humpback whales are in Antarctic waters, Dey et al. (2021) has recently recorded regular feeding frenzies off the west coast in recent years (see super pods below).

South African Context

It is of concern that no acoustic modelling was undertaken for the proposed seismic survey activity. Where the impact of sound was referred to in the EIAR, it appears that the most conservative estimates of impacts are used, with statements in the Marine Specialist Report (Pg. 9) including “Based on analogue sound sources, sound levels for the seismic survey can notionally be expected to attenuate below 160 dB less than 1,325 m from the source array.” However, the author then goes on to sight multiple examples of behavioural responses of species outside of this range including but not limited to cephalopods (2-5km, pg. 81), fish (up to 5km, pg. 88), turtles (up to 3.5 km pg. 103), cetaceans (beyond 5 km, and potentially displaying avoidance responses at 24km, pg. 118). It thus becomes very difficult to accurately assess risk without this critical piece of information, however there are some key concerns.

It is of concern that there are a number of 'unknowns' and 'warning bells' in terms of presence of and impacts on cetacean populations on the west coast. Despite various species being recorded frequently on the coast, the location of breeding grounds of Sei (*Balaenoptera borealis*) and Fin whales (*Balaenoptera physalus*) are unknown, the seasonality of pygmy (*Kogia breviceps*) and dwarf (*Kogia sima*) sperm whales are unknown and the abundance and occurrence of the offshore common dolphin (*Delphinus delphis*) is also unknown, highlighting that encounters with these animals cannot be predicted and the generic mitigation measures may be insufficient. Further to this, it is noted in the EIAR for the Tosaco exploration right that the two very well-studied and frequently observed species on the south and west coasts, the humpback and southern right whales, are expected to be regularly encountered and have a year-round occurrence in the seismic survey area. The period of humpback whales in this area is between July and February, with frequent feeding encounters during the months between December to February. Barendse et al. (2010), Best & Allison (2010), and Elwen et al. (2014) highlighted that there is no existing evidence of a clear 'corridor' of migration and humpback whales appear to be spread out widely across the shelf and into deeper pelagic waters, especially during the southward migration, in the Benguela ecosystem. Apart from this going against the spirit of avoiding whale periods by the oil and gas industry, Vermeulen *et al*. (2020) warned of an observed decrease in southern right whale calving success of the South African population and a strong link between foraging success and reproduction. They suggest an investigation into possible decreases and/or spatial or temporal shifts in their prey availability at higher latitudes due to environmental variability. They also highlight a concern of the continued low numbers of unaccompanied adults along the South African coast which could potentially have serious consequences for cow-calf pairs in relation to the country's whale-watching industry in the future.

Since 2011, South Africa has witnessed 'super-pods' of up to 200 humpback whales feeding in south and west coast waters between October to January. Research by the National DFFE, in collaboration with various academic partners, has led to the discovery of these 'feeding grounds' away from their traditional feeding grounds in the Antarctic[2]. This phenomenon requires understanding the ecosystem-wide impacts and benefits, while potential human/whale conflicts remain unknown. According to Dey et al. (2021), the formation of super-groups in recent years suggests that there might be a change in oceanographic or ecological characteristics which provide the conditions for this novel

[2] https://www.news24.com/news24/travel/watch-whale-super-pods-larger-than-usual-cause-stir-off-sas-west-coast-public-urged-to-keep-their-distance-20191216

feeding strategy in the Southern Benguela Upwelling System. Although the humpback whale population is increasing (Wilkinson, 2021), there is evidence to suggest that cetaceans in South African waters are being affected by changes in their ecosystem and it is not well understood yet what is driving these changes and what the long terms effects could potentially be to populations.

With other mammals, it was suggested by Thompson et al. (1998) that gray seals displayed strong avoidance behavior, altered foraging behavior and suggested an increased frequency of hauling out onto land to possibly escape the noise, while harbor seals had slower heart rates during controlled playback experiments. In contrast, during a study in shallow arctic waters, sighting rates of ringed seals (*Phoca hispida*) from a seismic vessel showed no difference when a different number of airguns were in use, did however suggest local avoidances based on distance from the sound source (Harris et al., 2001).

