Cottesloe Coastal Monitoring

Annual Summary Report – April 2015 to March 2016

59916809

Prepared for
Town of Cottesloe

13 May 2016

Cardno®
Shaping the Future

Contact Information

Cardno WA Pty Ltd
Trading as Cardno
ABN 77 009 119 000

11 Harvest Terrace, West Perth WA 6005

Telephone: 08 9273 3888
Facsimile: 08 9486 8664
International: +61 8 9273 3888

wa@cardno.com
www.cardno.com

Document Information

Prepared for	Town of Cottesloe
Project Name	Annual Summary Report – April 2015 to March 2016
File Reference	59916809_Rev1_SummaryReport.docm
Job Reference	59916809
Date	13 May 2016
Version Number	Rev1
Effective Date	13/5/2016
Date Approved:	13/5/2016

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
V1	22/04/2016	DRAFT	DRS	JGW
V2	10/05/2016	FINAL	DRS	JGW
Rev0	12/5/2016	FINAL	DRS	JGW
Rev1	13/05/2016	FINAL	DRS	JGW

Executive Summary

Cottesloe is one of the most iconic beachside suburbs in Australia and, as such, the land and infrastructure along its coastline holds significant financial and historical value. As for coastlines throughout the world, the effects of climate change and subsequent sea-level rise pose significant threat to beaches and adjoining land along Cottesloe's coastline.

The Town of Cottesloe (ToC) commenced a long-term monitoring program in 2014 to gain knowledge of the patterns in beach changes along its coastline and potentially identify longer-term trends in erosions and/or accretion. The program involves shoreline surveys undertaken approximately every 6 months, spread along the span of the Town's shoreline. Complementary to this, monitoring by remote camera units provide images every hour of two key sections of the Town's coastline; Cottesloe Main Beach and North Cottesloe Beach. Cardno has been commissioned to facilitate this photo monitoring for a period of 1 year from the end of 2015 and provide ongoing summary reports with observations from the captured imagery and analysis of survey data.

This report summarises an observation period of 1 year from the start of April 2015 to the end of March 2016 and includes an analysis of all captured imagery and surveyed profiles achieved during this time. The data has been assessed with respect to existing background information, including a coastal vulnerability assessment of the area (CZM & Damara 2008), geotechnical investigations (GBGMAPS 2010 & 2011) and the previous monitoring summary report (BMT Oceanica 2015). In addition to this, water level and wave data was obtained from the Department of Transport (DoT) and weather data from the Bureau of Meteorology (BoM) to provide context and explanation for the observations.

Hourly high resolution images of the shoreline at Cottesloe Main Beach and North Cottesloe Beach, including approximately 3 months of data from Cardno's cameras, was visually inspected. This allowed identification of shoreline movement, which generally followed seasonal trends, and an approximation of the timing of the most receded and advanced shoreline positions at each beach section.

The photographic dataset also allowed the observation of the nearshore sea-state and shoreline behaviour as a result of winter storm events. Several significant storm events were observed including one event in May with notably high wave run-up. Supporting metocean and weather data indicated the impact was the result of the highest significant wave height recorded at Cottesloe, highest water level measured at Fremantle, very low atmospheric pressure and strong winds all occurring on the same day.

Shoreline survey campaigns were undertaken during September 2015 and February/March 2016, to add to survey data from November 2014 and April 2015. Comparisons of the surveys were made to assess changes in beach morphology over the 2015 winter period and 2015/16 summer period. The results generally indicated a trend of accretion to the north of features, like the Cottesloe and Beach Street Groynes, and erosion to their south during winter and vice versa during summer. This is predominantly attributed to the direction of regional alongshore sand transport (northward in summer and southward in winter) and the influence of the groyne locally modifying currents, sediment transport and deposition.

Some preliminary assessment was made of the changes between survey campaigns approximately 1 year apart (i.e. November 2014 to September 2015 and April 2015 to February/March 2016). The results were slightly confounded due to the survey campaigns not lying truly within the seasonal transition period. The comparisons generally showed stable shoreline profiles in most sections of the coastline, with some potential long-term erosion occurring in certain areas. In particular, a section of North Cottesloe Beach previously identified as at risk should be monitored into the future. Observations of the photo record and survey measurement showed good agreement in patterns of beach morphology change, with metocean data providing a good basis for explanation of observed changes.

The monitoring program at present is relatively comprehensive given the Town's available resources. It is recommended the program is continued, in at least its current format, to gather a total dataset of 5-10 years before confident conclusions around trends in shoreline movement can be drawn. This period of time should account for interannual variability in weather and metocean conditions and longer term cycles such as El Niño/La Niña. The existing program would be improved slightly if survey campaigns were timed closer to the middle of the transition from summer to winter conditions and vice versa, and repeated at the same time each year. Greater capture of the Town's shoreline, through installation of additional cameras would provide valuable context to changes observed between surveys, particularly in the southern half of the study area. Measurement of nearshore current characteristics and sediment particle size along the coastline would also add valuable information around the local sedimentation regime.

The existing collection of water level and wave data at Fremantle and Cottesloe is important for placing the erosion / accretion events into context. It is recommended this continue.

Following completion of year 5 of monitoring, the data should be analysed for medium term trends, as well as for input into coastal management. For example, if medium term erosion trends were observed at a specific location, investigations could assist with management measures at that site. Data collection should still be ongoing, during and following this analysis.

Table of Contents

Tables

Figures

1 Introduction

1.1 Study Site

The Town of Cottesloe (herein referred to as 'the Town') is situated about 12 km to the west of Perth's city centre in Western Australia (**Figure 1-1**). With approximately 4 km of highly developed Indian Ocean coastline, Cottesloe has earned a reputation as one of Australia's iconic beach destinations. Substantial public and private infrastructure lies adjacent to the Town's shoreline, holding significant value. This value takes various forms including: private and commercial property, commercial business through several bars, restaurants and shops, public amenity through the beach itself, adjoining walkways and parks, key infrastructure, such as roads, and touristic and historical value. Given the close proximity of infrastructure to the shoreline and the inherent value provided by the coast itself, potential changes to sea level and coastal processes in the area, as a result of climate change, pose management challenges for the Town.

1.2 Study Purpose

Beaches along the Town's coastline experience short-term, event based and seasonal erosion, as well as accretion of sediment in some areas. The overall coastline may also be exhibiting a trend of long-term erosion (CZM & Damara 2008). In November 2014 the Town commenced a monitoring program to gather ongoing data that will improve its understanding of patterns of shoreline change. This data will be used to develop an adequate basis for future planning; to mitigate potential coastal hazards through protective management and adaptation. The major threats to the coastline are those associated with climate change, including predicted sea level rise and potential changes to meteorological and hydrodynamic conditions at the site.

At present, the Town's ongoing monitoring program includes the regular capture of imagery of two key sections of coastline. In addition to this, surveys of shoreline transects spread at roughly 100m intervals along the Town's coastline are undertaken approximately every six months. Cardno was commissioned to install and maintain cameras to continue the capture of remote imagery for a further 12 months. Alongside this, Cardno are to provide summary reporting on data collected, noting relevant coastal changes and their possible causes. This work will be carried out in the context of previous studies and collected data at the site to build, in an ongoing manner, a baseline for coastal processes and shoreline behaviour.

The purpose of this report is to analyse new data attained after that analysed in the previous summary report, carried out by BMT Oceanica in early 2015. The period of data available for analysis in this report was from April 2015 to March 2016, which is herein also referred to as 'the observation period'.

Figure 1-1 Study Site location and Town of Cottesloe boundary (Image source: NearMap, 2016).

2 Methodology

2.1 Review of Previous Studies

Cardno reviewed previous studies undertaken for the Town within the Study Area (defined as the coastline lying within the Town's local government area). This was carried out to provide background information and a basis of existing data for this monitoring program and summary report. The review comprised the following studies:

> Vulnerability of the Cottesloe Foreshore to the Potential Impacts of Climate Change (2008) by CZM and Damara;

> Geophysical Investigation for Subsurface Lithology Along the Foreshore of Cottesloe Beach, Cottesloe, Western Australia (2010) by GBGMAPS;

> Ground Penetrating Radar Investigation for Subsurface Lithology along Marine Parade, Cottesloe, Western Australia (2011) by GBGMAPS and

> Cottesloe Coastal Monitoring Summary Report – Summer 2014/15 (2015) by BMT Oceanica.

2.2 Remote Imagery Capture and Analysis

Remote imagery units were installed by BMT Oceanica on the 19th of November 2014 at two locations that monitored two important sections of the Town's coastline; Cottesloe Main Beach and North Cottesloe Beach. These units remained in place until the 9th of December 2015 and captured high resolution images, hourly, between 05:00 hours and 19:00 hours each day. Cardno installed remote imagery units at the same two locations on the 23rd of December 2015 to capture the same approximate sections of coastline. **Figure 2-1** shows the camera locations and the approximate spans of shoreline that they monitor. Cardno's units also capture high resolution images hourly, between 05:00 hours and 19:00 each day. Shortly after its capture a low resolution sample of each of these photos is transmitted via mobile network, to a Cardno & Town email inbox for daily observation. The units can also be remotely prompted by the user to send a high resolution image at the next upcoming capture interval. These units are to remain in place for one year from their installation date.

For this summary report Cardno reviewed approximately 1 year of shoreline images from the 13th of April 2015 (the limit of BMT Oceanica's review for the 2014/15 report) until the 30th of March 2016 when Cardno's units were serviced and downloaded. This dataset comprised approximately 8 months of imagery captured by BMT Oceanica and 3 months of imagery captured by Cardno. A gap in the imagery dataset exists between the 9th and 23rd of December, when no camera units were in place. The images were analysed to identify event based erosion or accretion events, such as those associated with storms and energetic wave conditions. Observations of seasonal trends in shoreline change were made and, given the availability of two full years of shoreline imagery, preliminary observations of potential medium-term trends could also be proposed.

2.3 Survey Profile Data Review and Analysis

The Town has commissioned or undertaken themselves shoreline transect surveying within the Study Area, which to date has been carried out in November of 2014, in April and September of 2015 and in February/March of 2016 (beach side in February and ocean side in March). Initially 39 transects were surveyed perpendicular to the shore, spanning the Town's coastline. Two of these transects (19 and 20) were deemed unnecessary for surveying in September 2015 due to the beach being primarily rock and, therefore, inactive. Cardno reviewed the results of the most recent surveys in September 2015 and February/March 2016 with respect to the previous survey results. This involved an initial quality check of the data by ensuring the geographic positions of survey points were congruent with previous survey transects and that the surveyed heights were sensible. The locations of transects surveyed during the observation period are presented in **Figure 2-2**.

The survey elevation profiles were plotted for comparison with previous survey profiles for each transect. Profile comparisons between the April and September 2015 surveys were analysed to give an indication of changes in beach morphology over the 2015 winter period. Comparisons between September 2015 and February/March 2016 profiles were used as indicators of changes to beach morphology occurring during the transition from winter to summer conditions. With approximately 1 year between the original survey in November 2014 and the September 2015 survey, some preliminary observation of potential medium-term changes in beach profile could also be noted. This was also the case of the comparison between the April 2015 and February/March 2016, where medium-term trends might be evident. Plots of surveyed profiles for each transect and survey program are provided in **Appendix A**.

Figure 2-1 Remote imagery camera locations and shoreline sections captured (Image source: NearMap, 2016).

Figure 2-2 September 2015 and February/March 2016 beach profile survey transect locations (Image source: NearMap, 2016).

2.4 Metocean Data Analysis

Cardno acquired and analysed metocean data for a 12 month period from April 2015 to March 2016 to accompany observations of photographic and beach profile monitoring data. The datasets, their source and location (**Figure 2-3**) are as follows:

> Cottesloe Wave Buoy Data (DoT), Location: 31.978°S, 115.687°E, hourly wave statistics – non-directional until 18/12/2015 then directional from this date;

> Rottnest Wave Buoy Data (DoT), Location: 32.094°S, 115.408°E, half hourly, directional wave statistics;

> Fremantle Tide Gauge (DoT), Location: 32.066°S, 115.748°E, 5 minute water level data (note this was raw instrument data and has not been quality controlled by DoT); and

> Swanbourne Weather Observations (BoM), Location: 31.96°S, 115.76°E, Daily observation of temperature, rainfall, wind speed and direction and mean sea level pressure (MSLP) (note pressure data reported for Swanbourne is measured at Perth Metropolitan Weather Station, Location: 31.92°S, 115.87°E).

The full metocean datasets are represented in **Appendices B to D**.

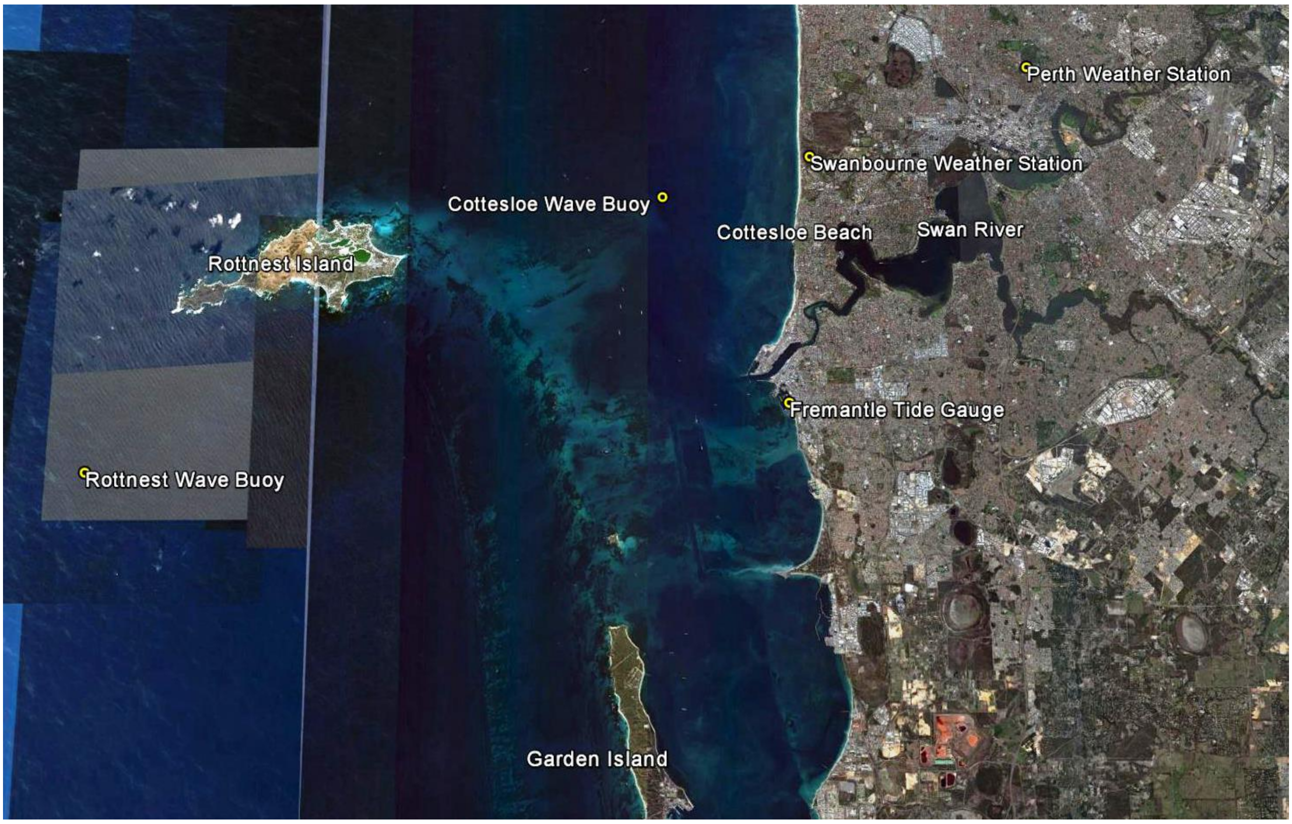


Figure 2-3 Data source locations (Image source: Google Earth, 2016).

3 Results

3.1 Relevant Background Information

3.1.1 Climate and Metocean Conditions

The Study Site is influenced by two dominant seasonal weather patterns. The summer period is characterised by south to south-westerly sea breezes that generally increase through the afternoon and can be very strong at times. The winter period is characterised by intermittent storms attributed to mid latitude low pressure systems, shifting the dominant wind direction to north-westerly.

The two seasonal weather modes dominate the local wave climate with locally generated seas from the south, south-west interrupting generally calm conditions during summer. Storms during winter lead to higher energy wave conditions and a greater presence of off-shore derived swell, which generally propagates from the south-west. Tropical cyclones that develop during the summer months off WA's north-west coast rarely track down to the Study Area's latitude, but have been recorded in the area and can cause significant damage to coastal infrastructure.

The Study Area is afforded protection from offshore wave conditions by Rottnest Island to the west and fringing limestone reef structures scattered adjacent to the coastline (visible in **Figure 2-3** above). Groynes constructed on the Town's coastline can provide local sheltering from inshore waves for some coastline sections, depending on the wave direction.

The Study Site experiences low tidal range from mixed but mainly diurnal tides. The tidal range varies from 0.3 m during neap tides to 0.7 m during springs. This small tidal movement allows wind to be the major driver of currents, particularly at the nearshore zone. Longshore currents correspond to seasonal wind and wave conditions, predominantly propagating northward during summer and to the south during winter. The interaction of these currents with shoreline features can form local eddy and rip currents, particularly when swell is present, driving substantial water movement perpendicular to the shore.

3.1.2 Sediment Dynamics

Shoreline sediments within the study area are primarily calcium carbonate sands, made up of biogenic material derived from offshore and eroded limestone material derived from the land (CZM & Damara 2008). Under the Department of Transport's sediment cell hierarchy, the Study Area lies within Primary Sediment Cell F - South Mole Fremantle to Pinaroo Point. Within this primary cell the Study Area is covered by two secondary sediment cells (25 and 26) and subsequently by two tertiary cells; 25b – Leighton salient to Mudurup Rocks and 26a – Mudurup Rocks to north Swanbourne pipe. The division of the Study Area into two secondary/tertiary sediment cells at Mudurup Rocks means different mechanisms of coastal change could be expected in the two cells over the short to medium term (i.e. interannual to decadal timescales).

Longshore sediment transport within the study area has been shown to be mainly northward from September to April, associated with prevailing currents over the summer period. A southward movement of sediment is usually observed during the winter months of June and July. The result is a net northward movement of material annually (CZM & Damara 2008). Nearshore structures can obstruct this sediment movement. The most notable example of this is the Cottesloe Groyne which exhibits accretion of sediment at its northern side in winter and alternatively erosion at the same site during summer.

Cross-shore sediment movement is also seasonal with sporadic periods of swell pushing sediment onto the shore, steepening the beach profile. Mid-year the beach is reformed by the energy of winter storms eroding the beach face and redepositing sediment to form sandbars just offshore. These formations become stable towards the end of winter and act as a buffer, preventing wave breaking at the shore and the substantial shifting of sediment it can cause.

3.1.3 Coastal Geology and Geomorphology

Cottesloe Main Beach is classified as a reef-protected, reflective sandy beach with strong currents, and North Cottesloe Beach is classified as a reflective (steep) beach (BMT Oceanica 2015). The stable component of the Study Area's geomorphology is the Tamala Limestone which underlies and backs the beaches and also forms headlands and offshore reefs.

The Town commissioned GPGMAPS to undertake geotechnical surveys in 2010 and 2011 to address the key knowledge gap in understanding the Study Area's local geology. Based on testing of a longshore segment between Curtin Avenue and North Street, the depth between ground level and bedrock ranged between approximately 5 metres and greater than 10 metres. Between just south of Curtin Avenue and Gibney Street this bedrock was mainly at or above mean sea level (MSL). Other sections of the survey showed that bedrock was below MSL, by greater than 2 metres in places. The compaction of beach sediment was found to be variable with depth along the tested segment, with generally poor compaction in the first 5 metres below the surface. Testing along a transect perpendicular to the shoreline revealed high variability in the depth from surface to bedrock; ranging from 2 metres to greater than 10 metres.

3.1.4 Engineered structures

Some manmade structures also play an important role in the local hydrodynamic and sediment regimes. The most notable structures are two groynes. One large groyne constructed at Mudurup Rocks (Cottesloe Groyne), forming the southern bound of Cottesloe's main beach, and a shorter groyne adjacent to Beach Street. A concrete seawall has also been constructed between Warnham Road and Cottesloe Surf Life Saving Club.

3.1.5 Coastal Vulnerability

CZM and Damara carried out a Coastal Vulnerability Investigation for the Town in 2008, which provided an assessment of areas at potential risk under various climate change scenarios in 2070. This assessment was restricted by a lack of geotechnical data at the time. BMT Oceanica reviewed this assessment in 2015, in light of the results of GPGMAPS's geotechnical investigations. Areas at high risk under likely 2070 climate change conditions were analysed against areas deemed to be at risk based on bedrock level relative to MSL. From this, the following sections of coastline were deemed to be most at risk of coastal impact:

> Between North Street and Grant Street

> South of Grant Street opposite Grant Marine Park

> Between Eric Street and Eileen Street

> Between Napier Street and Warnham Road

> Between Beach Street and Gibney Street

3.1.6 Recent Observations

3.1.6.1 Photo Monitoring

BMT Oceanica carried out an assessment of their captured imagery from the 2014/15 summer period. At Cottesloe Main Beach, over this period, a steady pattern of erosion was observed which reduced beach width and increased concave curvature of the beach to the north of Cottesloe Groyne. A slight recession of the shoreline was also observed at North Cottesloe Beach, but to a lesser extent.

The highest water level event over the summer period, notable at both beach sections, was observed on the 22nd of November 2014. This coincided with noticeably undulated beach morphology longshore, typically formed under larger/persistent wave conditions. Water level and wave data for this time was not available for comparison at the time of the review. Review of wind and mean sea level pressure did not show any anomalous conditions.

Another noted change in beach morphology was the process of scarping at Cottesloe Main Beach, leading to the formation of a step feature at the shoreline. This process was intermittent and particularly noticeable in December 2014.

A rough sea state accompanying a storm was noted in the period from the 15th to the 21st of March 2015. Rapid erosion was observed during this period, with very high water levels, lower than average MSLP and strong winds occurring. Wave data was not available to BMT Oceanica for analysis during this time.

On the 10th of April 2015 stormy conditions were observed and the beach was noticeably narrower than the previous day at both beach sections. Dark patches were noticeable in the nearshore zone which may have been seagrass wrack or exposed rock. MSLP was the lowest for the month at this time, very strong wind gusts were recorded and waves could be observed reaching the steps at the base of the Indiana Restaurant.

3.1.6.2 Survey Data

BMT Oceanica compared surveyed beach profiles undertaken in November 2014 and April 2015 to provide a preliminary indication of changes in beach morphology over the summer period. Generally a reduction in beach width was observed at beaches north of the Cottesloe Groyne. This was often accompanied by an increase in beach face steepness near the shoreline and small increase in beach height. In general, beaches to the south of Cottesloe Groyne experienced increased beach width and elevation. The analysis of surveyed beach profiles has been built upon below in **Section 3.3**.

3.2 Photo Monitoring Results

Cardno's cameras were installed on the 23rd of December, 2015 and serviced on the 30th of March, 2016, at which point all captured, high-resolution images were downloaded. Data return from this period was 100% from both cameras. Image quality was impaired for periods for the images from Camera 1, believed to be due to condensation within the camera housing. This did not prevent the ability to assess shoreline position or general beach morphology. Also in some images from Camera 1, the unit's aerial can be seen within the frame. The aerial was found to be damaged and dislodged, probably by a bird. The aerial did not interfere with the view of the shoreline or other areas of interest at any stage. Cardno's image dataset was combined with BMT Oceanica's images, captured between the 13th of April and the 9th of December, 2015, for qualitative analysis.

3.2.1 Metocean Observation

Multiple significant storm events were observed in the imagery data from April to October 2015, as expected under typical winter conditions in the region. These were generally characterised by a disturbed sea-state, large wave conditions and substantial turbulence at the shoreline. Following these storms, changes to the beach form is often evident. Such storm events can lead to both erosion and accretion, containing adequate energy to shift sediment on and offshore. The most notable storm events observed in the photo record occurred during the following periods:

> May 3-4 and 15-18, 2015

> June 2-8 and 18-22, 2015

> July 19-23 and 28-31, 2015

> August 8-11, 18-22 and 29-31, 2015

> September 10-13, 2015

> October 4-5, 2015

The most significant storm observed, in terms of wave run-up, was between May 15 and May 18, 2015. This storm had a long duration of large wave conditions and the water-level reach up the beach face was the highest seen at both beach sections for the observation period. The peak of the storm appeared to occur on May 17 and is displayed in **Figures 3-1** and **3-2** below. The metocean conditions recorded during this and other storm events are further discussed in **Section 3.4**.

Observations of photographs from the summer period indicate typical seasonal conditions of a generally calm to mild sea-state, particularly in the morning. When waves were present they were generally local seas coinciding with afternoon south-westerly sea breezes. **Figure 3-3** below shows typical summer wave conditions with short period, low-medium wave height, propagating from a south-westerly direction. Some periods of disturbed sea-state were noted during the transition to the summer period, but were mild in comparison to genuine winter events. These occurred on the following dates:

> November 17-19 and 23-24, 2015

> December 4-6, 2015

Figure 3-1 Storm conditions at North Cottesloe Beach on May 17, 2015.

Figure 3-2 Storm conditions at Cottesloe Main Beach on May 17, 2015.

Figure 3-3 Typical summer wave conditions at North Cottesloe Beach on January 12, 2016.

3.2.2 Beach Morphology Observations - Cottesloe Main Beach

An analysis of photographs taken of Cottesloe Main Beach revealed a typical pattern of beach morphology change over a one year period. At the commencement of the observation period in April the shoreline was in a relatively receded position. This would be expected at the end of the seasonal summer period, where relatively strong northward currents combine with water level fluctuations to move sediment northward longshore. The Cottesloe Groyne traps the material to the south or diverts its transport offshore away from the Cottesloe Main Beach face. Observations suggest the most receded shoreline of 2015 occurred towards the end of April to the start of May. **Figure 3-4** provides an example of this shoreline position.

The winter period saw this shoreline advance as material accreted on Cottesloe Main Beach. Winter wave conditions with significant offshore swell move sediment shoreward, feeding material to the nearshore zone and depositing it on the beach face at times. Storm events can drive erosion and accretion and lead to reshaping of beach form. The shift in longshore currents southward during this period means the Cottesloe Groyne can now act as a sediment trap to its northern side, aiding retention of material. The most advanced shoreline position appeared to occur after the winter period, around the start of November. **Figure 3-5** below gives an example of this position.

Figure 3-4 Example of a receded shoreline position at Cottesloe Main Beach after the effects of seasonal summer conditions on May 3, 2015.

Figure 3-5 Example of an advanced shoreline position at Cottesloe Main Beach after the effects of seasonal winter conditions on November 2, 2015.

The most recent summer period (2015/16) showed a steady recession of the shoreline that had been established during the winter period. It was at its most receded position at the end of the observation period (end of March) and may have receded further after that time. **Figure 3-6** below shows this recent, receded shoreline position. The shoreline movement was again accompanied by scarping, which is discussed further below in **Section 3.2.4**.

Figure 3-6 Example of a receded shoreline position at Cottesloe Main Beach after the effects of seasonal summer conditions on March 29, 2016.

3.2.3 Beach Morphology Observations - North Cottesloe Beach

The review of photographs captured of North Cottesloe Beach showed the shoreline section to be relatively stable over the observation period, in spite of considerable reshaping by winter storm events. The beach's sedimentation regime is less affected by Cottesloe Groyne in comparison to Cottesloe Main Beach. The beach is relatively open and exposed and its sedimentation is also influenced by a stunted headland at its northern end. The subtle shoreline movement, lack of a permanent reference point close to the shore and several changes in camera angle made it difficult to accurately track shoreline movement visually. However, it appears that average shoreline position experienced minimal movement between the commencement of the observation period (example **Figure 3-7**) and the end of January 2016 (example **Figure 3-8**).

Figure 3-7 Example of the shoreline position at North Cottesloe Beach at the end of the summer season on April 14, 2015.

Figure 3-8 Example of the shoreline position at North Cottesloe Beach during the summer season on January 29, 2016.

Beyond the end of January the shoreline appears to recede gradually until the end of the observation period, an example of which is shown in **Figure 3-9**. It is worth noting that the shoreline at this time appears to be the most receded observed during the observation period. The erosion of material during summer is likely due to a combination of waves and water levels suspending sediment and strong northward currents transporting it away from the area. Replenishment of the beach by sediment from the south is likely inhibited by Cottesloe Groynes influence on longshore currents.

Figure 3-9 Example of a slightly receded shoreline position at North Cottesloe Beach towards the end of the summer season on March 30, 2016.

3.2.4 Noted Observations

Scarping at the shoreline was prominent during the 2016 summer period at Cottesloe Main Beach (**Figure 3-10**). This was also observed during the previous summer period and commented on by BMT Oceanica. The step style feature is likely caused by a combination of summer swell waves and high water levels removing material from the beach up to and around the high water mark. The step feature is seen to remain for long periods of time, with generally calm summer conditions lacking the energy to reshape the shoreline.

Another interesting feature was the presence of beach cusps at North Cottesloe Beach (**Figure 3-11**). These are generally formed by larger wave conditions present in winter where flow channels are formed to accommodate the return flow of water after wave breaking. These are common features of shorelines in the region. As can be seen in **Figure 3-11**, the formations stay in place well into the summer period as they are gradually smoothed by summer conditions.

Figure 3-10 Observation of scarping at Cottesloe Main Beach on March 4, 2016.

Figure 3-11 Observation of beach cusps at North Cottesloe Beach on December 25, 2015.

Significant wrack was deposited on North Cottesloe Beach over the winter period. A large amount of wrack was deposited at the northern end of the beach during the significant storm around May 17 (**Figure 3-12**). The wrack appeared to be trapped and retained somewhat by the headland at the north of the beach. Further to this, wrack was deposited on the beach in various quantities throughout the winter period (**Figure 3-13**). This is a natural process and highlights the influence of energetic winter conditions in replenishing the shoreline with material from offshore.

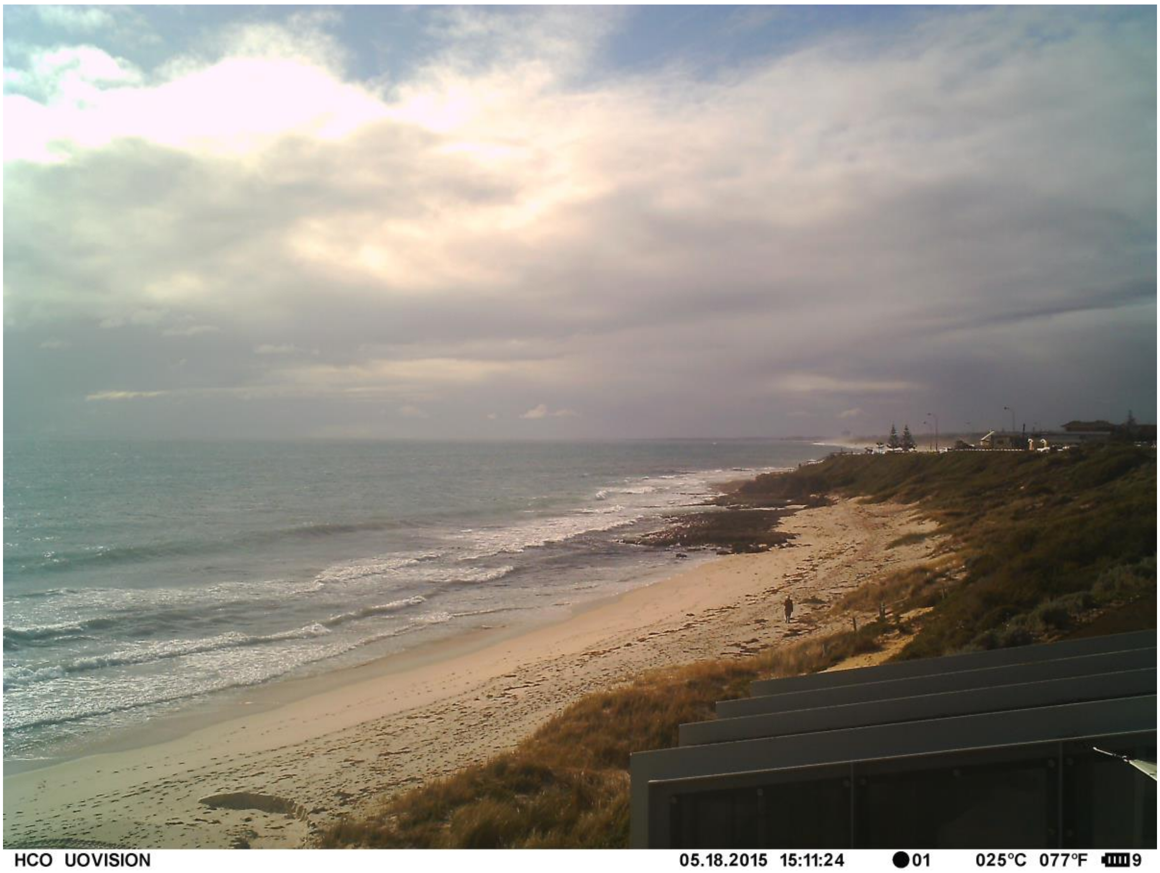


Figure 3-12 Build-up of wrack at North Cottesloe Beach observed on May 18, 2015 following a storm event.

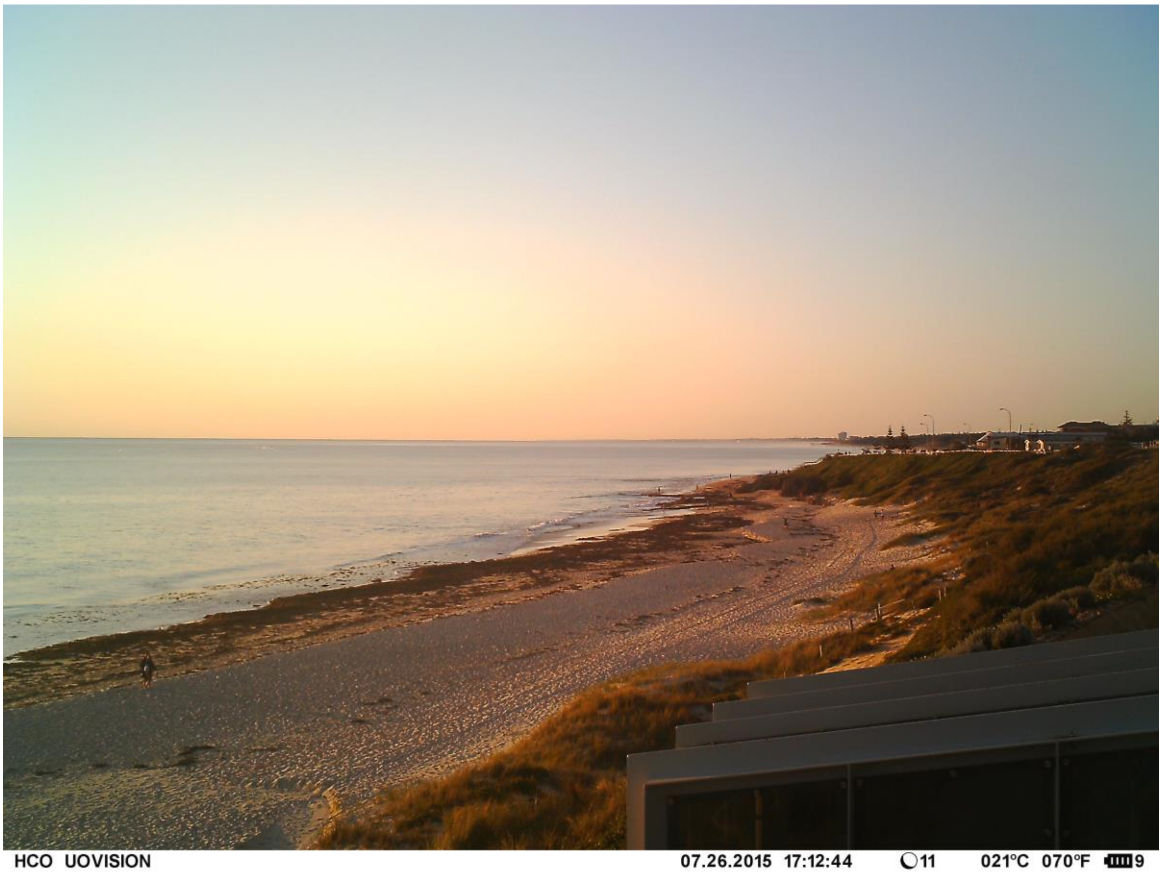


Figure 3-13 Build-up of wrack along North Cottesloe Beach observed on July 26, 2016.

