



Geophysical survey at the 'New Works' artificial entrance Lakes Entrance, East Gippsland, Victoria

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1.0 Introduction

Gippsland Ports engaged Geometria Ltd to undertake a geomagnetic archaeological survey of areas of prograded Ninety Mile Beach shore in East Gippsland, Victoria, immediately to the east and west of the artificial entrance to the Gippsland Lakes. The artificial entrance cuts the sandy barrier dunes of the Ninety Mile Beach shore (**Figure 1**). This entrance, which permits navigation between Bass Strait and the extensive lake and river system situated behind the barrier, has led to the establishment of the Port of Lakes Entrance.

The areas surveyed are part of the 'New Works' precinct which is included on the Victorian Heritage Register (VHR) as H1532 and is listed within the East Gippsland Planning Scheme heritage overlay as HO225 (Helms 2007). The aim of the survey was to determine whether proposed works to be performed in connection with the Lakes Entrance Sand Management Program (LESMP) might impact upon archaeological values within the precinct.

The survey, sampling a total area of 2.4 hectare, was undertaken during two days in August 2007.



Figure 1: Location of survey at lakes Entrance

2.0 Background

Environmental Resource Management, ERM (Duncan and Nicolson 2007), have produced a report to Gippsland Ports detailing the geomorphology (Duncan and Nicolson 2007, Section 2.1), the historic context (Section 3), database searches (Section 4) and provided a Historical Site prediction model (Section 5) for the survey area and beyond.

Though the historical background was discussed in earlier reports, detailed accounts focusing on the shipwrecks around the Lakes Entrance are essential for the interpretation of the geophysical survey results. Duncan and Nicolson (2007:21) alert to the shipwrecks in the geophysical survey area, but they omit detailed accounts of the shipwreck events. A short history of the development of the artificial Lakes Entrance in relation to the shipwrecks below can be found in Appendix A.

Fast flowing water through the entrance, particularly on the ebb tide, quickly scoured a deep channel between the entrance piers, but a sand bar had already begun to accumulate outside the entrance within two months of opening in 1889. That navigation of the new entrance by small sailing vessels, against the ebb stream, was dangerous was soon demonstrated by the 49 ton ketch *Abstainer* (b. 1877) being sheered off its inbound course by the tide. *Abstainer* collided with the eastern breakwater and the extent of damage caused the vessel to be beached. As a result of this accident, a steam tug was deployed to assist shipping at the entrance. However, when *Abstainer*, refloated and repaired, was being towed out over the bar during November 1889, the steamer *Rose of Sharon* cast off the tow prematurely and the ketch was lost in heavy seas near the western pier head, drowning the master and the cook. *Abstainer* was a timber vessel built by Charles Poole at Latrobe, Tasmania on the dimensions 55.7 x 16.6 x 6.5 feet, but lengthened to 68.6 feet in 1883. The wreck of *Abstainer* is included within the VHR as S001 and the location is listed as unknown (Stone 2006:3; Bird and Lennon 1989:35; Loney 1982:196; Loney 1968:55; Duncan and Nicholson 2007:32). According to Don Love (2003:103), divers removed the masts from *Abstainer* but the hull remained in 30 feet of water.

During December 1901, the ketch *Bella Watson* had the misfortune to have the rudder chains part in a heavy swell when outward bound across the bar. Unmanageable, the vessel came ashore, a total wreck, 200 metres west of the entrance. As-built of timber at Williamstown in 1887, *Bella Watson* originally displaced 16 tons and was rigged as a cutter. After being lengthened in 1890, the vessel, with an additional mast, displaced 25 tons on dimensions 64 x 14.6 x 4.2 feet (Stone 2006:93; Love 2003:126-7). The wreck of *Bella Watson* is listed in the VHR as S59 but the location is noted as unknown.

In December 1903, the 49 ton sailing vessel *Ethel B.T.*, outward bound for Melbourne with firewood, sank on the western side of the western pier at Lakes Entrance. Don Love (2003:128) has published an account of the loss given in the *Snowy River Mail* in which *Ethel B.T.* was set behind the western pier in a strong easterly wind. An anchor failed to hold and the vessel dragged onto the rocks beside the pier. Various described as a ketch and a schooner, *Ethel B.T.* was built by Edward Beattie at Brisbane Water in 1886 on dimensions 69 x 19.4 x 5.5 feet. The wreck of *Ethel B.T.* is registered within the VHR as S244 with unknown location (Stone 2006:300; Duncan and Nicholson 2007:32).



Figure 2: Ethel B.T. rigged as a schooner (Bairnsdale Historical Society in Love 2003:128)

A major incident at the new entrance during September 1911 led to the loss of the single screw iron steamer *Despatch* (Figures 5, 6 and 7 and 8).



