Department of Planning and Environment

Our ref: DA60-03-2001-PA-240

Linda Zanotto
Principal Approvals
ILLAWARRA COAL HOLDINGS PTY LTD
Port Kembla New South Wales 2505

05/10/2023

Subject: Dendrobium Mine - Area 3C Impact Report

Dear Ms Zanotto

I refer to the Area 3C Subsidence Impact Report, dated September 2023, submitted as required by Schedule 3, Condition 7 of consent for the Dendrobium Mine (DA60-03-2001). The department has reviewed the document and notes that Illawarra Metallurgical Coal (IMC) has consulted with WaterNSW and the Biodiversity and Conservation Division (BCD) in relation to the reported Level 3 soil moisture and groundwater triggers at Swamp 144. This correspondence indicates:

- IMC has requested, but is yet to receive, advice from Water NSW regarding any additional corrective management actions to be implemented for Swamp 144.
- BCD has requested that IMC continues to provide ongoing monitoring data for impacts to Swamp 144 on a three-monthly basis. The Department notes that the next set of data was scheduled to be provided in September 2023. The data presented in the Report is current to 27 June 2023; and
- BCD has indicated that it will provide further advice/requirements once this additional data has been analysed and outcomes confirmed.

The department requests that ongoing monitoring data is provided to BCD as requested and that this data, together with a summary of any additional correspondence with Water NSW and BCD and the status of all corrective management actions for impacts to Swamp 144, is reported in the End of Panel Report for Longwall 21.

Should you wish to discuss the matter further, please contact James McDonough on (02) 9585 6313 or james.mcdonough@dpie.nsw.gov.au.

Yours sincerely

Jessie Evans

Director, Energy and Resource Assessments
As nominee of the Planning Secretary

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30 August 2023

Contact: *Maria Dubikova*
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Our ref: *D2023/63840*

Linda Zanotto
Principal Approvals
Illawarra Metallurgical Coal

Email: Linda.Zanotto@South32.net

Dear Ms Zanotto

Subsidence Impact Reports - Swamps 144 and 15a

According to the TARP action plan IMC is required to report all identified landscape impacts to key stakeholders. WaterNSW has received Subsidence Impacts Reports dated 17/07/2023, 31/07/2023 and 18/08/2023 that identified:

- Level 3 trigger for Swamp 144 (Longwall 21) - groundwater recession rate greater than baseline and average soil moisture level below the baseline level. There is one monitoring locations in Swamp 144.
- Level 2 trigger for Swamp 15a (Longwall 19) - soil moisture level lower than baseline level at 50% of monitoring sites reported on 31 July; and
- Level 3 trigger for Swamp 15a (Longwall 19) - soil moisture level lower than baseline level at 80% of monitoring sites reported on 18 August.

While soil moisture and groundwater levels are not specifically linked to a swamp performance measure, WaterNSW considers that observed decline in soil moisture and groundwater levels are early and reliable indicators of irreversible changes in swamp hydrology on which ecosystem functionality is dependent. WaterNSW is concerned that a performance measure of minor environmental consequences for Swamp 144 and negligible environment consequences for Swamp 15a will be exceeded.

Moreover, the reported Level 3 exceedances for Swamp 144 and Swamp 15a occurred at distances greater than 61 m from Longwall 21 and Longwall 19 footprints. These monitoring results indicate that the 61m setback distance from longwalls is inadequate to prevent hydrological impacts to swamps over Dendrobium mine and warrant further and more rigorous assessment.

Please feel free to contact Maria Dubikova if you would like to discuss any of the above matters further.

Yours sincerely

Girja Sharma

Girja Sharma
Catchment Assessments Manager

8 September 2023

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Camilla Edmunds
Manager Environment and Catchment Protection
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Dear Camilla,

Dendrobium Mine Area 3 – Review of Empirical Model of Distance to Swamp Impacts – Subsidence Impact Report dated 14 March 2023

I refer to the Subsidence Impact Report dated 14 March 2023 (Version 2 included as Attachment 1) which identified a potential mining-related effect in Swamp 35b, near to Dendrobium Area 3B Longwall 18. In response, WaterNSW requested a reassessment of groundwater impacts to Swamp 35b and if necessary, a review of the empirical model of distance versus impact at swamp piezometers at Dendrobium Mine in letter dated 11 April 2023 (Attachment 2).