In South Africa, the Cape fur seals (*Arctocephalus pusillus pusillus)*, is the only resident seal along the west coast, occurring at numerous breeding and non-breeding sites on South Africa's mainland and on nearshore islands and reefs. Other vagrant seals occurring along the south and west coast include the southern elephant seal (*Mirounga leoninas),* subantarctic fur seal (*Arctocephalus tropicalis), Antarctica fur seal* (*Arctocephalus gazella*)*,* crabeater *(Lobodon carcinophagus)* and leopard seals (*Hydrurga leptonyx).* Cape fur seals are highly mobile and have large foraging areas including on the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979).

According to Kirkman et al. 2016, several morbillivirus epidemics have occurred in true seal (Phocid) populations in the northern hemisphere and, at the time it was agreed that no epidemic diseases were known to have infected Cape Fur Seals historically, but there was a considerable risk for disease transmission to the population through exposure to domestic or feral dogs and terrestrial carnivores, potentially resulting in mass mortality. Kirkman et al. (2016) cautioned that the health of individuals and their vulnerability to disease can be affected by feeding conditions, including the availability of prey, and that risk of disease may be exacerbated by anthropogenic pressures on the ecosystem.

In South Africa, since 10 September 2021, thousands of emaciated, dying and dead Cape fur seals (*Arctocephalus pusillus pusillus)*, have washed ashore along the south and west coasts. The cause of these die-offs remains unknown but avian flu has been ruled out and malnourishment appears to be the most widely accepted reason. It is of concern that although the cape fur seal population within

South Africa are healthy, they too are under pressure from various anthropogenic pressures and the seismic survey is likely to add stress to the population.

In South Africa, only a single focused field study on the impact of seismic surveys has been undertaken. This study, off Gqeberha, was within the foraging area of the endangered, endemic African Penguin (*Spheniscus demersus*). Pichegru et al. (2017) demonstrated that penguins avoided their preferred foraging areas during seismic surveys and foraged further from the survey vessel when in operation. Upon termination of seismic surveys, the penguins reverted to their normal behaviour (Pichegru et al. 2017), a behaviour which was also observed in Gray whales (*Eschrichtius robustus*) off Sakhalin Island in Russia (International Whaling Commission 2005). However, the long-term effects on populations of this temporary retreat of the area are unknown. Given the results of this study by Pichegru et al. (2017), strict management measures and decisions on seismic survey activities should have been established in South Africa. Furthermore, the cumulative effect of multiple, concurrent seismic surveys within the region may cause cumulative impacts.

Significant impacts on turtle species are a concern. Adult turtles may be less vulnerable to sound damage than cetaceans as the air spaces in their cochlear are smaller than those in cetaceans, making them less sensitive to sound shockwaves (Popper et al. 2014). However, while studies have shown that adult sea turtles have a moderate ability to move from an area being surveyed (Lenhardt 1994; O'Hara and Wilcox 1990), they are prone to TTS after exposure to sound within 1 km of a sound source, with signs of recovery only two weeks after injury (Lenhardt 1994). In a study undertaken on captive turtles, it was found that loggerhead turtles (*Caretta caretta*) responded to sound by swimming to the surface and remaining there or staying slightly submerged (Lenhardt 1994), as this area, regarded as a sound shadow, and is hypothesised as being where sound waves cancel each other out and the noise is at a minimum. Cummings et al. (2004) disputed this saying that although near the surface, could be a place where animals take refuge, they are not in a 'zone of silence'. With an increasing exposure of sound levels, the behaviour of caged green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles increased their swimming speed, potentially showing agitation to sound (McCauley et al. 2000). Turtle behaviour is difficult to interpret (DeRuiter and Doukara 2012), given that some studies have reported that turtles do not display any signs of distress (Pendoley 1997). Globally the Leatherback turtle (*Dermochelys coriacea)* is vulnerable, but critically endangered in the Southwestern Indian Ocean where this subpopulation is declining (Nel 2010, 2012; Nel et al. 2013). Loggerhead (*Caretta caretta*) populations are globally vulnerable but near threatened in the southwest Indian Ocean (Lombard & Kyle 2014).