Figure 3: SS Despatch in the Gippsland lakes (photo: Bairnsdale Historical Society, in Love 2003:133)

A vessel with a long familiarity to the Gippsland Lakes – Melbourne run, *Despatch*, when inward bound was forced by rough weather to stand off the entrance. However, a diminishing coal supply caused the master Frederickson to attempt the run in. According to Bull and Williams (1967:66), *Despatch* misjudged the channel, striking piles off the end of the eastern pier. Holed, the steamer swung on these piles and sank just off the entrance, fortunately without loss of life. A different version from an account published in the *Gippsland Times* is cited by Love (2003:135). When entering the channel at 6.30 PM, *Despatch* was swept against the eastern pier and struck the rock beaching. The heavy sea caused the vessel to bump repeatedly against the rocks and it sank four hours later. The subsequent inquiry found that incorrect tide signals shown at the flagstaff were the cause of the disaster (Love 2003:135).



Figure 4: Bulwark of sunken SS Despatch just visible on the water surface to the left (Photo: Loney 1987:92).

Despatch, registered under ON 60440 had dimensions 151 x 20.1 x 10.3 feet and tonnage 237 gross and 114 nett. The wreck of *SS Despatch* is included within the VHR as S170 and the location is listed as unknown. Bull and Williams, with access to local knowledge, claim that the hull of *Despatch* was located by “sounding equipment” and that “numerous surveys” have shown the wreck to have “actually changed position in the moving sands on the bottom” (Bull and Williams 1967:66; Gregory 1928:125; Stone 2006:230; Loney 1987:67; Parsons 1981:65; Duncan and Nicholson 2007:32). Don Love has published a drawing of a scuttle apparently recovered from the wreck of *Despatch* (2003:135)

Duncan and Nicholson (2007:21) note that small fishing vessels, including *Frolic* and *Dulcie*, were wrecked while traversing the entrance during the 1920s and 1930s, but no further details have been found. In more recent years, a steel trawler that had capsized on the bar was removed using explosives (Andrew Fullard pers. comm. August 2007). Don Love (2003:161), has included several oral accounts of unidentified shipwrecks near Lakes Entrance known to local fishermen, but none of these is within the study area.

From the record it seems plausible to expect up to four shipwrecks close to the entrance inside the study area. Three of them would be smaller traders with the *SS Despatch* the only larger vessel. The smaller vessels *Abstainer*, *Bella Watson* and *Ethel B.T.* are all recorded to have either wrecked or got into trouble on the western side of the entrance while it can be assumed that the *SS Despatch* was lost at the eastern side of the entrance.

3.0 Methodology

An area of 2.4 hectare was surveyed using a twin-probe Foerster Ferex 4.032 Fluxgate Gradiometer in 12 grids of various sizes (**Figure 6 to 8**). Transects were walked across these grids at 1.0 metre intervals. Recorded data was normalized to reduce errors resulting from walking transects over uneven ground surfaces. The corners of the survey grid were documented using a hand-held Garmin ETrek GPS receiver.



Figure 5: The sidcasting dredge April Hamer at work on the Lakes Entrance bar while Dr Bader conducts the gradiometer survey in grid E1 (photo: G. Hewitt)

3.1 Capability of the fluxgate gradiometer

Palaeomagnetism is used by magnetometric methods like the fluxgate gradiometer and is widely used in archaeological research competing mainly with soil resistivity using electrical resistance and ground penetrating radar using the reflection of radar waves usually in the 200 MHz to 900 MHz range (Goldberg et al 2006, p.313). Magnetometry is the method most commonly used due to its speed and reliability in widely different soil conditions (Goldberg et al 2006, p. 315, Johnson 2006, ch.9 by K. Kvamme).

The fluxgate gradiometer measures small underground magnetic anomalies. Both geomorphological changes and human-induced soil changes can be detected. A geomagnetic survey is influenced by three components (Zickgraf 1999, p.107-9):

- A. The magnetic field of the earth is constantly changing and is influenced by external changes, e.g. the intensity of radiation from the sun. When a magnetometric survey instrument is arranged as a gradiometer, one magnetometer is placed close to the soil surface while a second magnetometer is placed at a known height (often 1 metre) above it. This arrangement allows the external changes in magnetic field strength to be compensated for, thus revealing the presence of gradients that are due to local effects within the soil, including archaeological features.

- B. Magnetic susceptibility of any material inside a magnetic field changes the magnetic signature of different materials to different degrees. This allows the presence of foreign material in the soil to be detected. An example is shell midden concentrations in the topsoil. Ferromagnetic materials (e.g. iron) can have a magnetic signature on their own (remnant magnetism).
- C. Le Borgne effect: The susceptibility of the topsoil to about 30 cm depth can be up to 100 times stronger than the susceptibility of the soil at 100 cm depth. This is due to chemical reactions of the soil close to the surface. Therefore any trench or pit back filled with mainly topsoil shows a much stronger magnetic signature than the surrounding soil.