IMC engaged Watershed Hydrogeo to review the data and assess whether a mining-related impact was the likely cause of any change to swamp hydrology at site 35b_01. In addition, data from piezometer 15a_19 near to Longwall 19 in Area 3A was examined. This report dated 13 July 2023 recommended revision of the empirical model and is presented in Attachment 3.

Attachment 4 presents the report: *Update to geographic review of mining effects on Upland Swamps at Dendrobium Mine (data to June 2023)* prepared by Watershed Hydrogeo dated 7 September 2023.

Longwall 19A SMP was approved on 11 August 2023. Condition 7 of Schedule 3 of the SMP approval requires that Longwall 19A is set back at least 120 metres to the west of Swamp 15a. For further information, refer to: https://www.planningportal.nsw.gov.au/major-projects/projects/dendrobium-mine

If you have any queries, please do not hesitate to contact myself or Gary Brassington.

Sincerely

Linda Zanotto

Principal Mining Approvals

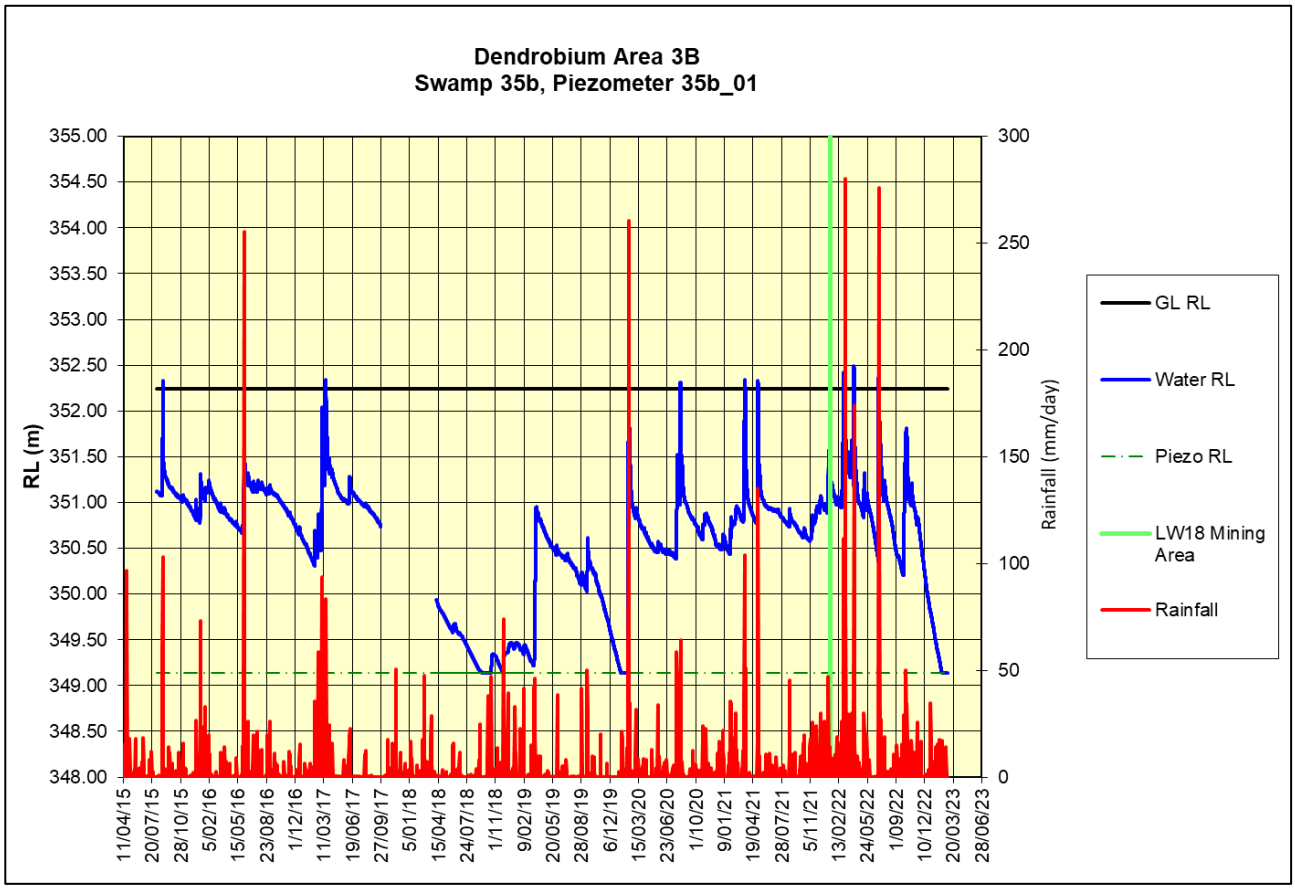
Monitoring of watercourses, swamps and landscape features is undertaken to identify subsidence impacts. These features are monitored by the Illawarra Metallurgical Coal Environmental Field Team (IMCEFT) monthly prior to mining, weekly during mining and again monthly during post-mining period. Monitoring is conducted in accordance with the relevant approved Swamp Impact, Monitoring, Management and Contingency Plan (SIMMCP). The Area 3B SIMMCP covers sites in the previous mining area, the subject of this report. Extraction of Longwall 18 ended on 17 May 2022. Recent analysis of groundwater data in Swamp 35b identified a shallow groundwater trigger in borehole *35b_01*.

