

## 4 ESTUARY VALUES, USES AND ISSUES OF CONCERN

### 4.1 Estuary Values

The values of Killick Creek, as identified through consideration of the scientific literature, consultation with the Coast and Estuary Management Committee (CEMC), and consultation with the wider community and stakeholder groups, have been defined as follows:

**Flora and fauna habitat** – Killick Creek is considered to be a mostly healthy estuary with a range of habitat types and aquatic communities.

**Aesthetics / natural values** – Crescent Head is a very popular tourist destination, due in part to the aesthetics and natural environment offered by the Killick Creek estuary. The majority of the estuary is fringed by bushland, which adds to the natural aesthetics of the system.

**Passive recreation** – The protected nature of the waters within Killick Creek make it ideal for a range of passive recreation activities, including swimming, fishing, canoeing, birdwatching and walking along the shore.

### 4.2 Uses of the Estuary

The uses of Killick Creek were also identified through consultation with the CEMC and local community and stakeholder representatives, as follows:

**Recreational** – The estuary is used for a variety of recreational activities, including swimming, fishing, canoeing and kayaking. The most intensive time for recreational activities in the creek is during summer holiday periods and other school holidays and public holidays.

**Commercial** – Commercial fishing is unlikely to be significant within Killick Creek, particularly as there is a gazetted net closure on Killick Creek under Section 8 of the Fisheries Management Act 1994 (but this does not limit commercial trapping, eg crab traps). Commercial tourism-based businesses within Crescent Head, such as the Caravan Park are somewhat reliant on the estuary to attract tourists to the area.

**Agricultural** – Killick Creek is used to help drain floodwaters from the very low-lying agricultural lands within the Belmore Swamp area through man-made agricultural drains, and from the upper Maria River through Connection Creek. Rapid drainage of water from farmland is considered important in maintaining viable agricultural industry in the naturally low-lying swamp areas.

**Urban** – Stormwater generated from the urban area of Crescent Head flows to Killick Creek, which then flushes the stormwater to the ocean.

### 4.3 General Issues of Concern

The following list of issues relevant to Killick Creek has been developed by the Killick Creek Working Group, and the Coastal and Estuary Management Committee:

- Water Quality Management;

- Flood mitigation management during flood and non flood periods;
- Sea level rise and implications of backswamp landuse management;
- Recreational use and access;
- Management of the creek entrance;
- Floodwater impacts on the state of the creek;
- Creek ecology functioning;
- Community consultation process;
- Bed sediment black ooze;
- Sedimentation and shoaling;
- Condition of the Caravan Park rock wall.

These issues were reflected by the comments provided by stakeholders and community members as part of the community consultation undertaken for this study (see Section 3.2). In addition to the above, other pertinent issues associated with Killick Creek were derived from the outcomes of the Killick Creek Estuary Processes Study (MHL, 2002) as follows:

- Saltwater impacts upstream of floodgates;
- Protection of SEPP 14 Wetlands;
- Algal blooms (Red Weed);
- Increasing resource pressures from tourist influxes and future developments;
- Increased wave penetration from permanently opening the entrance;
- Waste from local community, particularly recreational facilities situation close to the Creek; and
- Pollutant loads from the catchment, especially during wet weather.

The key management issues are discussed in further detail below.

## 4.4 Specific Issues Requiring Attention

### 4.4.1 Water quality

#### 4.4.1.1 Issue A: Urban stormwater inputs

Urban stormwater discharges to the lower estuary via a number of formal outlets, and the potential conflict with recreational use in the estuary due to possible degradation of water quality. Urban stormwater inputs are likely to contain elevated levels of nutrients, sediments, petro-chemicals and bacteria. These inputs would mostly be event-based (i.e. occurring during rainfall), but possible leaking sewerage and water supply, along with domestic watering etc may also contribute to a continuous low-flow discharge from the stormwater drains.

#### 4.4.1.2 Issue B: Degradation of water quality when entrance is shoaled

When the entrance is closed or highly shoaled, there is restricted tidal flushing of the estuary, which introduces a potential for degradation of the water quality by local catchment runoff inputs (especially the urban runoff inputs). Degraded water quality within the estuary potentially conflicts with the recreational uses, especially during Christmas and other school holiday periods.