3.3 Surveyed Beach Profiles

The beach profile surveys undertaken in September 2015 were compared with surveys carried out in April 2015 to assess general changes in beach morphology over the 2015 winter period. The September 2015 surveys were also compared with the initial surveys carried out in November 2014 to make a preliminary assessment of potential long-term trends. The most recent surveys, carried out in February/March 2016, were compared with the September 2015 surveys to assess interannual trends, and with the April 2015 surveys to assess potential long-term trends.

Surveys undertaken in February/March 2016 extend further offshore than previous surveys for each transect. This was done to capture the depth of closure of the Study Area's beaches. This additional survey is useful for observation but not comparable with other survey data at this stage.

The analysis uses a similar segmentation of beaches within the study area to that performed by BMT Oceanica, using shoreline features and perpendicular road alignments for reference. These segments and their corresponding beach descriptions (BMT Oceanica 2015) are as follows:

> North Street to Napier Street – *Sandy beach backed by dunes and calcarenite cliff, with some rock outcrops and areas fronted by discontinuous intertidal rock platform. Unconfined to the north.*

> Napier Street to Mudurup Rocks – *Sandy beach backed by concrete seawall and artificial lawned terraces. Confined by Cottesloe Groyne to the south.*

> Mudurup Rocks to Beach Street Groyne – *Perched sandy beach backed by dunes and calcarenite cliffs and fronted in places by discontinuous intertidal rock platform. Confined by rocky outcrops and Cottesloe Groyne to the north and Beach Street Groyne to the south.*

> South of Beach Street Groyne – *Sandy beach, confined by Beach Street Groyne to the north and partially confined by rocky outcrops to the south.*

3.3.1 Winter 2015

The pattern of change along the coastline observed between April and September 2015 corresponded to the expectations of a typical winter period. General patterns of change for the period are described in **Table 3-1** and visualised in **Figure 3-14** below.

There was a combination of stable or accreted beach morphology at all beaches to the north of Cottesloe Groyne. As supported by captured images there was little overall change to the shoreline at North Cottesloe Beach, but observations suggest significant turnover of sediment at the shoreline due to storm events. The combination of sediment being driven shoreward and a shift to southward flowing currents during the winter period is evident in accretion at beaches angled to face slightly northwards (e.g. south of North Street and just north of Eric Street).

Significant accretion at Cottesloe Main Beach over the period can most likely be attributed to sediment being available in the nearshore zone, due to erosion and offshore supply, and being transported southward by longshore currents and trapped to the north of Cottesloe Groyne.

At the beaches to the south of Cottesloe Groyne a pattern of erosion is generally observed for the period. The large groyne is probably the main influence in this, whereby southward longshore sediment transport is either blocked by the groyne or diverted further offshore, depriving the beaches to its south of material. This material might usually replenish the beaches, which lose material due to wave action and longshore flows. The Beach Street Groyne has a similar effect to the Cottesloe Groyne, creating accretion of material to its north and deficit of material to its south for the period.

Table 3-1 Noted changes and general patterns of change for surveyed beach profiles between April and September 2015.

Beach Section	Profile(s)	Noted Change	General Pattern
North Street to Napier Street	1-4	▪ Accretion, up to ≈ 3m increase in beach height; ▪ Increased beach width and advanced shoreline by ≈ 15 to 20m; and ▪ Reduction of beach slope (i.e. flattening of beach profile).	Accretion
	5-8	▪ No significant change.	Stable
	9-11	▪ Accretion, up to ≈ 1m increase in beach height; and ▪ Increased beach width and advanced shoreline by ≈ 10m.	Accretion
	12-13	▪ No significant change.	Stable
	14	▪ Minor accretion; and ▪ Increased beach width and advanced shoreline by ≈ 5 to 10m.	Accretion
Napier Street to Mudurup Rocks	15	▪ No significant change.	Stable
	16-18	▪ Accretion, up to ≈ 3m increase in beach height; and ▪ Increased beach width and advanced shoreline by ≈ 15 to 20m.	Accretion
Mudurup Rocks to Beach Street Groyne	19-20	▪ Not profiled September 2015.	NA
	21-25	▪ Erosion, up to ≈ 2m reduction in beach height; ▪ Decreased beach width and receded shoreline by ≈ 10m; and ▪ Scarping and formation of step feature at shoreline to south.	Erosion
	26	▪ Erosion of back beach, up to ≈ 1m; ▪ Accreted step feature at shoreline; and ▪ Minor enhancement of shoreline.	Reshaped
	27-29	▪ Accretion, up to ≈ 3m increase in beach height; and ▪ Increased beach width and advanced shoreline by ≈ 10m.	Accretion
South of Beach Street Groyne	30-33	▪ Erosion, ranging from ≈ 2m reduction in beach height to the north and ≈ 0.5m to the south; and ▪ Decreased beach width and receded shoreline ranging from ≈ 35m to the north and ≈ 5m to the south.	Erosion
	34-36	▪ No significant change.	Stable
	37-39	▪ Erosion, up to ≈ 2m reduction in beach height; and ▪ Decreased beach width and receded shoreline ranging from ≈ 5 to 25m.	Erosion

Figure 3-14 General patterns of change for surveyed beach profiles between April and September 2015 (Image source: NearMap, 2016).

3.3.2 Summer 2015/16

A comparison of survey profiles undertaken between September 2015 and February/March 2016 would be expected to show the initial effects of seasonal summer conditions on beach morphology change. It should be noted, however, that the effect of winter conditions can often extend into September and October, which may influence the useability of this comparison as a representation of summer changes. General patterns of change for the period are described in **Table 3-2** and visualised in **Figure 3-15** below.

Beaches to the north of Cottesloe Groyne exhibit a general pattern of erosion, with stable sections of beach interspersed. The groyne is again likely to be the major factor here, interrupting replacement material as strong northward flowing currents erode and transport material along shore. The influence of the groyne in this process is probably greater during summer than winter, with stronger longshore currents being the major driver of sediment movement during the season. Further to the north the subtle headland feature and angle of the coastline have a similar effect of interrupting deposition of material (i.e. transects 1-4).

To the south of Cottesloe Groyne a mixture of erosion and accretion was observed in a pattern different to that expected and what was observed in the previous summer period. There would usually be an erosion of material to the north of the Beach Street Groyne and an accretion of material to its south due to the effects of longshore sediment transport. Likewise we might expect to see an accretion of material to the south of Cottesloe Groyne. It is likely these patterns have not become evident due to the timing of survey campaigns. With some winter conditions still likely to be present after September, and February/March closer to the middle of the seasonal summer, the period between surveys may be more representative of a transitional period rather than the summer period for this section of coast. Ideally surveys would be carried out in late October/early November and late-April to identify changes over the summer season.

Table 3-2 Noted changes and general patterns of change for surveyed beach profiles between September 2015 and February/March 2016.

Beach Section	Profile(s)	Noted Change	General Pattern
North Street to Napier Street	1-4	▪ Erosion, up to ≈ 2m decrease in beach height; and ▪ Decreased beach width and receded shoreline by ≈7.5 to 15m.	Erosion
	5-8	▪ Stable; and ▪ Some minor accretion and/or reshaping.	Stable
	9-11	▪ Erosion, ≈ 1 to 2.5m decrease in beach height; and ▪ Decreased beach width and receded shoreline by ≈7.5 to 15m.	Erosion
	12-14	▪ Stable or minor accretion.	Stable
Napier Street to Mudurup Rocks	15	▪ Stable.	Stable
	16-18	▪ Erosion, ≈ 1.5 to 2.5m decrease in beach height; and ▪ Decreased beach width and receded shoreline by ≈ 10 to 20m.	Erosion
Mudurup Rocks to Beach Street Groyne	19-20	▪ Not profiled September 2015.	NA
	21-23	▪ Stable, minor accretion.	Stable
	24-26	▪ Minor accretion/reshaping.	Accretion
	27	▪ Stable.	Stable
	28-29	▪ Erosion, ≈ 2m decrease in beach height; and ▪ Decreased beach width and receded shoreline by up to ≈ 15m.	Erosion
South of Beach Street Groyne	30-32	▪ Erosion, up to ≈ 1m reduction in beach height.	Erosion
	33-36	▪ Stable.	Stable
	37-39	▪ Accretion, up to ≈ 1.5m increase in beach height; and ▪ Increased beach width and advanced shoreline by up to ≈ 10m.	Accretion

Figure 3-15 General patterns of change for surveyed beach profiles between September 2015 and February/March 2016 (Image source: NearMap, 2016).

3.3.3 Potential Medium-Term Trends

3.3.3.1 November 2014 to September 2015

The period between November 2014 and September 2015 represents nearly 1 year of shoreline influence. As such we might expect to see beach morphology at the end of the period returning to its original state. As mentioned previously the September survey lies more within the winter period than the transition period, so this might influence the results. General patterns of overall change for the period are described in **Table 3-3** and visualised in **Figure 3-16** below. It should be noted that due to different transect orientations, transects 1-2, 7 and 18-19 are not comparable for this period.

General stability or overall minimal change to beach morphology is observed along many sections of beach for the period, particularly to the south of Cottesloe Groyne. The exception in the southern half of the Study Area was around the Beach Street Groyne where there was an overall surplus of material just to its north and a deficit just to its south. This could indicate the most recent winter period involved greater sedimentation than the previous. This could be due to a greater net southward transport of sediment, possibly due to greater storm conditions.

A deficit of material to the north of Cottesloe Groyne at Cottesloe Main Beach suggests potentially more accretion in the area could occur before summer conditions began to erode the beach. This is supported by remote imagery showing the shoreline advancing through to early November. Unfortunately profile 18 was not comparable between surveys. It may also suggest that this section of beach is gradually eroding medium-term but the dataset is insufficient to confidently draw this conclusion.

North Cottesloe Beach also showed a deficit of material, potentially suggesting a medium-term trend of erosion. Again this is a very preliminary suggestion given the limited dataset. Sections of this coastline (including opposite Grant Marine Park and between Napier Street and Warnham Road) should, however, be monitored as they have been identified as at risk based on geotechnical data (GBGMAPS 2010 & 2011) and coastal vulnerability investigation (CZM & Damara 2008).

A surplus of material is observed to the north of the headland at North Cottesloe Beach. This would likely reduce to a similar level (to November 2014) by November 2015 as northward longshore currents start shifting material away from the beach. This notion is supported by the beach profiles in February/March 2016.

Table 3-3 Noted changes and general patterns of overall change for surveyed beach profiles between November 2014 and September 2015.

Beach Section	Profile(s)	Noted Change	General Pattern
North Street to Napier Street	3-4	▪ Accretion, up to ≈ 1.5m increase in beach height; ▪ Increased beach width and enhanced shoreline by up to ≈ 10m; and ▪ Formation of step feature.	Accretion
	5	▪ No significant change.	Stable
	6	▪ Minor erosion, up to ≈ 0.5m reduction in beach height; and ▪ Decreased beach width and receded shoreline by ≈ 7.5m.	Erosion
	8-9	▪ Erosion, up to ≈ 1m reduction in beach height; and ▪ Decreased beach width and receded shoreline by up to ≈ 12.5m.	Erosion
	10-13	▪ No significant change.	Stable
	14	▪ Accretion, up to ≈ 1.5m increase in beach height; and ▪ Increased beach width and enhanced shoreline by up to ≈ 5m.	Accretion
Napier Street to Mudurup Rocks	15-16	▪ Minor erosion, up to ≈ 0.5m reduction in beach height; and ▪ Decreased beach width and receded shoreline by ≈ 7.5m.	Erosion
	17	▪ No significant change.	Stable

Mudurup Rocks to Beach Street Groyne	19-20	▪ Inactive Beach – Not profiled September 2015.	Stable
	21-22	▪ No significant change.	Stable
	23	▪ Erosion, up to ≈ 1.5m reduction in beach height; and ▪ Decreased beach width and receded shoreline by ≈ 7.5m.	Erosion
	24-27	▪ Mostly unchanged; ▪ Some erosion of back beach; ▪ Accreted step feature at shoreline in some places; and ▪ Some minor enhancement of shoreline.	Stable/Reshaped
	28-29	▪ Minor accretion, up to ≈ 0.5m increase in beach height.	Accretion
South of Beach Street Groyne	30	▪ Erosion, up to ≈ 2m reduction in beach height; and ▪ Decreased beach width and receded shoreline by ≈ 25m.	Erosion
	31	▪ Minor erosion.	Erosion
	32-39	▪ No significant change.	Stable

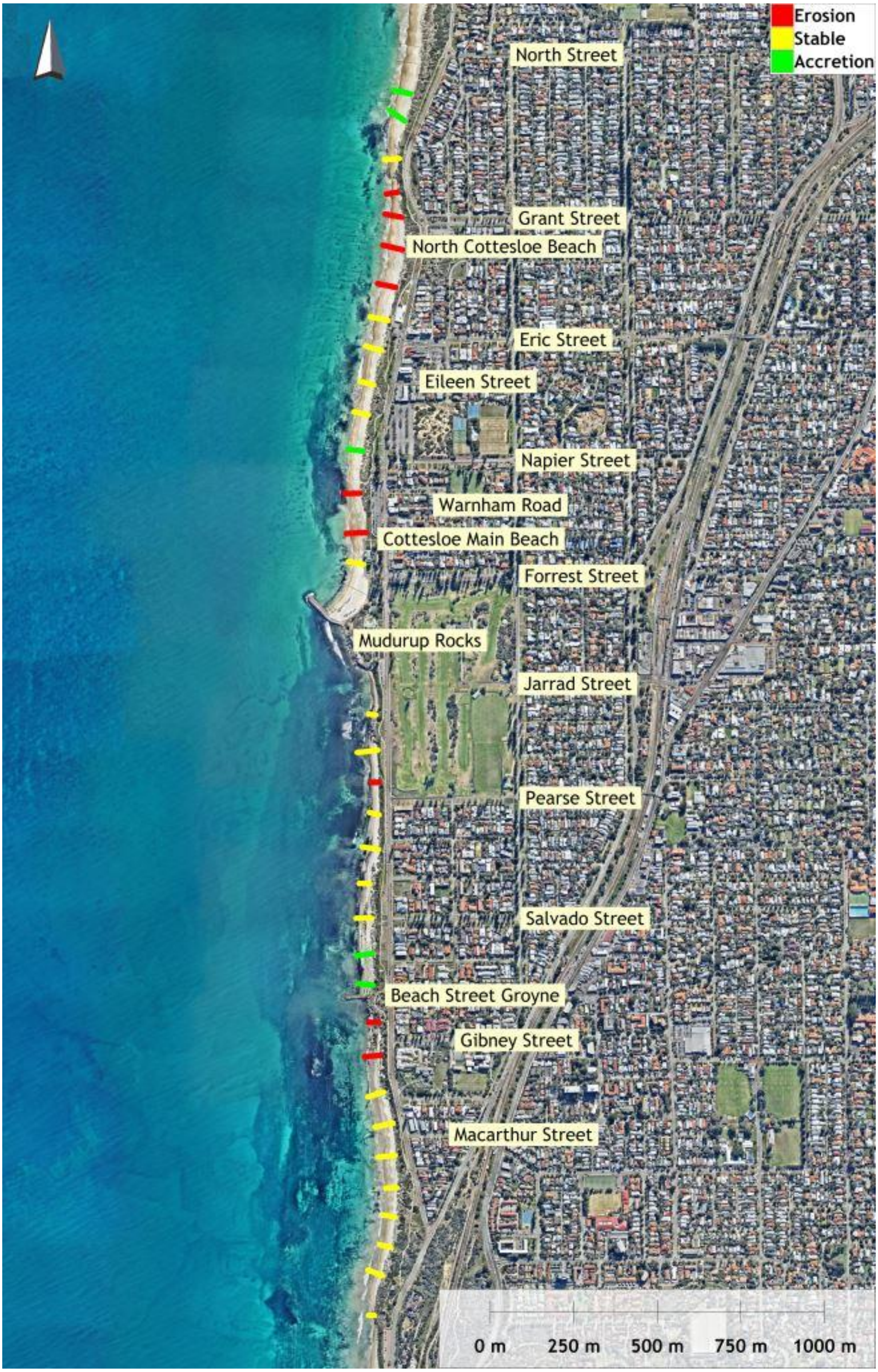


Figure 3-16 General patterns of overall change for surveyed beach profiles between November 2014 September 2015 (Image source: NearMap, 2016).

3.3.3.2 April 2015 to February/March 2016

The period between surveys in April 2015 and February/March 2016 represents approximately 1 year of shoreline changes. The February/March survey is not ideally placed in that changes due to summer conditions would still be occurring beyond this time; this will influence the ability to detect medium-term trends. However, a general restoration of beach morphology and shoreline position over the period would be expected. General patterns of overall change for the period are described in **Table 3-4** and visualised in **Figure 3-17** below.

As expected, much of the coastline within the Study Area was stable over the period, that is, it returned to a similar state at the end of the observation period to that seen at the start. A minor deficit of material was detected at North Cottesloe Beach. Again, this requires the collection of more data to be confirmed as a medium or long-term erosion trend. It is strongly recommended that this area be monitored into the future as it has also been identified as at risk of long-term erosion. A surplus of material was present adjacent to Napier Street, the location of a subtle headland. This will likely erode to a similar profile to that seen in April 2015 by April 2016, with further action of summer conditions. A beach section just north of Pearse Street shows an overall loss of material over the period which should be monitored into the future.

Table 3-4 Noted changes and general patterns of overall change for surveyed beach profiles between April 2015 and February/March 2016.

Beach Section	Profile(s)	Noted Change	General Pattern
North Street to Napier Street	1-7	▪ Generally stable, some minor accretion/erosion.	Stable
	8-9	▪ Minor erosion, ≈ 0.5m decrease in beach height.	Erosion
	10-13	▪ Stable.	Stable
	14	▪ Accretion, ≈ 2m increase in beach height; and ▪ Increased beach width and enhanced shoreline by ≈ 10m.	Accretion
Napier Street to Mudurup Rocks	15-18	▪ Stable.	Stable
Mudurup Rocks to Beach Street Groyne	19	▪ Surveys do not overlap for comparison.	NA
	20-22	▪ Stable.	Stable
	23	▪ Erosion, ≈ 1.5m decrease in beach height; and ▪ Decreased beach width and receded shoreline by ≈ 10m.	Erosion
	24-26	▪ Stable.	Stable
	27	▪ Accretion, ≈ 0.5m increase in beach height.	Accretion
	28-29	▪ Stable.	Stable
South of Beach Street Groyne	30-39	▪ Stable.	Stable

Figure 3-17 General patterns of overall change for surveyed beach profiles between April 2015 and February/March 2016 (Image source: NearMap, 2016).

3.4 Metocean Conditions

Wave statistics were examined for the Rottnest and Cottesloe wave buoys for the observation period. Wave data from the Cottesloe Buoy was non-directional until December 18, 2015. As such, the Rottnest buoy has been used to assess directional wave conditions and provide comparison of seasonal wave conditions. **Figure 3-18** below displays directional wave roses for the separated swell and sea components at Rottnest during winter and summer.

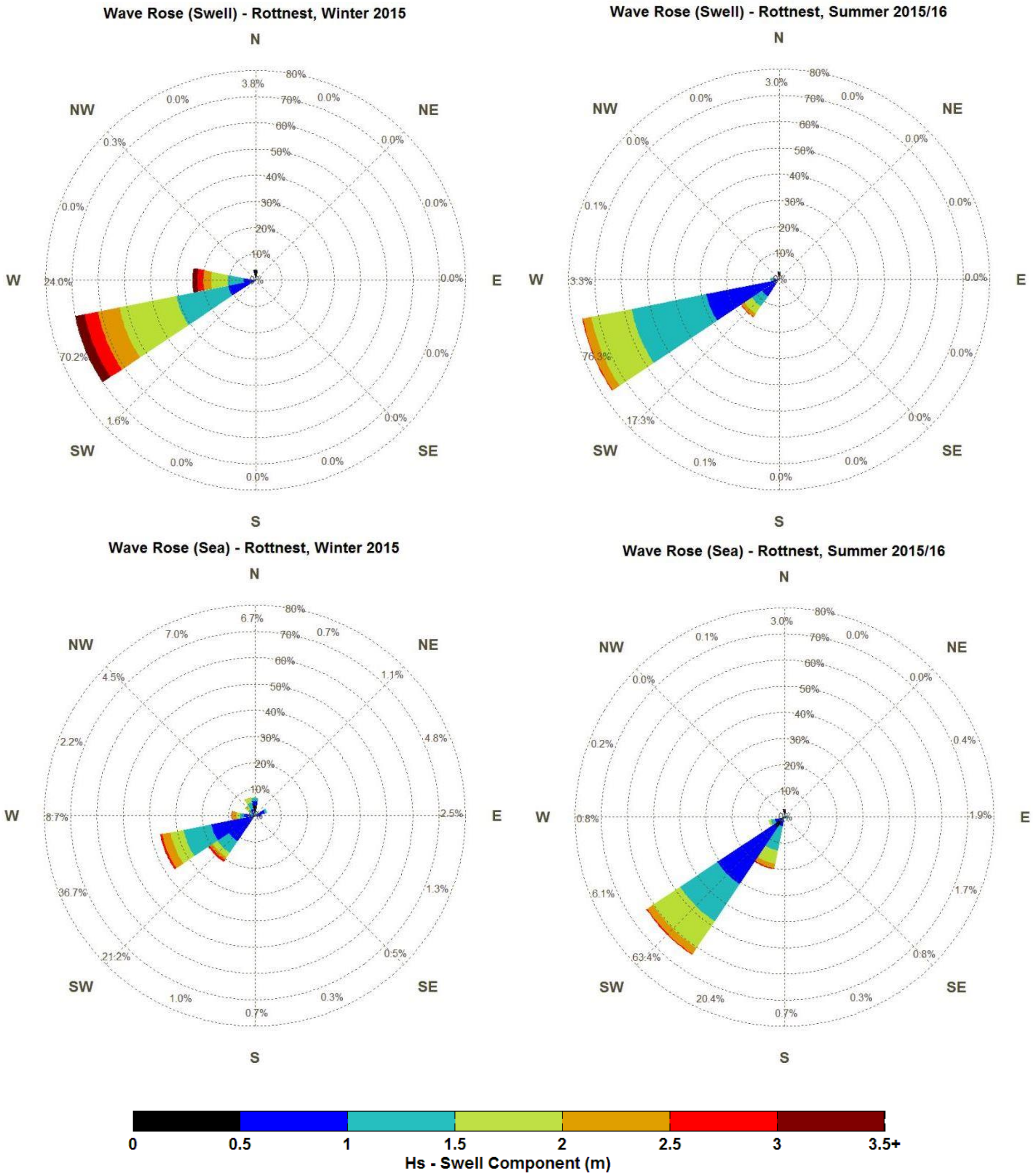


Figure 3-18 Wave height vs direction (coming from) rose plots for (clockwise from top left): winter swell component, summer swell component, summer sea component and winter sea component.

Swell conditions are much greater and more frequent in winter due to offshore storms and have a greater westerly component in comparison to summer swell conditions. Alternatively we see a stronger sea component in summer compared to winter, with a dominant south-westerly direction.

The major feature of both wave buoy datasets, and the most important for influence on beach morphology, were large wave heights recorded in association with winter storms. All winter storm events noted in **Section 3.2.1** during examination of imagery showed significant wave height (H_s) values above 1.5m at the Cottesloe Buoy. These storm periods can be identified by the wave height peaks in **Figure 3-19** below. Observation of the swell record alongside these events generally reveals a strong swell component. This is also supported by generally high peak period values, which are shown in **Figure 3-20** below. This is important because swell has a greater ability to drive sediment suspension than local seas of similar wave height. Plots of the full time-series datasets for relevant wave statistics for each buoy are provided in **Appendix B**.

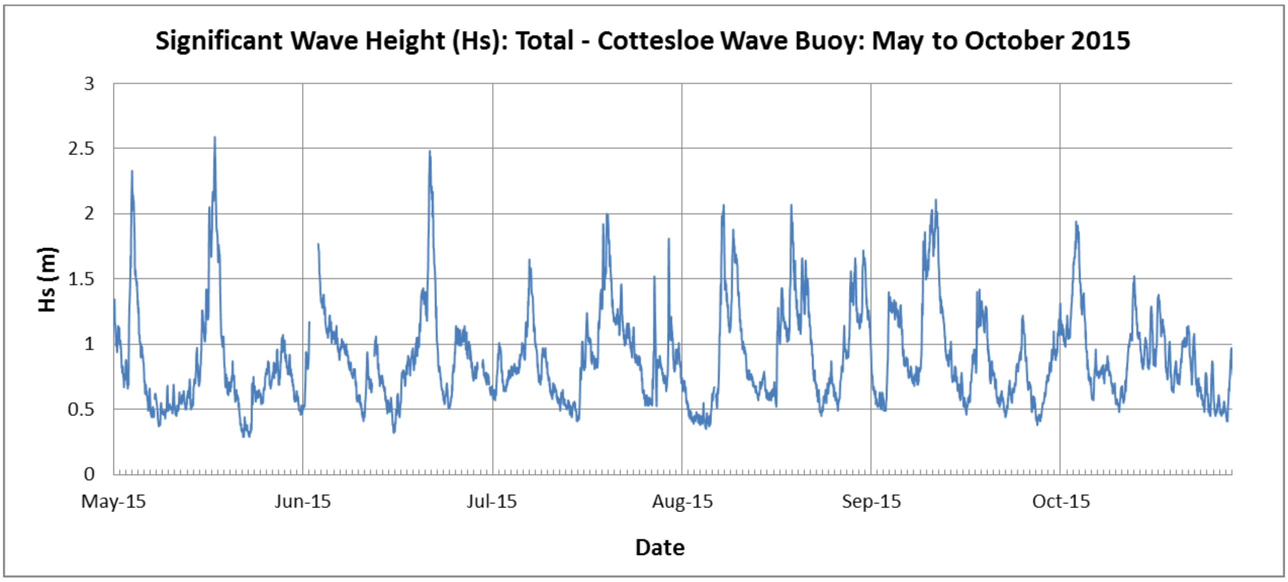


Figure 3-19 Significant wave height at the Cottesloe Wave Buoy over the seasonal winter period (Data source: DoT 2016).

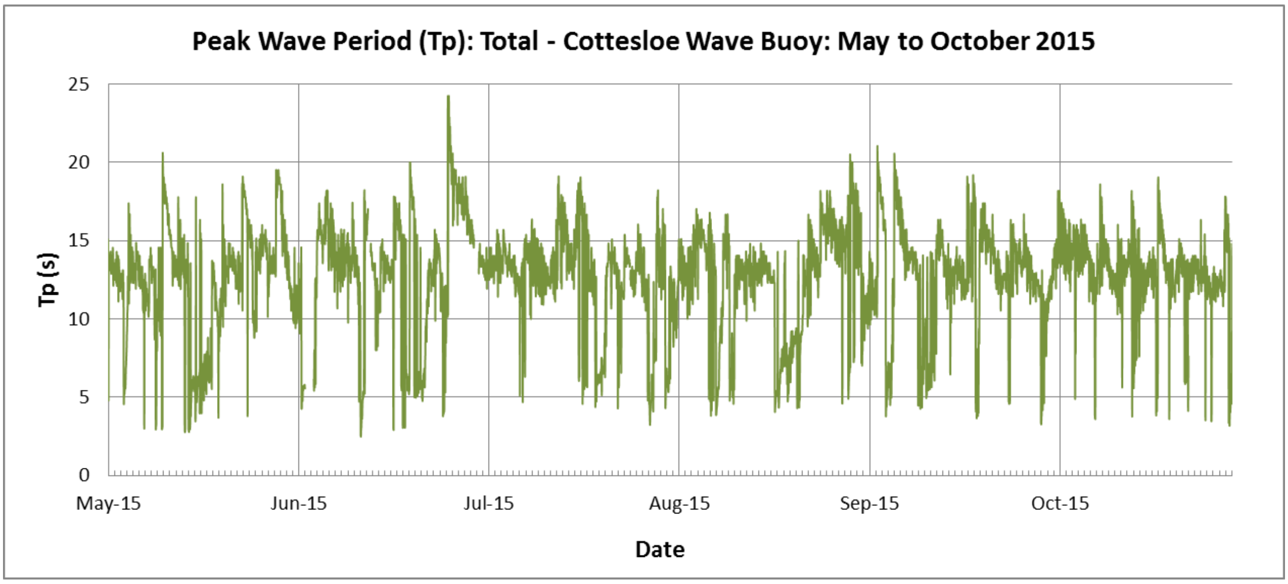


Figure 3-20 Peak wave period at the Cottesloe Wave Buoy over the seasonal winter period (Data source: DoT 2016).

The most significant of these storm events, referred to in **Section 3.2.1**, occurred during May 2015. The intensity of this event was confirmed by the wave record which showed H_s above 2.5m on May 17 around

1:00 PM (**Figure 3-21**), the highest value for the observation period. This did not, however, correspond with the peak of shoreline impacts and wave run-up observed in remote imagery, suggesting water level also had an influence.

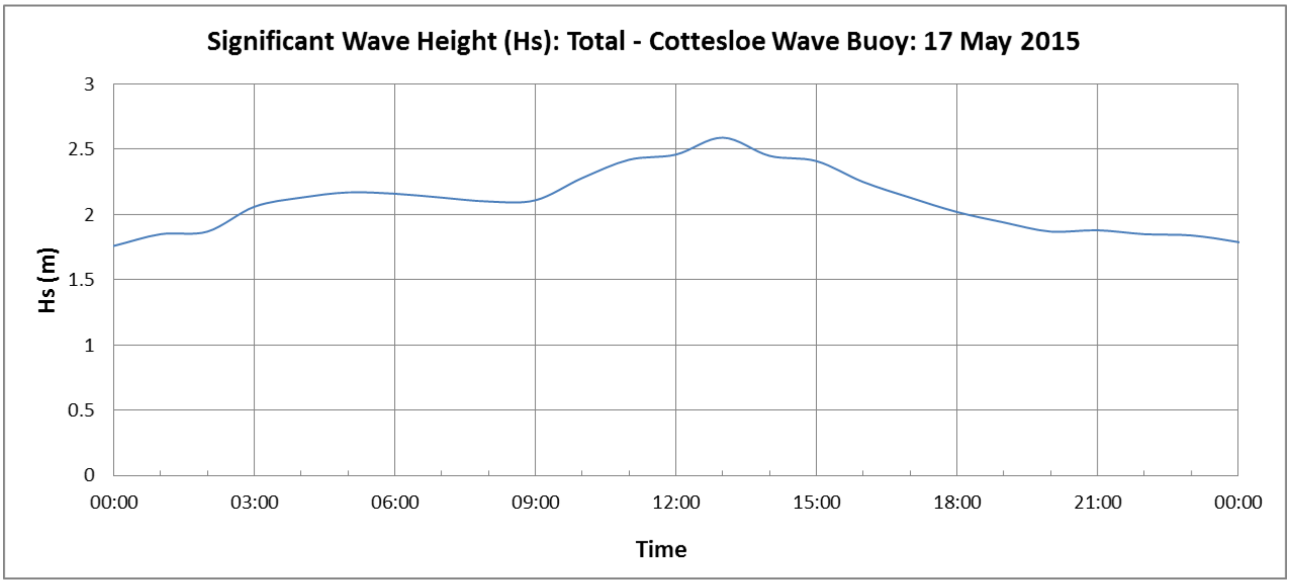


Figure 3-21 Significant wave height at the Cottesloe Wave Buoy on May 17, 2015 (Data source: DoT 2016).

An examination of raw water level measurements from Fremantle (note these were not quality checked by DoT) shows the peak water level for the year, 1.8 m above the historical low water mark (LWM), occurred on May 17 at around 8:30 AM (**Figure 3-22**). This corresponds with the peak of observations of coastal impact from remote imagery (see also **Figures 3-1** and **3-2**). Although this time was high tide, other influences may have been involved to enhance this peak. A review of MSLP from the BoM daily weather observations at Swanbourne (pressure recorded at Perth Metro Station) showed MSLP was 1005.9 hPa at 9:00 AM and 1002.8 hPa at 3:00 PM. Both these values were the lowest recorded, for their respective times, during 2015 of the observation period.

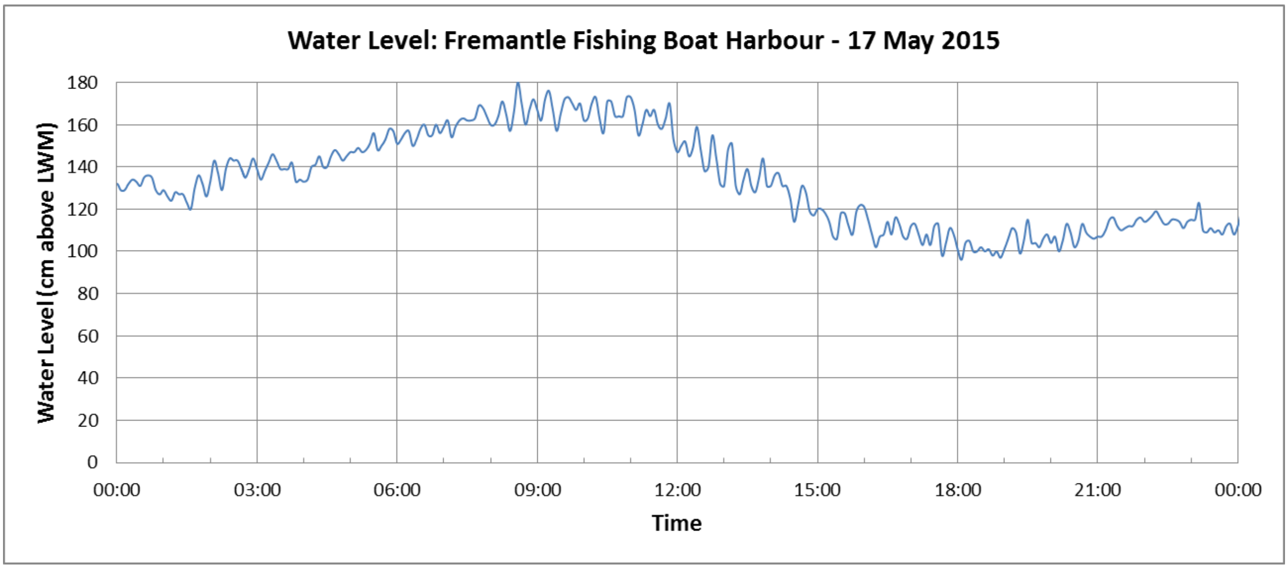


Figure 3-22 Raw water level measurements above LWM at Fremantle on May 17, 2015 (Data source: DoT 2016).

Winds were also the strongest recorded for the month on May 17 at 37 km/h from the north-west during the morning and 39 km/h from the west north-west in the afternoon. This wind and wave direction means little protection was afforded to Cottesloe Main and North Cottesloe Beach by the Cottesloe Groyne or Rottnest Island offshore.

A storm event with waves of similar magnitude was also observed on June 21, with the highest H_s values of the observation period occurring at the Rottnest Wave Buoy at over 5.5 m. Waves at the Cottesloe Wave Buoy were also above 2.5 m. This event, however, was much less noticeable in terms of coastal impact during the review of remote imagery. An analysis of water level data shows measurements dropping below 1 m as wave height reached its peak. MSLP was low at 1008.1 hPa, not as low as during the May storm. The difference in coastal impact of the two storms illustrates the important role water level plays. This is important to keep in mind considering the predicted rise in sea-levels from climate change.

Water-level data was obtained from the Department of Transport and the National Tide Centre for Fremantle from 1966 to 2015 inclusive. Extremal analysis of the data set was undertaken to determine a range of Average Recurrence Interval (ARI) events. A Weibull fit was selected as the most appropriate method of determination. The peak water level observed during the present monitoring period (1.8 m LWM) corresponds to approximately a 9 year ARI event. A range of water level ARI events are presented in Table 3-5 to allow future reference.

Table 3-5 Fremantle water levels for various ARIs

ARI (year)	Water Level (m LWM)
5	1.1
10	1.9
20	1.9
50	2.0
100	2.1

4 Discussion

The monitoring period was generally successful with both photographic monitoring and surveying achieving good quality datasets for analysis. Visual assessment of captured imagery provided good supporting evidence for the changes in beach profile quantified by comparison of shoreline surveys. As the ongoing monitoring program is in its early stages, there is still insufficient data to draw conclusions about medium to long-term trends in erosion or accretion. The observed changes, and potential trends they indicate, for the data collected so far (approximately 1.5 year duration) are discussed. Based on the inter-annual variability of weather and metocean conditions in the region, as well as the presence of longer term influences such as El Niño/La Niña (ranging from 2 to 7 year cycle), the program would require at least 5 years of continuous data before persistent trends could be proposed with some confidence.