This Version 2 of the report includes a summary of consultation with stakeholders undertaken since the initial report.

Swamp 35b

A near-surface groundwater trigger was recorded in Swamp 35b (borehole *35b_01*) during recent analysis of piezometer data for the swamp. Borehole *35b_01* is located 116m to the south of Longwall 18 (Figure 1). It entered the Longwall 18 400m buffer (mining area) on 16 January 2022, was passed by Longwall 18 on 3 March 2022 and remained in the mining area until the end of the longwall. The post mining rate of water level recession (17.94 mm/day calculated between 20/12/22 05:00 and 17/01/23 02:00) has exceeded the rate recorded at the same depth interval before mining (11.48 mm/day calculated between 1/11/19 18:00 and 15/12/19 08:00) (Graph 1). These results contribute to a Level 3 trigger according to the Dendrobium Swamps TARP (Table 1), specifically:

> **Level 3:** Groundwater level lower than baseline level at >80% of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at >80% of monitoring sites (within 400 m of mining) within the swamp. (It should be noted that there is only one shallow borehole/piezometer in Swamp 35b, therefore only a Level 3 trigger applies).



Graph 1: Near-surface groundwater levels at 35b_01, logged hourly, date range: 06/08/2015 to 28/02/2023

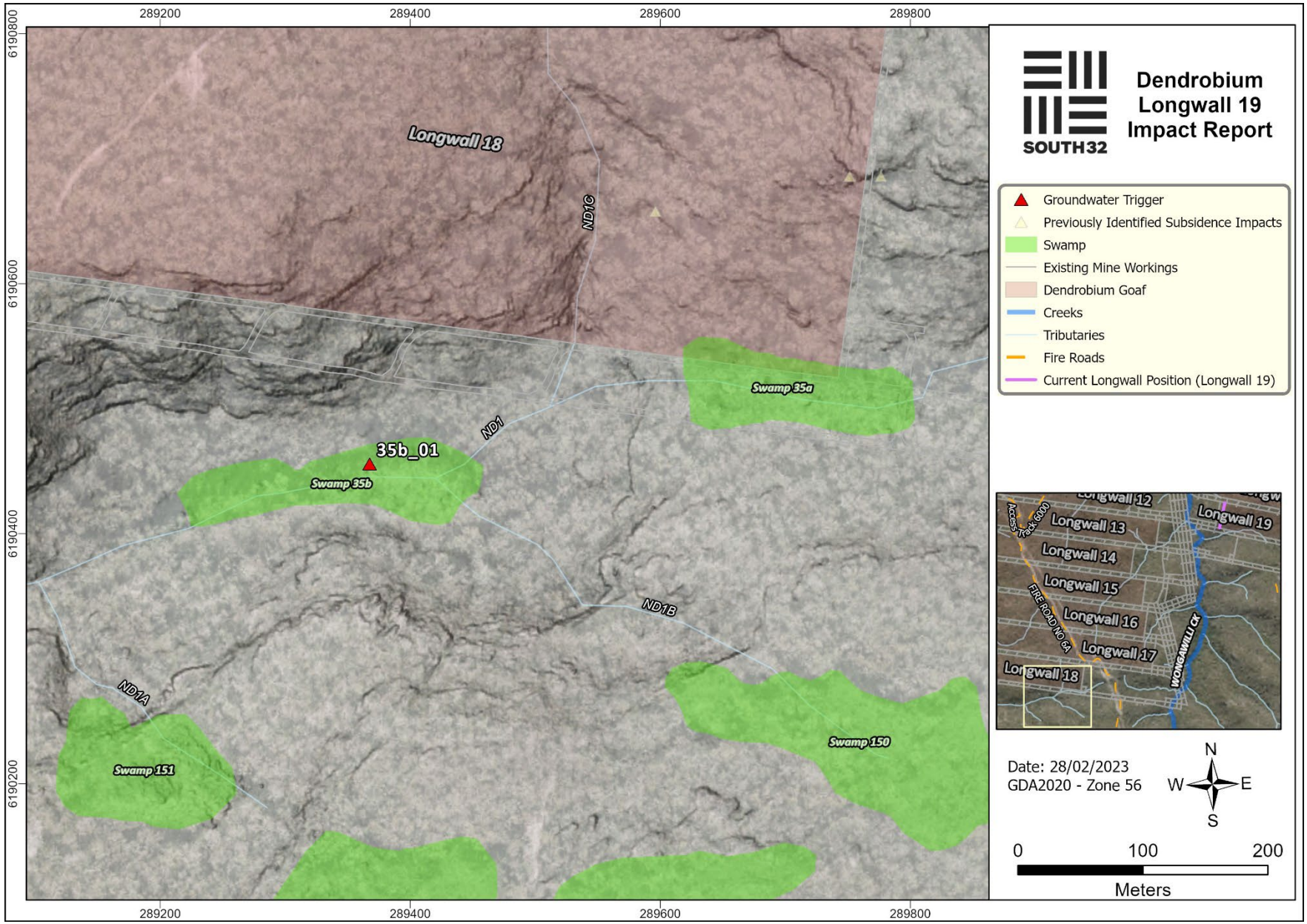


Figure 1: Map Showing Swamp 35b in relation to Longwall 18. Inset shows frame in relation to wider Dendrobium mine workings.
Title is 'Longwall 19' as it is the current longwall/reporting period.

Table 1: Extract from Area 3B Swamp Impact, Monitoring, Management and Contingency Plan.