The entrance closes relatively infrequently, but when it does, all inputs to the system are fully retained. The entrance naturally closed relatively frequently prior to the entrance training and flood mitigation works in the 1950s. Continued drought conditions is likely to result in more frequent closure of the entrance due to a lack of catchment flows that periodically scour out the entrance shoals. Good water quality in the lower reaches of the creek (where swimming and other primary contact activities are carried out) is dependent on effective tidal flushing of the creek by open entrance conditions.

#### 4.4.1.3 Issue C: Water Quality Impacts of Agricultural Drainage

There are recognised short and long term water quality implications for Killick Creek associated with connection to, and associated drainage from, Belmore Swamp and Connection Creek. Drainage from the upper catchment areas would typically contain water that has low oxygen levels, low pH levels and high organic content (it can appear to be stained). In the short-term, the release of this water into the estuary can cause an immediate stress to the existing communities (eg resulting in fish kills). In the long-term, it can change the whole structure of the ecological community.

Melaleuca (ti tree) stands around the estuary (particularly along the blind north arm) can also release organics into the water giving it a tannin stained appearance. The stained water can sometimes be wrongly perceived as having poor quality.

#### 4.4.1.4 Issue D: Red weed

Red weed is a marine (ocean) macroalgae (see Figure 4-1) that is sometimes pushed into Killick Creek by the tides. Once the algae get into the estuary, it is trapped in the deeper holes upstream of the entrance shoal. When the algae eventually die, it can reduce the amount of oxygen in the water, sometimes causing fish kills and generating odours. Red weed has been recorded in Killick Creek at least twice since 2000.





Figure 4-1 Red weed at entrance to Killick Creek (source: KSC)

#### 4.4.2 Entrance Management

##### 4.4.2.1 Issue E: Dangerous tidal currents in the entrance channel

Concerns have been raised regarding the strength of tidal currents within the entrance channel during large (king) tides (which often occur over the Christmas period). There is a relatively large exchange of water between the estuary and the ocean during each tide. For the king tides, the exchange is even greater, which means that tidal currents through the narrow throat of the entrance can be high, and potentially hazardous to people (especially children) who are attracted by the protected nature of the estuary.

##### 4.4.2.2 Issue F: Meander Correction and Artificial Entrance Opening

Kempsey Shire Council dredges the entrance channel of Killick Creek to “straighten the meander” that forms naturally adjacent to the Surf Club. Without correction, the meander pushes the main channel to the north, where it is feared that the channel will erode into existing coastal fore dunes. Dredging works within the estuary entrance channel have been carried out on a relatively regular basis, with benefits sometimes short-lived.

The Killick Creek entrance is usually kept open by natural processes, however, a recent exceptionally dry period has resulted in closure of the entrance. Council was required to artificially re-open the entrance to maintain water quality within the estuary given the recreational demands on the system (see Figure 4-2).



**Figure 4-2 Dredging of Killick Creek Entrance (October 2000, courtesy of Kempsey Shire Council)**

### 4.4.3 Sedimentation

#### 4.4.3.1 Issue G: Sand accumulation in entrance channel

In the early 1950s, the entrance channel was dredged and a permanent connection to the sea was constructed. Since that time, the entrance has been in an imbalanced state. Increased tidal and wave energy through the entrance has carried marine sands into the estuary to form an extensive flood tide delta (which now extends up to Muddy Arm). During the early years, floods were able to scour out much of the sediment that had accumulated within the entrance. It has been reported that the entrance channel was at its maximum size following significant floods in the early 1970s. The relative dearth of large floods over the past 30 years has allowed extensive accumulation of marine sand in the entrance, to the point that a large flood today would be unable to remove much of the entrance shoals (as highlighted by the 2001 flood event).

Within the past 2 years, the entrance to Killick Creek has closed completely on a number of occasions. It is considered that this recent tendency for closure is indicative of the entrance reaching a more stable, balanced (ultimate) condition. If the closed condition of the estuary is permitted to persist (as would be natural tendency), environmental conditions within the estuary would change once again, to be less dependent on regular marine flushing (which may result in die-back of mangroves for example).

It is considered that the accumulation of marine sands at the entrance may also impede discharge of floodwaters through the estuary (from the upstream floodplains), thus reducing the efficacy of Killick Creek as part of the Lower Macleay Flood Mitigation Scheme.