The seasonal patterns in beach change detected by comparison of survey profiles suggest the interaction of alongshore currents, carrying sediment, with shoreline structures is the major determinant of accretion and erosion. Over the winter period there was general accretion to the north of the Cottesloe Groyne and erosion to its south as southward alongshore sediment transport is trapped and retained to its north and deprived from nourishing beaches to its south. A similar effect is seen around the Beach Street Groyne. Subtle headland features and changes in beach angle along the coastline within the study area also appear to have a similar effect, to a lesser scale.

We generally see the opposite of this over the summer period as strong sea breezes create northward flowing currents and alongshore sediment transport. It is likely the full transformation of beach morphology over the 2015/16 summer period was not fully captured due to an early surveying campaign in February/March. This aside, changes observed in beach profiles suggest general erosion of material to the north of Cottesloe Groyne and some accretion to the south, consistent with observations of the previous summer period.

Comparison of surveys at similar times, one year apart, show a general stability of beach morphology at the end of the period in comparison to the original state. There were also some areas of considerable difference in these comparisons, which would be expected given the limited overall observation period, inherent variability in seasonal conditions and survey campaigns being undertaken at different dates between years. Some net erosion was noted at similar areas for both long term periods; primarily at beach sections just north of Pearse Street and along North Cottesloe Beach. This could be indicative of long-term erosion and should be monitored as more data is collected. Particularly given sections of North Cottesloe Beach have been identified as at risk under future climate change conditions.

Additional to survey data, remote imagery data was able to provide qualitative information of shoreline processes at a much higher temporal resolution. This included capturing daily observations of shoreline movement and morphology change and the effects of significant storm events during the winter period. One significant storm event in May highlighted the threat posed by sea-level rise with wave run-up appearing to reach the landward limit of the beach in places and also the base of the Indiana Restaurant. Supporting metocean and weather data indicated this impact was the result of the highest significant wave height recorded at Cottesloe, highest water level measured at Fremantle, very low atmospheric pressure and strong winds all occurring on the same day.

5 Recommendations

The current monitoring program is relatively comprehensive and well-targeted given the resources available to the Town. The addition of ocean based profiling in the most recent surveying campaign means beach profiles are captured on a comprehensive spatial scale throughout the Study Area. The following recommendations are suggested for the current monitoring program as it continues into the future:

> The program should continue, in at least its current format, for a period of time sufficient to account for inter-annual variability in weather and metocean conditions as well as longer term cycles such as El Niño/La Niña weather patterns (2-7 year cycle). It is recommended a dataset of at least a 5-10 year duration be collected to define trends in shoreline movement with some confidence.

> Sections of North Cottesloe Beach that were previously identified as at risk of medium to long-term erosion (based on geotechnical investigations and coastal vulnerability assessment) are of particular importance for continued monitoring. This area has shown initial signs of net sediment loss and, therefore, a potential medium-term erosion trend.

> Survey campaigns should be carried out as close as possible to the middle of the transition periods between winter and summer each year. This is generally around April/May and October/November. This will allow better segmentation of the two seasonal periods for analysis of beach profile change. It will also lead to greater confidence in the identification of potential long-term trends.

> The survey program has sufficient spatial resolution for interpolations to be made between survey transects to model three dimensional beach form and, subsequently, estimate gained or lost sediment volumes. This may be useful in the future to determine actual volumes of material being lost due to long-term erosion (if present) and inform renourishment programs if required.

> The Town could consider the installation of more remote imagery cameras, particularly at beaches to the south of Cottesloe Groyne that are currently not monitored. Currently there is considerable speculation around sedimentation processes occurring in this section of the Study Area (particularly when surveying is not ideally timed). Although this portion of the coastline does not hold the same public amenity value as the beaches to the north of the groyne, it forms a large component of the Study Area and its sediment regime. A photo dataset would better inform previous and future survey data.

> Sediment sampling would provide useful information regarding the particle size and potential source of sediment accumulating and being lost from beaches within the Study Area. This information would be useful in determining the key mechanisms of sediment movement, with swell waves (e.g. during winter) generally having the ability to suspend and shift larger particles than the combination of water levels and currents (e.g. during summer). The information would also inform renourishment programs should these be required in the future.

> Measurement of nearshore currents would provide data on a major component of the sedimentation regime within the study area. Ideally 1 year of current data would be captured to assess the respective spans of northward flows during the summer and southward flows during the winter, and characterise flow in the transition periods between the seasons. However, monitoring programs could be tailored to achieve useful data within required limitations. Acoustic current measurement instruments also provide measurements of backscatter, which can be used as a proxy for suspended sediment. This would allow estimates of sediment flux in the nearshore zone to be calculated.

> The existing collection of water level and wave data at Fremantle and Cottesloe is important for placing the erosion / accretion events into context. It is recommended this continue.

> Following completion of year 5 of monitoring, the data should be analysed for medium term trends, as well as for input into coastal management. For example, if medium term erosion trends were observed at a specific location, investigations could assist with management measures at that site. Data collection should still be ongoing, during and following this analysis.

6 References

BoM (2016) *Climate Data Online – Swanbourne, Western Australia, Daily Weather Observations*. Available from <http://www.bom.gov.au/climate/dwo/201604/html/IDCJDW6121.201604.shtml> [Accessed 11/04/2016]

BMT Oceanica (2015) Cottesloe Coastal Monitoring Summary Report – Summer 2014/2015. Prepared for the Town of Cottesloe by BMT Oceanica Pty Ltd.

CZM, Damara (2008) *Vulnerability of the Cottesloe Foreshore to the Potential Impacts of Climate Change.* Prepared for the Town of Cottesloe by Coastal Zone management Pty Ltd and Damara WA Pty Ltd.

GBGMaps (2010) *Geophysical Investigation for Subsurface Lithology Along the Foreshore of Cottesloe Beach, Cottesloe, Western Australia*. Prepared for the Town of Cottesloe by GBGMAPS Pty Ltd.

GBGMaps (2011) *Ground Penetrating radar Investigation for Subsurface Lithology Along Marine Parade, Cottesloe, Western Australia*. Prepared for the Town of Cottesloe by GBGMAPS Pty Ltd.

Stul T, Gozzard J R, Eliot I G, Eliot M J (2012) Coastal Sediment Cells between Cape Naturaliste and the Moore River, Western Australia. Prepared for the Department of Transport by Damara WA Pty Ltd and Geological Survey of Western Australia, Perth, Western Australia.

7 Appendices

7.1 Appendix A – Survey Profile Data: November 2014 to February/March 2016

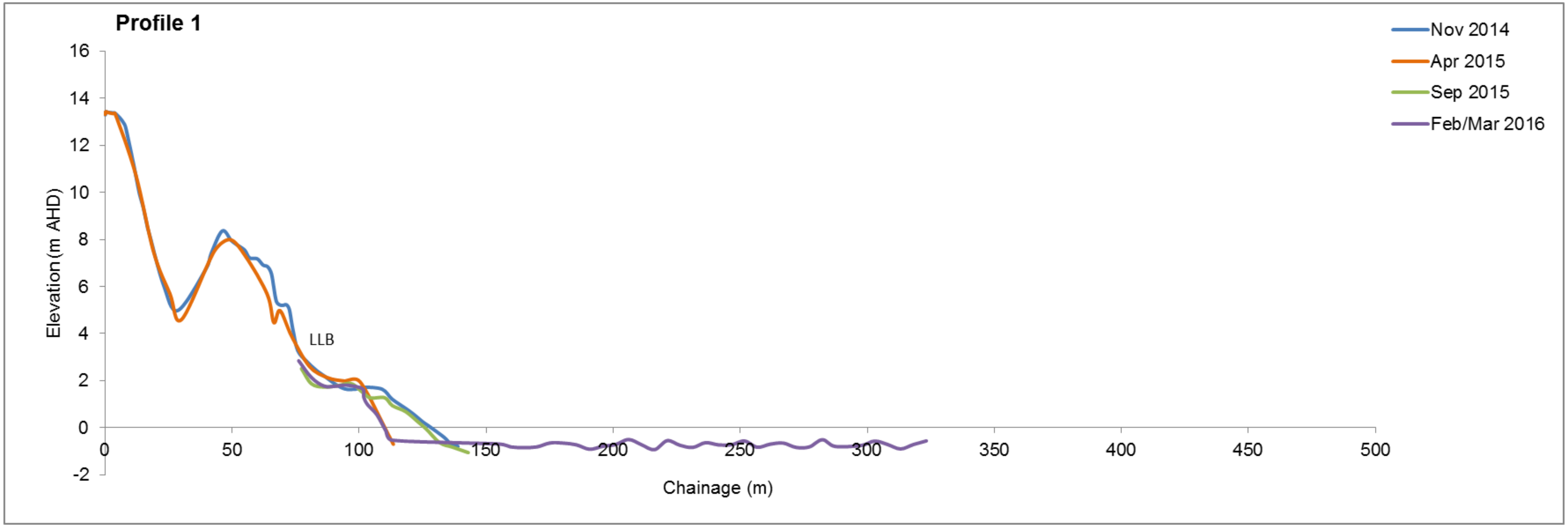
7.2 Appendix B – Wave Buoy Data at Rottnest and Cottesloe Wave Buoys: April 2015 to March 2016

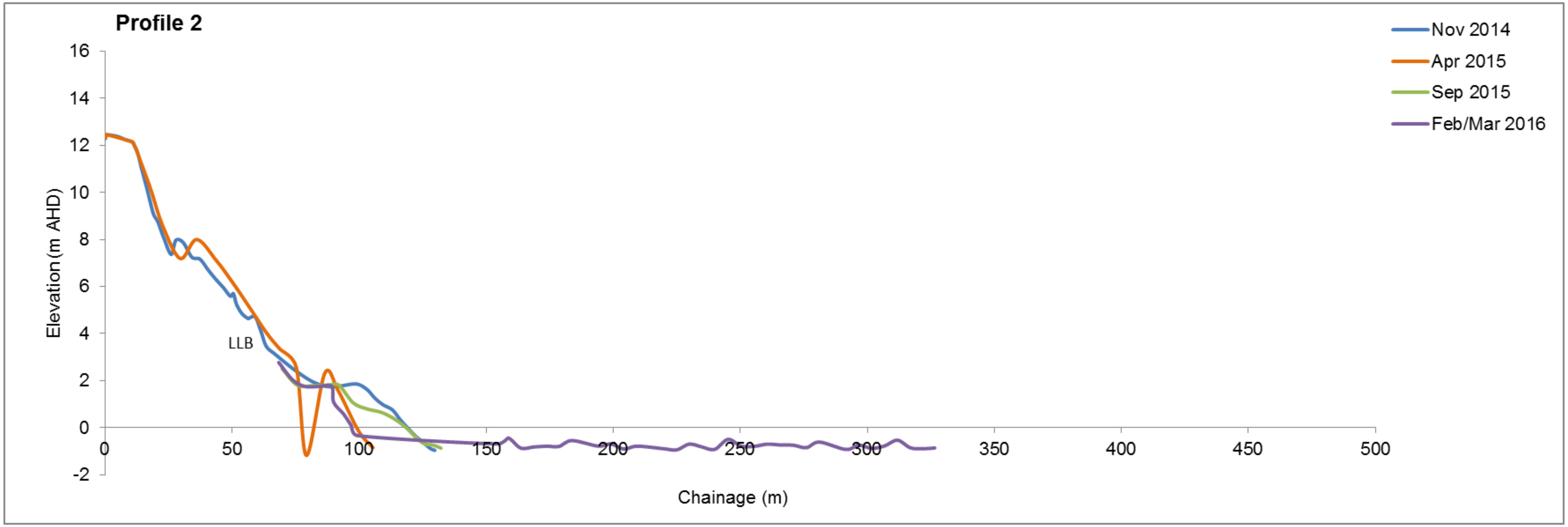
7.3 Appendix C – Water Level Data at Fremantle: April 2015 to March 2016

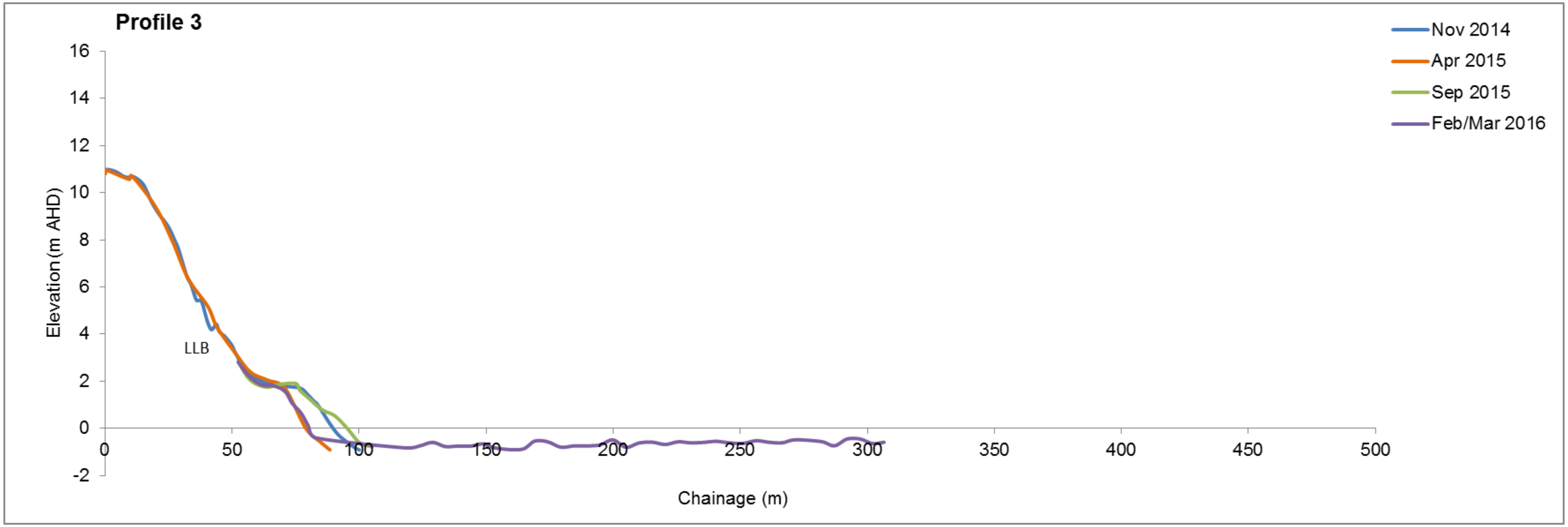
7.4 Appendix D – Daily Weather Observations at Swanbourne, WA: April 2015 to March 2016

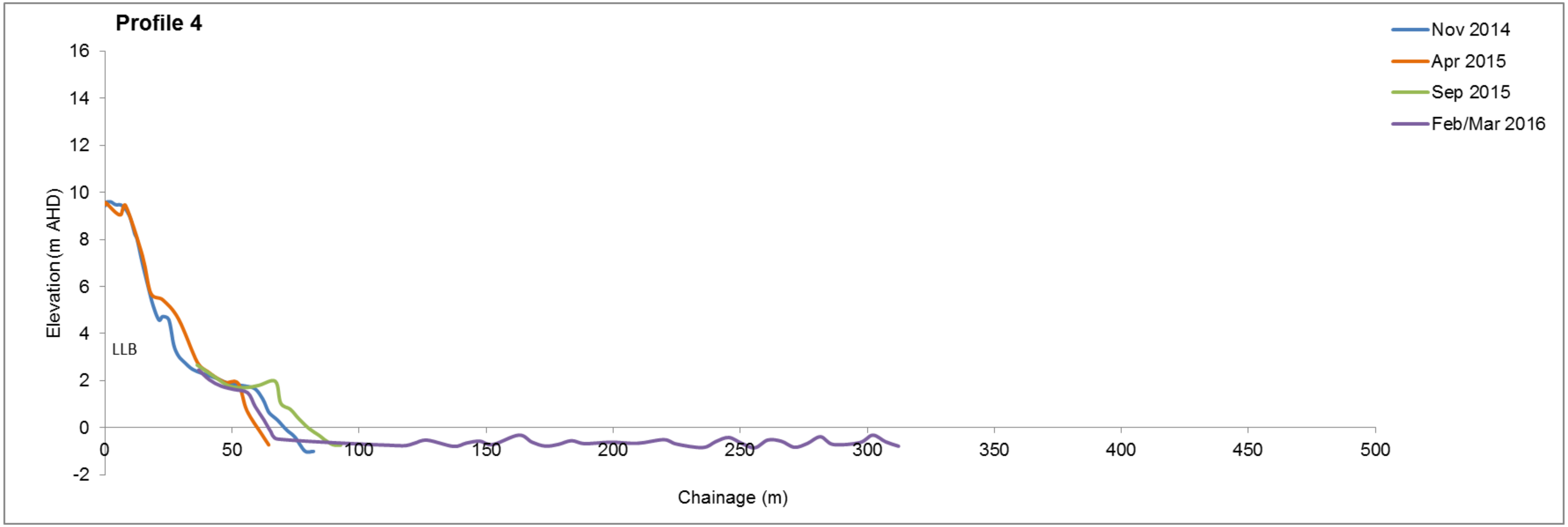
Appendix A

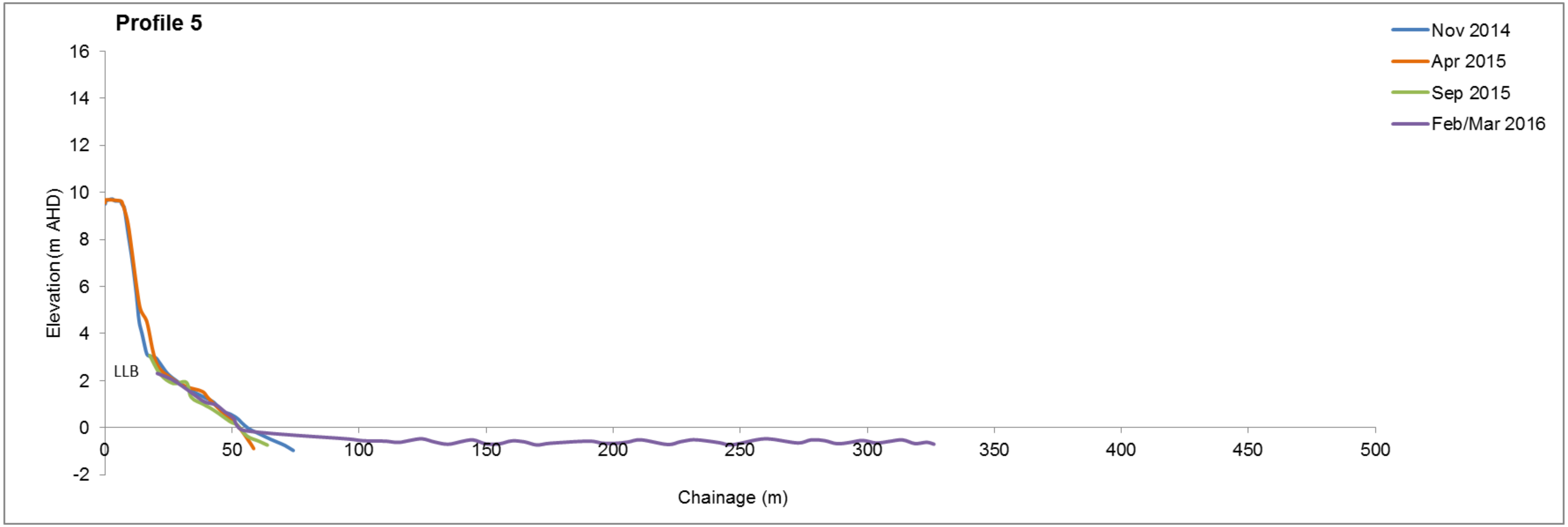
Survey Profile Data: November 2014 to February/March 2016

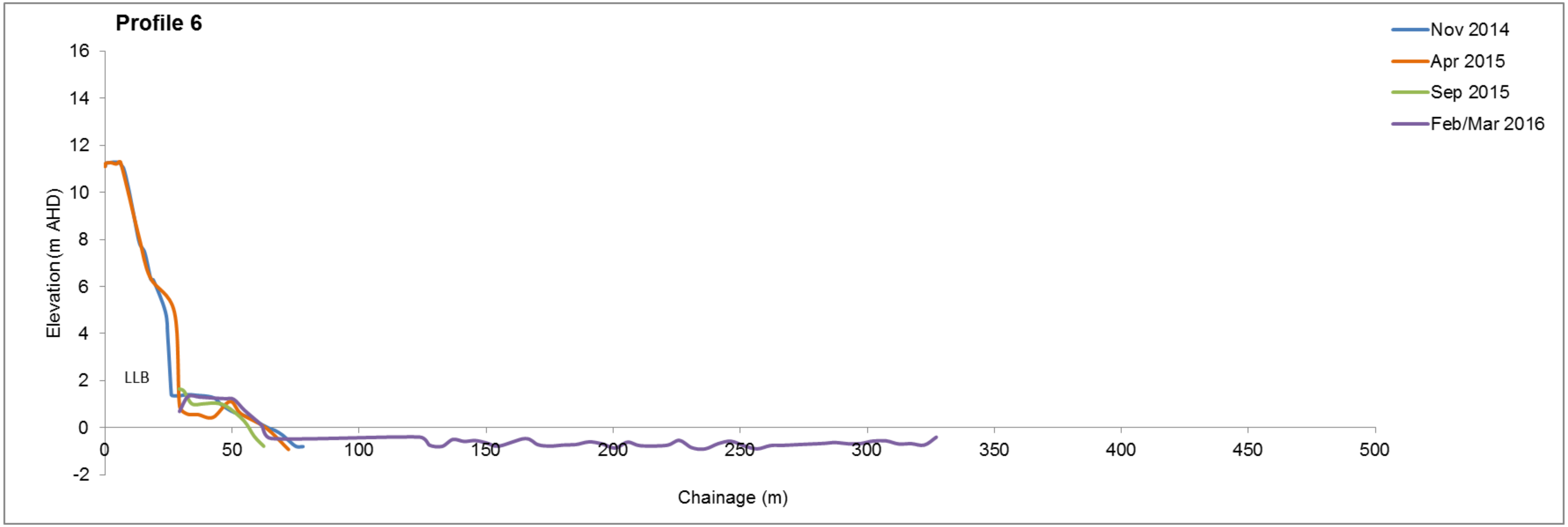

Profile 1
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
Chainage (m)
LLB
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500

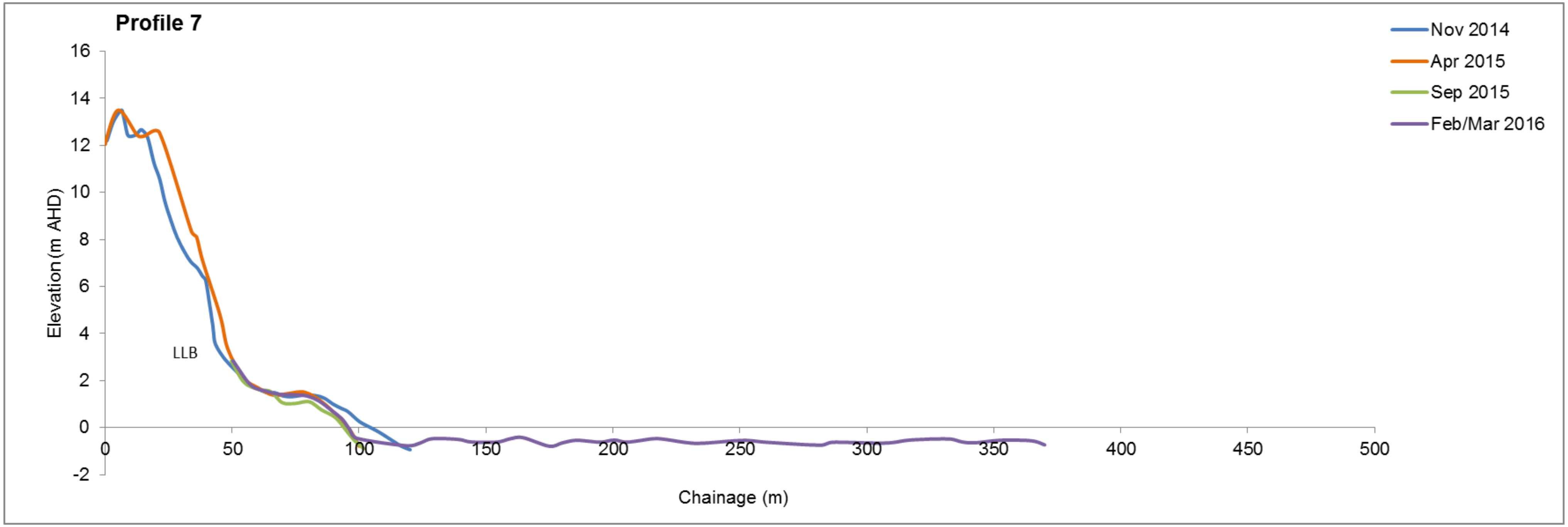

Profile 2
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
Chainage (m)
LLB
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500

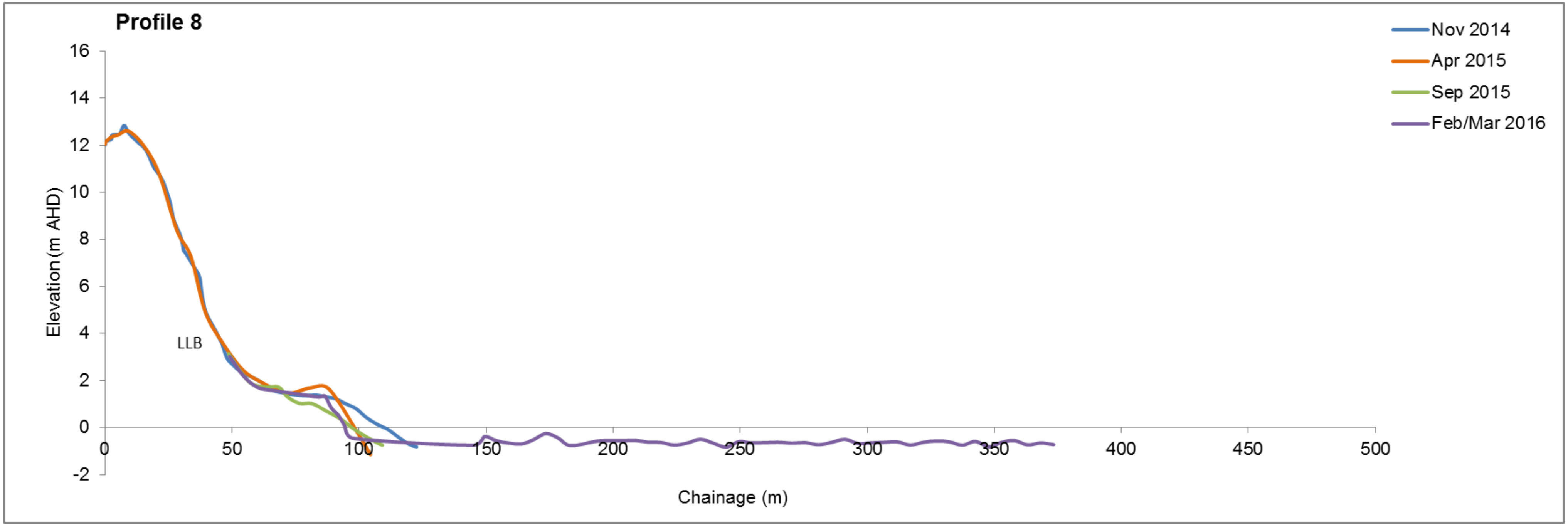

Profile 3
Elevation (m AHD)
Chainage (m)
LLB
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500

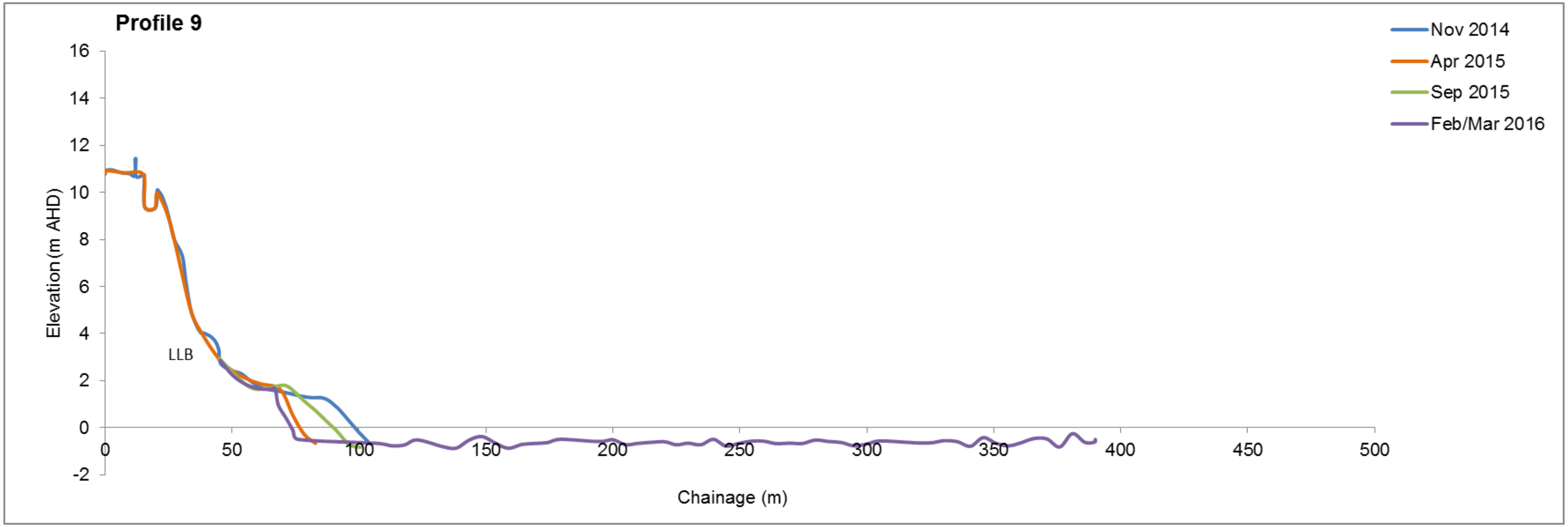

Profile 4
Elevation (m AHD)
Chainage (m)
LLB
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500


Profile 5
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016

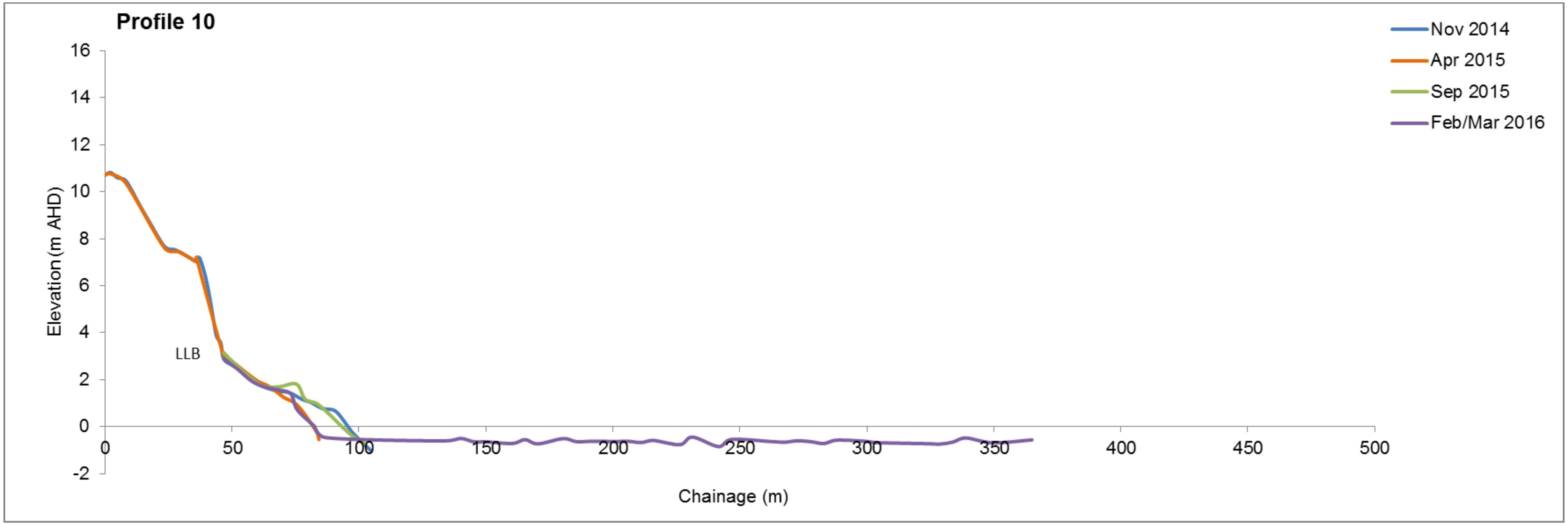

Profile 6
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016


Profile 7
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

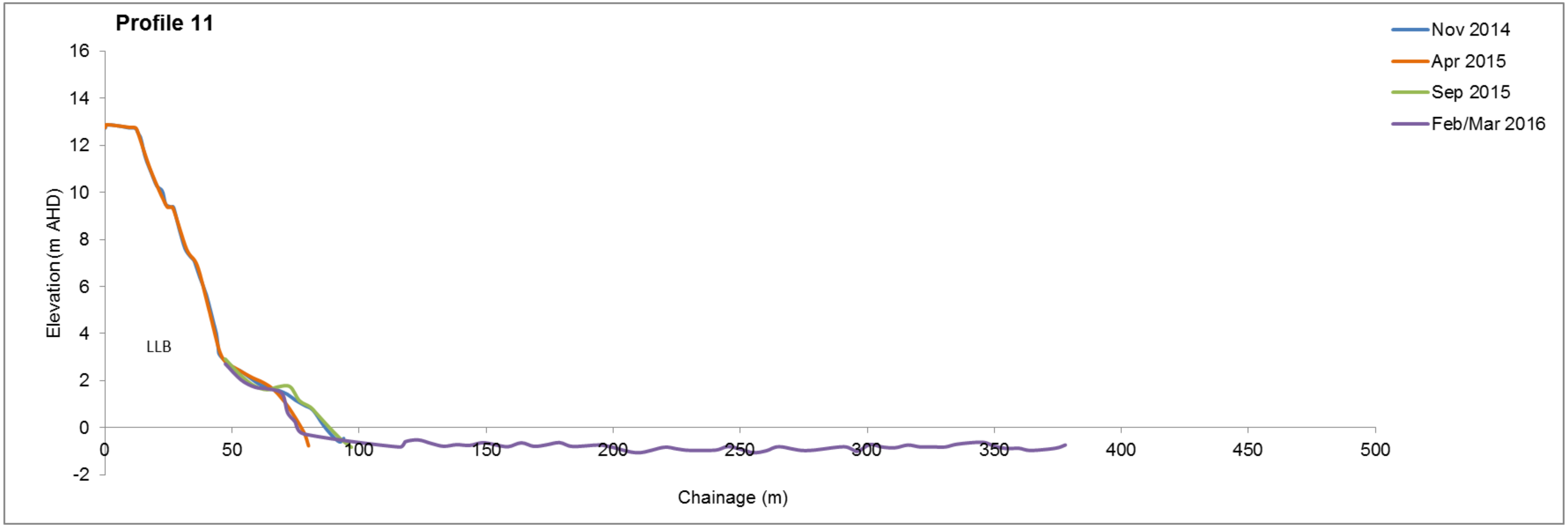

Profile 8
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

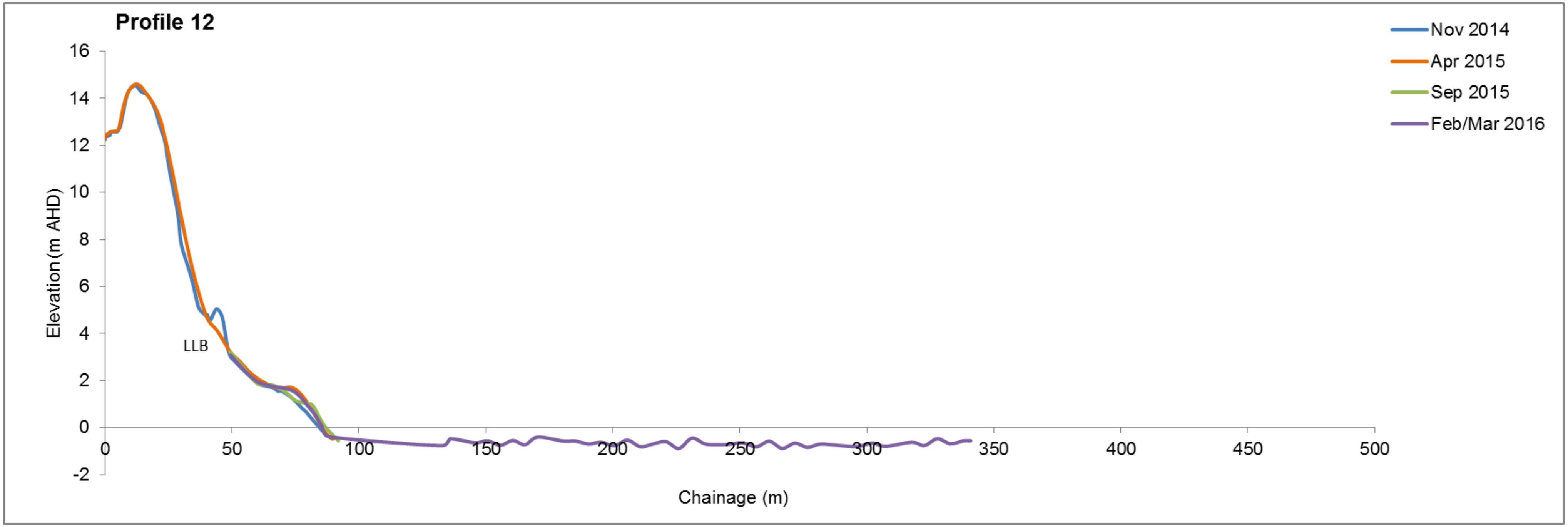


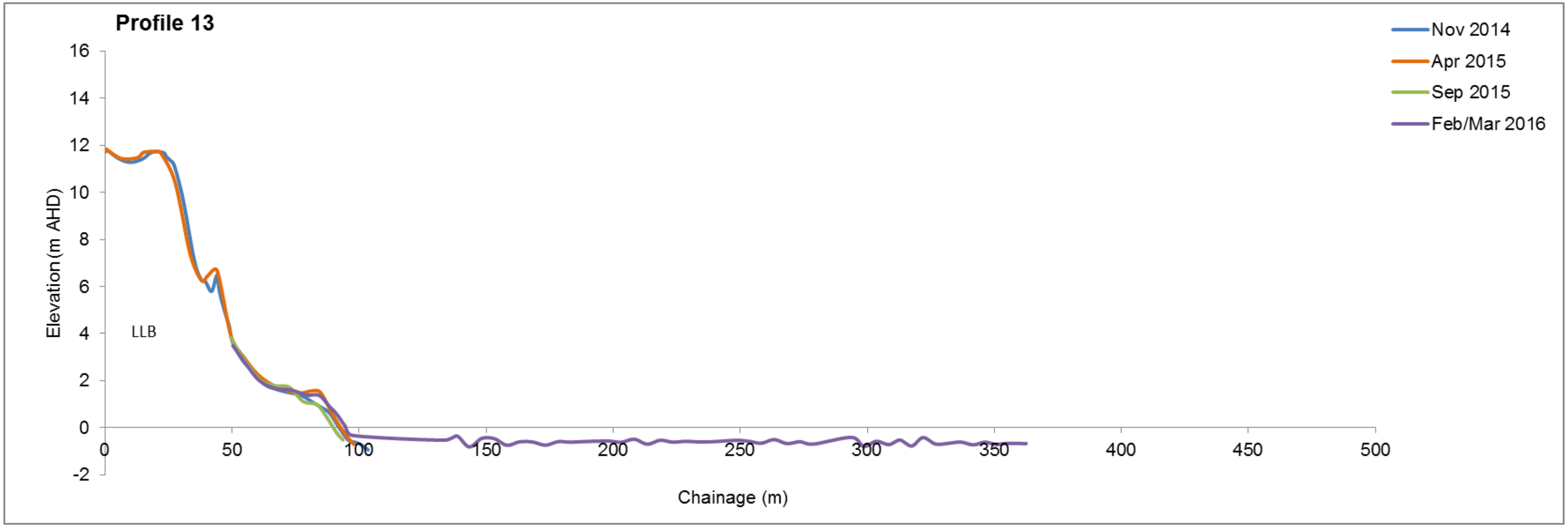
Profile 9
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016