Performance Measures	***Potential Impacts***	***Performance Triggers***	***Management Strategies***	***Offsets***	***Other Actions***
Minor changes in the ecosystem functionality of the swamps	Falls in surface or near-surface groundwater levels in swamps *NB. Not linked specifically to a PM and would not be considered a breach if predictions were exceeded.*	*Level 1:* Groundwater level lower than baseline level at any monitoring site within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at any monitoring site (measured as average mm/day during the recession curve). *Level 2:* Groundwater level lower than baseline level at **50%** of monitoring sites (within 400 m of mining) within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at a **50%** of monitoring sites (within 400m of mining) within the swamp. *Level 3:* Groundwater level lower than baseline level at **>80%** of monitoring sites (within 400m of mining) within a swamp (in comparison to reference swamps); and/or Rate of groundwater level reduction exceeds rate of groundwater level reduction during baseline period at **>80%** of monitoring sites (within 400 m of mining) within the swamp.	a) upfront mine planning b) groundwater monitoring c) implementation of swamp research program d) weeding e) fire management f) reporting g) update future predictions		Triggers for groundwater decline result in increased intensity and frequency of vegetation monitoring and/or further investigations of subsidence impacts on bedrock base and rockbars

Table 2: Summary of Longwall 19 impacts and triggers. Highlighted row indicates observation featured in this report.