#### 4.4.3.2 Issue H: Boatramp in Entrance Channel

There is a boatramp located within Killick Creek close to the ocean entrance. This boatramp is used to launch trailer boats accessing the ocean. The dynamic nature of the estuary entrance means that

the shoal conditions at this ramp are highly variable. At times, there is a deep channel at the base of the ramp, while at other times, it is dry and some distance from the channel. The boatramp is also used by the local surf life saving club to launch surfboats. Launching of boats from the boatramp is sometimes perceived as a conflict, or potential conflict, with bathers also utilizing this section of the waterway. It is understood that a Code of Conduct is being developed between NSW Maritime and the Crescent Head Surf Lifesaving Club regarding boating use and potential conflict with bathers in the channel and on Killick Beach. The boatramp would be utilized much more often during summer and other holiday periods, particularly by temporary residents of the adjacent Crescent Head Caravan Park.

The next closest boatramp offering access to the ocean for small trailer vessels is at Hat Head, otherwise the Macleay River at Kempsey or South West Rocks. Dredging would be required on a periodic basis if the boatramp is to remain usable at all times.

#### *4.4.3.3 Issue I: Accumulation of organic sediments (ooze)*

Organic-rich sediments accumulate on the bed in the upper, deeper reaches of Killick Creek. The organic matter in the sediment remains in a partly decomposed state and establishes an anaerobic environment surrounding the sediment. The upper reaches of the estuary were widened and deepened in the 1950s to improve their flood conveyance capacity. The enlarged creek, however, has mostly just been a large silt trap for sediments washed off the upper catchment areas and discharged via the agricultural drains. Unfortunately these sediments are fine-grained and contain a high organic content. Therefore, once they accumulate, they start to decompose, and can deplete oxygen from the sediments and the overlying water.

### **4.4.4 Ecology**

#### *4.4.4.1 Issue J: Marinisation of estuarine vegetation*

There has been a change in vegetation communities reflecting a more marinised environment, due to entrance training works that created a permanent connection to ocean approximately 50 years ago. The open entrance allows regular exchange of water between the estuary and the ocean. This means that marine-species can easily migrate and recruit to and from the estuary. Also, species that are dependent on salt and a regular tide, such as mangroves, have now established and thrive within the estuary, where previously the estuary would not have been as suitable.

As discussed in Issue G (refer Section 4-5), recent sediment accumulation at the entrance has closed the estuary on several occasions within the past couple of years. Without artificial intervention, it is considered that a closed entrance condition will be more persistent in the future. This will likely have a consequence on estuarine vegetation and fauna, which have previously adapted to the more open, marinised conditions in the estuary.

#### *4.4.4.2 Issue K: Preservation of aquatic and terrestrial habitats and communities*

The habitats and communities around Killick Creek are important and highly valued, and as such, should be preserved to maintain their existing values. The area is potentially used by a number of

threatened or protected species including Osprey, Green and Golden Bell Frog, Black necked stork, sooty and pied oystercatchers, comb-crested jacana, little tern, koala and the little bent-winged bat.

#### 4.4.4.3 Issue L: Fish kills in the estuary

A number of fish kills have been reported in Killick Creek, both upstream and downstream of the floodgates. Fish kills are related to poor water quality, which is influenced by the agricultural drainage waters. Fish kills generally occur due to anoxia (ie the lack of oxygen) in the water. This is the result of large organic loads entering the system which use oxygen during decomposition (decay). Fish kills can also be the result of low pH levels and high metals concentrations (which can be toxic to certain fish species). Fish kills that involve many different species is usually a sign of anoxic conditions (ie lack of oxygen in the water) rather than toxicity due to elevated metals concentrations. Fish kills have also occurred following the ingress of marine macroalgae (red weed) into the estuary, which subsequently dies off and consumes most available oxygen within the water in the process.

### 4.4.5 Upper Floodplain Management

#### 4.4.5.1 Issue M: Need for continued drainage of water from Belmore Swamp

Killick Creek has been used to facilitate drainage from the Belmore Swamp area for more than 100 years. Drainage of low-lying land in the upper Belmore Swamp area is critical to the agricultural productivity and economic viability of this land. However, in recent years, the broad coverage of land serviced by the Killick Drain and its tributaries, along with the poor performance of the Killick Creek floodgates structure, can compromise the ability of agricultural land to be rehabilitated and better managed.