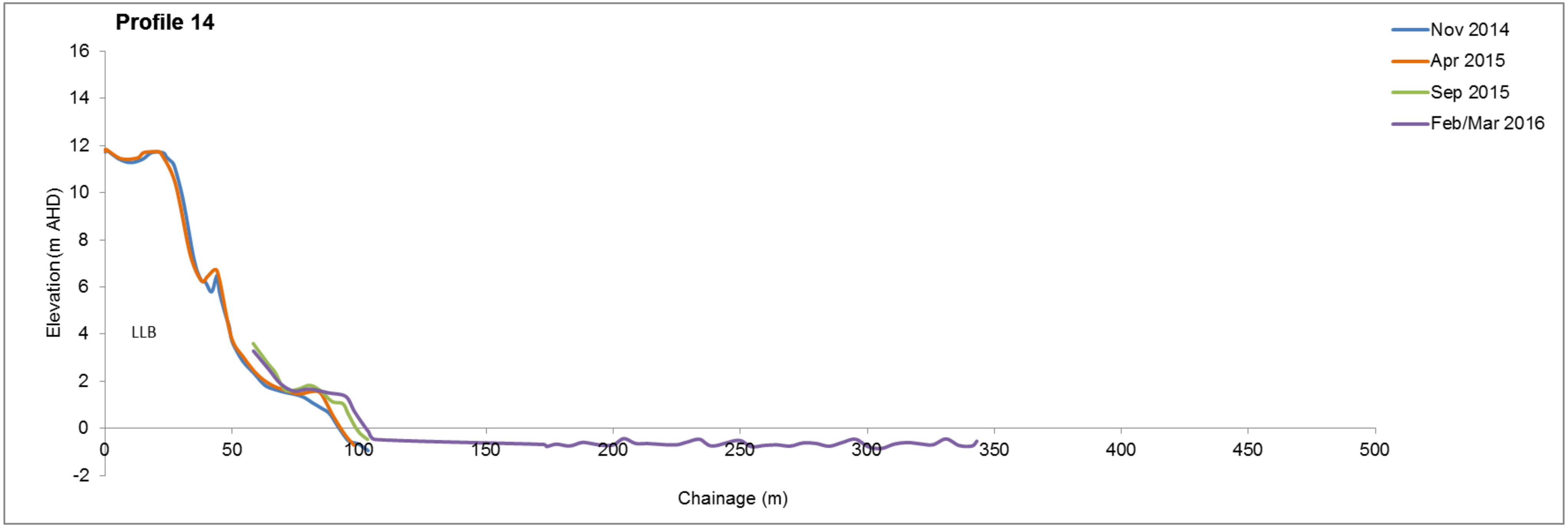


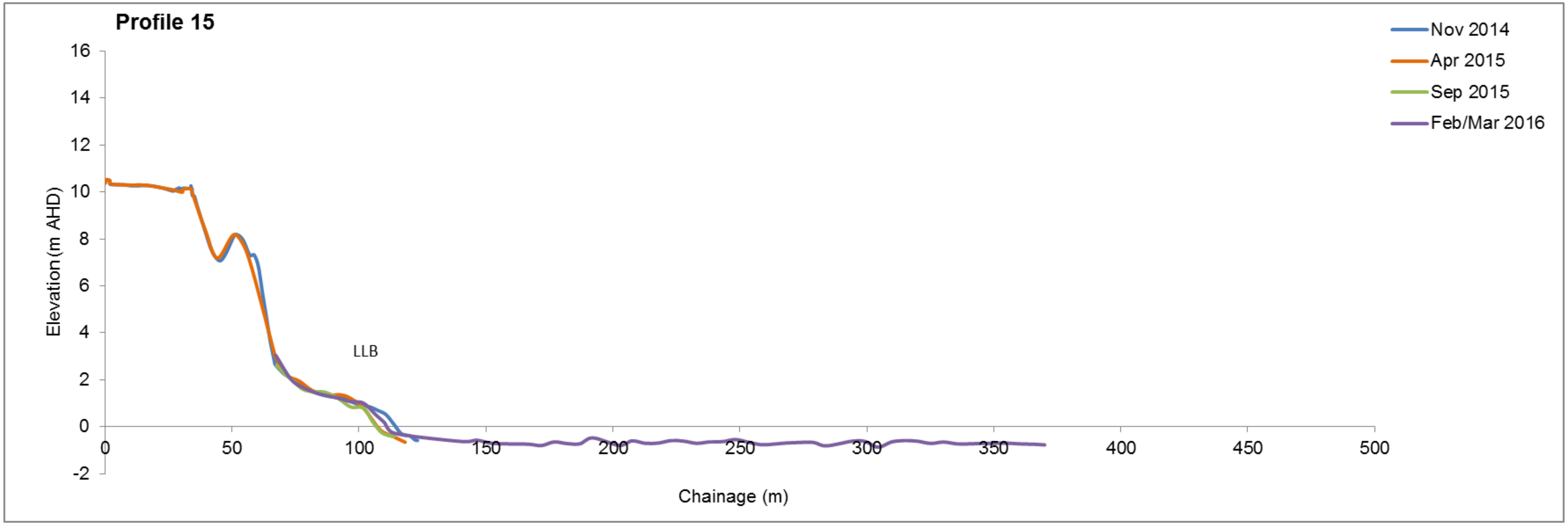
Profile 10
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016

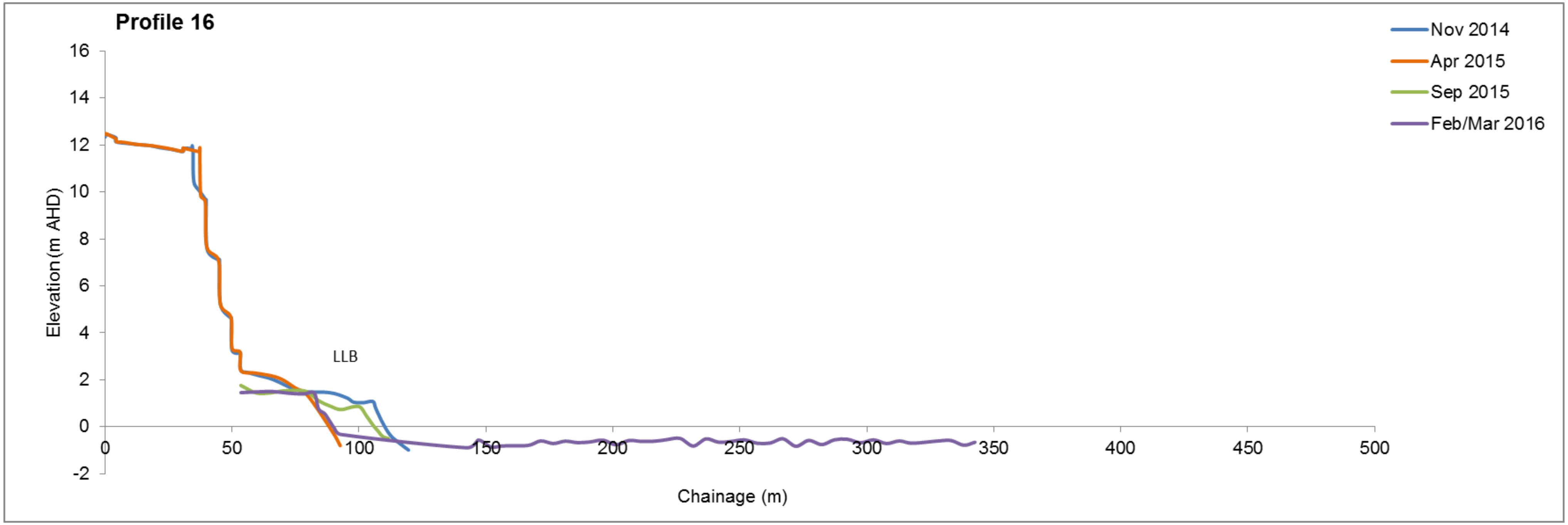

Profile 11
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

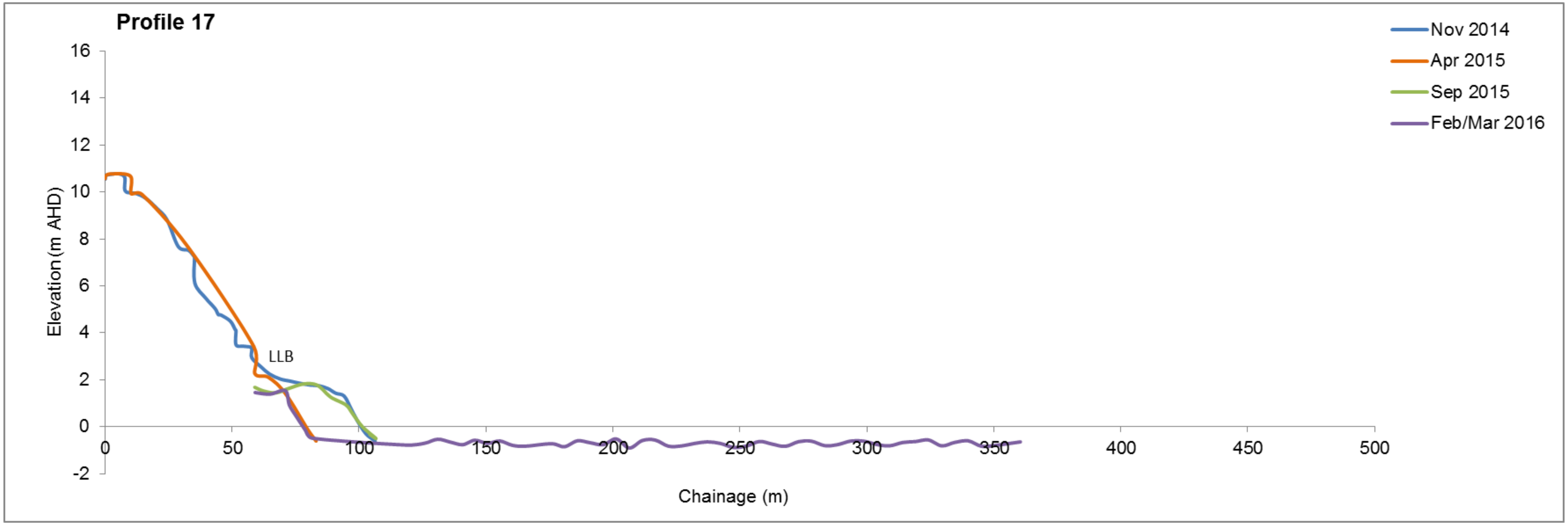

Profile 12
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

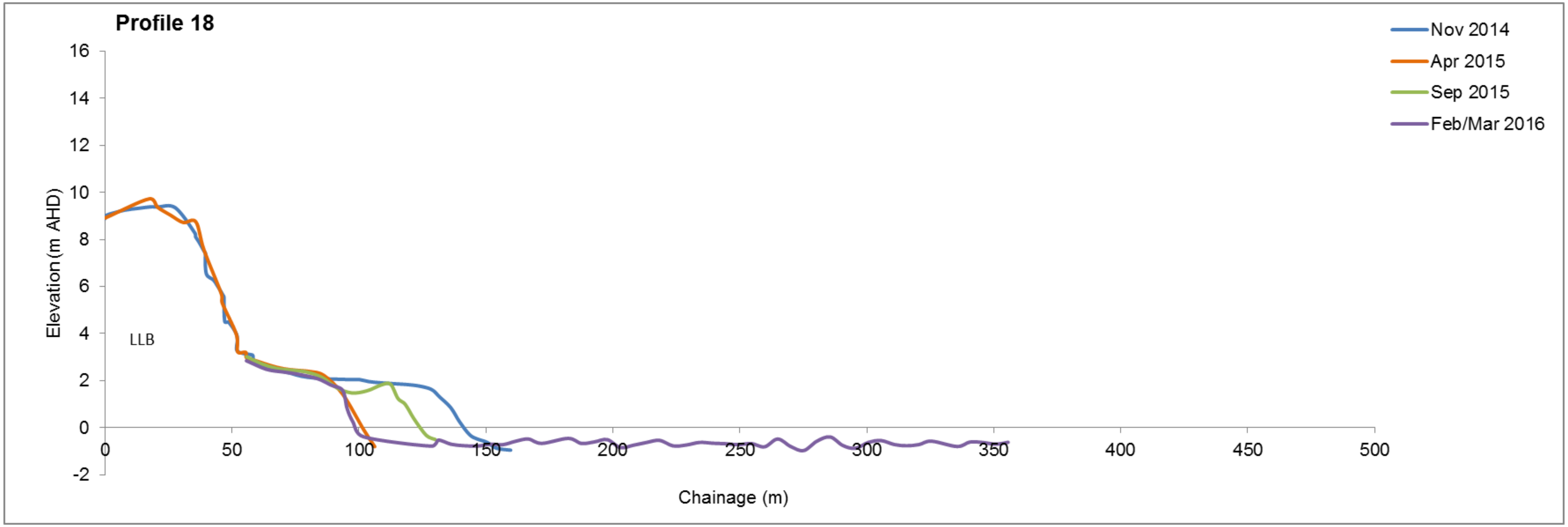

Profile 13
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

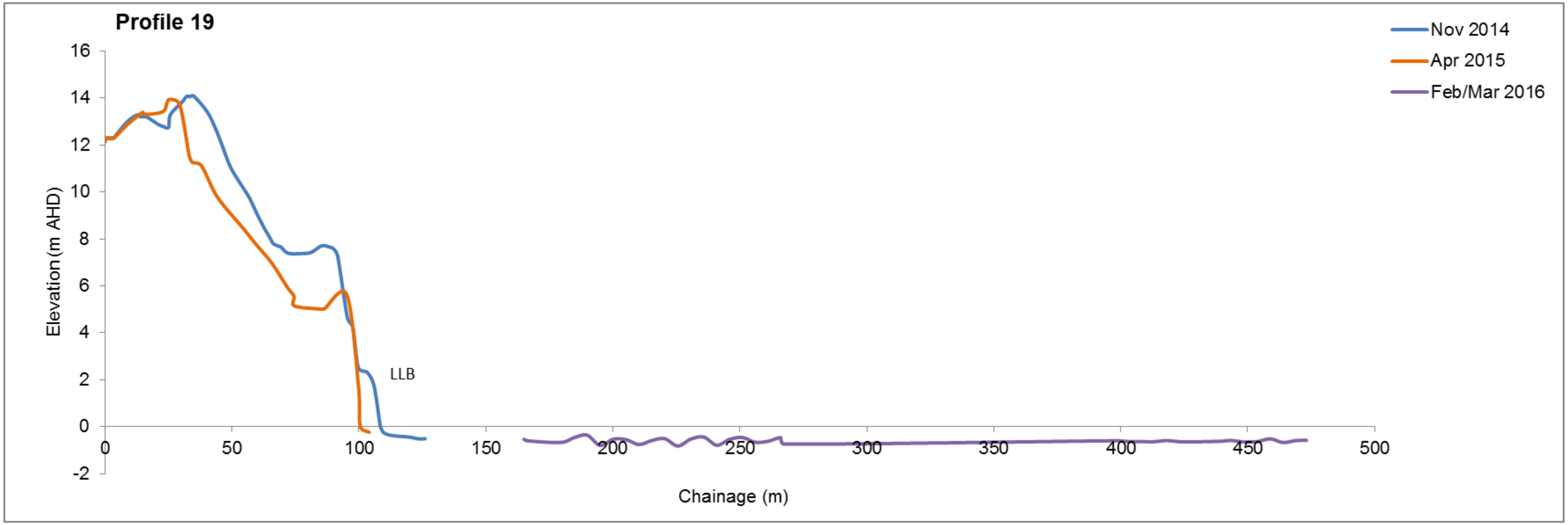

Profile 14
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

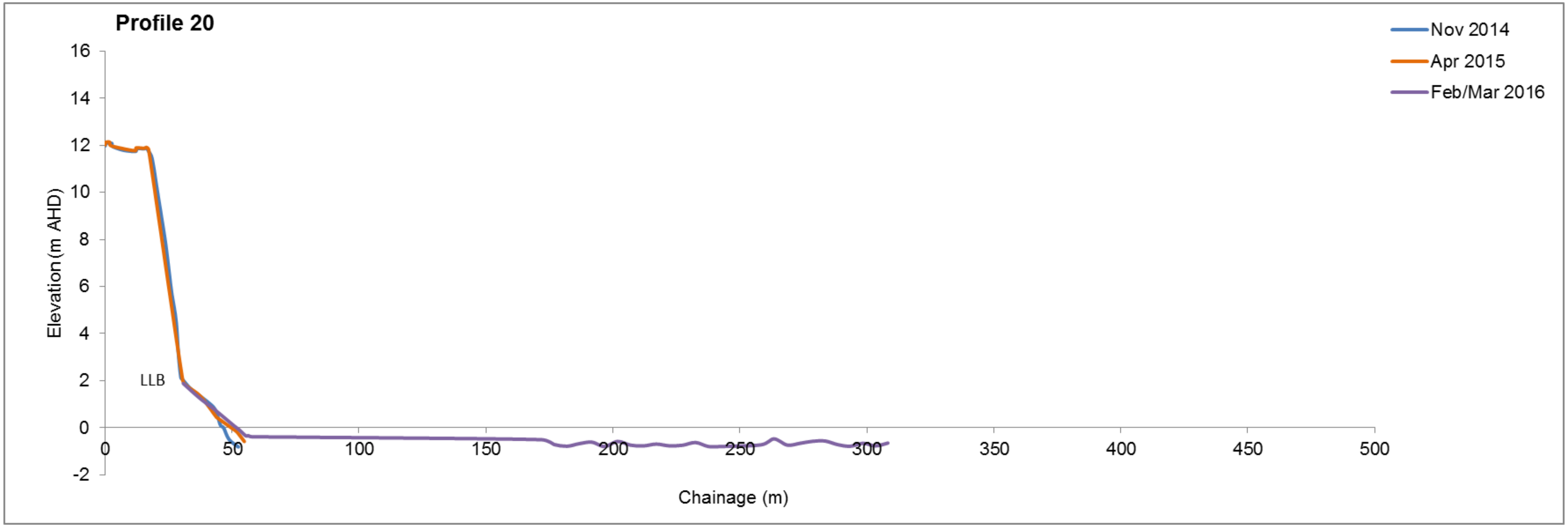

Profile 15
Elevation (m AHD)
Chainage (m)
LLB
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016

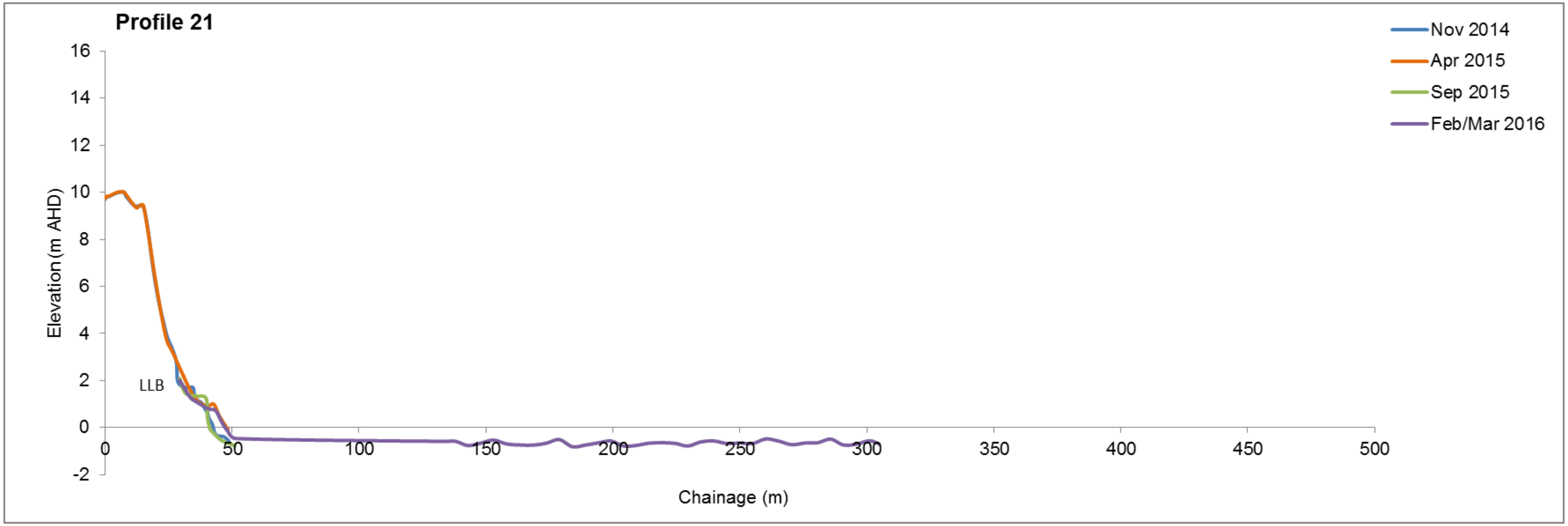

Profile 16
Elevation (m AHD)
Chainage (m)
LLB
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016


Profile 17
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

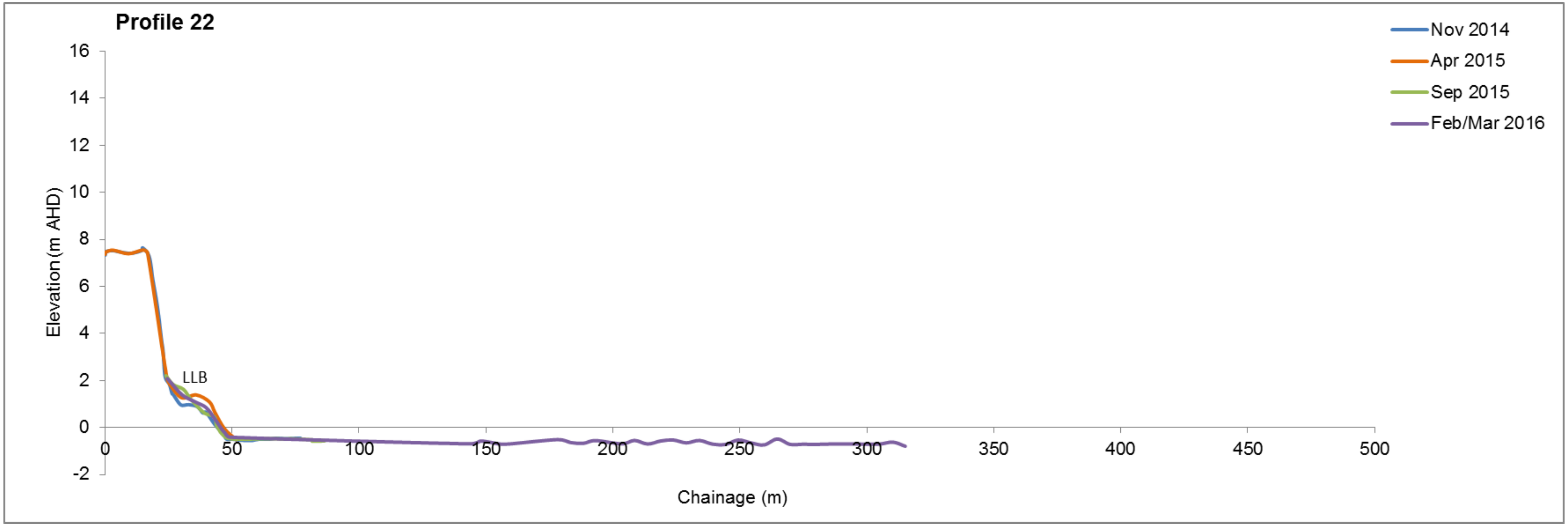

Profile 18
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)


Profile 19
Nov 2014
Apr 2015
Feb/Mar 2016
Elevation (m AHD)
Chainage (m)
LLB
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500

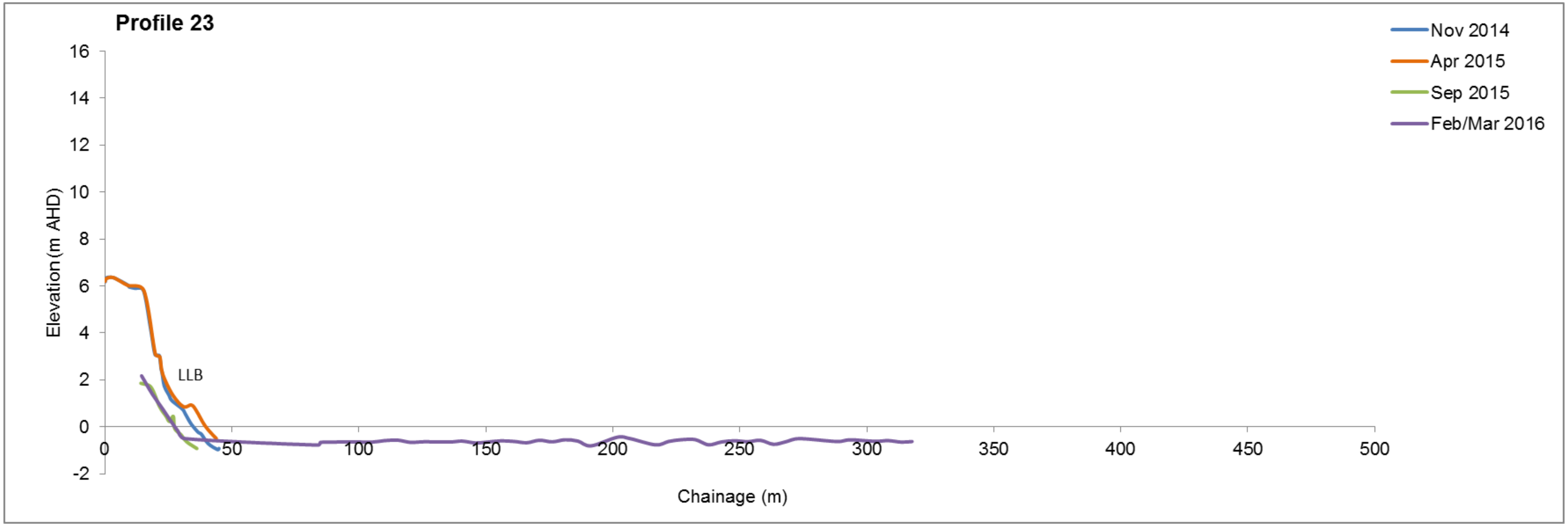

Profile 20
Nov 2014
Apr 2015
Feb/Mar 2016
Elevation (m AHD)
Chainage (m)
LLB
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500

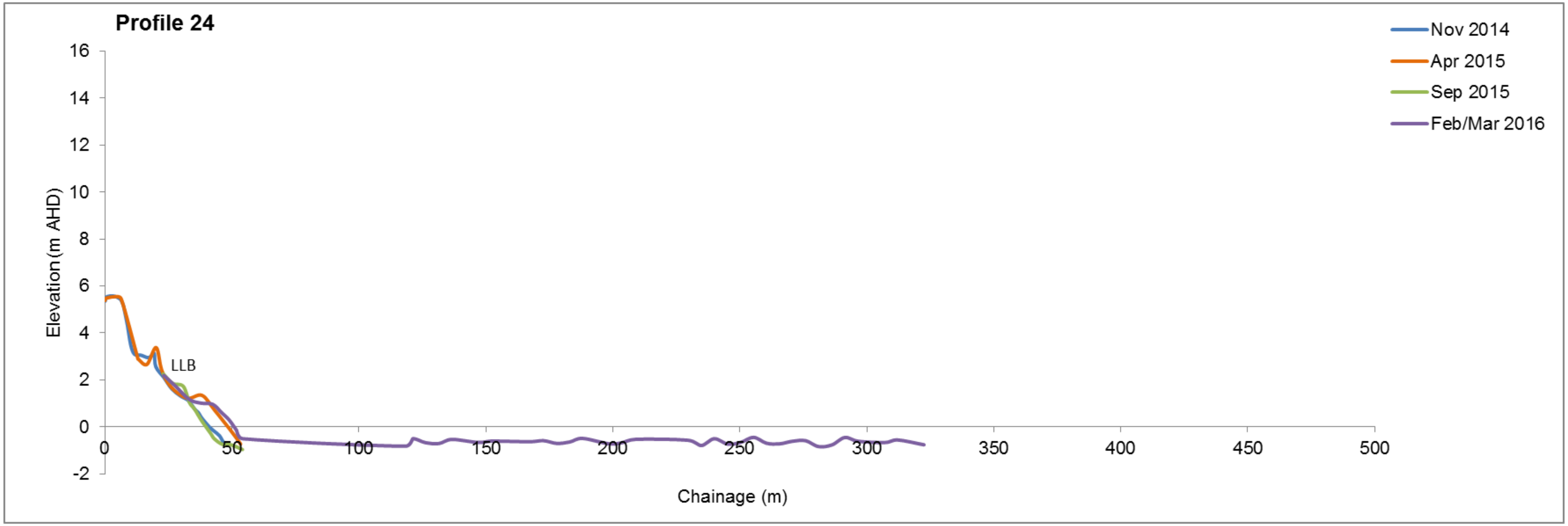


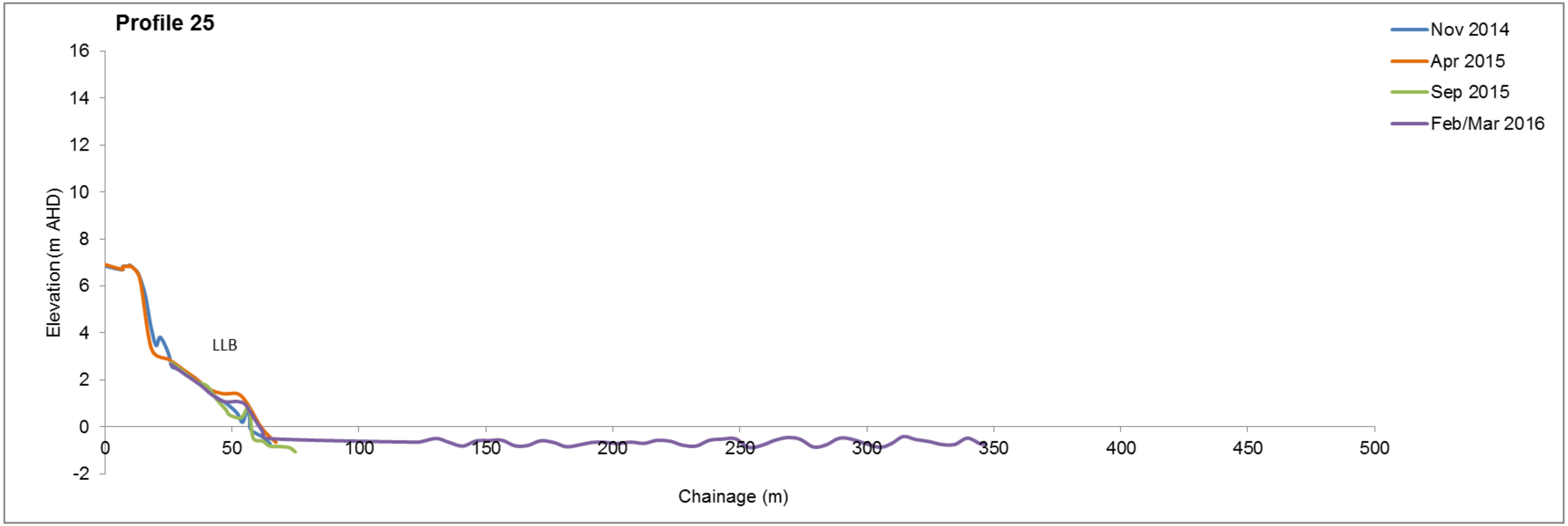
Profile 21
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

