
13.1 Existing Conditions

The Department of Health and Community Services (DHCS) was commissioned by BOPL to assess the potential for mosquito-borne disease transmission and mosquito pest problems at North Point and Princess Louise. DHCS were also asked to provide recommendations on management measures to prevent the mine sites from creating and exacerbating mosquito breeding, for preventing the transmission of mosquito borne diseases and for preventing the introduction of dengue mosquito species. Their full report on biting insects at Princess Louise and North Point is presented in Appendix F.

As part of the development of the Brocks Creek and Cosmo gold projects, baseline trapping was conducted at the Brocks Creek project area (Montgomery *et al* 1996a and Montgomery *et al* 1996b) and the Cosmo project area (Montgomery *et al* 1999a), which are located 5 km and 15 km (respectively) to the west of the proposed North Point and Princess Louise mine sites (refer Figure 1.2).

The results recorded at both the Brocks Creek project area and the Cosmo project area were similar. *Aedes normanensis*, *Culex annulirostris*, *Coquillettidia xanthogaster* and *Anopheles annulipes sensu lato* (*s.l.*) were among the most common species recorded during the baseline mosquito trapping. *Aedes vigilax* was also recorded at the Brocks Creek and Cosmo project areas. Other species of potential importance recorded at both project sites were *Anopheles farauti s.l.* and *Mansonia uniformis* (Warchot and Whelan 2007).

Due to the prevalence of these species at both the Brocks Creek and Cosmo Project Areas, and the similarity of habitats between the three project areas, DHCS anticipates that these species will also be present at Princess Louise and North Point (Warchot and Whelan 2007). This data was therefore used by DHCS as the basis for assessments of the likelihood of biting insects affecting the proposed mine sites at Princess Louise and North Point, and also the Cosmo Village.

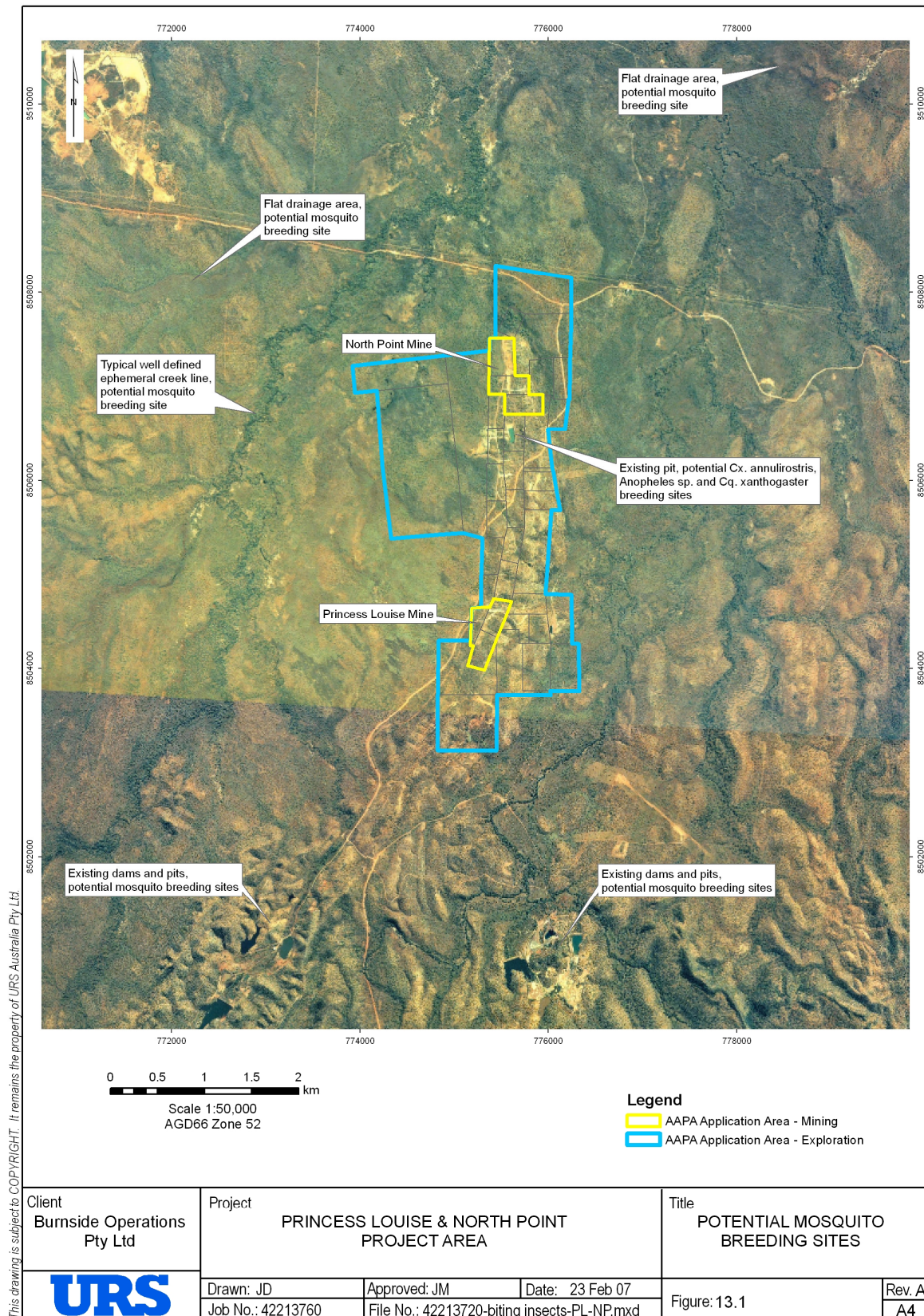
A description of each of the species recorded at Brocks Creek project area and Cosmo project area, and their likely abundance, is presented below. The location of potential breeding sites in the surrounds of North Point and Princess Louise is indicated in Figure 13.1.