Fireplaces, houses and pits are standard features commonly recognised in archaeological surveys (Zickgraf, 1999, for examples see Duensberg pp.130, Glauberg pp.140, Mardorf-3 pp.144 and Mardorf-23 pp.146) Although these references mainly describe detection of Neolithic and early Celtic earth-built structures and settlements in Central Europe, the archaeological signature is not dissimilar to pre-European Maori structures and archaeological deposits in New Zealand, together with prehistoric indigenous hearths and European settlements in Australia. The distribution of small metal artefacts can provide an indication of the presence and pattern of historic settlements, or indicate the location of a shipwreck from the presence of ferromagnetic masses.

Kvamme (in: Johnson 2006, p.216ff.) provides categories of human activities detectable using magnetometry:

1. Fires: hearth, fireplaces, burn-offs and accidental fires all create thermo-remnant anomalies.
2. Fired construction material like bricks can create the same effect.
3. Human occupation can enhance the Le Borgne effect (see above) and show the extent of settlements compared to unoccupied areas.
4. Accumulation of topsoil such as in the walls of sod houses can create anomalies. Often the natural backfill of a pit increases the amount of topsoil in the pit area and creates the same enhancement effect.
5. Removal of topsoil e.g. a ditch feature can create anomalies. Footpaths or animal traffic can result in these anomalies. The quick backfill of pits can result in similar anomalies as the topsoil may end up at the bottom of the pit and the subsoil on the top of the backfill.
6. Imported stone used for buildings or floor material often shows a difference to the surrounding soil matrix.
7. Iron objects will create dipolar anomalies. Often these anomalies, which may not be part of the archaeology being sought, are sufficiently strong to dominate the gradiometer signal hence they can 'hide' weaker archaeological anomalies.

In this survey, the signals detected consisted of dipolar anomalies due to the presence of iron objects of varying size and depth of burial.

3.2 Survey execution

Except where granite rock had been placed as part of the entrance pier and breakwater structures, the survey area was found to be well suited for a gradiometric survey with minimal background noise from the geological matrix. These rocks were avoided, as were large visible magnetic objects such as steel pipes and accumulations of steel droppers in the area to the east of the artificial entrance.

A large area consisting of sand with lenses of shelly sand on the eastern side presented few obstacles from live vegetation, although an array of drift timber and an early tiger snake on the foredune restricted movement somewhat. This area was surveyed using three grids E1, E2 and E3, all of 100 x 50 m (Figure 9). A fourth grid, E4, was subsequently placed in the intertidal zone in order to investigate anomalies detected in grid E3. Grid E4 covered an area of 50 x 19 m. Grids E1 to E3 were traversed in a north-south zig-zag, whereas grid E4 was traversed as an east-west zig-zag. The small corner between Grid E3 and E4 was covered by setting the instrument into 'Ferex' mode, whereby an audible alarm indicates strong magnetic anomalies (S-survey, see figure 7 & 8).

To the west of the artificial entrance, four grids, W1-W4 were placed between the wave lap and the first steep foredune ridge. A steeply wave eroded beach margin restricted the width of grids W1 and W2. Each of these grids had a length of 50 m, being traversed by east-west zig-zag. The width of grid W1 was 21 m, grid W2 had a width of 32 m, while both grids W3 and W4 had a width of 40 m.

A CAD file has been supplied to Gippsland Ports showing the extent of the works and the position of the anomalies discussed below.

The Gippsland Ports LESMP plan indicating the desired extent of the geophysical survey (Drawing 31-19622-K026 rev.B), showed the area of interest to extend to the north of the first beach ridge. This plan also showed a proposed western discharge pipeline generally following the direction of the swale behind the first beach ridge for a distance of approximately 500 m from the western breakwater. Accordingly three grids, W5, W6 and W7 were placed within this discontinuous swale where the absence of vegetation and intervening ridges permitted. Grid W5 covered an area of 30 x 12 m and was traversed as a roughly northeast - southwest zig-zag. Grid W6, separated from W5 by a steep sand ridge, covered an area of 20 x 21 m and was traversed as a roughly east-west zig-zag. Immediately to the west of W6, grid W7 covered an area of 45 x 14 m and was traversed in the same direction as W6. The swale to the west of grid W7 was both narrow and interrupted by steep sand ridges. As the terrain was inappropriate for a grid-based survey, the gradiometer was set to "Ferex" detector mode, with an audible warning when local field strength exceeded 100 nT and a meandering course (S-Survey, see figure 7 & 8) was walked through the swale from the west end of grid W7 to the point where the swale and the proposed discharge pipeline intersects the first beach ridge. A strong indication of the existence of buried ferromagnetic targets led to us setting out a small grid W8 to cover as much as was practicable of that location. Grid W8, which covered an area of 14 x 21 m, was traversed in a roughly northeast-southwest zig-zag. It was clear, however, from the 'Ferex' mode survey, that the magnetic anomaly extended a further 10 metres to the west into inaccessible ground.