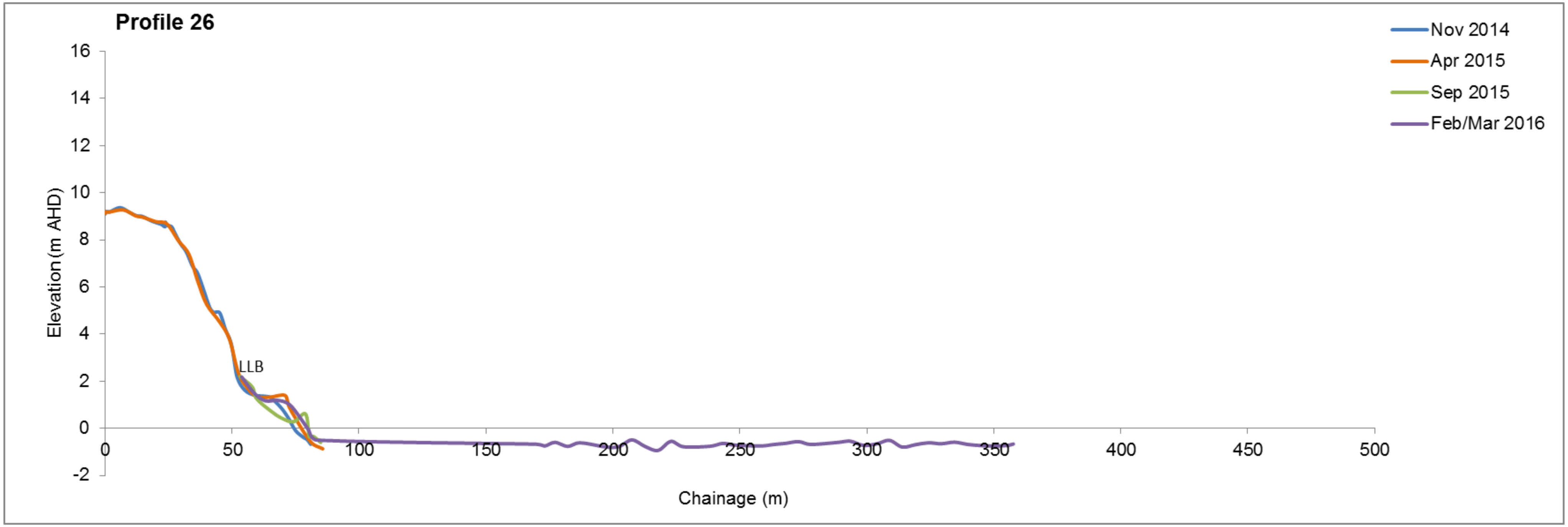


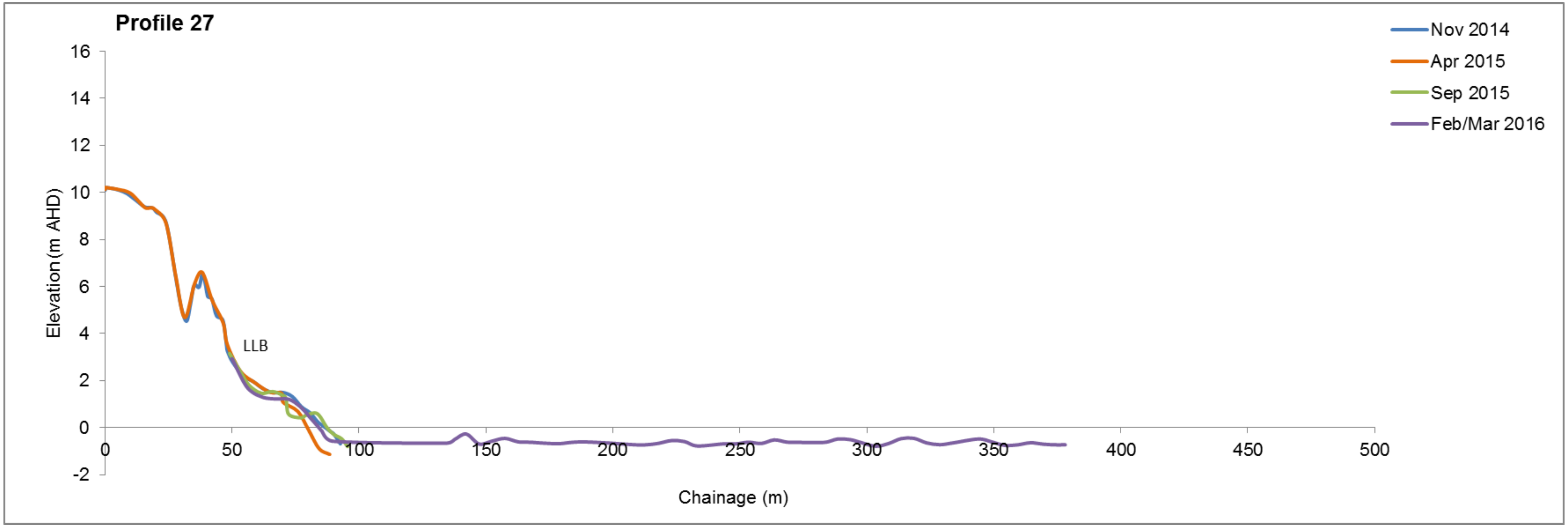
Profile 22
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

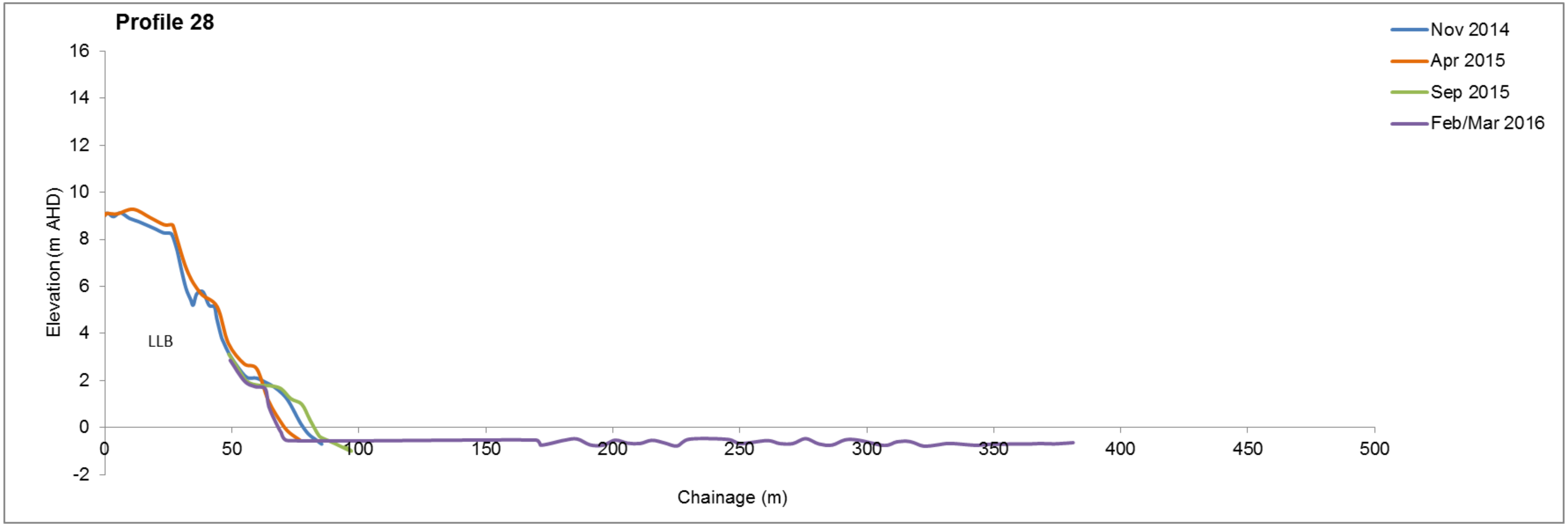

Profile 23
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

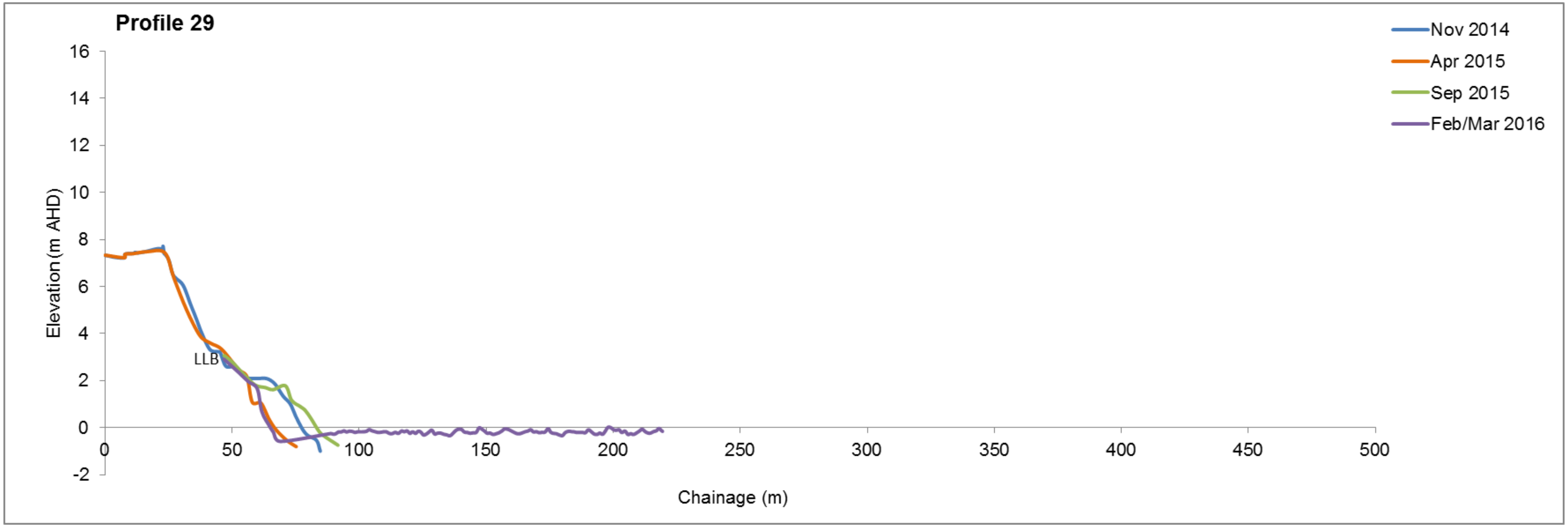

Profile 24
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

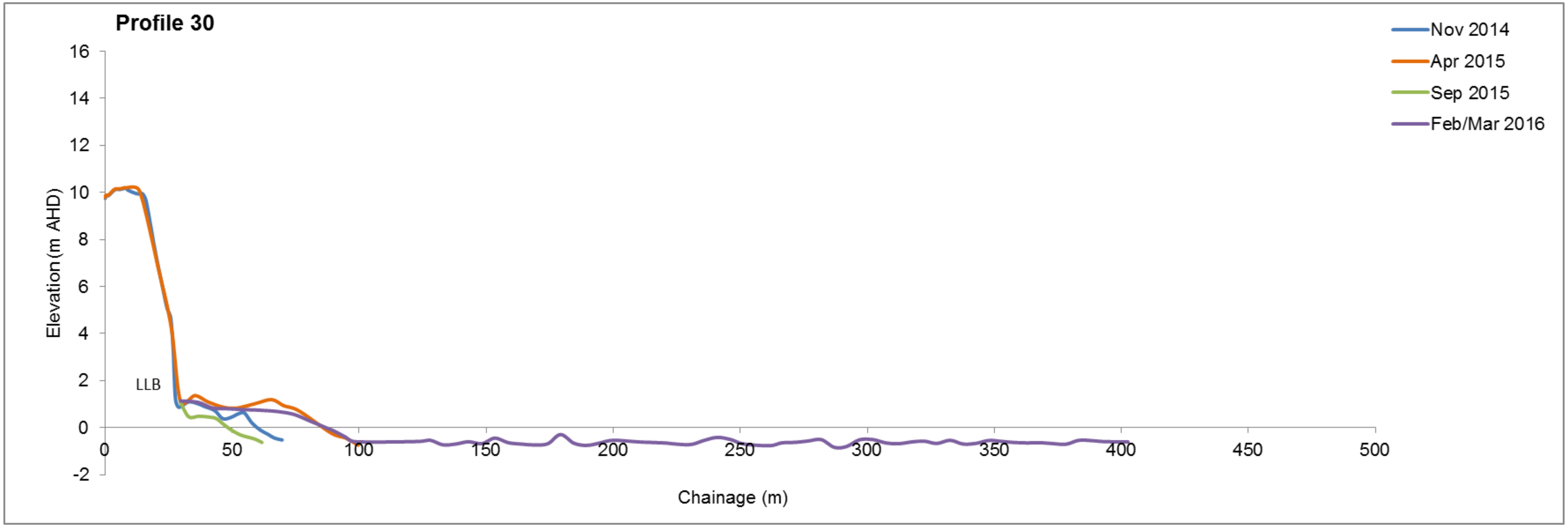

Profile 25
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

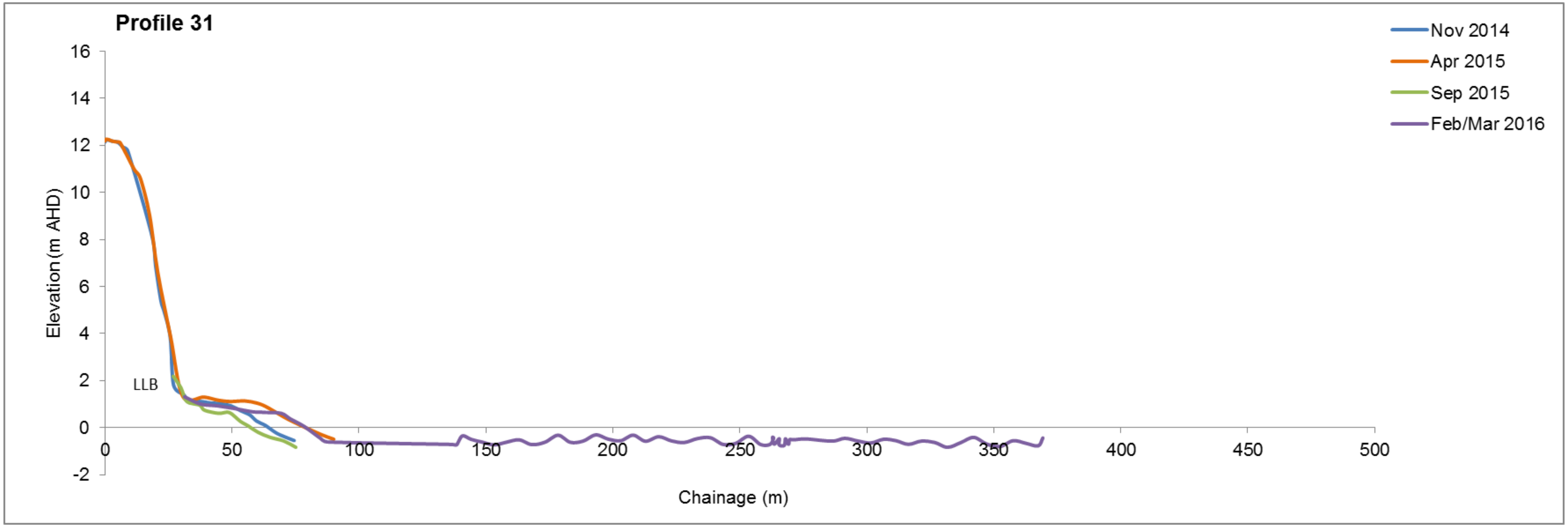

Profile 26
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

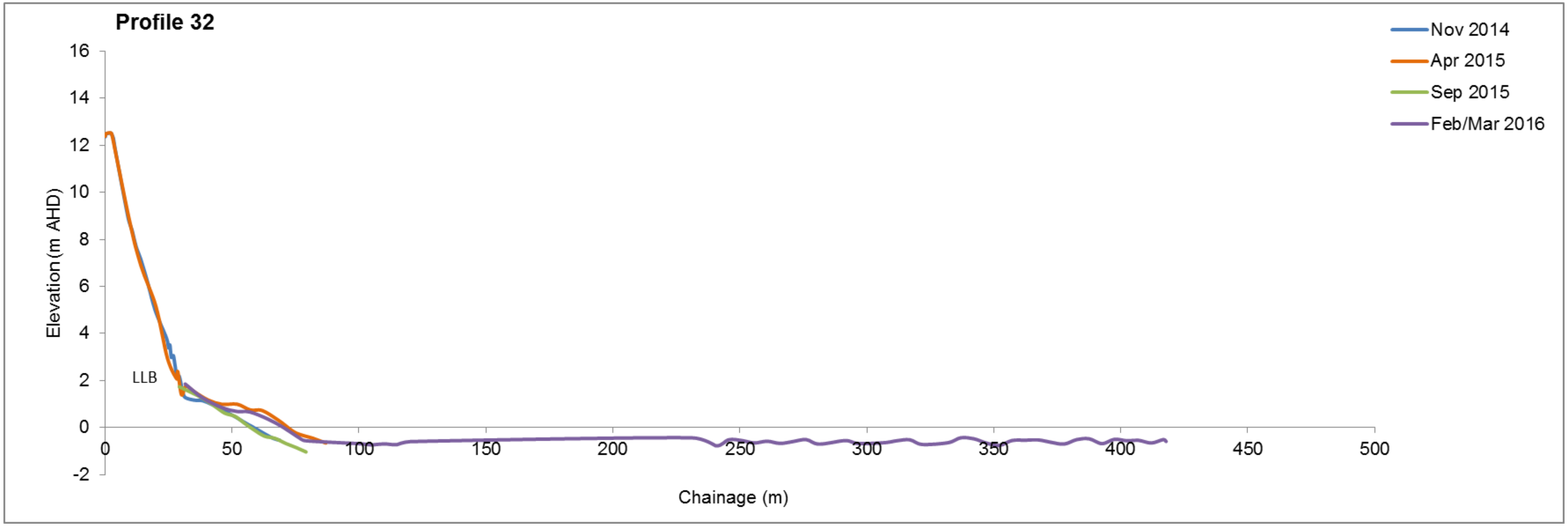

Profile 27
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016

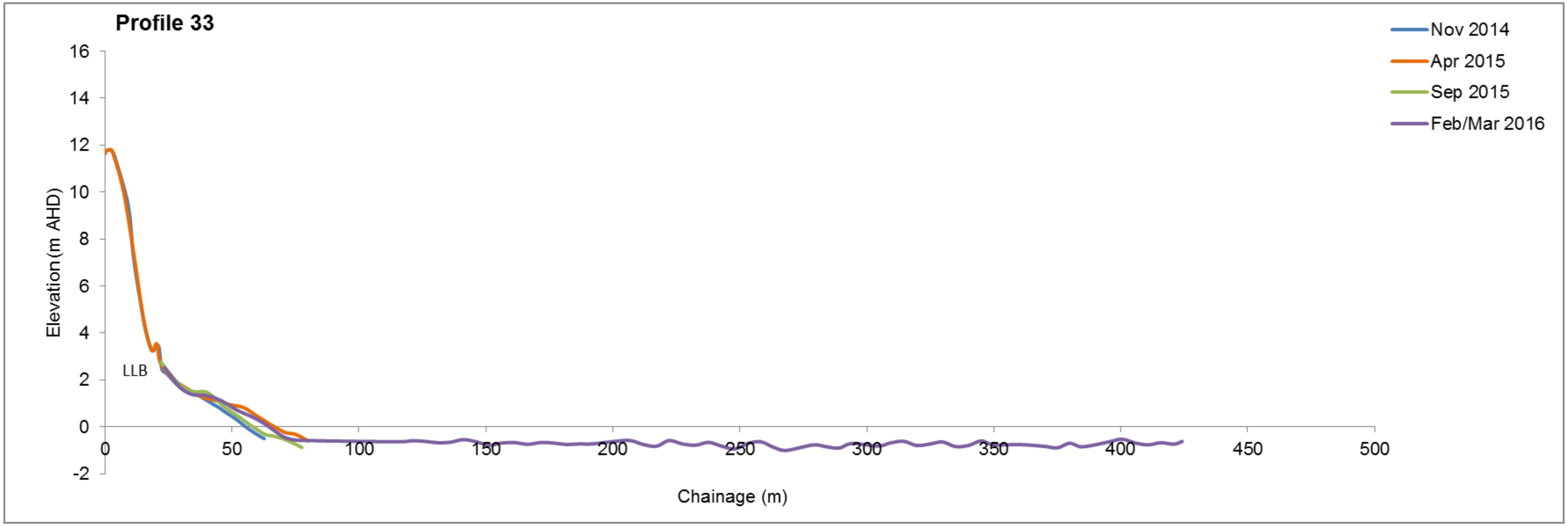

Profile 28
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016


Profile 29
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

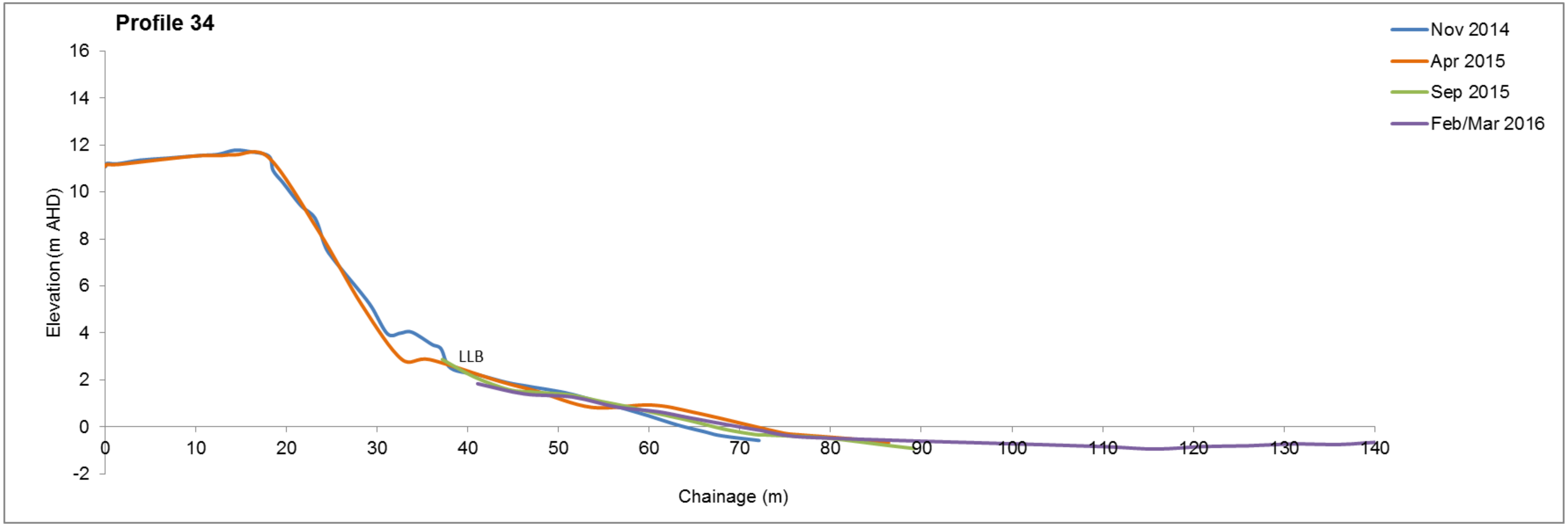

Profile 30
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)


Profile 31
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
LLB
Chainage (m)
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500

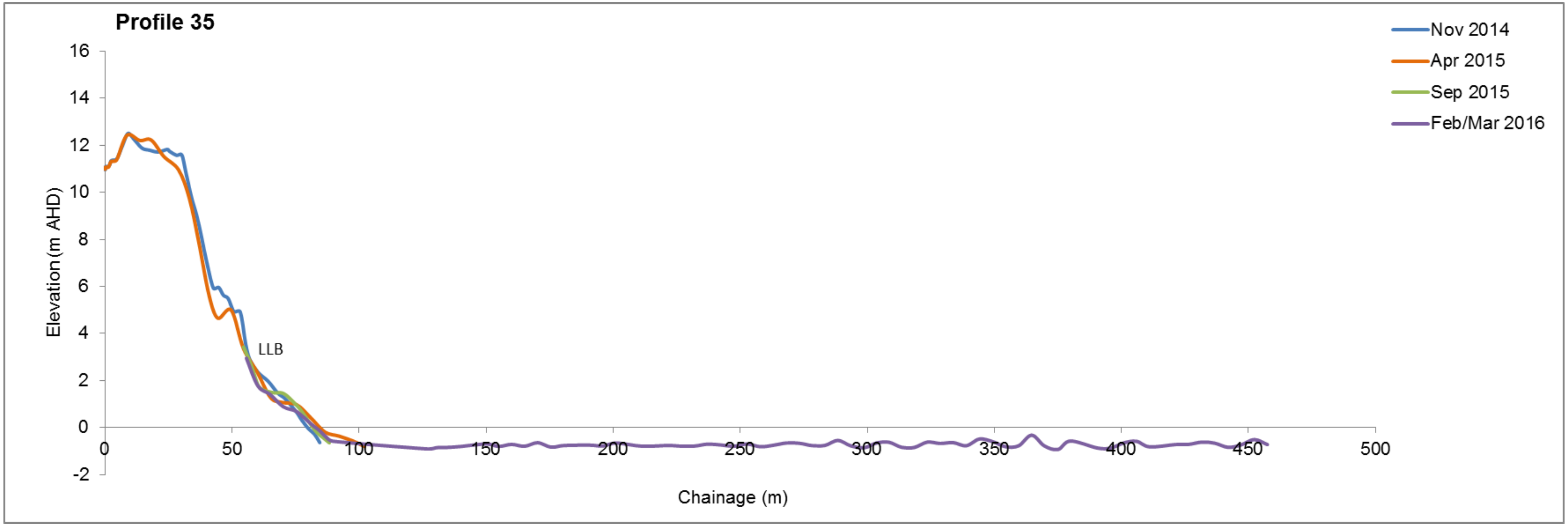

Profile 32
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
LLB
Chainage (m)
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500

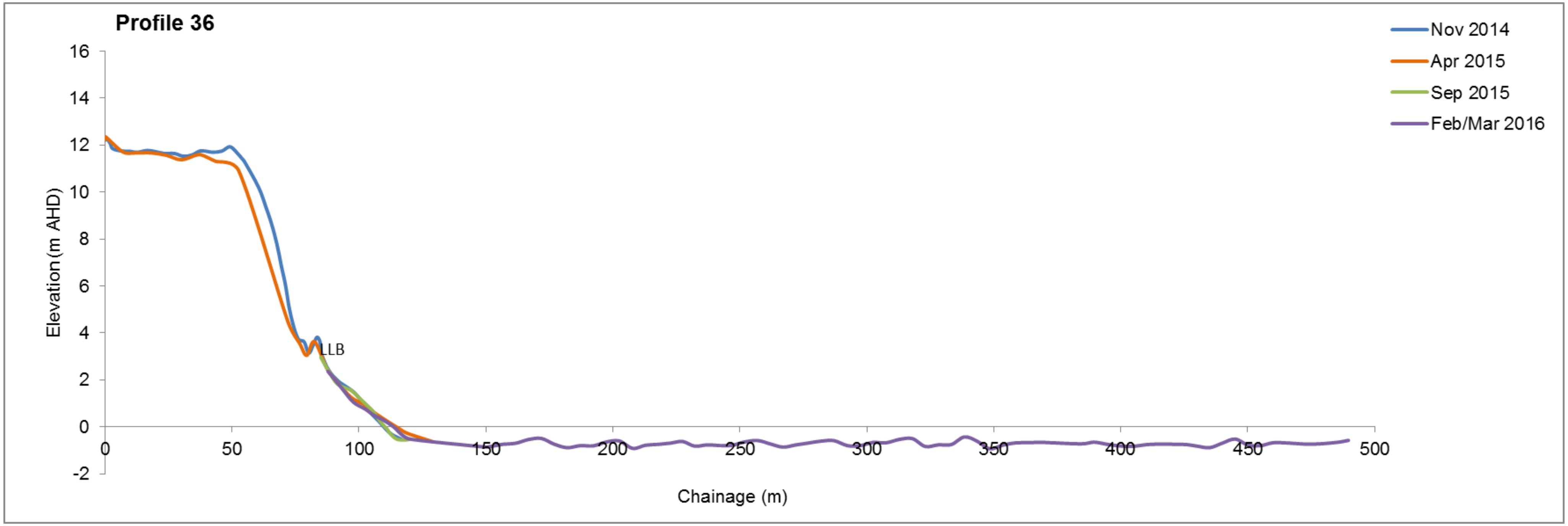


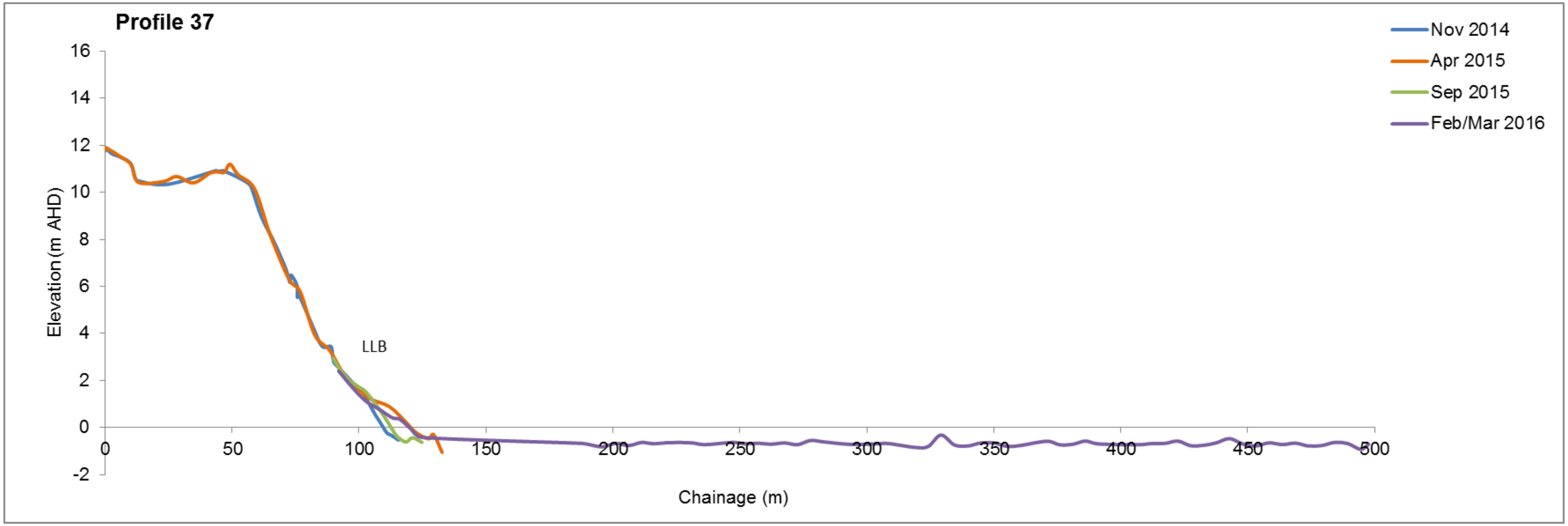
Profile 33
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
Chainage (m)
LLB
16
14
12
10
8
6
4
2
0
-2
0
50
100
150
200
250
300
350
400
450
500

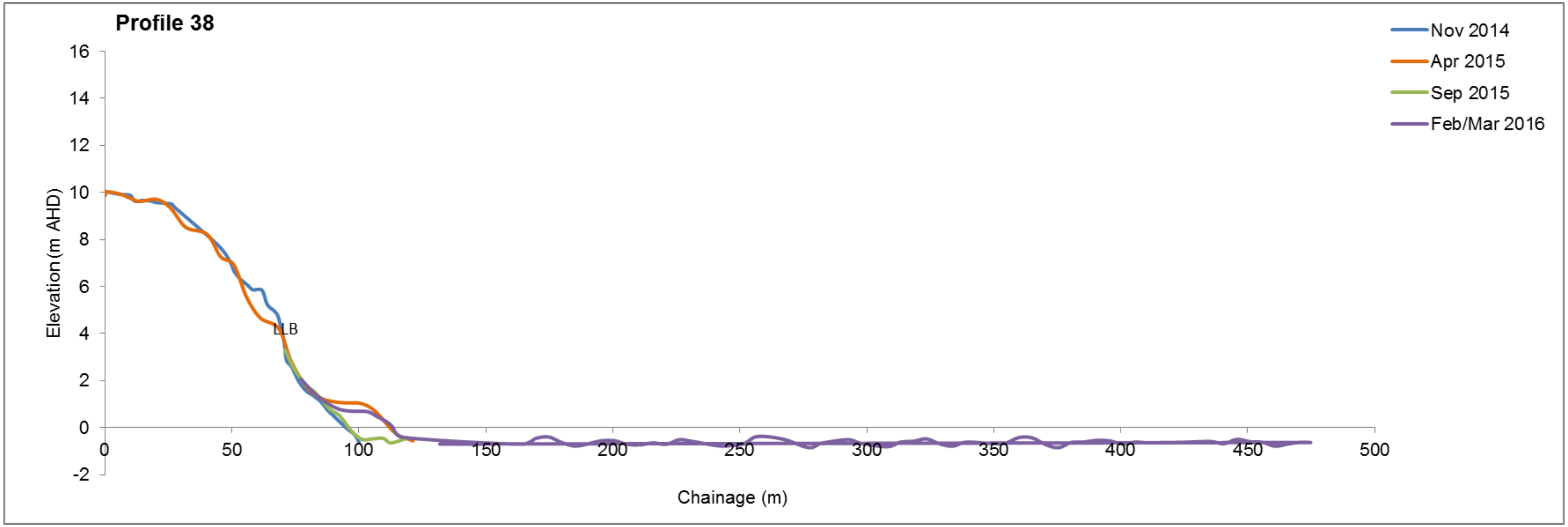


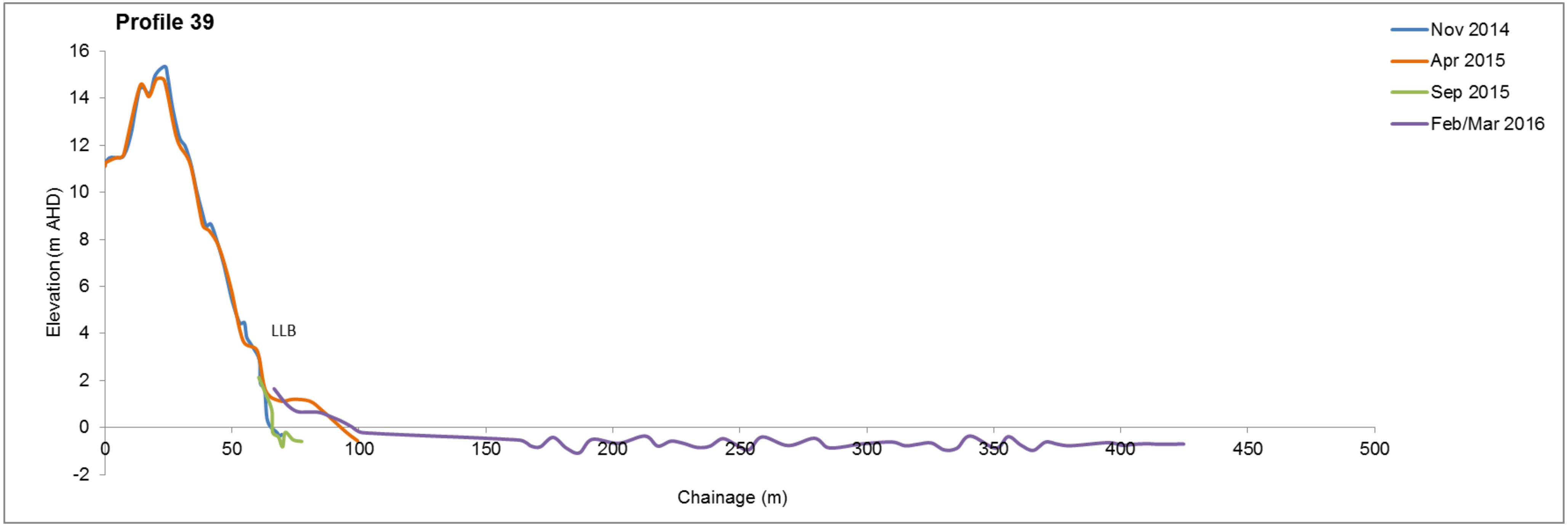
Profile 34
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
Chainage (m)
LLB
16
14
12
10
8
6
4
2
0
-2
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140


Profile 35
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)