Figure 4-3 Excavation to create Killick Drain in the 1950s (photo courtesy KSC)

#### 4.4.5.2 Issue N: Performance of the existing Killick Creek floodgates.

The floodgates on Killick Creek, which separate the estuary from the agricultural drains, are reportedly ineffective at times. Saltwater can migrate into the agricultural drains upstream of the gates, which significantly limits opportunities for land rehabilitation and other purposes. Their ineffectiveness may be related to poor design, poor maintenance or blockage/jamming of the gates by debris.



**Figure 4-4 Killick Creek Floodgates and dropboards (submerged)**

#### 4.4.5.3 Issue O: Partial infilling and other modifications to drains

It is considered that infilling of existing overly deep drains may be warranted if the drains are not required for major drainage (i.e. are not “mitigation” drains). Continued maintenance of the drains over the years is likely to have resulted in the drains now being quite deep. Partial infilling of drains may improve water quality, although they may become more susceptible to macrophyte growth. It is considered that construction of (removable) dropboards within drains may be a prudent first step towards infilling or removal of the drains in the future.

The extensive network of agriculture drains currently form significant barriers to access across the rural lands. Removal (i.e. complete infilling) of unnecessary drains would greatly improve access.

#### 4.4.5.4 Issue P: Generation of acid runoff in the upper Belmore Swamp area

Acid runoff is generated from the Belmore Swamp area due to over-drainage of swampland and exposure of Acid Sulfate Soils (ASS). It is reported that saltwater scalding of land has also exacerbated the exposure of ASS in the upper Belmore Swamp area.

ASS is generally not a problem until the land is drained and the soils are exposed to the atmosphere (ie oxidized). When oxidized, the ASS produces sulfuric acid, which lowers the pH of water in the associated drains. Low pH can result in the precipitation of dissolved iron and aluminium from the water and groundwater, and the scalding of the ground. Re-inundation of ASS will limit future oxidation, and thus limit the potential for water quality problems to be generated in downstream receiving waters. The drop-boards at the floodgates are currently managed to prevent too much drainage from the agricultural drains, and thus potentially oxidize more ASS.

#### *4.4.5.5 Issue Q: Flood mitigation for the Kempsey-Crescent Head main road*

In the past, flooding of the Kempsey – Crescent Head Road in the vicinity of Connection Creek (known as the ‘corduroy’) posed access problems for Crescent Head, with the village becoming isolated for extended periods during major flood events. The connection of Connection Creek to Killick Creek (via Killick Cut) has helped to drain this area, reducing inundation times, and thus providing effective flood mitigation for the village of Crescent Head.

#### *4.4.5.6 Issue R: Rehabilitation of agricultural lands*

Drainage of water from Belmore Swamp via Killick Creek plays an important role in the long-term rehabilitation of agricultural lands in the back swamp areas. Most degraded areas within Belmore Swamp are being actively managed by re-inundation, partial infilling overly deep drains and selective plantings. Accurate control of hydrology and water levels within Belmore Swamp is critical to the success of the rehabilitation programs.

#### *4.4.5.7 Issue S: Poor condition of the entrance rock training wall*

The rock training wall at the entrance of Killick Creek was constructed in the 1950s to facilitate the evacuation of flood waters from the estuary during flooding of the Lower Macleay River. The wall is comprised of loose rock rip-rap of varying size (up to approx. 0.5m diam.). The wall has lost material in several locations, resulting in localised erosion and bank retreat. The rocks are also subject to slumping, most likely due to an inadequate toe construction, and generally lack effective rock cover over the top 0.5 metres of wall (refer Figure 4-5). Rocks from in front of the wall toe are periodically replaced onto the top of the wall (as indicated by presence of oyster shells).

Furthermore, in the vicinity of some stormwater outlets, high flow stormwater discharges have dislodged rocks from the wall to form a rock-lined apron within the adjacent channel section (refer Section Figure 4-6). These swathes of rocks, which extent across the entire low flow channel, are particularly hazardous to recreational activities carried out in the vicinity.



**Figure 4-5 Existing rock wall at Killick Creek entrance**



**Figure 4-6 Rock apron formed from dislodged wall material**