4.0 Results

4.1 Classification of geophysical anomalies

The geophysical anomalies encountered in this survey were in the form of dipoles which show as adjacent black and white areas, ie. areas of high positive value (black) adjacent to areas of low negative value (white). A dipole anomaly indicates the presence of buried ferrous metal, the remnant magnetism of which shows up as a positive and a negative pole surrounding the object. The dipoles detected in this survey vary both in size and in sharpness and show clearly against the background (grey) which, except for the influence of non-local granitic rocks, is free from geological noise or other interference.

In general it might be inferred that the more diffuse a dipole appears, the deeper the metallic source is buried and the larger the dipole appears, the greater the ferrous mass that is producing it. Hence, very small and intense dipoles indicate small ferrous objects either buried at shallow depth or on the surface, whereas large diffuse dipoles suggest larger objects more deeply buried. It is not possible to be more specific than this and the geophysical maps produced from gradiometer surveys must be regarded as being essentially two dimensional. Archaeological excavation or systematic probing is necessary if determination of object size, nature and depth is required beyond the above generality.

The geophysical anomalies recorded in the survey (see **Figures 6 & 8**) have been classified according to the following categories:

1. Objects of modern origin and known engineering or structural features

These include small crisp dipoles and other indications that can be associated with visible infrastructure or as-constructed plans showing, for example, the actual routes and locations of buried pipelines or other sub-surface features. Anomalies interpreted as being within this category are colour-coded black on **Figures 6 & 8**.

2. Indeterminate objects

These include anomalies that may appear large and small, also close to the surface or deeply buried. As a general principle, indeterminate objects do not form coherent clusters or suggest meaningful patterns. Anomalies interpreted as being within this category are colour-coded blue on **Figures 6 & 8**.

3. Possible archaeological features

For the present work, the admittedly subjective criterion for considering an anomaly to potentially represent an archaeological feature has been set to include generally large and diffuse clustered indications that are suggestive of large and deeply-buried ferrous objects. Anomalies interpreted as being within this category are colour-coded yellow on **Figures 6 & 89**.



Figure 6: Interpretation of survey results



Figure 7: Survey results.



Figure 8: Schematic plan of survey results.

4.2 Interpretation of survey results

East side grids

A series of anomalies are present on the west edges of grids E1 and E2, consisting of a continuous low value shadow, apparently associated with rock beaching and wall structures adjacent to the eastern training wall. There is also a series of magnetic dipoles which are aligned with the ends of pipes exposed at the surface. These anomalies are interpreted as a buried pipeline aligned with the training wall and associated with previous sand shifter installations. An alignment of diffuse anomalies spaced at regular intervals trending roughly east-west is present at the northern edge of grid E1. These anomalies are interpreted as magnetic signals generated by the steel collars used to join individual lengths of a buried non-metallic pipeline. A non-metallic pipe riser protrudes vertically above ground level at UTM WGS84 co-ordinates 585622/5806006 and several anomalies appear in the vicinity. All of the foregoing, together with a scatter of small crisply-defined dipole anomalies towards the east of grids E1, E2 and E3 are considered to be small shallow-buried modern ferrous objects and recent infrastructure. They are coded black in the interpretive plans (**Figures 6 & 8**).

A series of larger and more deeply-buried anomalies, which are colour-coded blue in **Figures 7 & 9**, are scattered across grids E1, E2 and E3. We are not able to be certain regarding the interpretation of these anomalies. However, as we understand that a further recent buried pipeline, also associated with sand-shifter installation, has been placed in this region we are inclined to suggest that these indications lie within areas of recent disturbance and are not of archaeological interest.

The group of large, diffuse - and thus deeply-buried - anomalies at the southern margin of grid E3 and within grid E4 may not be explained by recent pipeline or sand-shifter installation. We consider that this group of anomalies, identified as **target 1** in **Figure 6 & 8**, may be parts of the hull or machinery of the iron steamer *Despatch* that is known to have sunk off the eastern mole. In **Figure 4**, *Despatch* appears to be lying on its beam ends with a small part of the bulwark visible. As the vessel is known to have had a beam of 20.1 feet, it follows that the water depth at the site of foundering must have been at least this. The hull of *Abstainer*, which according to the contemporary account, sank close to the seaward end of the western mole, remained in 30 feet of water after the masts were removed. Evidently, areas of deep water existed in close proximity to the entrance piers in places not directly effected by the growing ebb tide delta. The shore has prograded markedly in the form of cusped forelands on either side of the entrance since *Despatch* was lost, hence the presence of wreck remains, deeply buried within the present intertidal zone, presents a likely explanation for the anomalies at **target 1**.