Profile 36
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

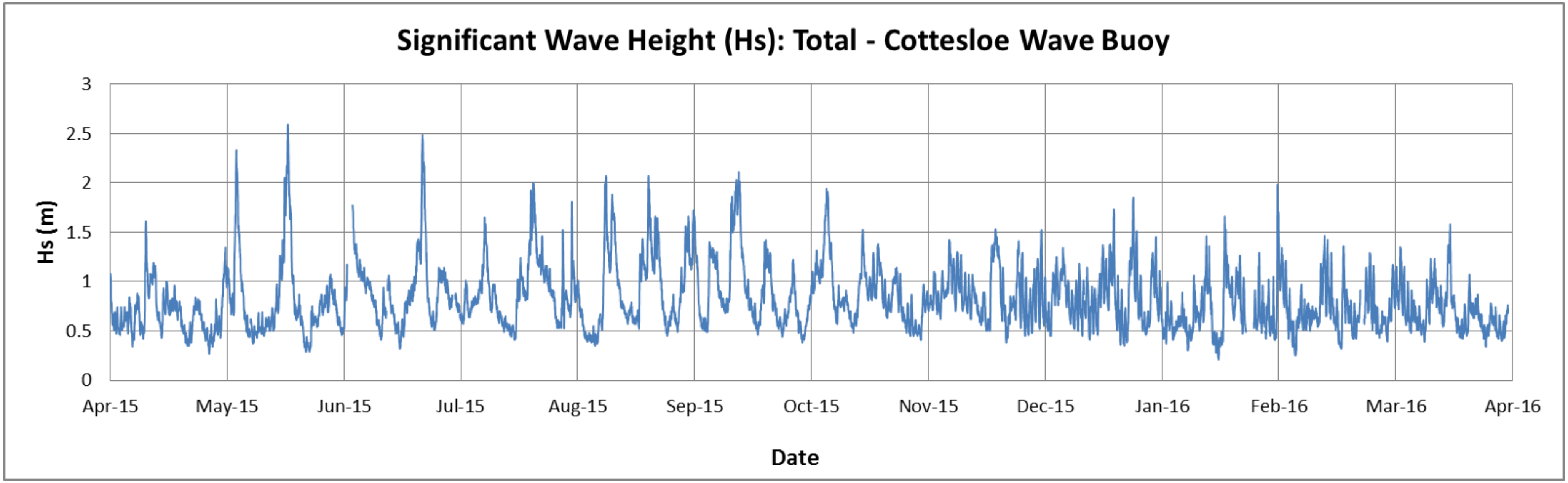

Profile 37
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

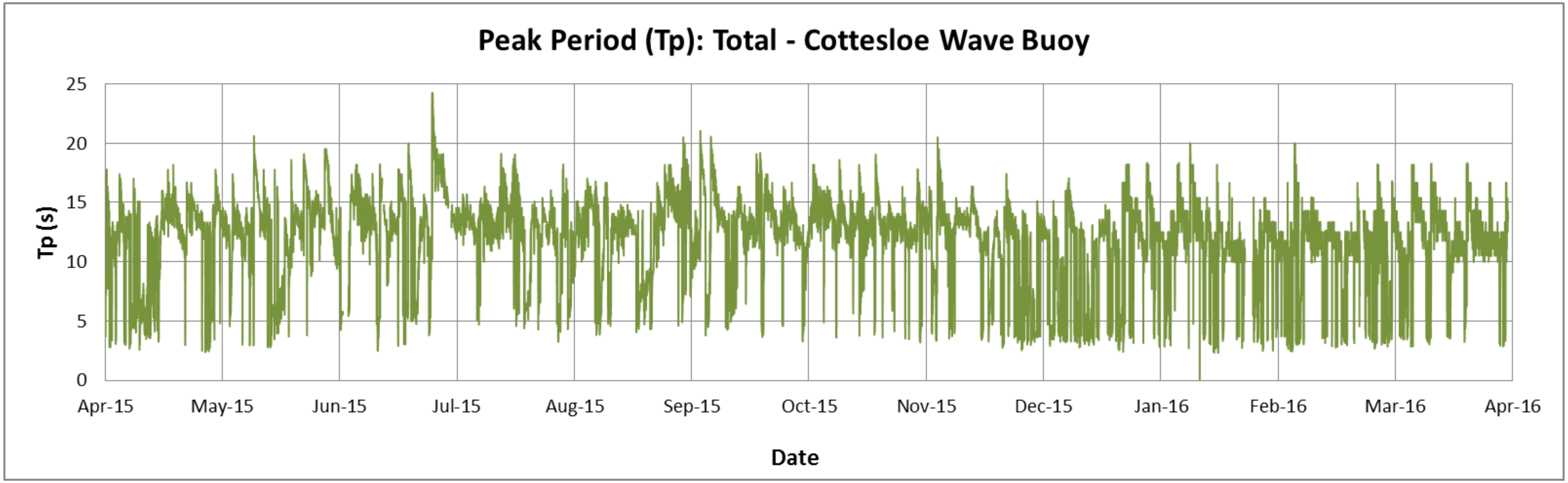

Profile 38
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

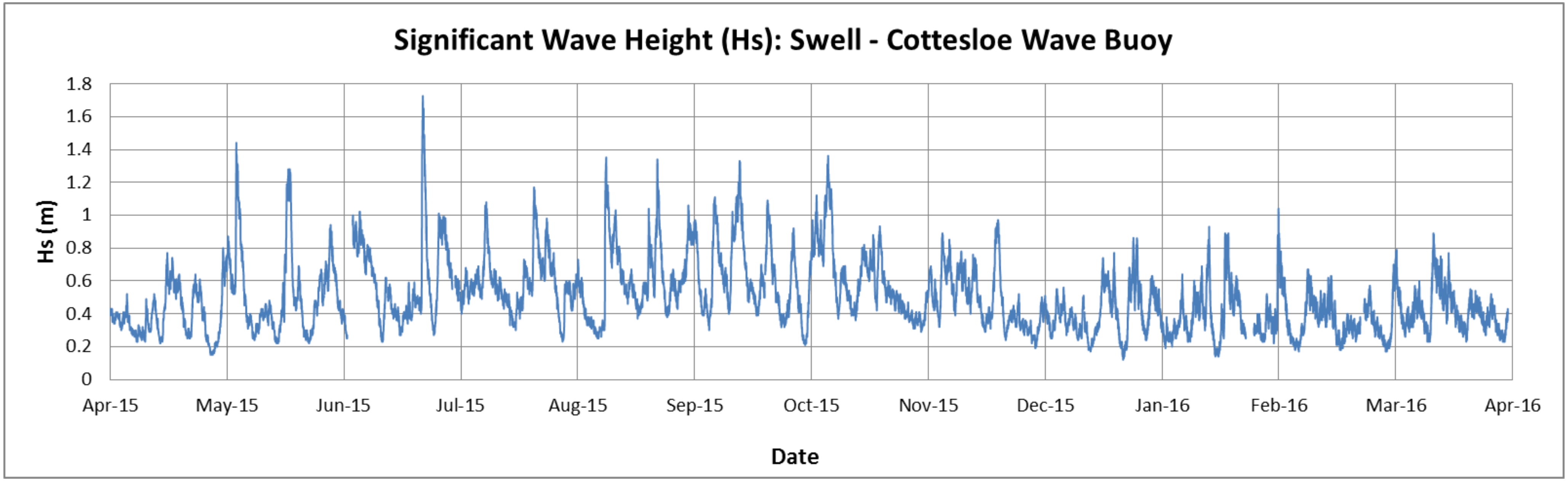

Profile 39
Nov 2014
Apr 2015
Sep 2015
Feb/Mar 2016
Elevation (m AHD)
16
14
12
10
8
6
4
2
0
-2
LLB
0
50
100
150
200
250
300
350
400
450
500
Chainage (m)

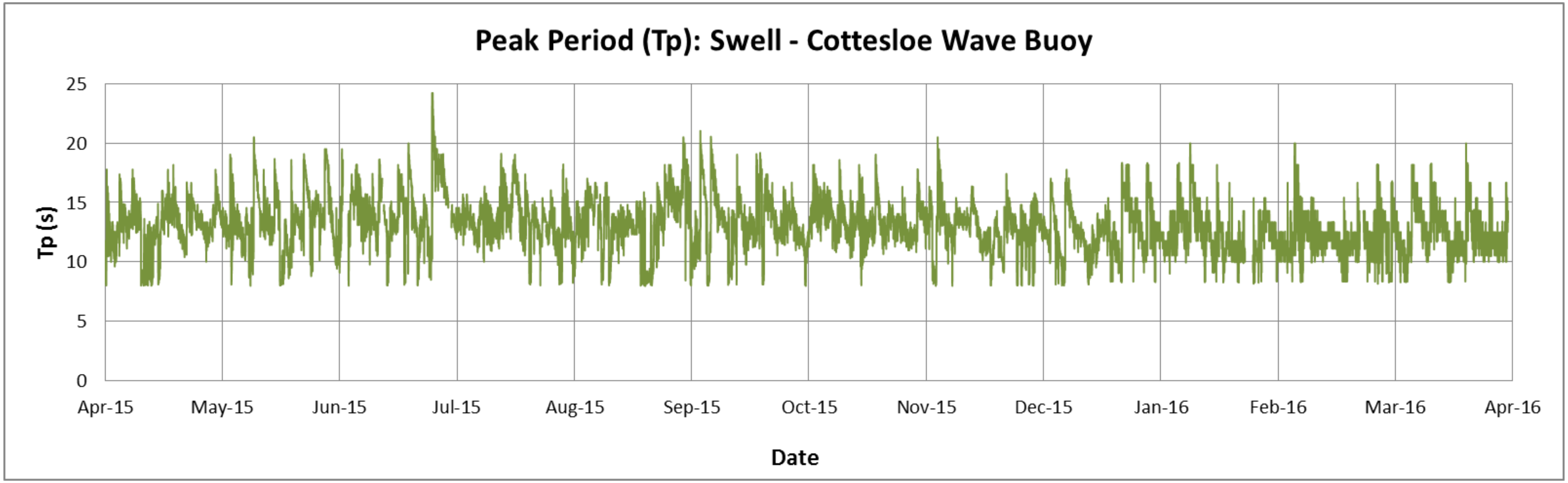
Appendix B

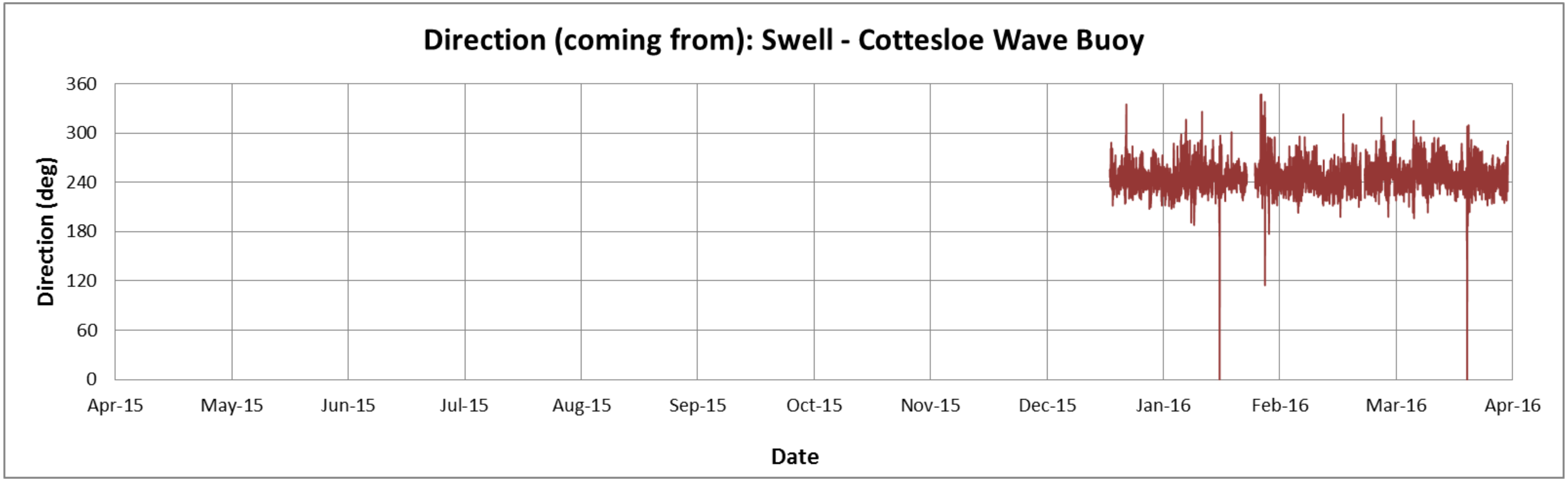
Wave Buoy Data at Rottnest and Cottesloe Wave Buoys: April 2015 to March 2016


Significant Wave Height (Hs): Total - Cottesloe Wave Buoy
Hs (m)
3
2.5
2
1.5
1
0.5
0
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

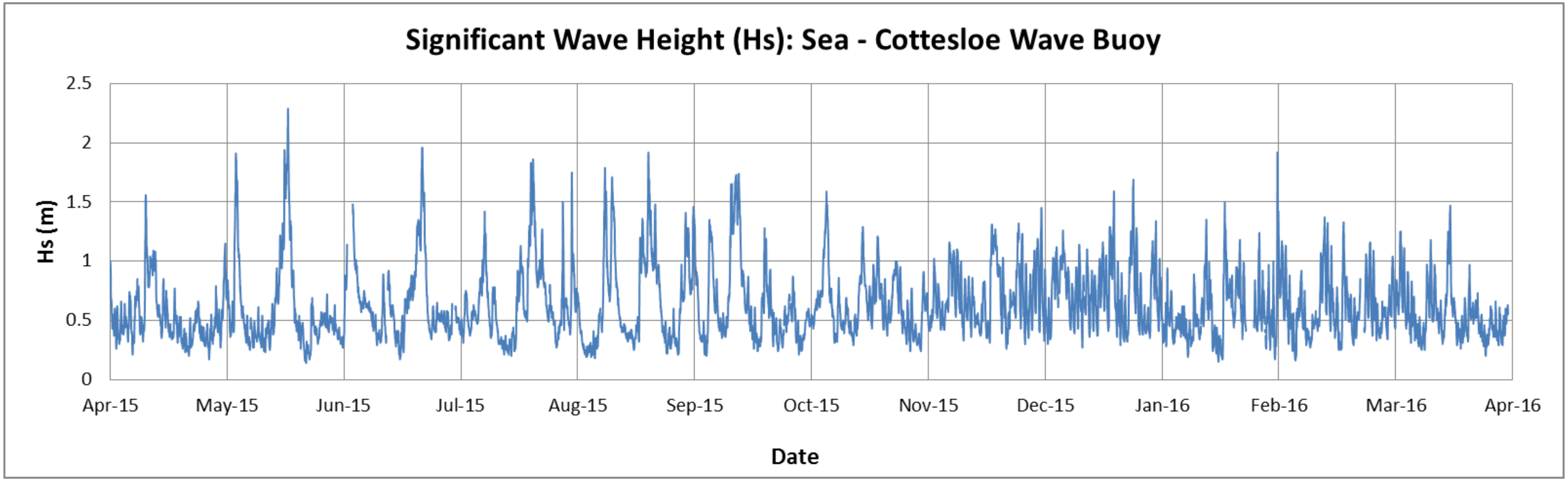

Peak Period (Tp): Total - Cottesloe Wave Buoy
Tp (s)
25
20
15
10
5
0
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date


Significant Wave Height (Hs): Swell - Cottesloe Wave Buoy
Hs (m)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

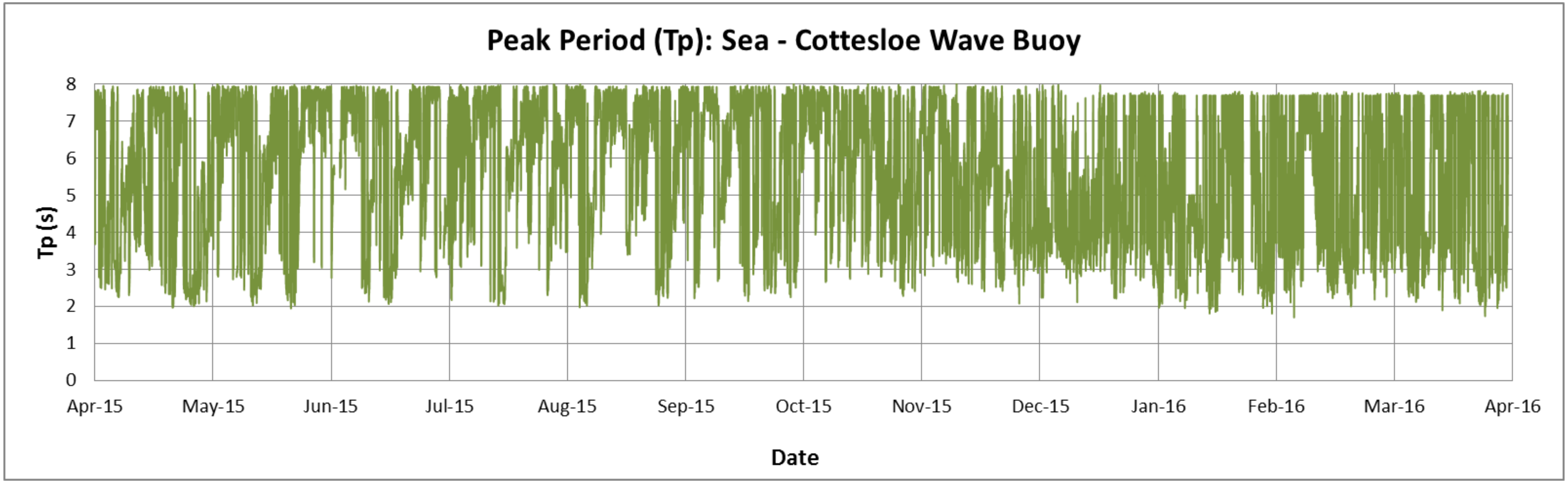

Peak Period (Tp): Swell - Cottesloe Wave Buoy
Tp (s)
25
20
15
10
5
0
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

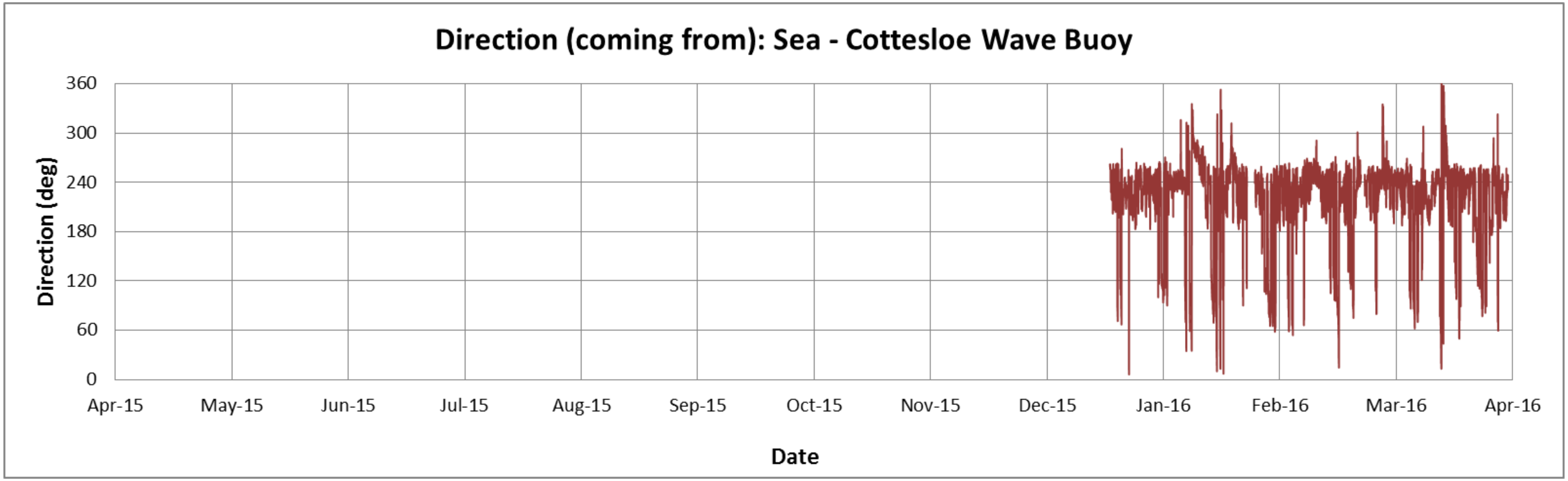


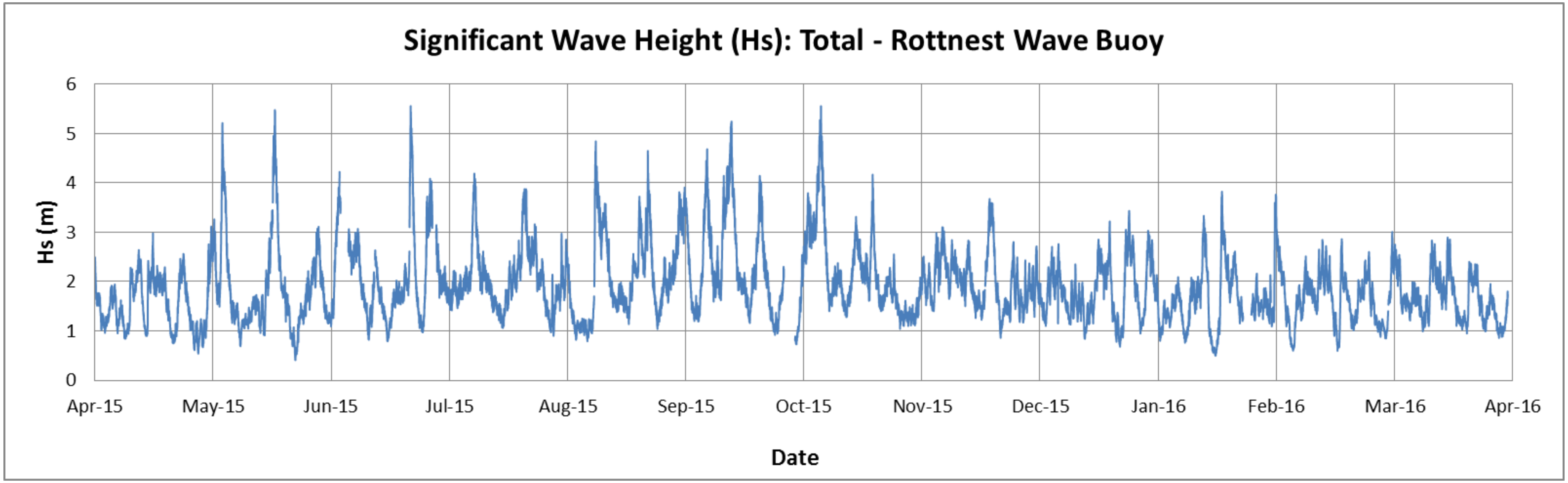
Direction (coming from): Swell - Cottesloe Wave Buoy
Direction (deg)
360
300
240
180
120
60
0
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

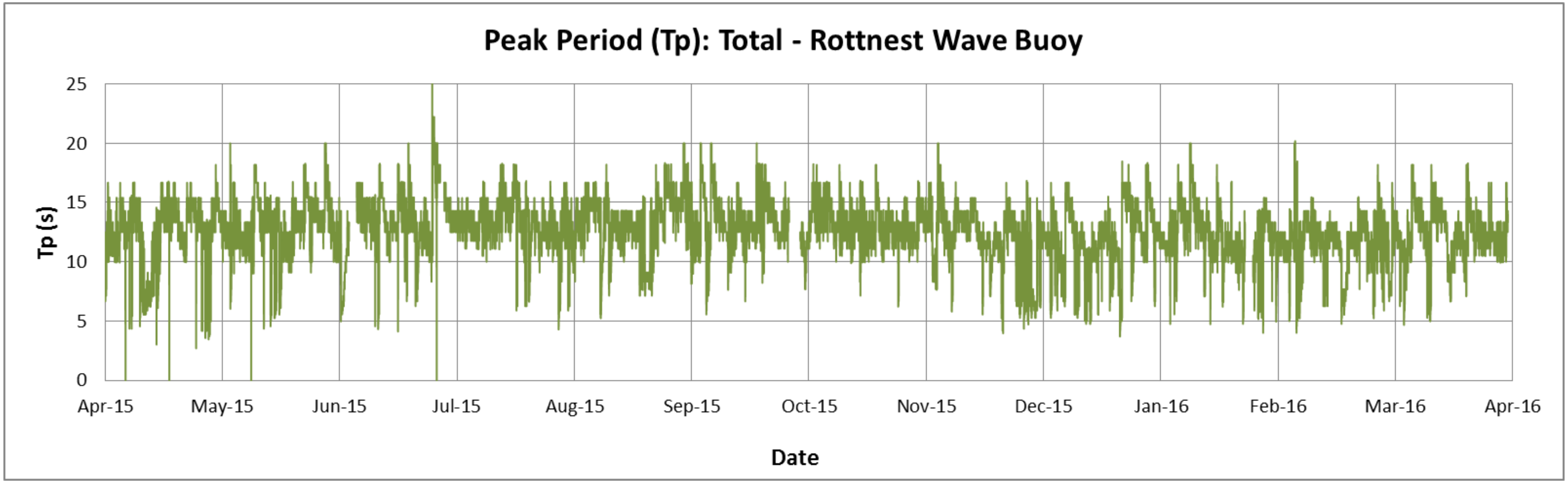


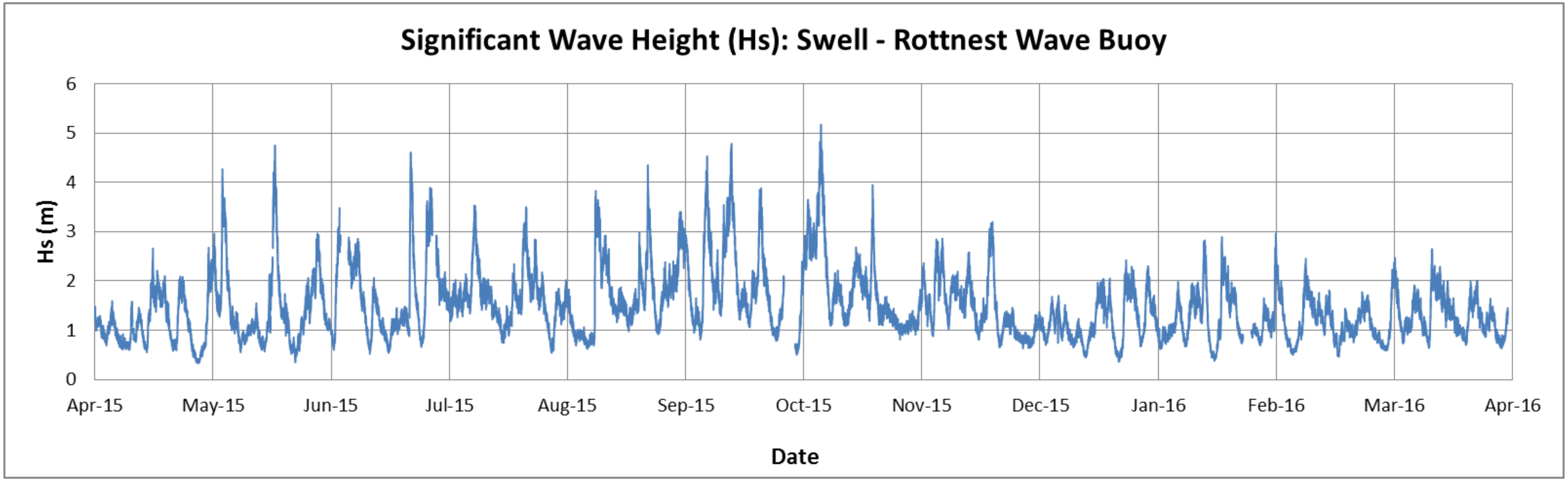
Significant Wave Height (Hs): Sea - Cottesloe Wave Buoy
Hs (m)
2.5
2
1.5
1
0.5
0
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

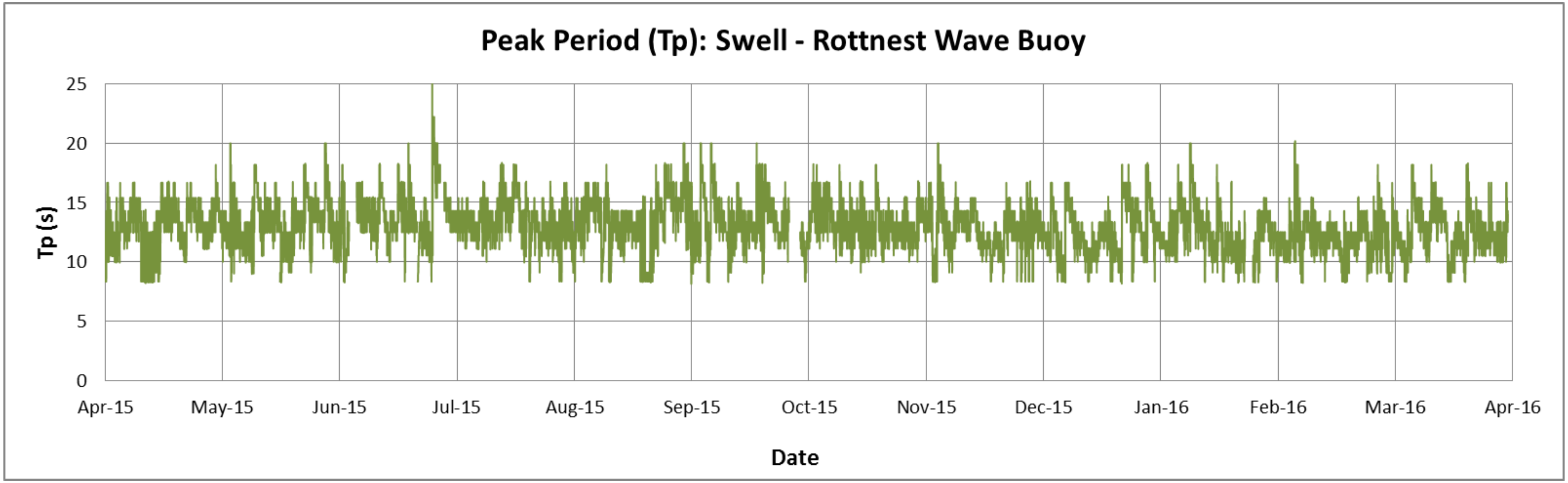

Peak Period (Tp): Sea - Cottesloe Wave Buoy
Tp (s)
0
1
2
3
4
5
6
7
8
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

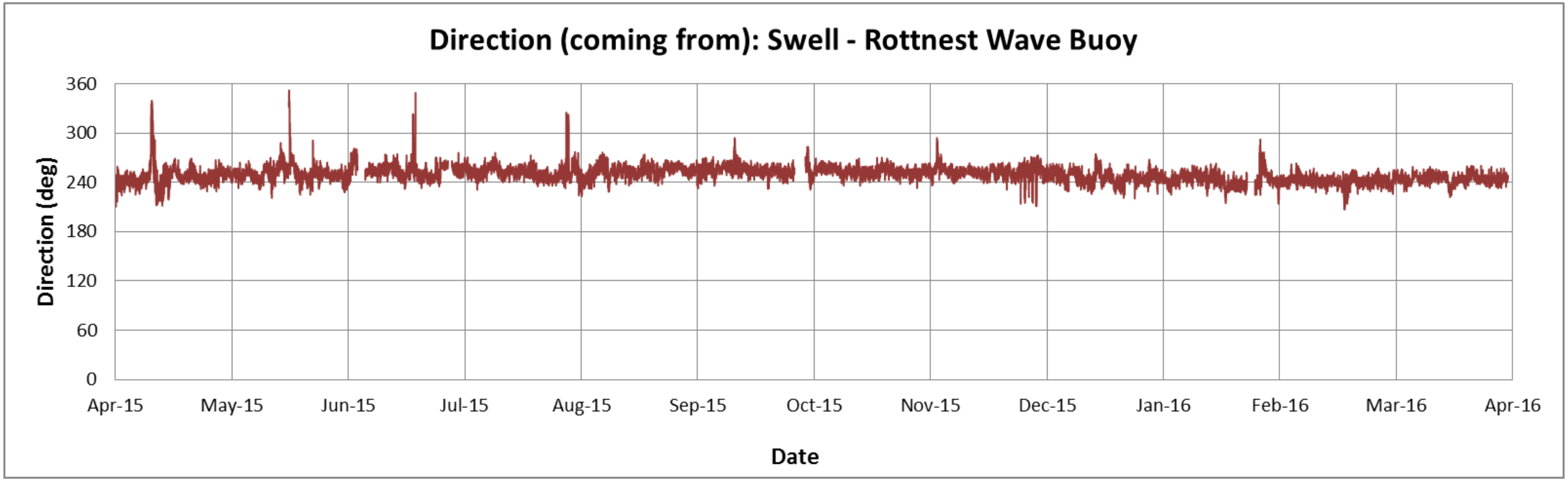

Direction (coming from): Sea - Cottesloe Wave Buoy
Direction (deg)
0
60
120
180
240
300
360
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date


Significant Wave Height (Hs): Total - Rottnest Wave Buoy
Hs (m)
0
1
2
3
4
5
6
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

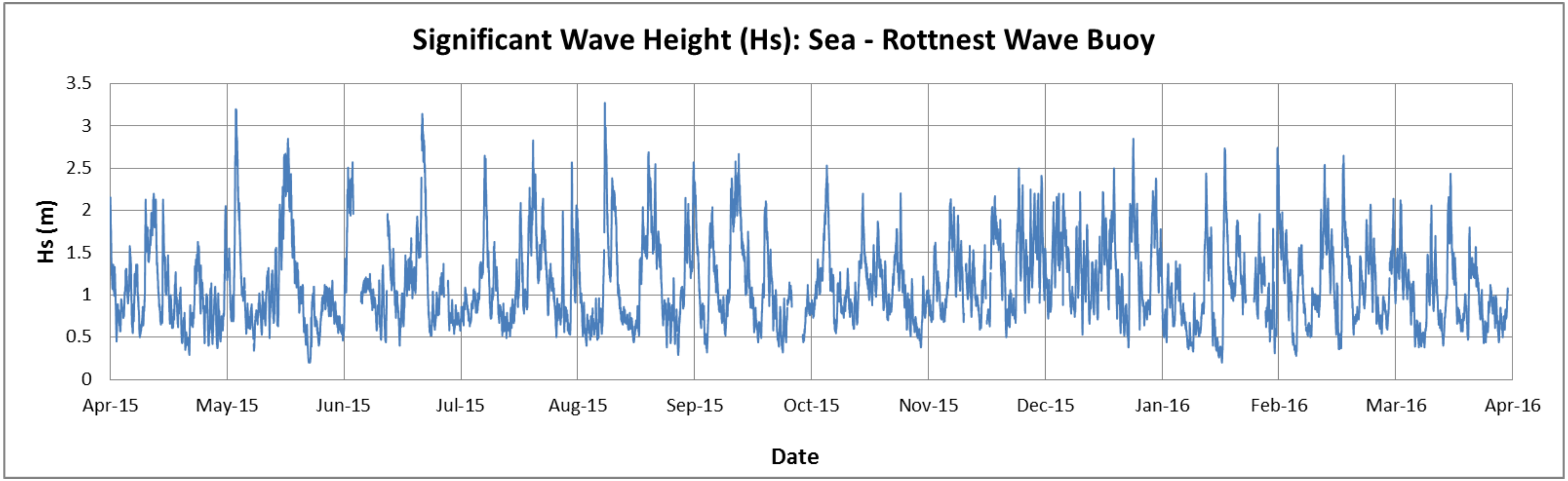

Peak Period (Tp): Total - Rottnest Wave Buoy
Tp (s)
0
5
10
15
20
25
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date


Significant Wave Height (Hs): Swell - Rottnest Wave Buoy
Hs (m)
0
1
2
3
4
5
6
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

