

## 2. Site description

The Wade Street landslip is located in Portland, a township with a population of approximately 10,000 situated 362 kilometres southwest of Melbourne (see Appendix A). The site of the landslip is located in a residential section of town at the top of cliffs which face east into Portland Bay. The coastal cliffs on this section of the Bay extend north from the Harbour to a point just before Dutton Way where they swing inland. An aerial view of the site of the landslip prior to failure is shown in Appendix B

PB initially inspected the landslip on Friday 28 September 2007 with GSC and DSE officers. PB has subsequently visited the site on numerous occasions and this sub-section provides a summary of the key visual observations.

A plan view of the Wade Street landslip highlighting key site features is presented in Appendix C. Photographs of the site features are included in Appendices D and E.

### 2.1.1 PB inspection: September 2007

Detailed observations from this site inspection are recorded in the report entitled 'Wade Street Landslip, Portland Inspection & Assessment Report', M07380, Draft: October 2007, Final: February 2008'. The key features of the landslip are summarised below. The following features were noted at the top parts of the landslip at the time of this inspection:

- A near vertical head scarp around 10-12m high, located south of Anderson Point, at the end of Wade Street very close to Clifton Court (Photo 4, Appendix D).
- A concrete slab which was the former footing for a bench seat was observed right on the edge of the head scarp whereas, aerial photography showed that it was probably 3 m to 4 m inland from the cliff crest before the landslip. Other current sections of the cliff edge appear to be up to 10 m inland from the pre landslip cliff edge (Photo 8, Appendix D).
- The extent of the Wade Street landslip was estimated to be 40 m wide and 10 m high.
- The failed mass was estimated to have a volume of approximately 2,600 cubic metres (6.5 m x 40 m x 10 m).
- The initial inspection noted significant rainfall runoff flowing down Wade Street and over the northern edge of the landslip.
- A 200 mm wide tension crack to the north of the head scarp was observed suggesting that a further landslip is developing. The tension crack was noted running from the north end of the landslipped zone northwards towards the stairs at Anderson Point. There is potentially a landslip developing there that may be larger than the current one (Photo 5, Appendix D). The tension crack observed may be well developed vertically as shown on the annotated Photo 5(a), Appendix D. It is possible that the whole area is active and very dangerous. The potential landslip to the north would likely destroy the stairs.
- Small soil steps were observed in the cliff crest to the immediate south of the Wade Street landslip which is an indication of creep movement and suggests propagation of the landslip to the south (Photo 7, Appendix D).

The following features were noted at the bottom parts of the landslip:

- The landslip was noted to have occurred in the top two thirds of the cliff face as the limestone present at the base of the cliff was inferred to be intact (Photo 10, Appendix D). Further evidence of this mechanism was the talus slope of landslip debris on the beach. The shape of this slope was a fan which is indicative of the debris falling from a height (Photo 11, Appendix D). Cobbles and boulders were observed rolling down the landslip debris suggesting ongoing slide activity (Photo 9, Appendix D).
- Soil material which was inferred to be Maretimo Clay was noted on the beach in front of the landslip debris. The position of the material suggested that it was thrown out of the landslipping mass before the debris cascaded over the limestone portion of the cliff. The clay material was noted to be slicken-sided (Photo 12, Appendix D).
- A cliff depletion area was noted between the current landslip and the cliff stairs, suggesting a landslip has occurred there in recent geological time.
- Old landslip debris was noted at the toe of the cliff slope near the base of the steps.
- Angles of the natural slopes above the limestone to the south of the landslip were measured by hand-held clinometer and found to be around 35 degrees from the horizontal (Photo 13, Appendix D).
- The seawall on the beach at the toe of the landslip was noted to be partially inundated with sand which would reduce its effectiveness.

#### **Potential mechanisms of failure**

The failure mechanism for the Wade Street landslip is believed to have originated within the thin plastic clays (Maretimo clay) located on the surface of the limestone. The trigger for the landslip is not known, but it is likely that surface water has been percolating vertically down through the weathered basalt and has been perched on top of the Maretimo Clay, elevating pore water pressures within the cliff and reducing the strength of the Maretimo Clays until a critical strength has been reached.

At the foreshore, the groundwater level will be similar to sea level therefore a hydraulic gradient, of the groundwater within the cliff must exist. This gradient, being towards the coastline, will tend to promote slope failure.

The coastline in the area of the Wade Street landslip is characterised by limestone overlying Maretimo Clay and both units are visible above beach level below the landslip. The presence of the stronger limestone in the cliff has meant that the landslip was relatively limited in size. In addition, the presence of the limestone has meant that debris material has flowed over the limestone to create a metastable talus slope which is a fan shape. This material is loose and vulnerable to erosion.

The complication in the Wade Street area is that the limestone surface dips down towards the north and is not visible on the north side of the current landslip. The large tension crack noted running from the current landslip towards the north (near Anderson Point) is likely to be the beginnings of a larger landslip, as its landslip surface could be deeper seated. This larger landslip will likely destroy the cliff steps to the north of Wade Street and its run-out could reach the sea.

### 2.1.2 PB inspections: May 2008 to November 2008

A site inspection was undertaken in May 2008 which was then followed by monthly site inspections as part of the inclinometer monitoring program which commenced during June 2008.

The following comments are a result of ongoing observations at the site:

- A clay berm constructed prior to the July 2008 inspection appeared to have partially stopped significant rainfall run-off over the cliff edge but could only be regarded as a temporary measure.
- Sections of the upper headscarp have continued to retrogressively fail since September 2007 (see site Photos 7 & 8 in Appendix E).
- The majority of further movement was noted to have occurred at the northern end of the headscarp adjacent to the existing side scarp which ran approximately north south.
- Some vertical joints had noticeably opened up during the period of observations probably due to lateral relaxation within the exposed rock face (see Photo 17, Appendix E).
- A large tension crack was noted to exist directly above the northern side scarp and survey monitoring at Survey Point No. 2 (see Appendix F). Whilst this indicated considerable lateral movement of the surface directly above the side scarp, there did not appear to have been significant failures from this near vertical face.
- The width of the tension crack at Survey Point No. 2 increased since observations were first made in September 2007.
- A large rounded boulder (approx diameter = 1.5 m) was noted to have travelled from some part of the upper site to the lower exclusion fence on the beach sometime between the June 2008 and July 2008 site inspections (see Photos 3 & 4, Appendix E).
- Further smaller boulders and cobbles were noted on the beach during the August 2008 inspection.
- Additional landslip debris including another rounded boulder was noted to have travelled onto the lower debris/talus slope between the July 2008 and August 2008 inspections (see photos in Appendix E).
- The site, including exposed faces and debris materials, generally looked much wetter during the August 2008 inspection than previously observed (visual observation only).
- There was a general perception that the area immediately on the cliff edge adjacent to borehole I(1) and near survey point 2004 (see Appendix D) has possibly subsided slightly since inspections commenced although there was no visible distortion at the kerb. This observation was noted during the 11-12 September 2008 site visit.
- An undulation in the ground surface profile causing a step approximately 0 - 1.0m high was observed in front of Inclinometer I(4). Survey points 2, 4, 6 and 8 are located in the vicinity.

Photographs of the site features are included in Appendix E.