Site ID	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3A_LW19_001	Rock Fracturing	Steep Slope/ Step	3/08/2022	1	Rock fracturing to a steep slope/ step, east of Fire Road 6F.	5/08/2022
DA3A_LW19_002	Rock Fracturing	Steep Slope/ Step	3/08/2022	1	Rock fracturing to a steep slope/ step, east of Fire Road 6F.	5/08/2022
DA3A_LW19_003	Iron Staining	WC14	16/08/2022	2	Increase in Iron staining at tributary WC14	17/08/2022
DA3A_LW19_004	Rock Fracturing and Fragmentation	Steep Slope/ Step	19/08/2022	1	Rock fracturing to a steep slope/ step, west of Swamp 15b.	23/08/2022
DA3A_LW19_005	Rock Fracturing	Steep Slope/ Step	19/08/2022	1	Rock fracturing to a steep slope/ step, west of Swamp 15b.	23/08/2022
DA3A_LW19_006	Soil Cracking	Bushland	31/08/2022	2	Soil cracking to bushland south of tributary SC10C.	5/09/2022
DA3A_LW19_007	Soil Cracking	Bushland	18/10/2022	1	Soil cracking in bushland between Longwall 19 and Swamp 15b.	20/10/2022
DA3A_LW19_008	Rock Fracturing	Rock Outcrop	7/11/2022	1	Rock fracturing to rock outcrop east of Fire Road 6F.	9/11/2022
DA3A_LW19_009	Rock Fracturing	Rock Outcrop	7/11/2022	1	Rock fracturing to rock outcrop east of Fire Road 6F.	9/11/2022
DA3A_LW19_010	Rock Fracturing	Rock Outcrop	7/11/2022	1	Rock fracturing to rock outcrop east of Fire Road 6F.	9/11/2022
DA3A_LW19_011	Rock Fracturing	Rock Outcrop	7/11/2022	1	Rock fracturing to rock outcrop east of Fire Road 6F.	9/11/2022
DA3A_LW19_012	Rock Fracturing	Rock Outcrop	7/11/2022	1	Rock fracturing to rock outcrop east of Fire Road 6F.	9/11/2022
DA3A_LW19_013	Rock Fracturing and Rock Movement	Steep Slope/ Step	7/11/2022	2	Rock fracturing and rock movement at a steep slope/ step, east of Fire Road 6F.	9/11/2022
DA3A_LW19_014	Rock Movement	Boulder	7/11/2022	1	Dislodgement of a boulder east of Fire Road 6F.	9/11/2022
DA3A_LW19_015	Rock Fracturing	Steep Slope/ Step	7/11/2022	2	Rock fracturing to a steep slope/ step, north of Swamp 15a.	9/11/2022