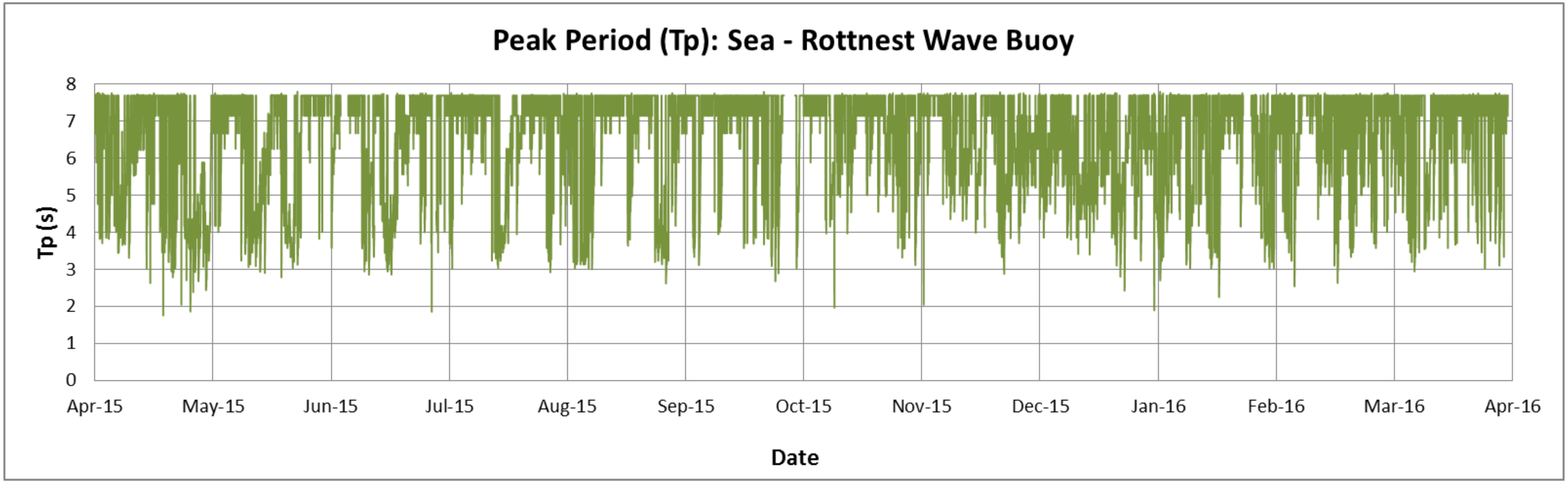

Peak Period (Tp): Swell - Rottnest Wave Buoy
Tp (s)
0
5
10
15
20
25
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

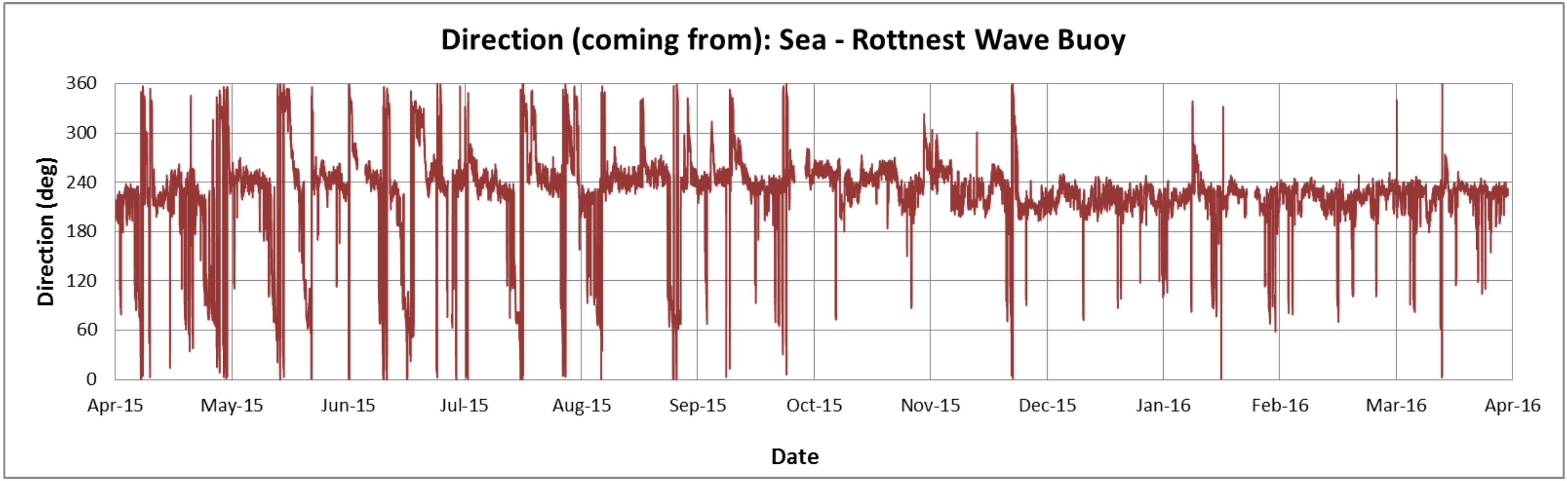


Direction (coming from): Swell - Rottnest Wave Buoy
Direction (deg)
360
300
240
180
120
60
0
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date



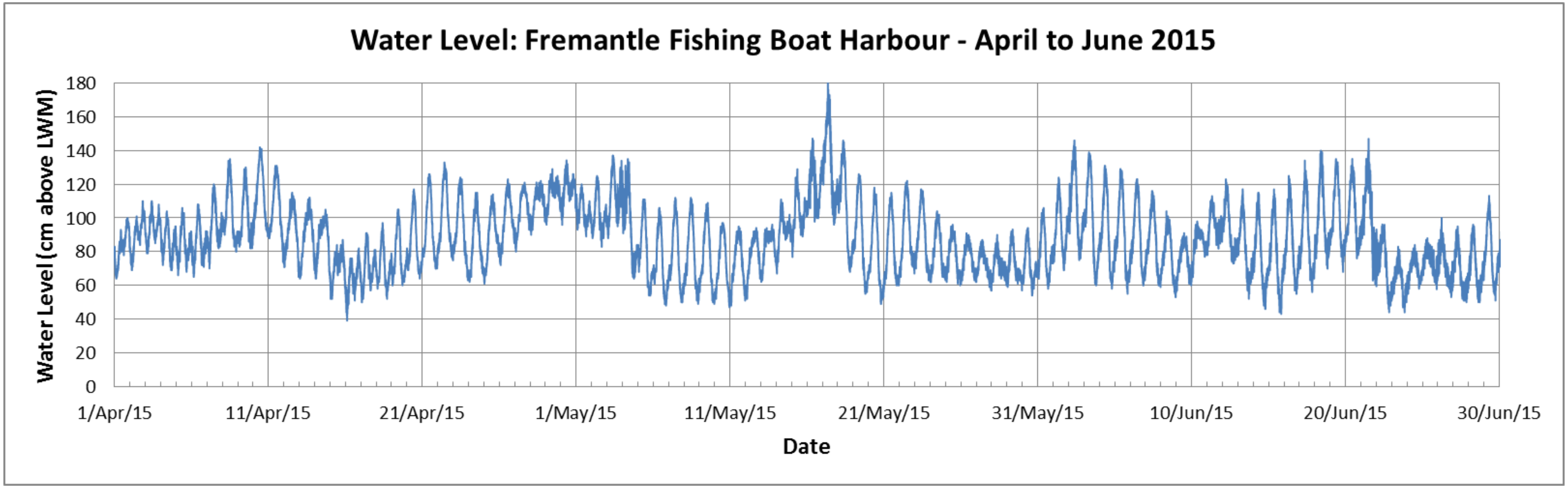
Significant Wave Height (Hs): Sea - Rottnest Wave Buoy
Hs (m)
3.5
3
2.5
2
1.5
1
0.5
0
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date


Peak Period (Tp): Sea - Rottnest Wave Buoy
Tp (s)
0
1
2
3
4
5
6
7
8
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

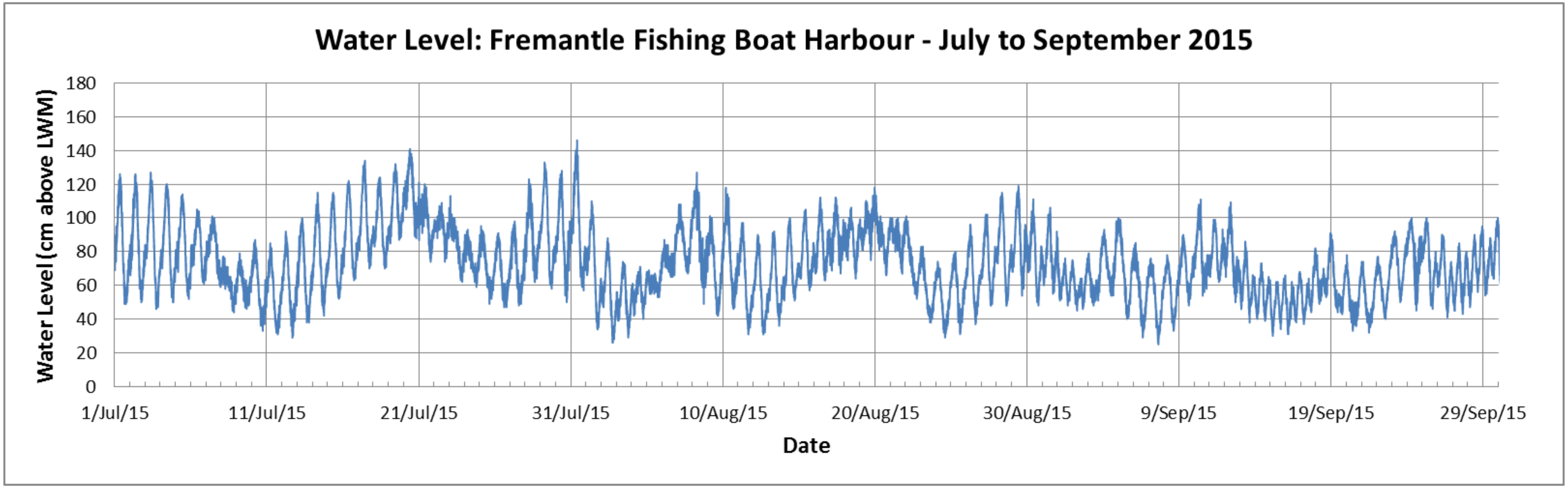

Direction (coming from): Sea - Rottnest Wave Buoy
Direction (deg)
0
60
120
180
240
300
360
Apr-15
May-15
Jun-15
Jul-15
Aug-15
Sep-15
Oct-15
Nov-15
Dec-15
Jan-16
Feb-16
Mar-16
Apr-16
Date

Appendix C

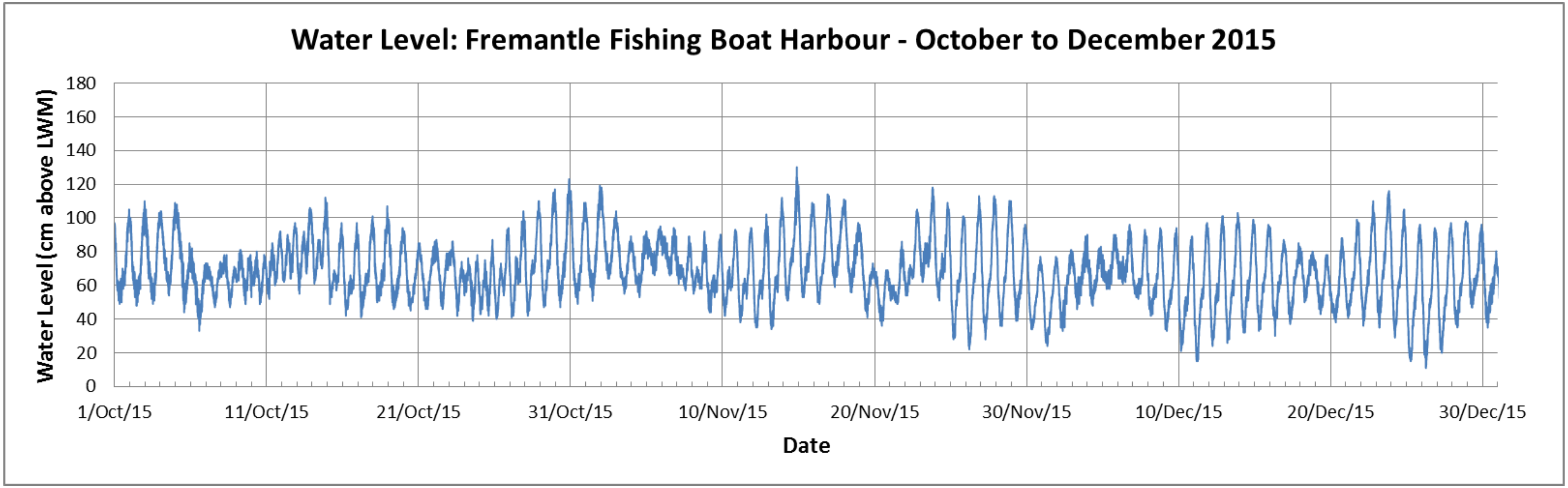
Water Level Data at Fremantle: April 2015 to March 2016

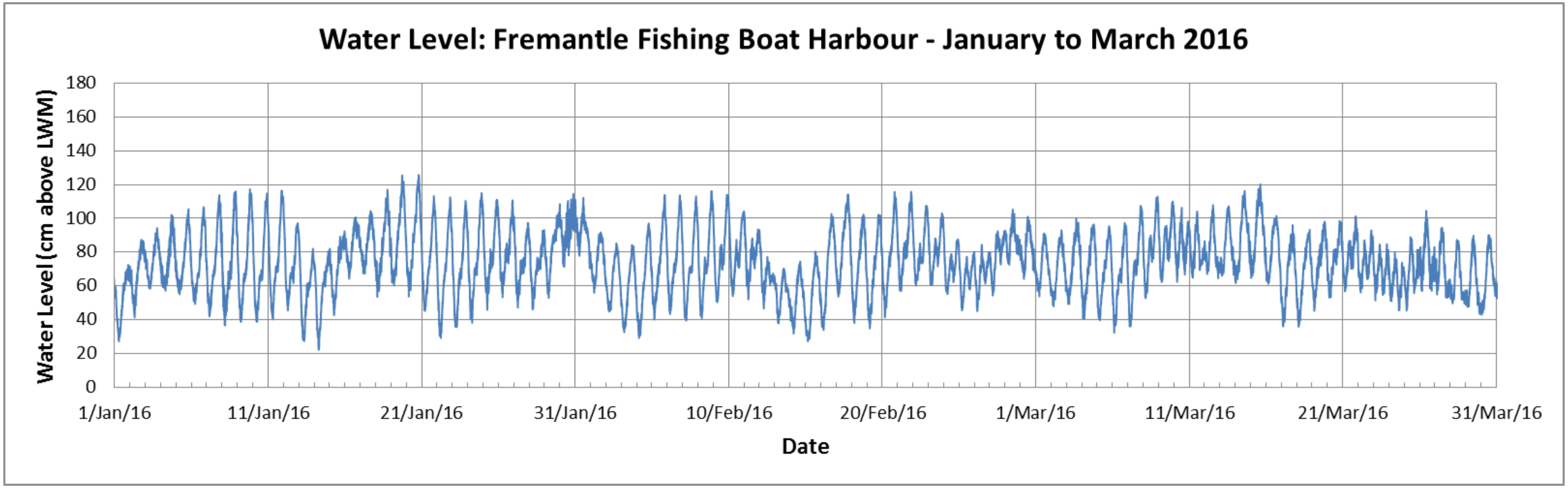


Water Level: Fremantle Fishing Boat Harbour - April to June 2015
Water Level (cm above LWM)
180
160
140
120
100
80
60
40
20
0
1/Apr/15
11/Apr/15
21/Apr/15
1/May/15
11/May/15
21/May/15
31/May/15
10/Jun/15
20/Jun/15
30/Jun/15
Date



Water Level: Fremantle Fishing Boat Harbour - July to September 2015
Water Level (cm above LWM)
180
160
140
120
100
80
60
40
20
0
1/Jul/15
11/Jul/15
21/Jul/15
31/Jul/15
10/Aug/15
20/Aug/15
30/Aug/15
9/Sep/15
19/Sep/15
29/Sep/15
Date


Water Level: Fremantle Fishing Boat Harbour - October to December 2015
Water Level (cm above LWM)
0
20
40
60
80
100
120
140
160
180
1/Oct/15
11/Oct/15
21/Oct/15
31/Oct/15
10/Nov/15
20/Nov/15
30/Nov/15
10/Dec/15
20/Dec/15
30/Dec/15
Date


Water Level: Fremantle Fishing Boat Harbour - January to March 2016
Water Level (cm above LWM)
0
20
40
60
80
100
120
140
160
180
1/Jan/16
11/Jan/16
21/Jan/16
31/Jan/16
10/Feb/16
20/Feb/16
1/Mar/16
11/Mar/16
21/Mar/16
31/Mar/16
Date

Appendix D

Daily Weather Observations at Swanbourne, WA: April 2015 to March 2016

Swanbourne, Western Australia
April 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	13.6	28.6	0			E	33	17:08	19.1	59		SE	13	1023.8	26.2	37		E	6	1020.1
2	Th	15.1	28.8	0			E	41	04:50	19.3	54		E	24	1021.9	24.5	54		SW	22	1016.9
3	Fr	15.2	28.4	0			SSW	33	17:52	23.0	51		ENE	11	1018.3	25.2	61		SSW	20	1014.9
4	Sa	15.3	26.5	0			SSW	28	15:26	20.1	59		SSE	6	1018.0	25.1	58		SSW	15	1015.7
5	Su	17.3	31.8	0			E	48	23:45	22.0	54		ESE	19	1020.9	30.5	27		ESE	15	1017.8
6	Mo	16.9	25.3	0			E	56	01:10	18.8	59		E	26	1021.3	25.0	39		E	24	1017.3
7	Tu	14.3	20.8	12.6			ENE	46	11:26	16.3	98		E	22	1018.9	20.1	66		NE	24	1016.4
8	We	16.1	24.3	16.6			ENE	33	00:50	18.0	98		ENE	13	1015.2	24.1	80		WNW	13	1013.6
9	Th	18.0	24.8	2.0			NE	41	22:42	19.3	99		E	9	1015.4	21.2	99		NE	9	1012.3
10	Fr	19.1	24.4	14.0			N	56	02:35	21.5	99		WNW	13	1009.4	22.1	78		WSW	17	1010.7
11	Sa	19.3	24.1	0.8			WSW	48	10:44	22.4	65		W	22	1013.8	22.1	67		WSW	26	1012.5
12	Su	16.4	22.7	11.2			SW	46	06:18	17.7	98		SSW	24	1015.4	21.8	64		SW	22	1014.1
13	Mo	14.0	22.9	0.2			SW	30	15:22	18.5	78		SSW	6	1016.6	21.5	63		SW	19	1013.5
14	Tu	15.6	24.3	0			SE	31	19:51	18.1	78		ENE	6	1017.0	21.8	64		SW	15	1015.7
15	We	11.3	23.9	0.4			SW	39	13:37	17.0	58		ESE	17	1026.4	23.1	38		SSE	17	1024.1
16	Th	12.3	24.1	0			E	37	10:00	16.8	55		ENE	17	1031.7	23.6	33		SE	15	1026.9
17	Fr	12.0	22.9	0			S	30	19:51	18.4	50		E	7	1026.1	21.4	59		SW	19	1021.4
18	Sa	12.4	28.3	0			E	35	09:34	19.2	56		ENE	15	1024.6	27.0	28		ESE	15	1021.4
19	Su	15.4	28.8	0			ENE	44	09:13	20.0	52		ENE	24	1026.8	27.4	26		E	15	1023.3
20	Mo	15.9	29.1	0			ENE	35	09:14	20.4	51		ENE	20	1026.0	28.3	29		E	9	1021.7
21	Tu	14.3	26.7	0			E	28	08:37	20.1	37		ENE	15	1022.5	24.9	44		SW	13	1018.8
22	We	11.8	25.9	0			SW	20	16:38	20.0	38		ENE	11	1021.2	23.6	58		SW	11	1018.5
23	Th	12.3	27.4	0			ESE	41	22:50	18.9	56		SE	13	1023.4	26.1	35		ESE	15	1021.8
24	Fr	11.1	22.3	0			E	48	23:34	14.6	49		ESE	22	1029.0	21.3	34		SE	17	1025.0
25	Sa	12.3	24.0	0			E	43	00:33	15.8	52		E	17	1027.1	23.6	28		E	13	1022.7
26	Su	12.6	25.7	0			E	41	07:53	16.7	47		E	17	1026.1	24.8	26		E	15	1022.4
27	Mo	13.4	26.5	0			ENE	44	09:01	18.3	41		ENE	22	1025.7	26.1	24		E	15	1022.1
28	Tu	15.6	26.5	0			NE	44	09:29	19.5	37		ENE	24	1022.6	24.6	29		NNE	9	1020.4
29	We	17.7	24.9	0			N	30	10:53	20.3	37		ENE	13	1019.8	22.0	50		NNW	7	1016.6
30	Th	19.2	25.8	0			WSW	41	23:58	21.9	42		NNE	11	1013.7	23.7	81		NW	11	1012.9
Statistics for April 2015																					
	Mean	14.9	25.7							19.1	60			15	1021.3	24.1	49			15	1018.4
	Lowest	11.1	20.8							14.6	37		#	6	1009.4	20.1	24		E	6	1010.7
	Highest	19.3	31.8	16.6			#	56		23.0	99		E	26	1031.7	30.5	99		WSW	26	1026.9
	Total			57.8																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201504 Prepared at 13:10 GMT on 12 Apr 2016

Swanbourne, Western Australia
May 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Fr	13.7	23.0	0			SW	41	00:52	17.2	58		SE	15	1020.6	20.6	41		SW	22	1016.7
2	Sa	11.4	21.7	0			ESE	28	01:09	16.3	53		ESE	11	1017.5	20.7	49		SW	9	1013.9
3	Su	11.8	22.6	0			WSW	78	22:37	18.0	52		N	4	1014.0	21.9	52		WNW	28	1011.7
4	Mo	9.4	17.8	5.8			SSW	69	02:52	11.9	75		SE	20	1023.0	14.9	68		SSW	20	1023.8
5	Tu	7.8	20.9	0.4			SSW	31	15:38	14.1	63		ESE	11	1029.5	19.6	52		SSW	17	1026.1
6	We	8.8	21.6	0			SW	24	14:45	14.3	72		E	9	1030.3	19.5	51		SW	17	1026.9
7	Th	9.4	23.5	0			SSW	26	15:27	15.7	66		ENE	13	1030.9	21.4	44		SW	15	1027.2
8	Fr	9.4		0						15.3	63		E	9	1028.2	21.2	50		SSW	17	1025.2
9	Sa	10.9	22.4				SW	28	15:23	15.9	79		E	7	1028.7	21.1	58		SW	17	1026.2
10	Su	10.9	24.6	0.2			E	31	10:16	16.1	71		ESE	7	1029.4	21.1	54		SSW	22	1026.1
11	Mo	11.8	26.1	0			E	31	11:10	17.0	71		E	19	1028.3	22.1	60		SSW	15	1025.3
12	Tu	13.8	24.5	0			E	44	10:37	16.8	62		E	17	1029.6	23.9	38		E	9	1026.2
13	We	12.8	24.3	0			NE	41	09:21	16.7	54		ENE	20	1029.8	23.6	33		ENE	13	1025.5
14	Th	14.5	26.9	0			NE	44	08:04	17.8	47		NE	20	1027.0	26.7	25		NE	6	1024.0
15	Fr	16.6	26.1	0			NNE	44	09:57	20.0	21		NE	22	1023.9	25.7	16		NNE	20	1018.8
16	Sa	12.1	17.6	11.0			NNE	61	13:58	12.2	95		NE	9	1015.2	14.7	73		N	26	1010.6
17	Su	11.3	18.4	34.6			NW	78	11:48	16.6	75		NW	37	1005.9	16.7	95		WNW	39	1002.8
18	Mo	14.4	19.6	51.4			SSW	33	04:54	15.9	99		SSE	6	1015.2	17.8	70		SSW	17	1016.2
19	Tu	9.1	19.0	0.8			ESE	35	09:37	12.1	79		SE	11	1025.2	16.6	61		ESE	13	1024.6
20	We	8.5	17.7	0			E	44	10:56	12.0	66		E	24	1030.2	16.9	45		E	19	1027.4
21	Th	9.9	20.0	0			E	39	10:23	11.4	58		E	20	1027.4	18.8	40		ENE	19	1023.2
22	Fr	9.8	22.6	0			E	26	09:26	15.0	60		E	15	1020.3	19.9	53		SW	13	1016.7
23	Sa	9.3	22.6	0			SSW	35	17:47	14.9	70		ENE	7	1019.2	20.2	65		WSW	19	1018.0
24	Su	10.3	21.3	0.4			SE	24	00:33	13.3	98		SE	7	1022.6	20.3	55		SW	13	1020.2
25	Mo	11.4	21.3	0			SW	22	15:48	15.7	64		E	11	1022.3	20.6	49		SW	13	1020.5
26	Tu	11.3	21.3	0			SSE	22	10:42	15.8	74		NE	7	1023.8	18.5	62		S	6	1022.4
27	We	9.9	19.8	0.2			S	28	16:14	13.9	74		E	7	1024.1	18.9	44		SSE	11	1021.0
28	Th	7.1	19.8	0			E	28	12:27	11.7	78		E	11	1024.5	19.1	41		SE	11	1022.5
29	Fr	7.8	21.1	0			ENE	30	10:04	12.4	73		E	13	1026.6	20.6	48		S	9	1023.0
30	Sa	10.3	21.4	0			E	24	04:47	14.1	59		E	15	1026.8	20.1	56		SSW	11	1023.6
31	Su	8.4	21.5	0			ENE	19	23:27	13.0	68		ENE	9	1024.0	20.0	41		W	4	1020.5
Statistics for May 2015																					
	Mean	10.8	21.7							14.9	67			13	1024.0	20.1	51			15	1021.2
	Lowest	7.1	17.6							11.4	21		N	4	1005.9	14.7	16		W	4	1002.8
	Highest	16.6	26.9	51.4			#	78		20.0	99		NW	37	1030.9	26.7	95		WNW	39	1027.4
	Total			104.8																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201505 Prepared at 13:10 GMT on 11 Apr 2016

Swanbourne, Western Australia
June 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	10.1	21.9	0			NNE	41	10:59	14.7	45		NE	15	1019.0	20.4	31		N	13	1013.0
2	Tu	13.8	21.1	9.2			WNW	57	12:58	19.2	56		WNW	24	1012.8	19.6	70		NW	33	1013.2
3	We	16.3	22.2	1.2			WNW	48	03:59	20.4	69		WNW	31	1018.3	18.1	98		W	19	1019.6
4	Th	14.5	22.9	2.4			NNW	24	12:35	16.3	95		NNE	7	1024.0	22.1	64		NW	9	1022.1
5	Fr	12.2	23.3	0.4			ENE	17	02:13	16.2	86		E	7	1021.1	22.2	58		WNW	6	1019.3
6	Sa	13.7	21.1	1.0			SW	26	16:14	16.9	99		ENE	2	1022.7	19.3	65		SW	15	1021.7
7	Su	10.7	22.1	0.2			NE	13	08:01	14.0	89		NE	7	1026.0	20.6	61		WSW	6	1024.6
8	Mo	10.2	21.7	0			E	24	11:30	14.2	88		ENE	11	1027.5	20.4	49		SSE	11	1025.5
9	Tu	11.4	22.8	0			E	44	08:52	14.7	65		E	26	1027.5	22.5	44		E	20	1024.3
10	We	12.9	24.2	0			ENE	37	08:29	15.9	62		ENE	19	1024.9	23.9	39		NE	13	1020.6
11	Th	13.6	24.6	0			NE	35	08:51	17.5	50		NE	19	1019.8	21.1	47		N	9	1016.9
12	Fr	14.4	20.5	0			S	37	10:27	15.6	96		S	11	1019.6	19.6	68		SSW	17	1017.5
13	Sa	10.1	18.7	0			SSW	22	13:48	12.7	82		SE	7	1022.6	17.6	52		SSE	13	1019.9
14	Su	7.7	19.5	0			ESE	28	10:55	11.8	73		ESE	9	1023.5	18.8	43		ESE	11	1020.6
15	Mo	7.5	20.1	0			ENE	35	09:41	12.9	72		E	13	1022.7	19.2	41		E	11	1019.2
16	Tu	11.7	21.5	0			ENE	39	23:42	15.5	50		ENE	22	1020.8	21.2	36		ENE	13	1016.2
17	We	14.5	19.7	0			ENE	52	05:42	15.1	63		ENE	22	1015.4	19.6	50		ENE	19	1011.9
18	Th	13.6	22.3	1.2			ENE	48	03:06	14.9	78		ENE	20	1010.8	20.9	65		E	11	1009.3
19	Fr	14.9	22.7	18.8			N	35	20:16	17.1	99		NNE	15	1013.6	21.7	74		NNW	13	1011.7
20	Sa	17.1	22.7	13.6			WNW	56	20:35	19.4	84		NW	22	1012.4	20.6	77		WNW	22	1010.9
21	Su	14.8	19.0	37.0			WSW	87	16:58	15.7	91		W	22	1006.8	14.5	62		WSW	44	1008.1
22	Mo	9.9	15.4	24.2			S	59	02:18	10.0	98		SSE	20	1021.7	15.0	52		SSW	19	1022.4
23	Tu	4.3	16.9	0			E	19	09:50	8.2	91		ENE	9	1029.6	15.3	49		SW	9	1027.3
24	We	6.9	19.3	0.2			NNE	28	10:43	11.1	85		NNE	7	1030.5	18.7	53		WNW	9	1027.8
25	Th	6.9	20.4	0.2			N	22	11:39	12.2	71		NNE	9	1027.6	19.8	50		NW	9	1024.2
26	Fr	9.7	21.9	0			ESE	19	22:16	13.3	72		E	11	1028.7	19.9	50		SE	4	1026.8
27	Sa	9.5	19.4	0			E	35	09:42	12.3	80		E	19	1031.4	19.0	47		E	15	1028.3
28	Su	10.0	21.0	0			ENE	37	08:46	13.0	66		ENE	20	1029.5	20.5	41		E	11	1026.6
29	Mo	9.6	23.7	0			ENE	31	06:32	14.1	51		ENE	7	1025.7	22.8	30		NNW	6	1022.6
30	Tu	9.8	22.8	0			NE	28	08:37	13.8	49		NE	15	1023.6	21.6	47		WNW	6	1021.8
Statistics for June 2015																					
	Mean	11.4	21.2							14.6	75			14	1022.0	19.9	53			13	1019.8
	Lowest	4.3	15.4							8.2	45		ENE	2	1006.8	14.5	30		SE	4	1008.1
	Highest	17.1	24.6	37.0			WSW	87		20.4	99		WNW	31	1031.4	23.9	98		WSW	44	1028.3
	Total			109.6																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}.

IDCJDW6121.201506 Prepared at 13:09 GMT on 10 Apr 2016

Users of this product are deemed to have read the information and accepted the conditions described in the notes at http://www.bom.gov.au/climate/dwo/IDCJDW0000.pdf

Swanbourne, Western Australia
July 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	13.6	19.6	0			NE	20	10:48	16.3	65		ENE	9	1024.0	18.8	49		N	4	1023.3
2	Th	13.6	22.3	2.0			ENE	28	08:33	15.0	68		ENE	17	1022.9	22.0	45		N	9	1020.8
3	Fr	13.5	21.5	6.0			NE	15	01:13	15.8	99		ENE	6	1022.9	20.9	75		WNW	7	1021.6
4	Sa	11.0	22.1	1.4			W	37	19:23	14.5	99		ENE	6	1023.0	17.5	98		WSW	15	1021.1
5	Su	11.2	20.1	3.4			NNW	26	11:13	14.9	99		ENE	6	1022.0	16.1	98		NNW	6	1020.7
6	Mo	10.4	19.6	8.8			NNW	31	14:43	13.3	99		NE	11	1022.6	16.4	98		NNW	17	1020.2
7	Tu	13.3	18.8	16.4			S	50	21:38	14.4	98		N	9	1020.1	17.6	93		WSW	20	1017.8
8	We	8.8	15.5	12.2			SSE	41	02:25	10.7	73		SE	13	1026.5	14.4	47		SE	11	1024.5
9	Th	3.7	16.4	0			NW	22	20:29	7.9	79		ESE	7	1029.7	15.4	44		SSW	2	1025.7
10	Fr	7.7	17.1	4.2			SSW	30	14:50	9.9	98		ENE	6	1027.3	16.4	59		S	13	1027.4
11	Sa	5.9	17.5	0.4			E	30	10:50	9.8	77		ENE	11	1034.7	17.0	45		ESE	6	1032.0
12	Su	5.5	17.6	0			ENE	26	09:55	10.6	65		E	15	1033.1	16.9	43		ESE	11	1029.2
13	Mo	6.8	17.2	0			E	30	10:48	9.6	70		E	15	1032.5	16.4	48		E	13	1028.8
14	Tu	7.2	18.9	0			ENE	31	11:23	12.4	66		E	11	1032.2	18.2	47		E	15	1028.9
15	We	9.6	18.1	0			E	39	11:42	12.3	77		E	24	1030.7	17.6	50		ENE	19	1027.1
16	Th	8.9	19.9	0			NE	50	09:51	12.1	54		NE	26	1026.7	19.3	38		NNE	15	1023.0
17	Fr	11.7	21.6	0			NE	44	08:44	14.7	41		NE	24	1023.3	19.7	40		NNE	7	1021.0
18	Sa	13.4	20.7	1.0			NNW	17	19:42	14.4	98		NE	6	1024.2	20.4	73		N	4	1021.7
19	Su	14.4	19.3	1.0			N	41	23:06	16.1	40		N	15	1018.2	18.6	39		N	13	1013.7
20	Mo	14.4	20.3	21.8			WSW	57	19:52	15.9	85		W	24	1008.9	17.6	64		W	31	1006.4
21	Tu	9.3	16.9	6.4			SW	50	05:34	11.6	90		ENE	9	1016.3	16.0	54		SSE	7	1017.3
22	We	8.9	17.5	1.6			W	43	15:28	14.4	62		N	11	1018.8	15.4	98		NW	11	1016.5
23	Th	10.2	17.3	11.6			WSW	50	02:16	12.1	98		ESE	9	1021.0	16.3	55		SSW	20	1022.0
24	Fr	5.5	18.0	0			SW	20	23:44	10.1	74		E	9	1028.7	17.1	51		SW	7	1026.2
25	Sa	9.9	18.7	0.2			SSW	33	02:42	12.2	89		NE	7	1028.1	18.3	56		SSW	15	1027.0
26	Su	7.3	19.7	0			ENE	28	10:26	10.9	87		ENE	19	1032.9	17.7	51		ESE	4	1029.8
27	Mo	8.9	22.1	0			ENE	35	09:58	11.9	66		ENE	19	1029.8	21.1	31		NNE	15	1024.4
28	Tu	11.6	15.1	1.0			NNE	43	10:48	11.7	85		NNE	17	1019.4	14.3	85		NE	13	1014.7
29	We	11.3	18.9	9.6			N	26	13:56	15.0	99		ENE	7	1018.6	18.4	91		NNW	13	1018.2
30	Th	15.0	19.7	3.2						16.5	99		ENE	9	1020.5	19.3	80		N	11	1017.1
31	Fr	15.8	21.0				NE	48	03:12	17.2	99		N	9	1013.4	19.7	76		SW	11	1010.7
Statistics for July 2015																					
	Mean	10.3	19.0							13.0	80			12	1024.3	17.8	61			11	1021.9
	Lowest	3.7	15.1							7.9	40		#	6	1008.9	14.3	31		SSW	2	1006.4
	Highest	15.8	22.3	21.8			WSW	57		17.2	99		NE	26	1034.7	22.0	98		W	31	1032.0
	Total			112.2																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201507 Prepared at 13:10 GMT on 9 Apr 2016