Both loggerhead and leatherbacks are known to occur within the Tosaco 2D/3D seismic survey area but known migration corridors of adult leatherbacks lie just offshore of the survey area. Harris et al. (2018) highlighted the migration path for leatherback turtles into the south-eastern Atlantic (Agulhas-Benguela Corridor), adjacent to the survey area. Leatherback turtles inhabit deeper waters and are considered a pelagic species, traveling within the ocean currents. However, they have a moderate ability to avoid areas with an increase of noise in the water. According to Hays et al. (2004), these animals may dive to depths over 600 m and remain submerged for up to 54 minutes. Mitigation measures for turtles in seismic surveys include observers, although it is unclear how an observer would be able to observe these animals at such a distance (especially as large animals such as whales are only observed 44% of the time at best). A second mitigation measure, is to install 'turtle-guards' to prevent them from becoming entangled in the gear. These devices are accepted as being useful in terms of entrapment but not for sound in the water. Given the sighting probability of a turtle by an observer is minimal (as explained above) and that turtle guards are recommended gear, not compulsory for this survey, these two mitigation measures do not instil confidence that impacts on turtles are effectively mitigated.

Effectiveness of Mitigation [Marine Mammal Observers (MMO) and Passive Acoustic Monitoring (PAM)]

During the 2018 and 2019 humpback whale (*Megaptera novaeangliae*) migration period along the east coast of South Africa, Wilkinson (2021) estimated the relative abundance of migrating humpback whales sighted by trainer observers from two towers located 22m apart (both observers viewing the same area), located at 70m above sea level on a dune with a horizontal vantage length of approximately 20 km. Over the observation periods during the peak of migration, it was estimated that observers from both towers missed between 41-44% of whale groups while distance offshore decreased the probability of sightings. Assuming that the best percentage sighting (56%) was achieved within 1-5km of the observers' vantage point, then more than 40% of whales were missed. Given that this survey was done during the northward migration when mostly larger animals are present, the sighting success may be less when small calves are present as well (as would be the case in December). This begs the question of the efficacy and reliability of the mitigation method of Marine Mammal Observers (MMO), while assuming that whales (and other cetaceans) are thus regularly missed by MMOs and could be harmed.

Furthermore, bearing in mind the examples above, i.e., blue and fin whales ceasing to sing, the use of Passive Acoustic Monitoring (PAM) technology to detect cetaceans is baseless if cetaceans do not vocalise. As per best practice, in an effort to improve mitigation, PAM technology is complemented by visual searching over an area of 500m around the vessel by qualified Marine Mammal Observers (MMO). However, this technique is also fatally flawed because it cannot be used at night, during rain, and effectively in sea states more than three on the Beaufort Sea State Scale. Therefore, both PAM and MMO's are insufficient to detect, with certainty, cetaceans within the surrounding survey area and these types of mitigation will only be effective for all affected species if airgun firing ceases between sunset and sunrise, and adverse weather conditions that limit visibility.

The cumulative and long-term effects of seismic survey sound are not entirely understood (Jasny et al. 2005); however, it is accepted that ocean noise may have ecosystem-scale effects (Hildebrand, 2005) and the "knock-on" effects on animals, their prey and their predators will have consequences within the food chain (Koper and Plön 2012). It has been suggested that research and a critical review on mitigation measures (McCauley et al. (2017) as well as a better understanding of ecosystem-scale effects of sound (Koper and Plön 2012), especially at the lower trophic levels are imperative. Considering the ecosystem services provided by the Benguela Current Marine Ecosystem and its associated diversity and biomass, mitigation and understanding should be a conservation imperative in South African marine waters. Up to now, there has been no effort in increasing the knowledge of the impact of these seismic surveys by industry or South African environmental departments despite them being known to have impacts on marine animals and having been undertaken in South African waters for a number of decades.