Site ID	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3A_LW19_016	Rock Fracturing and Rockfall	Steep Slope/ Step	7/11/2022	2	Rock fracturing and small rock fall at a steep slope/ step, east of Fire Road 6F.	9/11/2022
DA3A_LW19_017	Rock Fracturing	Rock Outcrop	13/12/2022	1	Rock fracturing to a rock outcrop, east of Fire Road 6F.	15/12/2022
DA3A_LW19_018	Rock Displacement	Steep slope	13/12/2022	1	Rock displacement to a steep slope, east of Fire Road 6F.	15/12/2022
DA3A_LW19_019	Rock Displacement	Steep slope	13/12/2022	1	Rock displacement to a steep slope, east of Fire Road 6F.	15/12/2022
DA3A_LW19_020	Soil Cracking	Bushland	13/12/2022	2	Soil cracking at the base of a rock outcrop, east of Fire Road 6F.	15/12/2022
DA3A_LW19_021	Soil Cracking and Rock Displacement	Boulders	13/12/2022	2	Soil cracking and rock displacement to boulders, east of Fire Road 6F.	15/12/2022
DA3A_LW19_022	Soil Cracking, Rock Fracturing and Rock Displacement	Bushland/ Rock Outcrop	13/12/2022	2	Soil cracking, rock fracturing and rock displacement in bushland, east of Fire Road 6F.	15/12/2022
DA3A_LW19_023	Rock Fracturing	Rock Outcrop	13/12/2022	1	Rock fracturing to a rock outcrop, east of Fire Road 6F.	15/12/2022
DA3A_LW19_024	Rock Fracturing and Soil Cracking	Step/ Bushland	20/12/2022	2	Rock fracturing to a step and soil cracking to bushland, east of Fire Road 6F.	22/12/2022
DA3A_LW19_025	Rock Displacement	Boulder	20/12/2022	1	Rock displacement away from soil, east of Fire Road 6F.	22/12/2022
DA3A_LW19_026	Soil Cracking	Fire Road 6F	21/12/2022	1	Soil cracking to Fire Road 6F.	22/12/2022
DA3A_LW19_015 (Update)	Rock Fracturing	Steep Slope/ Step	7/11/2022	2	Rock fracturing to a steep slope/ step, east of Fire Road 6F.	9/11/2022 & 22/12/2022
DA3A_LW19_016 (Update)	Rock Fracturing, Fragmentation and Rockfall	Steep Slope/ Step	7/11/2022	2	Rock fracturing, fragmentation and rock fall at a steep slope/ step, east of Fire Road 6F.	9/11/2022 & 22/12/2022
S148_01	Soil Moisture	*Swamp 148*	22/12/2022	3	Soil moisture lower than baseline trigger in *Swamp 148*.	22/12/2022
DA3A_LW19_027	Rock Fracturing and Rockfall	Step	10/01/2023	1	Rock fracturing and two small rockfalls at a step, west of Fire Road 6F.	11/01/2023

Site ID	Impact Type	Feature Affected	Identification Date	Trigger Level	Description	Refer to Impact Report/s Dated
DA3A_LW19_028	Rock Fracturing	Rock Outcrop	6/02/2023	1	Rock fracturing to rock outcrop east of Fire Road 6F	09/02/2023
DA3A_LW19_029	Gas Release	Wongawilli Creek	18/01/2023	1	Gas release in WC_Pool 50, Wongawilli Creek	09/02/2023
DA3A_LW19_025 (Update)	Rock Displacement, Rock Fracturing and Soil Cracking	Rock Step/Outcrop	20/12/2022, 17/01/2022 (update)	1	Rock displacement away from soil, rock fracturing and soil cracking east of Fire Road 6F	22/12/2022 and 09/02/2023
DA3A_LW19_030	Rock Fracturing	Rock Outcrop	15/02/2023	1	Rock fracturing to rock outcrop east of Fire Road 6F	17/02/2023
DA3A_LW19_031	Rock Fracturing	Rock Outcrop	15/02/2023	1	Rock fracturing to rock outcrop east of Fire Road 6F	17/02/2023
DA3A_LW19_032	Rock Fracturing	Rock Outcrop	15/02/2023	1	Rock fracturing to rock outcrop east of Fire Road 6F	17/02/2023
DA3A_LW19_033	Rockfall	Rock Step/Outcrop	15/02/2023	1	Rockfall on rock outcrop east of Fire Road 6F	17/02/2023
DA3A_LW19_034	Rock Fracturing	Rock Outcrop	15/02/2023	1	Rock fracturing to rock outcrop east of Fire Road 6F	17/02/2023
35b_01	Groundwater	*Swamp 35b*	27/02/2023	3	Groundwater recession rate greater than baseline	14/03/2023

CONSULTATION

Summary of consultation undertaken in relation to the subsidence impact report

The impact report was uploaded to the Major Projects Portal on 15 March 2023 and issued with reference number DA60-03-2001-PA-194. Consultation with BCD and WaterNSW was elected to be undertaken via the portal. The impact report was also emailed directly to WaterNSW, BCD and the Resources Regulator.