West side grids

Although the eastern end of grid W1 shows interference from the granitic rock used to reinforce the entrance structure, no significant magnetic anomalies were detected. Except for the two category 1 dipole anomalies present, grid W2 is also free from significant

magnetic anomalies. Grid W5 also shows evidence of interference from the training wall, but is otherwise clear.

The adjacent grids W6 and W7 show the presence of two large anomalies, the one within the southeast corner of grid W6, being buried at shallower depth or having a larger mass. This cluster, which has been identified as **target 2** on **Figure 6 & 8**, is considered to be of archaeological interest. The historical record suggests that the schooner *Ethel B.T.* was wrecked on the rocks adjacent to the outside of the western mole and the location of **target 2** is entirely consistent with that record. Although *Ethel B.T.* was a vessel constructed from timber, ferromagnetic materials will have been present within the hull, rigging, tackle and fittings. A suite of iron anchors and lengths of iron chain will have been present. As an Australian-built hull, many of the fastenings and structural knees may have been of iron. Also, iron may have been used as ballast in this shallow-draught design, while blacksmith's work will have been present in the standing rigging, the windlass, pumps and steering gear. In addition, iron winches and sheaves may have been shipped for handling and stowing the cargo. It is clear that the clustering of anomalies evident in **target 2** occupies a larger area than the known dimensions of the vessel. However, this may be explained by the vessel breaking up during the wrecking process or, alternatively one major anomaly may correspond to the anchor let go during the emergency, according to the historical records. Interestingly, *Ethel B.T.* went ashore stern-first with a dragging anchor and the apparently larger of the two anomalies is the one to seaward.

The group of deeply-buried ferromagnetic anomalies found under the beach in grid W3, which are regarded as probable archaeological features, have been designated as **target 3**. Two of the anomalies, at the north and south ends of the group, which have a more crisply-defined appearance than the remainder in the group, are probably small objects with shallow cover and may not be of archaeological interest. However, they have been included within the envelope of **target 3** as a precaution.

A further clustering of anomalies is present in grids W4 and W8. This cluster, which has been identified as **target 4** on **Figure 6 & 8**, consists of three deeply-buried anomalies under the beach and a fourth very large and/or more shallow anomaly in the swale behind the first beach ridge in - and extending west of grid W8. The extent of this target was investigated with additional 'spaghetti' survey (S-Survey) as the ground cover prevented enlargement of the systematically gridded area W8.

The historical record states that the ketch *Bella Watson* came ashore 200 metres (yards?) west of the western pier, a position consistent with the location of **target 4**. The remarks above concerning the magnetic signature of timber vessels equally apply to *Bella Watson* and to the wreck of *Abstainer*, which, by a process of elimination, may be represented by **target 3**. If these clusters of anomalies are indeed the remains of small sailing vessels, then it is clear that the hulls of the vessels have broken up during, or subsequent to, the wrecking process, prior to burial beneath the prograding shore.

5.0 Summary

A geomagnetic survey of a total area of 2.4 hectare has been conducted on both sides of the artificial entrance at the Lakes Entrance 'New Works' site. Interpretation of the results has shown that a magnetically clear area exists to the east of the eastern pier and to the west of archaeological **target 1**. This area appears, from this technique, to be suitable for installation of the proposed LESMP sand shifter without impacting upon archaeological values. A similar area may also be present immediately to the west of the western pier, but present beach morphology did not permit a complete survey to the low water mark at that position. Also, it would appear from the geophysical survey that a corridor of disturbed ground, some forty metres wide and probably with no surviving archaeological value, exists parallel to and immediately to the east of the eastern training wall.

One cluster of magnetic anomalies (**target 1**) was found within the intertidal zone beginning approximately 70 metres ESE of the seaward end of the eastern mole and extending an unknown distance seaward. It is considered most probable that these anomalies are parts of the iron screw steamer *Despatch* (1869-1911); a shipwreck protected under the *Heritage Act 1995* and listed on the Victorian Heritage Register as S170, although without a previously recorded location.