Proximity to Marine Protected Areas and Critical Biodiversity Areas

The authorised Tosaco Block 1 exploration right area encompasses a proportion the Orange Shelf Edge MPA, and completely surrounds the Namaqua Fossil Forest MPA (See EIAR Figure 14 pg. 41). While it is noted that a 5 km buffer has been included around these MPAs in relation to the associated 2D/3D seismic survey, there is still cause for concern as the impact of noise from the array can influence the behaviour of some species at distances of over 5 km. The marine specialist report continually identifies the impact on marine species to be no more than 1.5 km, with impacts on fisheries of up to 5 km from the sound source. However, a report on seismic operations from a proposed vessel in the same area (Searcher), using the same technology indicated *"the cumulative zone of impact for the 3D survey extends to 800 m for permanent threshold shifts (PTS) and to 8 000 m for temporary threshold shift (TTS) for physiological injury, and the cumulative zones for PTS and TTS while the 2D survey is 500 m*

and 5 000m, respectively". The Orange Shelf MPA forms key feeding grounds for the endangered Atlantic Yellow-nosed Albatross, the near-threatened Black-browed Albatross and the critically endangered Tristan Albatross (Birdlife International unpublished data) and it provides an important foraging and aggregating area for cetaceans and large fish species. A significant concern should seismic activities occur nearby. Furthermore, the 2D/3D survey area abuts the Namaqua Fossil Forest MPA, meaning that the vessel will be active for an extended period, up to four months, in very close proximity to the MPA.

It should be noted that, according to the National Environmental Management: Protected Areas Act 57 of 2003: section 48A reads:

"48A Restriction of activities in marine protected areas:

> *Despite any other legislation, no person may in a marine protected area-*
>
> *….*
>
> *(e) in any manner which results in an adverse effect on the marine environment, disturb, alter or destroy the natural environment of disturb of alter the water quality or abstract sea water;*
>
> *(f) carry on any activity which may have an adverse effect on the ecosystem of the area;…."*

It cannot be ignored that the proposed seismic activity will still have potential adverse effects on the ecosystem within the area and disturb the natural environment.

Further to this, large portions of the Tosaco exploration right area comprise Critical Biodiversity Areas (CBA) both 1 and 2, with a significant proportion of the 3D area comprising CBA 1 and 2. CBA 1 areas are irreplaceable or near-irreplaceable, while CBA 2 are sites that are the best option available for representing the features in a spatial prioritisation (Harris *et al.* 2020). The primary of objective, and national policy is that both CBA 1 and 2 areas remain in natural or near-natural states for conservation management, while portions of these areas be ear-marked for future MPAs.

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Curriculum Vitae

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PERSONAL DETAILS

Name	:	Jean Mary Harris
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EDUCATION

1993 PhD (Zoology), University of Cape Town. Focus: Trophic ecology in estuarine and intertidal systems.
1984 B.Sc. Hons. (Marine Biology), University of Cape Town, First Class
1982 B.Sc. (Zoology), University of Cape Town
1979 Matriculated, A-grade, Clarendon Girls High School, East London

AWARDS:

- PEW Fellowship in Marine Conservation, 2000
- Purcell Memorial Prize for best Zoology PhD thesis, 1993
- FRD Special Merit Doctoral Award, 1990

SELECTION OF PROFESSIONAL OFFICES HELD

Pew Fellow in Marine Conservation, Pew Fellows Program in Marine Conservation, 2000 - present
Trustee: South African Association for Marine Biological Research, 2016- July 2017
Member: Programme Steering Committee for the Marine Science for Management Association (MASMA), Western Indian Ocean Marine Science Association (WIOMSA) 2004-2015.
Chair: Subsistence Fisheries Task Group 1999-2000.
Chair: SA Network for Coastal and Oceanographic Research (SANCOR) National Steering Committee 1997-2001.
Member: IUCN Species Survival Commission – Marine Conservation Committee, 2018-present
Member: IUCN SSC Red List Committee, 2018-2021
Executive Trustee: Wildlands Conservation Trust, 2015- April 2017
Member: Scientific Authority 2014-2017. Advises the SA Minister of Environment on biodiversity matters
Chair: Symposium of Contemporary Conservation Practice (SCCP) 2012- July 2017.
Member: East African Marine EcoRegion Programme Committee (EAME) 2004-2010

EMPLOYMENT RECORD

Executive Director WILDOCEANS, Wildlands Conservation Trust, August 2017 - current
Research Associate, Institute for Coastal and Marine Research, Nelson Mandela University, 2016-present
Senior General Manager: Scientific Services, Ezemvelo KZN Wildlife, October 2006 – July 2017
Ecological Advice Co-ordinator, Coast Region, Ezemvelo KZN Wildlife, 2002- September 2006
Regional Ecologist Marine/Scientist, Scientific Services, KZN Nature Conservation Service, 1995 – 2002
Senior Scientific Officer, Terrestrial Antarctic Biology Research Programme, Ornithology, UCT, 1991-1994

SELECTION OF RESEARCH AND MANAGEMENT EXPERIENCE

Project Leader Blue Action Fund "Oceans Alive" iSimangaliso MPA Project (2019-current): This project has 3 main objectives 1) Build knowledge of the biodiversity and socio-economics of the MPA and its communities, 2) Support effective management of the iSimangaliso MPA, and 3) Ensure benefits and improved livelihoods for rural communities living alongside the iSimangaliso MPA.