Aedes normanensis

Aedes normanensis is likely to be sourced from the ephemeral creek lines and flooded ground depressions within 5 km of the proposed mine sites and the Cosmo Village. This species is likely to be present during the wet season months of October to April, with peak numbers occurring from nine days to up to two weeks, after significant flooding rains (Warchot and Whelan 2007).

Natural and artificial breeding sites located within 2 and 5 km of the mine sites, and the Cosmo Village, are likely to be the major source of this species (Warchot and Whelan 2007).





Culex annulirostris

Culex annulirostris generally breeds in freshwater and brackish water swamps or streams with emergent vegetation like grasses and semi-aquatic reeds, as well as sewage ponds with vegetation and semi-polluted stormwater drains. It is most commonly recorded within 2 km of breeding sites (Warchot and Whelan 2007).

At Princess Louise and North Point, natural breeding sites are likely to be vegetated margins of ephemeral creek lines and flooded ground depressions. Artificial breeding sites include the existing pits and dams in the area (e.g., Yam Creek pit) if the edges contain grasses or semi-aquatic reeds (Warchot and Whelan 2007).

Artificial breeding sites at the Cosmo Village Camp could be created via inappropriate disposal of sewage (Warchot and Whelan 2007).

Culex annulirostris is generally most common in the months of January to August in the Top End of the NT, depending on the type of nearby habitat (Warchot and Whelan 2007).

Culex annulirostris is a major arbovirus vector in the NT, capable of transmitting Ross River virus (RRV), Barmah Forest virus (BFV), Murray Valley encephalitis virus (MVEV), Kunjin virus and many other diseases. This species may cause seasonally low to moderate pest problems and disease risk, which could be increased if artificial breeding sites are created (Warchot and Whelan 2007).

Aedes vigilax

Aedes vigilax (salt marsh mosquito) breeds in coastal areas, so the closest likely sources for this species at Princess Louise and North Point are the tidal reaches of the Adelaide River or Daly River, depending on wind direction. *Aedes vigilax* can disperse up to 50 km, so it is likely to be seasonally present at the mine sites (Warchot and Whelan 2007).

This species is likely to appear at the mine sites around 14 - 15 days after monthly high tides or significant rainfall over the tidal areas of the Adelaide River or Daly Rivers in the months of September to January inclusive (Warchot and Whelan 2007).

Aedes vigilax is a painful and persistent biter, and will bite during the day in shaded areas and during the night. The species is a vector of RRV and BFV, particularly between November and January (Warchot and Whelan 2007).

Anopheles farauti sensu lato (s.l.)

Anopheles farauti s.l. (North Australian malaria mosquito) is a species complex that includes three species that are impossible to separate morphologically. Habitat indicators for the species are brackish water reed swamps, freshwater reed swamps, vegetated creeks and the upper reaches of mangrove creeks. The species are most common within 1.5 km of breeding sites (Warchot and Whelan 2007).



Potential breeding sites near Princess Louise and North Point are the vegetated margins of nearby ephemeral creeks and flooded ground depressions, as well as the existing pits and dams in the area if they have shallow, vegetated margins (Warchot and Whelan 2007).

These species are most abundant in the late wet season and early dry season months of March to June (Warchot and Whelan 2007).

These species are more timid biters than *Ae. vigilax*, *Ae. normanensis* and *Cx annulirostris*, therefore are of lower pest significance; however, they are vectors for malaria. The risk of malaria transmission will occur if a person with the infectious stages of malaria is bitten by *Anopheles* mosquitoes at the Princess Louise and North Point mine sites or the Cosmo Village. *Anopheles* mosquitoes only bite at night, so will only pose a potential malaria risk or pest problem after sundown (Warchot and Whelan 2007).

Other species

Other mosquito species, such as *Coquillettidia xanthogaster* and *Mansonia uniformis*, may be seasonally present at the Princess Louise and North Point mine sites, most likely sourced from vegetated areas of nearby ephemeral creek lines and flooded ground depressions. These species may also be sourced from the existing pits adjacent to the North Point and Princess Louise mines if the margins are vegetated with grass or semi-aquatic reeds (Warchot and Whelan 2007). Artificial breeding sites that could affect the Cosmo Village include artificial water bodies within 2 km of the mine camp.