Three clusters of magnetic anomalies (**targets 2, 3 and 4**) were found under the beach and within a swale behind the first beach ridge. The historical record suggests that these anomalies may indicate the presence of the wrecks of three small timber sailing vessels known to have been wrecked at the west side of the artificial entrance, but with no hitherto confirmed location. The distribution of anomalies suggests that these vessels may have broken up during the wrecking or post-wrecking processes. As timber vessels do not have a uniformly distributed ferromagnetic component, it is possible that coherent or fragmentary timber structure, not detected by the survey method, may be present both within and without the drawn boundaries of the anomaly clusters. If the anomalies detected are indeed the remains of wrecked vessels, it is possible that they are respectively the schooner *Ethel B.T.* (1886-1903), the ketch *Abstainer* (1877-1889) and the ketch *Bella Watson* (1887-1901). Again respectively, these shipwrecks are listed on the Victorian Heritage Register as S244, S001 and S59.

In addition to the individual VHR listings, the magnetic anomalies found lie within the boundaries of the VHR listing for the 'New Works' precinct, H1532 (Helms 2007).

CAD-formatted digital data, including the extent of archaeological target areas, the position of survey grids and the location of all anomalies detected during the survey, has been handed over to Gippsland Ports. Co-ordinates for the archaeological targets and the positions of the survey grids will be supplied to Heritage Victoria, in due course, to fulfill the statutory requirements for the reporting of shipwreck finds under the *Heritage Act 1995*.

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Appendix A: Historic Development and Shipwrecks at Lakes Entrance

No passage connecting the lakes to Bass Strait was found when European settler Angus McMillan first explored the region at the close of 1839. The entrance, at the east end of the lake system near Lake Bunga, discovered in 1842 by John Reeve, was found to be impermanent, barred, shifting and unsuitable for navigation (Bird and Lennon 1989:3). At that time, Port Albert, situated to the west, had begun to develop as the major port for the Gippsland trade. Discovery of gold in the Nicholson River hinterland during 1854 provided the impetus for development of new access routes through the lakes region, but Charles Marshall's resultant whaleboat ferry across the lakes did not approach the open sea. Four years later, after seasonal flooding had reopened the natural entrance, Malcolm Campbell navigated his schooner *Georgina Smith* through it to enter the Tambo River (Toghill 1984:128; Bird and Lennon 1989:8). Although agitation for government action to stabilise the entrance and provide a permanent channel came to nothing, a flood event during May 1863 opened an improved access which persisted for sufficient time for a maritime trade to begin. Although the loss of the schooner *Apollo* on the bar in 1864 demonstrated the dangerous nature of the channel, an optimistic approach toward the viability of the east Gippsland trade resulted in the formation of the Gippsland Lakes Navigation Company (Bird and Lennon 1989:11). However, the company soon purchased a 28 ton timber paddle steamer the *T. Norton* (known as the '*Tommy Norton*', Stone 2006:879) to assist vessels in crossing the entrance. Despite this, the small schooner *Jane* sank after striking the sand and the 150 ton schooner *Lady Darling* grounded on the bar and remained stuck until freed by a gale more than twelve months later. While the *Lady Darling* bided its time, the entrance shoaled and the steamers *Trio* and *Charles Edward* became trapped. The natural entrance remained unreliable throughout 1866 and 1867 to the detriment of a growing export trade. This time, deputations to government were fruitful and Inspector-General of Public Works William Wardell recommended that a new artificial entrance be cut through the barrier dunes opposite Jemmy's Point, the site of the 'New Works'.

Following delays in funding and disputation over selection of the most appropriate site, tenders were called late in 1869 for the first stage of construction of a new entrance. John Carpenter's contract price of £1,900 was accepted and in 1870, work commenced on the construction of two parallel timber piers 400 feet apart between the lake and the sea. The expectation that winter floods would carve a channel between the piers was not realised and when floods finally arrived in 1874, a new natural entrance was opened well to the east of the construction. The works at the site of the artificial entrance were damaged by the winter storms but the sand remained. Attempts at promoting scour by trenching were thwarted by wind-blown sand. Repairs to the structures were expensive and proposals to construct training walls within the lakes to divert the outgoing stream towards the artificial entrance stalled due to lack of money. Bird and Lennon (1989:18) have remarked that the reluctance to outlay further funds on the project might be explained by the expenditure of £18,655 over five years of effort with no useful result. They also point out that the natural entrance had permitted navigation for much of that time. Indeed, a growing concern that an artificial cut would suffer the same problems of sanding as the natural entrance was added to the optimistic notion that the westward trend in the position of the natural entrance might, through improved flow, allow it to become permanently navigable (Bird and Lennon 1989:18). Construction of the Gippsland

Railway from Oakleigh to the lakes port of Sale allowed further government prevarication while the effect of this alternative transport mode was assessed. During this time, the uncompleted works at the intended artificial channel deteriorated and accidents continued to occur at the natural entrance. The tug '*Tommy Norton*' became a total loss on the bar during 1877 and the schooner *La Trobe* was wrecked there the following year.