Directs the following WILDOCEANS projects for the Wildlands Conservation Trust (2017-current): Ocean Stewards, WhaleTime, MPA Expansion Project, Shark and Ray Conservation Project, Comoros Fish and Benthic Biodiversity Project, iSimangaliso Oceans Alive (MPA expansion, effective management and benefits to communities) Project, Blue Crew project in the Durban bay estuarine environment (plastic pollution action).

Principle Investigator and Co-ordinator for NRF-funded African Coelacanth Ecosystem Programme research projects: Biodiversity Surrogacy (2014-2017), Spatial Solutions (2016-2018) and Canyon Connections (2018-2020). Offshore biodiversity survey and sampling to test validity of modelled biozones, to refine conservation planning, and to support marine protected area expansion and the National Biodiversity Assessment (CBD).

Project leader for WWF-SA, NRF and ACEP funded project: SeaPLAN – development of a systematic conservation plan for the east coast of south Africa (2004-2012). Integrates shoreline biodiversity mapping, reef biodiversity surveys and key species and processes.

Project leader Wildlands Trust funded project: Rare and Endangered Species of the Greater St Lucia Wetland Park (2002-2005). This project aims to update the records of these species in the park and provide a management handbook. It is focussed on terrestrial and freshwater wetland species and employs a full-time researcher. This project has become entrenched and is ongoing.

Project leader for NRF funded project: KwaZulu-Natal and Transkei Indigenous knowledge of subsistence harvesters (2002-2006): Aims to document traditional knowledge and management systems of rural subsistence harvesters, compare regional differences, and integrate into current management practices.

Chairperson of Subsistence Fisheries Task Team, on behalf of Marine and Coastal Management (DEAT), managed a national programme for coast-wise identification of and consultation with subsistence fishers (1999-2000). Acted as Program manager and supervisor of 8 Regional Fieldworkers (Northern Cape, West Cape (x2), South coast, Eastern Cape (x2), KwaZulu-Natal (x2), and a National Co-ordinator and project researcher. – Project leader and finance vote-holder (ca R1 mill)

Project executant (co-ordinator & researcher, and supervisor of 2 project staff) for 5-year project funded by The Green Trust, WWF-SA: The development of sustainable utilization of mussels by artisanal and subsistence gatherers along the northern KwaZulu-Natal coast – Sokhulu community alongside iSimangaliso 1995-2000.

POST-GRADUATE STUDENT SUPERVISION:

6 MSc and 2 PhD students

PUBLICATION SUMMARY:

Papers in refereed journals:	37
Book/ book chapter	8
Reports and Popular articles	10

PUBLICATIONS AND REPORTS

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42(3)

Book Chapters

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Branch GM, Harris JM, Parkins C, Bustemante RH, Eekhout S 1992 Algal "gardening" by grazers: a comparison of the ecological effects of territorial fish and limpets. In: Plant-animal interactions in the marine benthos (DM John, Hawkins SJ & JH Price, eds.) Systematics Association Special Volume: 46: 405-423, Clarendon Press, Oxford

Selected Conference Presentations

Harris JM (2017) Contribution of MPAs to building ecological and social resilience. In Session: The role of MPAs in Achieving Ocean Health and Sustainable Blue Economies, 4th International Protected Areas Conference, Chile. September 2017. Invited oral presentation.

Harris JM, Lombard AT (2017) Why we need more Marine Protected Areas – tossing red-herrings off the table. South African Marine Science Symposium. July 2017. Port Elizabeth. Oral presentation.

Harris JM (2017) Marine Protected Area Expansion in South Africa. 10x20 Symposium. Ocean Conference New York, USA. June 2017. Invited oral presentation.