The Resources Regulator responded via email on 15 March 2023 and issued reference number MAAG0015759 indicating that an assessment officer would be in contact should further information be required. No further correspondence was received.

WaterNSW responded via the portal with a letter dated 11 April 2023 requesting reassessment of groundwater impacts to swamp 35b in Longwall 19 End of Panel Report.

BCD responded via the portal with a letter dated 12 April 2023 requesting further information for on-going assessment of these impacts.

Summary of the comments received during consultation

WaterNSW

WaterNSW noted the following:

- The different approach has been implemented for assessment of groundwater recession rates in this SIR and the EOPR. The EOPR includes results of 3-day groundwater recession rates plotted together with groundwater levels, while SIR compares recession rates for two periods when groundwater levels in Swamp 35b decline below the instrument RL (the swamp become dry)
- Groundwater hydrograph for Swamp 35b indicates that there has been a change in groundwater recession rates during 2022. It is not clear what could cause this post drought change and if mining in Area 3B could have any influence on Swamp 35b
- The exceedance in postmining groundwater recession rate would be greater if the estimated post Longwall 18 rate (December/January 2023) was compared with the recession rate during the period of drought (June 2017 to October 2018)

WaterNSW recommend reassessment of groundwater impacts to Swamp 35b in Longwall 19 End of Panel Report and confirm results are consistent with previous analysis by Watershed (2019, 2021) concluding about mining effects not been observed at distances greater than 60 m from a longwall panel.

Biodiversity and Conservation Division (BCD)

BCD concerns included:

- The longwall does not directly overlie the swamp and impacts may be occurring at least 116 m to the south of the nearest longwall.
- Impacts to Swamp 35b could affect the population of Littlejohn's treefrog downstream along WC ND1 as identified in the Swamp Impact Monitoring and Management Contingency Plan (Area 3B SIMMCP).

BCD requested further information including:

- All raw monitoring data from Swamp35b, Swamp35a, Swamp150 and Swamp151;
- All vegetation and threatened species data within a 500-meter radius of Swamp 35b;
- Monitoring data for all pools along ND1; and
- Ongoing monitoring data, as specified above, on a 6 monthly basis

Summary of actions taken by Illawarra Metallurgical Coal in response to comments received during consultation

In response to comments from WaterNSW and BCD, IMC have undertaken the following actions:

- Engaged a groundwater expert to reassess groundwater impacts to Swamp 35b. Results of this assessment are to be included in the Longwall 19 End of Panel Report to satisfy WaterNSW recommendations.
- Provided a data pack to BCD on 11 May 2023 that included:
    - Raw monitoring data from Swamp 35b, Swamp 35a, Swamp 150 and Swamp 151;
    - Ecology data within a 500-meters of Swamp 35b
    - Monitoring data for pools along ND1
    - Rainfall data
    - Associated spatial data
- End of Panel data pack for future longwalls will be provided to BCD to satisfy provision of ongoing monitoring data.
- Implementation of on-going corrective management actions (CMAs) as detailed above.

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11 April 2023

Contact: *Maria Dubikova*
email: *maria.dubikova@waternsw.com.au*
Our ref: *D2023/31806*

Linda Zanotto
Specialist Environment – Systems and Reporting
Illawarra Metallurgical Coal
Email: Linda.Zanotto@South32.net

Dear Ms Zanotto

Subsidence Impact Report - Swamp 35b

According to the TARP action plan IMC is required to report all identified landscape impacts to key stakeholders. WaterNSW has received Subsidence Impacts Reports dated 14/03/2023 that assessed and identified Level 3 trigger for rate of groundwater level reduction in Swamp 35b.