The engagement of harbour engineer Sir John Coode as advisor to the Melbourne Harbour Trust Commissioners during 1878, reinvigorated the campaign for a permanent entrance to the Gippsland Lakes. Coode's report, received by the Victorian Government during 1880, concurred with the existing construction site opposite Jemmy's Point but recommended significant alterations to the detail with an estimated cost of £85,700 (Bird and Lennon 1989:21). After the due process of legislation and the raising of loan funds in Britain, work on the new entrance – the 'New Works' - began again early in 1884. Undermining of extensions to the pier structures on either side of the planned artificial entrance by winter storms delayed progress, but by 1888, work had begun on dredging away the sand between the piers from the inside. Despite the maintenance of a sandbag barrier at the seaward end, the channel was breached by natural forces during a storm in June 1889. Finally, the artificial entrance was open after twenty years and the expenditure of £115,000.

Reconstruction of the entrance, more or less according to the recommendations of Coode, took place during that period of expansion and speculative optimism in Victoria characterised by the Land Boom, intensive urbanisation and the extraordinary growth of the railway network under the notorious "Octopus" Act (Venn 1973; Beever 1971). Seen against the background of the ensuing crash, intense economic depression, retrenchment and the general abandonment of public works that followed the Land Boom, the timing of this accidental breaching of the artificial cut might be considered fortuitous indeed.

Fast flowing water through the entrance, particularly on the ebb tide, quickly scoured a deep channel between the entrance piers, but a sand bar had already begun to accumulate outside the entrance within two months of opening in 1889. That navigation of the new entrance by small sailing vessels, against the ebb stream, was dangerous was soon demonstrated by the 49 ton ketch *Abstainer* (b. 1877) being sheered off its inbound course by the tide. *Abstainer* collided with the eastern breakwater and the extent of damage caused the vessel to be beached. As a result of this accident, a steam tug was deployed to assist shipping at the entrance. However, when *Abstainer*, refloated and repaired, was being towed out over the bar during November 1889, the steamer *Rose of Sharon* cast off the tow prematurely and the ketch was lost in heavy seas near the western pier head, drowning the master and the cook. *Abstainer* was a timber vessel built by Charles Poole at Latrobe, Tasmania on the dimensions 55.7 x 16.6 x 6.5 feet, but lengthened to 68.6 feet in 1883. The wreck of *Abstainer* is included within the VHR as S001 and the location is listed as unknown (Stone 2006:3; Bird and Lennon 1989:35; Loney 1982:196; Loney 1968:55; Duncan and Nicholson 2007:34-5). According to Bull and Williams (1967:43), *Abstainer* was engaged in the timber trade. The vessel was under the ownership of Andrew O'Keefe, the contractor for the Whitelaw's Track (Korumburra) to Toora section of the Great Southern Railway (Love 2003:103; Healy 1988:91-109; Bowden 1970:82-9), which suggests that the function of *Abstainer* may have been carriage of sawn timber for the railway project from the lakes region to Stockyard Creek, Foster landing, Bowen and Bennison, as one of the fleet of fifteen small sailing vessels so engaged (Healy 1988:95; Bowen 1970:84). According to Don Love (2003:103), divers removed the masts from *Abstainer* but the hull remained in 30 feet of water. The

steamer *Rose of Sharon*, the master of which was found guilty of causing the loss of *Abstainer*, was also owned by Andrew O'Keefe (Healy 1988:106-7, Stone 2006:3).

Also during 1889, the schooner *Mariner*, outward bound to Melbourne, broached in a heavy sea and went ashore near the entrance. Although initially thought to be a total loss, *Mariner* was refloated and repaired at Paynesville to continue a career marked by much incident and possible confusion in the literature. *Mariner*, of 63 tons (also given as 64) was built at Whangape, New Zealand in 1867 on the dimensions 82.9 x 17.2 x 6.7 feet and later lengthened (Stone 2006:586; Loney 1968:55).

The entrance piers were reinforced and extended to seaward during 1891, while the channel between them grew deeper. Nonetheless, the sand bar continued to accumulate outside the entrance. This is the ebb-tide delta that continues at the present time to require dredging to maintain navigability (Wheeler and Peterson 2005:3; 2005a).