REFEREES

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SKILLS

- Class IV Commercial Diver (2004).
- SAMSA Skipper - Category C [Surf Launch] (2017)
- SAMSA Short Range VHF Radio Operators Certificate (2017)
- IMO[1] STCW[2] Basic (in progress; awaiting the end of lockdown)
- First aid - Level 3 (in-date).
- Quantum GIS (2015)

Profile

A marine scientist with a keen interest in marine biodiversity. I have a proven knowledge of essential scientific skills and technical experience, including data collection, data analysis, as well as worthy presentation and report writing skills. This resume validates my excellent work ethic and personal attributes, including sound organizing and planning skills, together with the ability to work both independently or in a team.

Education

PhD (Zoology) - 2016
University of Cape Town, South Africa.
Taxonomy, biodiversity and biogeography of the brittle stars (Echinodermata: Ophiuroidea) of South Africa.

MSc (Biological Sciences) - 2006
University of KwaZulu-Natal, Oceanographic Research Institute.
Zonation of the benthic communities on Aliwal Shoal, KZN, South Africa.

BSc Hons (Marine Ecology) - 2003
University of Natal, Durban.
Age, growth and stock assessment of Otolithes ruber from KwaZulu-Natal, South Africa.

BSc degree (Natural and Environmental Sciences) - 2002
Rand Afrikaans University.

Higher Certificate in Environmental Law and Liabilities for the Regulated Community - 2019
University of South Africa.

Employment History

Wildlands Conservation Trust - Marine Conservation Scientist - August 2020 - Present
Provide scientific oversight on the WILDOCEANS Shark and Ray Protection Project, funded by the Shark Conservation Fund.

Ezemvelo KZN Wildlife - Marine Ecologist - 2007 - 2020.
Provide ecological advice and decision support to conservation managers on priority biodiversity information needs in KZN. Develop and implement biological monitoring programmes for several marine ecosystems and resources. Contribute to policy development, guidelines and legislation tackling marine biodiversity conservation concerns. Provide training to field staff on aspects of marine protected areas, threatened and protected species and marine resources. Liaise with external organisations on issues relating to marine research and the marine environment.

[1] IMO (International Maritime Organisation)
[2] Standards of Training, Certification and Watchkeeping

Oceanographic Research Institute - Research Assistant - 2006.
Sort, process and identify benthic samples, including data capture and maintain a benthic reference collection database.

Oceanographic Research Institute - MSc Fellowship - 2004 - 2005.
In addition to completing an MSc, maintain the ORI research aquarium, capture data for the east coast reef survey project and assist with oyster, crayfish and mud prawn surveys.

IUCN Shark Specialist Group - Workshop assistant
Batoid Workshop - September 2003.
Sub-Equatorial Africa Workshop - September 2004.
General and administrative assistance for the duration of the workshop, and aid in documenting elasmobranches for IUCN red data list criteria.

Publications

2020 Dames, V., Bernard, A., Floros, C., Mann, B., Speed, C., Maggs, J., Laing, S., Meekan, M., **Olbers, J.M.** 2020. Zonation and reef size significantly influence fish population structure in an established marine protected area, iSimangaliso Wetland Park, South Africa. *Ocean and Coastal Management*, 185: 105040

2019 **Olbers, J.M.,** Griffiths, C.L., O'Hara, T.D. & Samyn, Y. 2019. Field guide to the brittle and basket stars (Echinodermata: Ophiuroidea) of South Africa. *Abc Taxa* 19: 1-346.

2018 Atkinson L.J, Mah C., Filander Z., **Olbers J.** and Thandar A. 2018. Phylum Echinodermata In: Atkinson L.J. and Sink K.J. (eds) *Field Guide to the Offshore Marine Invertebrates of South Africa*, Malachite Marketing and Media, Pretoria, pp. 393-476. DOI: 10.15493/SAEON.

2015 **Olbers, J.M.,** Samyn, Y. and Griffiths, C.L. 2015. New or notable records of brittle stars (Ophiuroidea: Echinodermata) from South Africa. *African Natural History* 11:83-116.

2014 **Olbers, J.M.**, Rowe, F.W.E., Griffiths, C.L. and Samyn, Y. 2014. The rediscovery of a collection of echinoderms including two holotypes in the Durban Natural Science Museum, South Africa. *Novitates*: 36: 1-13.