Peak season abundance for both of these species is likely to occur in the months of March to June (Warchot and Whelan 2007).

13.2 Potential Impacts of Mining

The Princess Louise and North Point mine sites have the potential to exacerbate mosquito populations through the creation of favourable breeding environments and conditions, such as construction of the sediment dams, drainage lines near roads and the final pit voids, which will fill with water. Dust suppression spraying may also create small puddles or damp areas, particularly in vegetation along roadsides.

Mine sites also have the potential to introduce new mosquito species into the NT from North Queensland, such as the dengue mosquito *Aedes aegypti*, if mining equipment, such as buckets, drums, used tyres, machinery and other receptacles that can hold water, are sourced from these areas, without adequate wash-down or mosquito management controls (Warchot and Whelan 2007).

13.3 Management of Potential Mosquito Breeding Sites

Management measures to prevent the mine sites from creating and exacerbating mosquito problems extend across the dry and wet seasons, so that the rehabilitation phase of operations can be accommodated.



Personnel protection measures for the mine sites and Cosmo Village will be in accordance with DHCS guidelines “*Personal Protection from Mosquitoes & Biting Insects in the NT*”, a copy of which is provided in Appendix F. It is most likely that personal protection from mosquitoes will be required during certain periods of the year, particularly the wet season and early dry season.

Most mosquito species bite at night time, and as mining activities will be conducted at night, personal protection will be required. *Aedes vigilax* and *Aedes normanensis* can bite during the daytime in shaded areas, so personal protection from these species may be periodically required during the day and night for the months of September to January inclusive for *Ae. vigilax*, and October to April for *Ae. normanensis* (Warchot and Whelan 2007).

Management strategies for the prevention of mosquito breeding sites associated with the mine sites will be in accordance with DHCS guidelines (Appendix F). As indicated in the guidelines, the best method of control to prevent mosquito breeding is to prevent the creation of suitable habitat for mosquito larvae, through the appropriate design and maintenance of artificial water impoundments. Design considerations may include deepening of any shallow edges around artificial water bodies or removal of vegetation to prevent mosquito breeding.

Temporary mosquito controls at artificial sites, if required, will be achieved by using mosquito larvicides such as methoprene or *Bacillus thuringiensis* var. *israelensis* (B.t.i.), until mosquito populations are controlled (Warchot and Whelan 2007).

Adult mosquito control will be utilised around the mine camp and mine facilities during the period of high mosquito populations. Advice from DHCS is that the insecticide of choice is bifenthrin, due to the low irritancy of this insecticide (Warchot and Whelan 2007).

Any receptacle that can pond water that is sourced from North Queensland has the potential to introduce the dengue mosquito *Aedes aegypti* as it has drought resistant eggs. Artificial receptacles that have previously held rainwater, and are sourced from North Queensland, will be treated with a ten per cent chlorine solution or appropriate residual insecticide to prevent the introduction of *Ae. aegypti* to the North Point and Princess Louise mine sites.

Periodic inspection of artificial receptacles will be conducted around the Princess Louise and North Point mine sites in the wet season. Any receptacle that has the potential to pond water will be appropriately disposed of, stored under cover away from rain, be fitted with drainage holes or treated with an appropriate larvicide, to prevent endemic mosquito breeding and minimise the potential for the re-introduction of *Ae. aegypti* from North Queensland.

A rehabilitation and decommissioning plan will be put in place that ensures no actual or potential mosquito breeding sites remain after cessation of mining operations. This plan will be in accordance with DHCS guidelines, as outlined in Appendix F, and will ensure the removal or appropriate grading of mine landforms and infrastructure that has the potential to sustain mosquito breeding.



13.4 Commitments

BOPL commits to advising all workers that pest and disease-carrying mosquito species may be periodically present at the Princess Louise and North Point mine sites. BOPL will also provide advice on appropriate personal protection measures and ensure appropriate personal protection equipment is available in accordance with DHCS guidelines.

BOPL commits to ensuring that all water impoundments, access roads, mine waste dumps, sediment traps, pit watering activities, wetland filters and stockpile sites will be constructed and operated in accordance with DHCS guidelines.

BOPL commits to treating any equipment sourced from North Queensland, which has previously held rainwater, with a ten per cent chlorine solution or appropriate residual insecticide in order to kill mosquito eggs in accordance with DHCS guidelines.

BOPL commits to the periodic inspections of artificial receptacles around the Princess Louise and North Point mine sites in the wet season. Any receptacle that has the potential to pond water will be appropriately disposed of, stored under cover away from rain, be fitted with drainage holes or treated with an appropriate larvicide, to prevent mosquito breeding.

After mining, BOPL commits to the rehabilitation of Princess Louise and North Point mine sites in accordance with DHCS guidelines.