Further maritime accidents, resulting in the loss of vessels, have occurred during navigation of the artificial entrance. During December 1901, the ketch *Bella Watson* had the misfortune to have the rudder chains part in a heavy swell when outward bound across the bar. Unmanageable, the vessel came ashore, a total wreck, 200 metres west of the entrance. As-built of timber at Williamstown in 1887, *Bella Watson* originally displaced 16 tons and was rigged as a cutter. After being lengthened in 1890, the vessel, with an additional mast, displaced 25 tons on dimensions 64 x 14.6 x 4.2 feet. When lost, *Bella Watson* was owned by William Cowper and Sons of Melbourne (Stone 2006:93; Love 2003:126-7). The wreck of *Bella Watson* is listed in the VHR as S59 but the location is noted as unknown.

In December 1903, the 49 ton sailing vessel *Ethel B.T.*, outward bound for Melbourne with firewood, sank on the western side of the western pier at Lakes Entrance. Don Love (2003:128) has published an account of the loss given in the *Snowy River Mail* in which *Ethel B.T.* was set behind the western pier in a strong easterly wind. An anchor failed to hold and the vessel dragged onto the rocks beside the pier. Various descriptions as a ketch and a schooner, *Ethel B.T.* was built by Edward Beattie at Brisbane Water in 1886 on dimensions 69 x 19.4 x 5.5 feet and registered at Melbourne to owners William Cowper and others during 1888. The wreck of *Ethel B.T.* is registered within the VHR as S244 with unknown location (Stone 2006:300; Duncan and Nicholson 2007:33).

The common ownership of *Bella Watson* and *Ethel B.T.*, together with the firewood cargo of the latter, is suggestive of links beyond the ill fortune of William Cowper. When the depression of the 1890s bit deep into the building industry, the demand for sawn timber fell dramatically away with dire effect for sawmillers and those employed in the timber industry. An economic strategy based upon the supply of firewood to urban centres was adopted at this time by localities such as Wandong and Nagambie; localities that had previously been significantly dependent upon sawmilling, but were also handy to relatively cheap transportation by water and/or rail. It is possible that the timber industry within the Gippsland lakes region responded to economic hard times in a similar way. This is a subject warranting further historical and archaeological investigation.

A major incident at the new entrance during September 1911 led to the loss of the single screw iron steamer *Despatch* (**Figures 3, 4 and 9 and 10**).



Figure 9: Huddart Parker and Co.'s SS Despatch (1869-1911) early in its career (photo: Gregory 1928: opp. p.119).

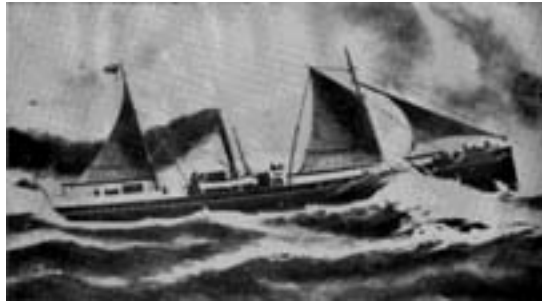


Figure 10: SS Despatch in its later guise (image: Bull and Williams 1967:94)

Built by T.B. Seath in Glasgow during 1867, *Despatch* saw long and eventful service. Following employment in the Port Phillip Bay trade between 1869 and 1877, *Despatch* was chartered to the government as a lighthouse tender until the Government Steamer *Lady Loch* was completed. After lying out of commission at Geelong, *Despatch* was substantially altered in 1893. When a new 51 hp compound engine by Rankin and Blackmore of Greenock was installed during 1902, *Despatch* was changed to a single-stacker (Figure 5). According to Parsons (1981:65) placement onto the Gippsland run occurred immediately subsequent to installation of the new engines, but Stone (2006:230) has *Despatch* working in Gippsland from 1893, a date supported by earlier incidents at Lakes Entrance. *Despatch*, registered under ON 60440 had dimensions 151 x 20.1 x 10.3 feet and tonnage 237 gross and 114 nett. The wreck of *SS Despatch* is included within the VHR as S170 and the location is listed as unknown. Bull and Williams, with access to local knowledge, claim that the hull of *Despatch* was located by “sounding equipment” and that “numerous surveys” have shown the wreck to have “actually changed position in the moving sands on the bottom” (Bull and Williams 1967:66; Gregory 1928:125; Stone 2006:230; Loney 1987:67; Parsons 1981:65; Duncan and Nicholson 2007:33). Don Love has published a drawing of a scuttle apparently recovered from the wreck of *Despatch* (2003:135)

Duncan and Nicholson (2007:23) note that small fishing vessels, including *Frolic* and *Dulcie*, were wrecked while traversing the entrance during the 1920s and 1930s, but no further details have been found. In more recent years, a steel trawler that had capsized on the bar was removed using explosives (Andrew Fullard pers. comm. August 2007). Don Love (2003:161), has included several oral accounts of unidentified shipwrecks near Lakes Entrance known to local fishermen, but none of these is within the study area.