2013 Smit, A.J., Roberts, M., Anderson, R.J., Du Fois, F., Dudley, S.F.J., Bornman, T.G., **Olbers, J.M.** and Bolton, J.J. 2013. A coastal Seawater Temperature dataset for biogeographical studies: Large biases between in-situ and remotely-sensed datasets around the coast of South Africa. *PLoS ONE*, 8(12): e81944. Doi: 10.1371/journal.pone.0081944.

2013 Okanishi, M, **Olbers, J.M.** and Fujita, T. 2013. A taxonomic review of the genus *Asteromorpha* Lütken (Echinodermata: Ophiuroidea: Euryalidae). *The Raffles Bulletin* 61(2): 461-480.

2012 **Olbers, J.M.** and Samyn, Y. 2012. The *Ophiocoma* species (Ophiurida: Ophiocomidae) of South Africa. *Western Indian Ocean Journal of Marine Science*, 10(2): 137-154.

2009 **Olbers, J.M.**, Celliers, L. and Schleyer, M.H. 2009. Zonation of benthic communities on the subtropical Aliwal Shoal, Durban, KwaZulu-Natal, South Africa. *African Zoology* 44(1): 8-23.

2007 **Olbers, J.M.** and Fennessy, S.T. 2007. A retrospective assessment of the stock status of *Otolithes ruber* (Pisces: Sciaenidae) as bycatch on prawn trawlers from KwaZulu-Natal, South Africa. *African Journal of Marine Science*, 29(2): 247-252.

2005 **Brash, J.M.** and Fennessy, S.T. 2005. Age and growth of *Otolithes ruber* of KwaZulu-Natal, South Africa. *Western Indian Ocean Journal of Marine Science*, 4(1): 21-28.

References

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KENDYL ANDREA WRIGHT

SYNOPSIS

Kendyl is a well-rounded scientist with experience in both the academic and applied fields. She completed her master's in environmental consultancy at the University of Plymouth in 2011, before returning to South Africa. With 10 years of professional work experience including the commercial, academic, governmental, and scientific sectors, she specialises in both estuarine and offshore macrobenthic research on the KwaZulu-Natal coastline. Kendyl has managed several different environmental projects including environmental authorizations, environmental management programme development, ecological assessments and undertaking stakeholder engagement. She has completed a PhD in macrobenthic research at the University of KwaZulu-Natal, undertaking a thesis to identify the connections between coral reefs and the adjacent sandy benthos. A competent passionate ocean enthusiast, she has experience diving (rescue diver), power boating (category C <10m), sailing and surfing.

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Gender

Female

Education

PhD Marine Biology	| University of KwaZulu-Natal	| 2020
MSc Environmental Consultancy	| University of Plymouth United Kingdom	| 2011
BSc (Honours) Marine Biology	| University of KwaZulu-Natal	| 2009
BSc Marine Biology and Geography	| University of KwaZulu-Natal	| 2008

Employment

WildOceans	| 2021 - current |	Marine Protected Area Scientist
Oceanographic Research Institute	| 2018 - 2021 |	Assistant Scientist
University of KwaZulu-Natal, Westville	| 2016 - 2017 |	Contractual Lecturer
Anchor Environmental	| 2014 - 2015 |	Contractual Consultant
GCS Water and Environmental Consultants	| 2014 - 2015 |	Contractual Consultant
WSP Environment and Energy	| 2014 - 2015 |	Contractual Consultant
WSP Environment and Energy	| 2012 - 2014 |	Consultant
Oceanographic Research Institute	| 2011 |	Laboratory Assistant

KENDYL ANDREA WRIGHT

Selected Project Related Experience

Marine

2014-2019: Identification of macrozoobenthic zonation and ecosystem linkages in the iSimangaliso Wetland Park

Kendyl spent a year sampling the nearshore macrobenthos inshore of 2-Mile Reef in Sodwana Bay, KwaZulu-Natal. An area that is not well studied, she hoped to provide improved insight into biodiversity in the region. She is currently compiling two scientific papers for publication from her doctoral thesis, allowing for improved management in the region.