Swanbourne, Western Australia
August 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Sa	10.3	19.1	0.4			ESE	48	02:12	13.0	70		SE	20	1023.3	17.3	50		SE	17	1024.5
2	Su	6.1	18.0	0			SE	26	12:46	11.2	66		ESE	7	1034.3	17.1	44		ESE	11	1031.6
3	Mo	6.2	19.7	0			E	24	11:27	11.9	70		E	9	1035.5	17.7	44		ESE	7	1032.3
4	Tu	9.1	19.2	0			E	28	13:51	12.6	65		E	11	1033.7	18.7	43		E	13	1030.4
5	We	8.1	19.7	0			NE	39	12:20	12.5	75		E	19	1030.1	18.7	41		ENE	17	1025.7
6	Th	10.0	20.9	0			ENE	37	11:41	11.8	62		E	20	1021.4	20.8	36		NNE	7	1017.2
7	Fr	11.8	18.8	1.2			WSW	30	19:30	13.4	89		NNE	9	1015.3	16.5	86		NNW	13	1013.2
8	Sa	12.4	15.4	7.2			WSW	72	15:05	13.5	97		WNW	19	1013.1	14.6	54		WSW	35	1013.7
9	Su	5.4	16.8	8.6			WNW	41	23:22	9.0	97		NE	9	1024.3	13.3	54		WNW	4	1021.5
10	Mo	9.0	18.9	6.0			WSW	67	09:11	16.6	71		WNW	33	1020.7	18.3	61		WSW	28	1019.4
11	Tu	11.1	19.0	3.6			SSW	39	00:50	13.8	67		SE	7	1029.0	17.1	53		SSW	20	1028.3
12	We	8.6	18.4	0			SE	24	00:11	12.7	80		ENE	9	1031.7	17.6	58		SE	6	1028.6
13	Th	12.6	17.4	0			N	15	09:50	15.0	73		NNW	6	1028.0	15.9	70		NW	7	1025.0
14	Fr	8.2	19.8	0.2			SSW	20	15:22	13.1	86		NE	4	1025.1	18.5	60		SSW	15	1020.9
15	Sa	11.8	28.0	0			NE	31	09:18	17.6	52		ENE	19	1022.0	25.7	32		WNW	7	1019.4
16	Su	13.1	22.7	0			NNW	24	14:55	18.3	52		ENE	6	1021.7	20.5	80		NW	17	1020.2
17	Mo	15.3	20.6	7.2			NW	56	16:49	16.5	99		ENE	9	1019.0	18.3	82		NNW	20	1015.5
18	Tu	15.3	20.6	10.6			W	46	05:52	17.6	63		W	24	1017.0	19.9	58		W	17	1015.5
19	We	13.8	20.6	0.4			WNW	67	15:29	17.7	69		W	15	1013.7	18.0	66		NW	28	1008.9
20	Th	11.4	18.3	14.6			WSW	61	01:50	14.7	82		SSW	13	1013.0	18.0	55		SW	24	1013.4
21	Fr	11.7	16.3	8.8			WSW	52	16:12	14.3	93		NW	15	1012.7	16.0	60		WSW	28	1010.4
22	Sa	7.0	17.5	19.2			SSW	31	15:36	10.3	98		NE	6	1018.3	15.7	69		SSW	17	1019.4
23	Su	7.1	19.4	1.0			ENE	26	09:19	11.2	75		E	15	1028.9	16.6	63		SW	11	1026.7
24	Mo	9.4	19.3	0			E	39	09:19	13.2	70		ENE	19	1031.0	17.2	48		ESE	13	1027.6
25	Tu	9.2	20.4	0			ENE	35	08:51	13.3	60		ENE	19	1027.7	19.1	30		NE	13	1023.6
26	We	9.9	22.2	0			NE	33	09:18	14.1	51		NE	19	1021.9	20.8	33		N	7	1019.0
27	Th	11.5	26.3	0			NE	30	13:02	15.4	50		E	17	1018.3	24.1	36		NNW	9	1013.5
28	Fr	12.0	21.0	0			NW	37	13:25	17.8	78		N	15	1016.2	20.6	76		WNW	7	1014.3
29	Sa	13.6	21.3	2.0			NNW	50	12:17	15.8	98		NNE	13	1014.0	20.1	78		WNW	22	1011.9
30	Su	14.2	18.9	15.0			SW	44	04:25	16.0	54		SW	22	1019.5	16.8	52		SSW	13	1019.8
31	Mo	9.8	18.2	0			WSW	59	15:31	17.1	50		WNW	15	1019.1	15.7	71		WSW	26	1016.5
Statistics for August 2015																					
	Mean	10.5	19.8							14.2	72			14	1022.6	18.2	56			15	1020.3
	Lowest	5.4	15.4							9.0	50		NE	4	1012.7	13.3	30		WNW	4	1008.9
	Highest	15.3	28.0	19.2			WSW	72		18.3	99		WNW	33	1035.5	25.7	86		WSW	35	1032.3
	Total			106.0																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201508 Prepared at 13:10 GMT on 8 Apr 2016

Swanbourne, Western Australia
September 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	6.6	15.4	5.0			SSW	54	00:17	11.2	63		SE	20	1024.2	14.9	52		SSW	20	1023.1
2	We	4.8	18.1	0			E	28	12:35	11.3	60		ESE	11	1028.3	15.5	44		ESE	9	1024.8
3	Th	8.5	20.9	0			E	37	07:47	13.1	60		ENE	20	1023.5	19.2	39		SW	11	1019.8
4	Fr	7.8	20.4	0			NW	44	20:37	16.2	64		ENE	4	1017.6	18.0	67		NW	19	1015.5
5	Sa	13.8	19.4	3.4			SSW	50	12:28	17.7	62		WSW	22	1020.7	17.8	57		SSW	22	1021.6
6	Su	7.1	19.4	0			SSW	35	16:59	13.9	58		E	13	1029.2	17.9	47		SSW	19	1026.7
7	Mo	7.4	21.6	0			SSW	28	15:25	15.8	51		E	15	1028.7	19.1	51		SSW	19	1024.6
8	Tu	11.7	26.4	0			NE	37	08:56	19.4	37		NE	20	1024.1	23.6	36		SW	7	1020.4
9	We	13.7	32.5	0			N	43	14:26	20.3	29		NE	20	1018.6	25.9	36		NNW	24	1014.3
10	Th	19.0	20.2	0			W	59	11:52	19.3	80		NW	20	1014.2	16.1	84		NW	31	1016.2
11	Fr	13.9	20.9	5.6			WNW	56	20:53	18.1	70		NW	24	1018.6	20.1	61		NW	33	1016.2
12	Sa	12.7	17.0	10.8			W	61	08:36	14.4	80		W	22	1015.4	15.6	50		W	35	1016.0
13	Su	8.1	18.2	6.8			SSW	37	12:41	12.2	82		S	4	1024.6	17.4	46		SSW	24	1024.0
14	Mo	9.7	18.8	0			SSW	31	19:51	15.4	64		WSW	2	1027.5	17.5	66		SW	13	1025.8
15	Tu	6.8	18.8	0.4			SE	28	02:02	12.4	53		SE	17	1029.1	17.9	38		SSE	11	1025.7
16	We	6.5	20.9	0			SSW	37	14:42	13.7	53		ENE	17	1029.1	17.3	52		SSW	24	1024.8
17	Th	9.1	24.9	0			E	30	08:50	16.6	45		E	17	1025.6	21.0	39		SSW	19	1021.9
18	Fr	10.1	21.3	0			S	35	13:47	19.0	48		E	2	1021.3	18.7	63		SSW	24	1019.8
19	Sa	11.8	19.0	3.0			SSW	48	16:13	15.1	62		S	22	1026.0	16.7	53		SSW	30	1024.4
20	Su	7.5	20.2	0			SSW	39	16:37	13.7	50		ESE	15	1030.8	17.0	56		SSW	24	1026.9
21	Mo	9.7	24.1	0			E	41	07:31	14.8	48		E	19	1030.0	23.5	28		SE	13	1025.9
22	Tu	12.1	26.3	0			ENE	43	07:48	18.8	34		ENE	19	1027.6	25.5	20		NNE	19	1023.9
23	We	15.2	31.0	0			NE	44	09:19	21.3	27		NE	26	1024.8	28.1	26		WSW	7	1021.3
24	Th	17.7	31.5	0			W	46	12:29	23.8	23		NNE	20	1019.3	22.2	58		W	13	1018.0
25	Fr	14.2	22.0	0.2			SSW	35	17:08	19.6	66		S	9	1021.2	19.8	60		SW	19	1019.9
26	Sa	10.9	22.2	0			SSW	41	16:35	17.5	62		SE	13	1025.1	19.8	60		SSW	26	1022.1
27	Su	13.6	26.7	0			E	48	07:14	17.9	58		E	28	1023.7	25.7	32		E	11	1018.9
28	Mo	12.9	24.3	0			E	37	01:06	19.1	54		ENE	11	1017.2	20.1	62		WSW	17	1014.4
29	Tu	14.5	22.4	0			WNW	24	12:01	18.8	73		W	7	1018.3	21.7	55		WNW	13	1018.1
30	We	13.0	23.0	0			NW	22	11:30	19.1	72		NNW	11	1024.6	21.5	67		WSW	13	1023.4
Statistics for September 2015																					
	Mean	11.0	22.3							16.7	56			15	1023.6	19.8	50			18	1021.3
	Lowest	4.8	15.4							11.2	23		#	2	1014.2	14.9	20		#	7	1014.3
	Highest	19.0	32.5	10.8			W	61		23.8	82		E	28	1030.8	28.1	84		W	35	1026.9
	Total			35.2																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201509 Prepared at 16:10 GMT on 7 Apr 2016

Swanbourne, Western Australia
October 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Th	12.4	27.3	0.2			NNE	26	09:32	22.7	47		NNE	11	1022.0	23.9	54		WNW	11	1019.1
2	Fr	16.7	23.8	0			NNW	28	11:40	21.2	46		NNW	13	1021.1	22.0	60		NNW	11	1017.9
3	Sa	17.4	23.4	0			WSW	22	05:25	21.0	75		SW	9	1022.0	22.6	68		WNW	15	1021.6
4	Su	15.9	23.9	0			WNW	39	17:51	19.2	89		NNW	13	1020.4	21.4	68		WNW	24	1018.6
5	Mo	15.7	20.5	6.2			WSW	61	13:31	17.5	61		WSW	31	1019.0	16.9	62		SW	28	1020.9
6	Tu	7.6	22.6	1.0			ESE	33	08:41	14.9	44		E	19	1029.7	21.7	27		ESE	13	1025.9
7	We	11.3	28.1	0			ENE	37	06:24	20.0	30		ENE	17	1024.3	25.6	26		SW	9	1019.5
8	Th	13.7	25.4	0			SSW	37	16:33	22.4	30		SE	4	1021.7	22.8	56		SSW	22	1019.0
9	Fr	14.3	27.5	0			SSW	22	15:45	22.6	38		WSW	4	1021.7	24.8	47		SSW	15	1019.0
10	Sa	15.5	26.1	0			SSW	33	12:34	21.5	76		SW	9	1022.8	21.9	74		SSW	22	1020.0
11	Su	16.7	32.8	0			E	35	08:22	25.3	46		ENE	17	1021.6	26.9	49		SSW	20	1018.5
12	Mo	18.1	29.4	0			E	33	01:00	26.4	38		ENE	7	1018.7	26.6	46		SW	17	1014.8
13	Tu	15.4	26.8	0.2			WSW	37	12:26	20.7	78		NNE	4	1014.5	22.6	69		WSW	9	1011.4
14	We	15.9	22.0	4.6			WSW	48	18:18	15.9	98		WSW	17	1014.4	19.0	65		WSW	20	1014.2
15	Th	14.6	21.0	0.4			WSW	48	00:39	17.1	51		SSW	17	1022.5	18.9	43		SW	19	1021.3
16	Fr	9.8	22.3	0			SW	33	16:37	18.7	43		SSE	9	1023.9	20.0	44		SW	20	1020.6
17	Sa	9.6	24.1	0			SSW	37	18:22	22.2	41		SE	6	1017.8	21.6	67		SW	22	1013.5
18	Su	15.4	22.9	0			SW	46	22:31	19.8	55		W	17	1017.4	17.2	85		NW	20	1017.0
19	Mo	13.4	21.0	2.8			SW	37	01:01	17.2	58		SE	13	1022.9	19.5	52		SW	19	1021.0
20	Tu	10.7	25.1	0			S	37	17:15	20.7	48		ENE	13	1021.7	22.3	58		SSW	19	1018.1
21	We	12.8	28.5	0			E	41	07:36	23.7	39		ENE	15	1017.3	23.1	59		SSW	22	1014.8
22	Th	16.5	23.2	0			W	31	22:57	20.3	83		WSW	9	1014.2	22.3	67		WSW	13	1014.4
23	Fr	17.3	22.8	0			SSW	35	16:29	20.1	68		SW	20	1016.6	21.6	63		SSW	20	1016.2
24	Sa	15.5	22.3	0			SSW	44	17:18	18.8	63		SSE	7	1020.1	20.5	67		SSW	28	1017.2
25	Su	14.9	23.6	0			E	43	07:48	19.5	51		ESE	9	1019.8	23.2	46		SSE	19	1016.9
26	Mo	13.8	26.6	0			SSW	39	15:14	19.3	59		SE	17	1019.0	22.6	62		SSW	22	1015.1
27	Tu	15.5	24.5	0			E	43	06:42	19.6	62		ESE	20	1015.8	20.9	73		SSW	20	1013.2
28	We	16.9	24.3	0.4			WSW	26	11:47	22.2	69		W	7	1014.8	22.7	67		SW	17	1013.7
29	Th	16.4	24.1	0			WNW	24	13:57	20.2	85		NW	13	1016.2	23.0	68		W	15	1014.2
30	Fr	16.9	24.7	0			NW	37	21:04	21.3	71		NNW	19	1016.1	21.9	80		NW	24	1014.9
31	Sa	17.3	23.2	26.8			SSW	33	16:24	21.6	80		WSW	9	1016.6	22.7	62		SW	15	1015.5
Statistics for October 2015																					
	Mean	14.6	24.6							20.4	58			12	1019.6	22.0	59			18	1017.4
	Lowest	7.6	20.5							14.9	30		#	4	1014.2	16.9	26		#	9	1011.4
	Highest	18.1	32.8	26.8			WSW	61		26.4	98		WSW	31	1029.7	26.9	85		#	28	1025.9
	Total			42.6																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201510 Prepared at 13:10 GMT on 6 Apr 2016

Swanbourne, Western Australia
November 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Su	13.2	23.5	0			W	39	23:00	17.4	74		NE	7	1013.9	22.5	57		W	11	1008.7
2	Mo	14.4	23.1	31.4			SW	35	15:40	17.8	75		SSE	9	1010.4	22.2	63		SW	22	1012.1
3	Tu	14.4	23.7	0			S	35	17:16	20.9	49		ENE	9	1018.7	22.6	61		SW	22	1016.2
4	We	14.9	23.1	0			SW	30	14:35	20.4	58		SSE	7	1015.5	21.3	55		SW	19	1011.3
5	Th	14.2	23.6	0			W	28	11:36	20.9	56		WNW	9	1008.1	21.8	53		W	19	1006.5
6	Fr	16.8	22.9	0			SSW	50	15:49	20.9	55		SSE	11	1007.1	22.4	68		SSW	26	1003.7
7	Sa	17.0	23.0	1.8			SSW	43	15:49	18.5	65		SSW	20	1013.6	20.4	67		SSW	24	1013.5
8	Su	14.1	22.5	0			SSW	46	14:57	19.6	67		SW	15	1019.0	20.9	68		SSW	30	1017.2
9	Mo	15.4	25.3	0			SSW	44	14:34	21.3	61		SE	9	1019.9	23.5	64		SSW	28	1016.2
10	Tu	17.4	28.1	0			E	48	05:24	24.4	48		ENE	11	1017.1	22.6	69		SSW	24	1014.4
11	We	15.2	24.8	0			SSW	37	15:39	21.9	68		SW	9	1017.2	23.1	68		SSW	22	1015.2
12	Th	16.9	29.3	0.2			SSW	39	14:39	24.6	50		SE	11	1019.1	24.3	63		SSW	24	1017.1
13	Fr	20.3	33.2	0			E	43	07:47	26.4	38		E	20	1018.4	28.7	45		SSW	17	1014.6
14	Sa	21.2	37.4	0			E	43	02:10	33.0	23		NE	17	1012.1	29.5	47		SW	15	1008.6
15	Su	19.9	27.6	0			SSW	39	12:24	26.3	44		SE	9	1012.5	23.8	69		SSW	20	1012.0
16	Mo	15.4	26.4	0			SSW	26	17:07	25.9	38		ENE	7	1012.3	24.7	55		SW	15	1009.3
17	Tu	16.1	25.9	0			WNW	52	14:36	23.9	66		NW	20	1006.1	19.0	98		W	19	1009.3
18	We	16.8	22.9	2.2			WSW	56	11:08	20.4	49		WNW	24	1015.9	20.2	48		WSW	31	1016.3
19	Th	13.4	21.8	2.2			W	43	00:39	20.0	51		SW	19	1023.2	20.1	43		SW	22	1022.5
20	Fr	13.2	26.8	0			SSW	46	15:19	20.4	43		E	15	1026.1	22.3	56		SSW	30	1020.8
21	Sa	16.4	35.0	0			E	54	06:22	25.2	30		ENE	28	1020.8	34.1	10		E	20	1016.4
22	Su	22.8	33.3	0			E	50	03:12	31.1	16		NNE	20	1014.8	24.9	68		NNW	22	1013.4
23	Mo	19.4	25.7	0			NW	31	09:57	23.2	71		NW	19	1014.8	23.4	67		W	15	1012.6
24	Tu	19.0	23.6	0			SSW	54	14:32	20.5	69		SSW	20	1015.2	22.7	59		SSW	33	1013.0
25	We	14.9	23.3	0			SSW	50	13:53	19.0	59		SSE	9	1017.4	22.2	56		SSW	31	1014.0
26	Th	14.8	28.8	0			ESE	50	01:20	20.7	42		E	24	1017.5	23.1	59		SSW	30	1012.2
27	Fr	16.3	26.6	0			SW	37	16:05	25.0	38		ENE	9	1012.3	24.5	54		SW	22	1010.1
28	Sa	16.5	24.6	0			SSW	41	14:49	22.3	51		SE	7	1014.8	23.1	64		SW	26	1013.8
29	Su	15.4	23.8	0			S	52	18:17	21.8	58		SW	19	1016.3	22.4	55		SSW	28	1015.3
30	Mo	13.1	22.5	0			S	56	18:48	19.1	51		SSE	17	1020.3	21.0	52		SSW	33	1017.3
Statistics for November 2015																					
	Mean	16.3	26.1							22.4	52			14	1015.7	23.2	58			23	1013.5
	Lowest	13.1	21.8							17.4	16		#	7	1006.1	19.0	10		W	11	1003.7
	Highest	22.8	37.4	31.4			#	56		33.0	75		ENE	28	1026.1	34.1	98		SSW	33	1022.5
	Total			37.8																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201511 Prepared at 13:10 GMT on 5 Apr 2016

Swanbourne, Western Australia
December 2015 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	13.9	28.1	0			SSW	44	15:22	19.9	40		E	19	1021.7	25.0	42		SW	20	1017.2
2	We	16.7	34.4	0			E	48	08:04	24.6	33		E	24	1015.6	26.8	55		SSW	17	1009.6
3	Th	20.7	24.5	0.2			SW	43	15:14	23.9	76		SW	11	1009.1	21.7	73		SW	22	1009.2
4	Fr	16.4	22.9	0			SSW	46	13:14	20.3	60		S	11	1012.4	21.9	54		SSW	28	1011.6
5	Sa	12.1	20.1	10.6			W	61	09:05	12.8	86		W	39	1012.6	15.9	69		SSW	15	1011.4
6	Su	11.6	22.0	6.6			SW	50	09:31	17.9	90		SW	30	1013.4	19.9	73		SW	22	1013.8
7	Mo	15.5	22.6	0.6			SSW	46	14:27	19.2	64		SSW	15	1018.2	19.6	59		SSW	22	1017.9
8	Tu	12.0	22.2	0			S	37	18:50	19.0	53		SE	9	1020.9	20.9	54		SW	20	1018.8
9	We	15.2	23.3	0			SSW	37	20:48	21.0	57		SSW	9	1020.4	22.3	59		SW	22	1017.8
10	Th	14.4	24.2	0			SSW	52	15:51	20.9	48		ESE	15	1020.2	22.2	52		SSW	31	1017.7
11	Fr	16.3	30.2	0			SSW	46	14:22	22.7	36		E	22	1019.3	23.2	60		SSW	28	1014.3
12	Sa	17.4	24.2	0			SSW	44	15:56	22.9	58		SSW	15	1011.5	22.2	67		SSW	26	1010.8
13	Su	17.0	24.0	0			SSW	37	23:52	22.3	65		SW	17	1014.7	22.9	59		SW	22	1013.0
14	Mo	15.3	23.8	0			SSW	44	15:58	20.5	66		W	9	1014.7	22.4	52		SW	28	1013.8
15	Tu	15.1	25.0	0			SSW	41	23:19	21.8	58		SW	11	1013.5	22.3	66		SSW	22	1012.0
16	We	16.8	24.5	0			SSW	46	14:47	21.9	55		SSW	22	1014.7	23.1	64		SSW	28	1012.8
17	Th	17.3	25.2	0			SSW	46	15:20	22.2	61		SSW	19	1013.7	23.0	59		SW	30	1009.9
18	Fr	17.3	24.5	0			SSW	50	15:21	22.2	52		NW	11	1009.6	21.7	65		SW	33	1009.2
19	Sa	14.6	21.5	0			SSW	57	16:29	18.4	41		S	20	1014.8	20.2	42		SSW	35	1012.3
20	Su	15.5	29.6	0			E	52	07:45	19.9	44		E	24	1015.4	27.3	36		SSW	11	1010.0
21	Mo	17.9	33.9	0			E	46	07:02	27.3	30		ENE	26	1010.3	27.2	48		SSW	26	1007.9
22	Tu	23.5	36.4	0			SSW	46	15:09	31.9	30		E	13	1011.8	29.0	45		SSW	26	1009.1
23	We	22.2	38.3	0			SSW	43	17:16	32.8	34		NE	15	1010.2	29.3	54		SW	22	1006.1
24	Th	18.3	23.7	0			SSW	61	20:11	21.3	64		SSW	30	1010.8	22.5	60		SSW	33	1010.3
25	Fr	13.5	24.6	0			SW	48	13:58	19.2	40		SE	15	1018.2	22.0	54		SSW	26	1015.0
26	Sa	13.9	30.7	0			E	46	00:52	22.0	36		E	19	1016.6	23.8	58		SW	28	1012.5
27	Su	17.9	36.5	0			SSW	37	15:52	30.6	15		NE	19	1014.7	32.2	20		SSW	20	1012.4
28	Mo	20.0	35.9	0			SSW	37	15:24	34.7	10		NNE	17	1013.9	33.0	25		SSW	20	1010.8
29	Tu	23.7	26.9	0			SSW	43	20:55	24.1	76		SW	17	1008.2	23.7	72		SSW	24	1007.6
30	We	19.9	28.2	0			SSW	46	13:49	23.6	47		SE	15	1011.1	23.9	62		SSW	30	1009.1
31	Th	17.8	32.2	0			ESE	59	00:00	22.8	46		E	20	1014.9	31.7	24		SE	15	1011.8
Statistics for December 2015																					
Mean		16.8	27.2							22.7	50			18	1014.4	24.0	54			24	1012.1
Lowest		11.6	20.1							12.8	10		#	9	1008.2	15.9	20		SSW	11	1006.1
Highest		23.7	38.3	10.6			#	61		34.7	90		W	39	1021.7	33.0	73		SSW	35	1018.8
Total				18.0																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201512 Prepared at 13:09 GMT on 4 Apr 2016

Swanbourne, Western Australia
January 2016 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Fr	17.2	34.9	0			E	56	01:18	22.6	45		E	30	1015.9	33.7	21		ENE	22	1010.8
2	Sa	22.2	34.5	0			ESE	50	07:36	26.2	42		E	24	1011.4	27.3	55		SSW	22	1008.0
3	Su	22.9	33.0	0			SSW	35	16:09	27.6	44		ESE	15	1012.1	26.3	64		SW	20	1009.5
4	Mo	22.8	29.5	0			E	31	00:29	27.0	51		SSW	7	1010.9	27.7	59		W	7	1010.2
5	Tu	20.0	25.8	0			NW	28	22:27	22.2	82		NNW	13	1012.2	24.2	72		WNW	17	1010.6
6	We	19.2	33.9	0			SW	30	13:39	23.4	75		W	11	1014.8	25.9	73		WSW	19	1012.4
7	Th	20.1	39.8	0			E	43	03:07	33.9	25		ENE	26	1014.6	28.5	58		SW	15	1010.5
8	Fr	25.3	39.1							33.0	28		ENE	15	1012.3	33.6	31		ESE	22	1010.9
9	Sa	20.5	31.4	2.2			W	37	16:10	24.4	80		WNW	11	1012.4	27.6	66		W	19	1009.5
10	Su	19.9	25.9	0			WSW	28	13:28	22.5	69		WSW	15	1013.1	24.9	56		WSW	17	1012.6
11	Mo	18.8	27.1	0			SSW	30	20:50	23.5	69		NW	7	1013.0	26.2	60		WNW	17	1011.8
12	Tu	19.5	24.8	0			S	43	11:47	21.1	86		WSW	19	1014.3	23.2	59		SSW	26	1014.7
13	We	14.9	30.8	1.0			ESE	50	23:28	20.3	44		ESE	22	1023.4	29.6	19		SE	17	1019.7
14	Th	16.2	34.9	0			ENE	54	08:57	22.4	38		ENE	28	1023.8	32.9	17		ENE	17	1018.6
15	Fr	21.6	35.8	0			NE	41	09:12	29.9	25		ENE	20	1019.0	29.8	38		SSW	24	1014.9
16	Sa	22.6	36.6	0			NE	37	08:35	32.8	25		NE	19	1013.5	30.2	46		SW	11	1011.0
17	Su	20.8	26.9	0			SSW	50	18:31	24.6	78		SW	15	1010.5	25.7	67		SSW	26	1007.1
18	Mo	18.5	23.4	0.2			SW	33	09:15	19.2	98		SW	20	1006.2	22.2	63		WSW	11	1004.6
19	Tu	14.1	24.2	0.4			SSW	43	16:40	19.2	62		NE	13	1005.2	21.7	54		SSW	30	1003.5
20	We	14.8	25.3	0			SW	35	16:57	19.9	70		S	4	1008.4	23.0	64		SW	20	1007.2
21	Th	16.8	26.4	0			SSW	48	17:57	20.7	66		SSE	15	1014.2	23.7	66		SSW	28	1012.9
22	Fr	16.8	28.8	0			SW	43	15:42	21.8	49		E	17	1018.2	23.7	58		SSW	28	1015.1
23	Sa	18.5	33.8	0			SSW	48	15:17	28.7	38		E	17	1014.8	27.4	49		SSW	30	1011.5
24	Su	19.8	32.2	0			SSW	41	16:11	27.7	53		E	15	1015.3	26.7	63		SSW	28	1011.6
25	Mo	22.9	32.2	0			SSW	39	15:19	26.4	59		E	24	1010.6	27.9	60		SSW	20	1007.9
26	Tu	21.2	31.0	1.0			S	52	20:01	26.4	60		SE	11	1012.5	26.4	67		SSW	30	1010.6
27	We	21.4	32.5	0			ESE	41	23:17	24.7	48		ESE	17	1015.6	26.8	57		SSW	26	1013.2
28	Th	17.7	34.7	0			E	46	09:21	24.3	46		E	20	1016.9	33.5	23		ESE	15	1013.5
29	Fr	19.9	37.8	0			E	63	05:34	24.5	45		ENE	35	1013.1	36.6	20		E	20	1008.6
30	Sa	24.4	27.0	0			ENE	50	15:36	26.8	37		ESE	15	1006.3	19.6	98		E	24	1006.0
31	Su	19.2	22.9	10.4			SSW	69	13:51	22.0	85		SSW	15	1001.7	20.1	61		S	39	1002.7
Statistics for January 2016																					
	Mean	19.7	30.9							24.8	55			17	1013.1	27.0	53			21	1010.7
	Lowest	14.1	22.9							19.2	25		S	4	1001.7	19.6	17		W	7	1002.7
	Highest	25.3	39.8	10.4			SSW	69		33.9	98		ENE	35	1023.8	36.6	98		S	39	1019.7
	Total			15.2																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201601 Prepared at 13:09 GMT on 17 Apr 2016

Swanbourne, Western Australia
February 2016 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	12.6	21.8	0			SSW	46	16:56	17.6	47		SSE	17	1011.7	20.7	45		SSW	26	1010.8
2	Tu	11.9	23.9	0			SSW	46	15:28	18.1	46		ESE	15	1019.1	22.2	54		SSW	28	1016.1
3	We	16.8	29.6	0			SSW	46	17:36	22.6	42		ENE	19	1020.9	25.3	55		SSW	22	1017.0
4	Th	18.7	33.9	0			SSW	43	17:15	25.6	38		ENE	20	1019.3	29.4	34		SW	22	1014.4
5	Fr	18.8	34.1	0			SW	43	13:39	29.7	27		ENE	9	1015.0	27.9	46		SSW	19	1012.8
6	Sa	19.9	27.8	0			SW	37	12:44	26.9	39		NNW	2	1015.3	26.3	63		SSW	20	1013.3
7	Su	20.4	37.6	0			E	46	06:48	27.7	40		ENE	26	1015.8	28.5	55		SSW	20	1012.9
8	Mo	23.6	42.8	0			ENE	39	08:23	34.1	14		NE	20	1015.7	39.5	14		SW	13	1012.2
9	Tu	22.7	38.3	0			SSW	28	17:13	33.8	16		NE	9	1014.8	35.5	19		WSW	15	1012.3
10	We	21.3	33.6	0			SW	31	14:13	31.1	31		E	11	1013.8	29.9	42		SSW	17	1011.1
11	Th	19.9	28.3	0.2			SSW	37	21:25	24.7	88		NW	11	1013.0	27.1	73		SW	17	1011.3
12	Fr	18.9	26.2	0			SSW	46	13:44	23.9	71		SSW	13	1017.3	25.5	62		SSW	26	1015.7
13	Sa	18.4	28.3	0			SSW	54	16:01	22.1	55		ESE	20	1021.3	24.7	53		SSW	33	1017.1
14	Su	16.5	31.3	0			SSW	46	16:07	22.4	43		E	17	1021.4	26.2	55		SW	22	1017.3
15	Mo	18.2	34.1	0			E	50	08:25	23.5	44		E	22	1021.1	32.8	21		ESE	19	1016.3
16	Tu	20.4	39.1	0			ENE	57	08:58	26.7	31		ENE	31	1016.4	38.1	13		NE	9	1012.1
17	We	24.9	30.6	0			S	48	20:59	30.4	27		NW	13	1012.3	24.7	68		SW	22	1012.0
18	Th	18.3	30.9	0			SE	46	21:28	22.1	58		ESE	15	1016.7	29.4	35		SSE	19	1013.8
19	Fr	19.3	31.4	0			ESE	50	20:44	23.9	47		SE	22	1016.1	30.1	31		E	22	1012.1
20	Sa	19.4	31.5	0			E	46	04:46	23.0	55		E	17	1012.1	26.4	59		SSW	26	1007.9
21	Su	19.5	26.2	0			WNW	28	14:20	22.6	81		NW	19	1011.7	24.8	63		WNW	19	1011.3
22	Mo	18.6	24.6	0			SW	35	09:35	21.8	62		SW	19	1016.9	22.5	55		SW	20	1016.5
23	Tu	14.7	23.8	0			SSW	43	18:43	21.0	57		NNE	4	1016.3	22.6	55		SW	20	1014.0
24	We	12.6	22.6	1.6			SSW	46	17:48	18.4	54		ESE	15	1019.0	21.3	43		SSW	28	1016.8
25	Th	14.6	26.9	0			SSW	44	15:59	19.3	45		ESE	20	1021.9	22.7	52		SSW	30	1018.5
26	Fr	17.9	34.8	0			E	44	09:17	23.8	37		E	28	1018.8	29.6	40		SSW	20	1013.4
27	Sa	22.7	32.6	0			NW	31	23:52	29.9	34		NW	7	1012.4	30.7	44		NW	11	1010.6
28	Su	20.9	25.8	0			NW	37	00:31	23.3	70		WSW	11	1015.9	24.9	61		SW	17	1014.6
29	Mo	17.2	25.9	0			SSW	35	20:08	22.0	61		W	9	1016.3	23.6	54		WSW	19	1016.4
Statistics for February 2016																					
	Mean	18.6	30.3							24.6	46			15	1016.5	27.3	47			20	1013.8
	Lowest	11.9	21.8							17.6	14		NNW	2	1011.7	20.7	13		NE	9	1007.9
	Highest	24.9	42.8	1.6			ENE	57		34.1	88		ENE	31	1021.9	39.5	73		SSW	33	1018.5
	Total			1.8																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201602 Prepared at 16:09 GMT on 16 Apr 2016

Swanbourne, Western Australia
March 2016 Daily Weather Observations

Most observations from a site just under 1 km from the coast, combined with some from Mount Lawley.

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Tu	15.7	23.7	0			SSW	43	14:07	20.5	64		SSE	9	1020.3	22.1	51		SSW	26	1017.7
2	We	15.0	25.6	0			S	39	14:44	22.2	49		E	13	1019.3	24.6	60		SSW	22	1015.7
3	Th	16.7	24.7	0			SSW	48	17:11	21.5	68		SSW	13	1017.1	22.4	68		SW	24	1016.0
4	Fr	15.8	24.5	0			SSW	44	17:56	20.1	65		SSE	13	1020.5	23.6	60		SW	24	1016.5
5	Sa	16.6	27.0	0			SSW	41	15:10	21.6	54		ESE	15	1019.3	23.7	63		SSW	26	1016.3
6	Su	18.2	29.8	0			SSW	41	15:33	23.1	59		E	22	1019.7	25.0	65		SSW	24	1016.6
7	Mo	19.6	33.2	0			E	50	02:17	23.8	55		E	31	1019.3	28.7	46		SSW	20	1015.7
8	Tu	20.6	32.9	0			E	33	06:51	26.4	41		ENE	17	1015.8	30.7	39		SW	13	1012.0
9	We	19.0	33.7	0			SW	30	13:43	27.7	37		ENE	11	1012.9	28.2	38		SSW	17	1009.9
10	Th	19.0	26.2	0			SSW	46	16:02	23.8	74		SSW	7	1012.5	25.2	58		SSW	24	1010.6
11	Fr	18.1	25.8	0			SSW	48	16:33	22.5	54		SSE	15	1015.9	24.7	64		SSW	26	1013.1
12	Sa	19.8	29.8	0			SSW	41	17:03	24.1	55		ESE	17	1016.1	25.0	66		SSW	26	1012.7
13	Su	21.2	39.6	0			E	44	08:38	28.9	41		E	26	1014.6	38.1	14		ESE	13	1011.3
14	Mo	26.8	40.7	0			ENE	52	09:45	31.5	28		NE	28	1013.4	38.9	15		ENE	20	1008.6
15	Tu	22.3	27.2	0			SW	30	14:28	23.7	81		NW	9	1009.8	24.9	71		SW	22	1007.1
16	We	19.7	24.2	0			SW	56	15:36	21.3	65		S	17	1012.1	22.8	56		SSW	33	1010.1
17	Th	15.9	28.2	0			ESE	43	23:44	19.2	50		ESE	19	1016.1	27.2	26		SE	15	1011.4
18	Fr	17.1	29.9	0			ESE	43	00:15	20.4	52		E	26	1014.5	28.7	35		E	13	1010.0
19	Sa	20.5	26.1	0			ENE	41	02:30	22.0	52		E	13	1012.0	25.1	47		SE	17	1009.0
20	Su	18.9	28.3	0.2			SSW	31	15:32	23.9	63		ESE	11	1013.6	25.0	66		SSW	20	1010.3
21	Mo	21.2	29.4	0			SSW	35	15:06	26.5	49		ENE	4	1011.5	24.4	70		SSW	22	1009.1
22	Tu	20.4	27.0	0			ESE	39	22:18	23.4	62		ESE	19	1012.3	25.5	53		ESE	20	1011.4
23	We	19.2	23.6	0			ESE	41	18:04	20.4	69		SE	17	1017.9	22.5	59		SE	19	1016.4
24	Th	18.7	27.1	0			ESE	43	00:19	21.4	68		E	17	1022.6	26.4	51		E	17	1020.1
25	Fr	21.2	33.6	0			E	43	05:25	25.2	60		E	24	1020.8	27.9	60		SSW	13	1017.6
26	Sa	19.8	22.9	14.8			E	28	10:46	20.0	99		ESE	11	1019.9	20.9	99		E	13	1016.5
27	Su	16.6	23.9	11.6			ESE	43	10:44	17.4	77		SE	17	1019.0	23.1	51		ESE	24	1018.4
28	Mo	14.0	25.5	0			SW	33	16:22	18.5	67		ESE	15	1024.1	24.9	39		SE	17	1021.9
29	Tu	14.0	27.2	0			SSW	33	17:15	21.3	55		ENE	15	1025.8	24.0	53		SW	20	1021.8
30	We	15.0	27.3	0			SW	28	15:13	23.2	51		ENE	9	1023.2	25.2	58		SSW	17	1018.2
31	Th	17.1	24.0	0			SW	33	19:04	21.0	73		SSE	11	1016.5	22.6	64		SW	20	1014.8
Statistics for March 2016																					
	Mean	18.5	28.1							22.8	59			15	1017.0	25.9	53			20	1014.1
	Lowest	14.0	22.9							17.4	28		ENE	4	1009.8	20.9	14		#	13	1007.1
	Highest	26.8	40.7	14.8			SW	56		31.5	99		E	31	1025.8	38.9	99		SSW	33	1021.9
	Total			26.6																	

Temperature, humidity, wind and rainfall observations are from Swanbourne {station 009215}. Pressure observations are from Perth Metro {station 009225}

IDCJDW6121.201603 Prepared at 13:09 GMT on 14 Apr 2016