2016: KwaZulu-Natal Environmental Outlook Report – Marine Specialist Component

In order to align with government legislation, a specialist report assessing the current state and pressures experienced by the KZN coastal environment was compiled. Indicators to assess the impact of these pressures were outlined for monitoring purposes. The specialist report provided improved decision-making capabilities at all levels of government.

2013-2014: Richards Bay Oil Spill and Subsequent Mangrove Monitoring, Contractual Consultant

Following a crude oil spill within Richards Bay harbour, assistance and advice were sought for the implementation of a clean-up strategy and a monitoring plan. Kendyl spent time in the field, assisting in the management of staff tasked with the clean-up. She also undertook the post-clean-up monitoring of the mangroves.

2015: Mhlanga Estuarine Assessment, KwaZulu-Natal, Contractual Consultant Anchor Environmental:

An estuarine assessment was undertaken for a Water Use License Application to permit discharge from a Waste Water Treatment Facility. Kendyl undertook the identification of the invertebrates and compiled the specialist report.

Basic Assessment

2013 – 2014: Ecocycle Waste Solutions (Pty) Ltd, Facility Expansion, KwaZulu-Natal, Consultant:

Basic Assessment for the expansion of the current Ecocycle Health Care Risk Waste Facility including stakeholder engagement, environmental assessment and report development.

2013 – 2014: Lanxess Isithebe Decommissioning, Consultant:

Waste management license and basic assessment process application to facilitate the decommissioning and decontamination of the Lanxess, Isithebe inorganic chemical manufacturing facility.

2013 - 2014: eThekwini Municipality, Mnini Reservoir Inlet Pipeline, Consultant:

Basic Assessment for the installation of 3 km of pipeline and associated reservoir inlet pipeline.

2012 – 2013: Transnet National Ports Authority Waste Compaction Facility, KwaZulu-Natal, Consultant:

Basic assessment and waste management license for the construction of a hazardous galley waste handling and compaction facility within the Port of Durban.

KENDYL ANDREA WRIGHT

2011 - eThekwini Water & Sanitation, Veary Road Sewer Extension, Kingsburgh, KwaZulu-Natal, South Africa, Assistant Consultant:

Basic assessment for the proposed sewer extension in Kingsburgh, Durban. Assisting in the stakeholder engagement, environmental assessment and report development.

2011 - On-going: L. Toyi & Associates CC, Dukuduku Bulk Water Supply, Mtubatuba, KwaZulu-Natal, South Africa, Assistant Consultant:

Basic Assessment for the proposed construction of a water reservoir and bulk water supply pipeline in the area of Mtubatuba, KwaZulu-Natal. Assistant consultant in preparing the amended EMPr for submission to the Department of Environmental Affairs.

Environmental Impact Assessment

2013 – 2014: Proposed Pemba Port and Logistics Base, Assistant Consultant:

Scoping and EIA for the development and construction of a new Port based in Pemba, northern Mozambique.

2013 – 2014: BrightSource Kalahari Solar Energy Power Project, Assistant Consultant:

Scoping and Environmental Impact Assessment for the installation of a Solar Power Plant in Upington, Northern Cape.

2012 - 2014: Illovo Sugar South Africa (Pty) ltd, Proposed Green Boiler Project, Assistant Consultant:

Scoping and environmental impact assessment for the construction of boilers at Eston and Noodsberg to convert bagasse to energy for export to the national grid. Assistant consultant in stakeholder engagement and report writing.

Rehabilitation Plans

2011 - 2013: Stefanutti Stocks (Pty) Ltd, Umbilo Canal Rehabilitation Plan, Cato Manor, Durban, KwaZulu-Natal, South Africa, Environmental Consultant Officer:

Rehabilitation Plan for the Umbilo Canal, adjacent to the Golden Gate School in Cato Manor, Durban. Compilation of the addendum to the rehabilitation plan including the need for Dwarf Chameleon monitoring and management as well as undertaking the roe of Environmental Control Officer.

Environmental Screenings

2012 – Africa Sun Oil, Environmental Screening of a Proposed Shopping Centre, Reservoir Hills, Consultant:

Environmental Screening of the proposed new Reservoir Hills Shopping Centre based on virgin land, including the identification of potential impacts or areas of concern.

KENDYL ANDREA WRIGHT

References: *additional references on request


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