Based on the assessment presented in the Subsidence Impact Report (SIR) it is understood that:

- Borehole 35b_01 in Swamp 35b is located 116 m from Longwall 18 footprint.
- Calculated groundwater decline rate increased from 11.5 mm/day during pre-mining period (Nov-Dec 2019) to 17.9 mm/day postmining (Dec 22-Jan 23).
- There is only one (35b_01) monitoring location in swamp 35b, therefore only Level 3 trigger applies (greater than 80% of impacted sites within a swamp).

WaterNSW reviewed data presented in this SIR as well as in the Longwall 18 End of Panel Report (EOPR) and noted the following:

- The different approach has been implemented for assessment of groundwater recession rates in this SIR and the EOPR. The EOPR includes results of 3-day groundwater recession rates plotted together with groundwater levels, while SIR compares recession rates for two periods when groundwater levels in Swamp 35b decline below the instrument RL (the swamp become dry).
- Groundwater hydrograph for Swamp 35b indicates that there has been a change in groundwater recession rates during 2022. It is not clear what could cause this post drought change and if mining in Area 3B could have any influence on Swamp 35b.
- The exceedance in postmining groundwater recession rate would be greater if the estimated post Longwall 18 rate (December/January 2023) was compared with the recession rate during the period of drought (June 2017 to October 2018).

It is recommended to reassess groundwater impacts to Swamp 35b in Longwall 19 EOPR and confirm if results are consistent with previous analysis by Watershed (2019, 2021) concluding about mining effects not been observed at distances greater than 60 m from a longwall panel.

Please feel free to contact Maria Dubikova if you would like to discuss any of the above matters further.

Yours sincerely

Camilla Edmunds
Manager Environment and Catchment Protection
WaterNSW

13 Jul 2023

Watershed HydroGeo
ABN: 95 615 827 499

To: Linda Zanotto
Illawarra Metallurgical Coal

81 North St, Nowra N.S.W.
AUSTRALIA 2541

phone: +61 (0)432 812 773

cc: Josh Carlon

From: Will Minchin

will.minchin@watershedhg.com

Dendrobium Mine: impact report for swamp piezometers 35b_01 and 15a_19

Your Ref: Linda & Cody emails 12/04/2023 Our Ref: IMC118-20230706c

1 Introduction

In March 2023, IMC (2023) identified a potential mining-related effect on swamp water tables at swamp piezometer 35b_01, near to Dendrobium Area 3B Longwall 18. This was communicated to agencies in an impact report dated 14/03/2023.

In response, WaterNSW (2023) requested a review of the data from this site to confirm the impact, and if necessary a review of the empirical model of distance versus impact at swamp piezometers that has been developed at Dendrobium Mine.

Additionally, this report examines data from piezometer 15a_19, near to Longwall 19 in Area 3A.

This document first reviews the data and the assesses whether a mining-related impact was the likely cause of any change to swamp hydrology at each site, and following that, an assessment or conceptualisation of the processes by which an impact may have occurred. Recommendations regarding the need for further work are stated.

2 Swamp 35b - piezometer 01

Swamp 35b is located approximately 90 m south of the long edge of Area 3B Longwall 18 (**Figure 2-1**). This swamp is in a valley formed by tributary ND1 of Native Dog Creek. Minor tributary ND1C flows across Longwall 18 before entering ND1 approximately 75 m upstream of Swamp 35b. The piezometer 35b_01 is the only piezometer in this swamp feature, and is 110 m from the edge of the longwall void footprint. Longwall 18 was extracted between 02/12/2021 and 17/05/2022.

Prior to the SMP approval of Longwall 18, the Longwall 18 SMP Groundwater Assessment (Watershed HydroGeo, 2020) stated: "*In the lower HBSS, water levels are predicted to be drawn down by 5-15 m in response to Longwall 18. These drawdowns are likely to cause a decline in regional water levels below the base of Swamp 35b, and suggest a reduction in the baseflow that is inferred to occur at that swamp*".

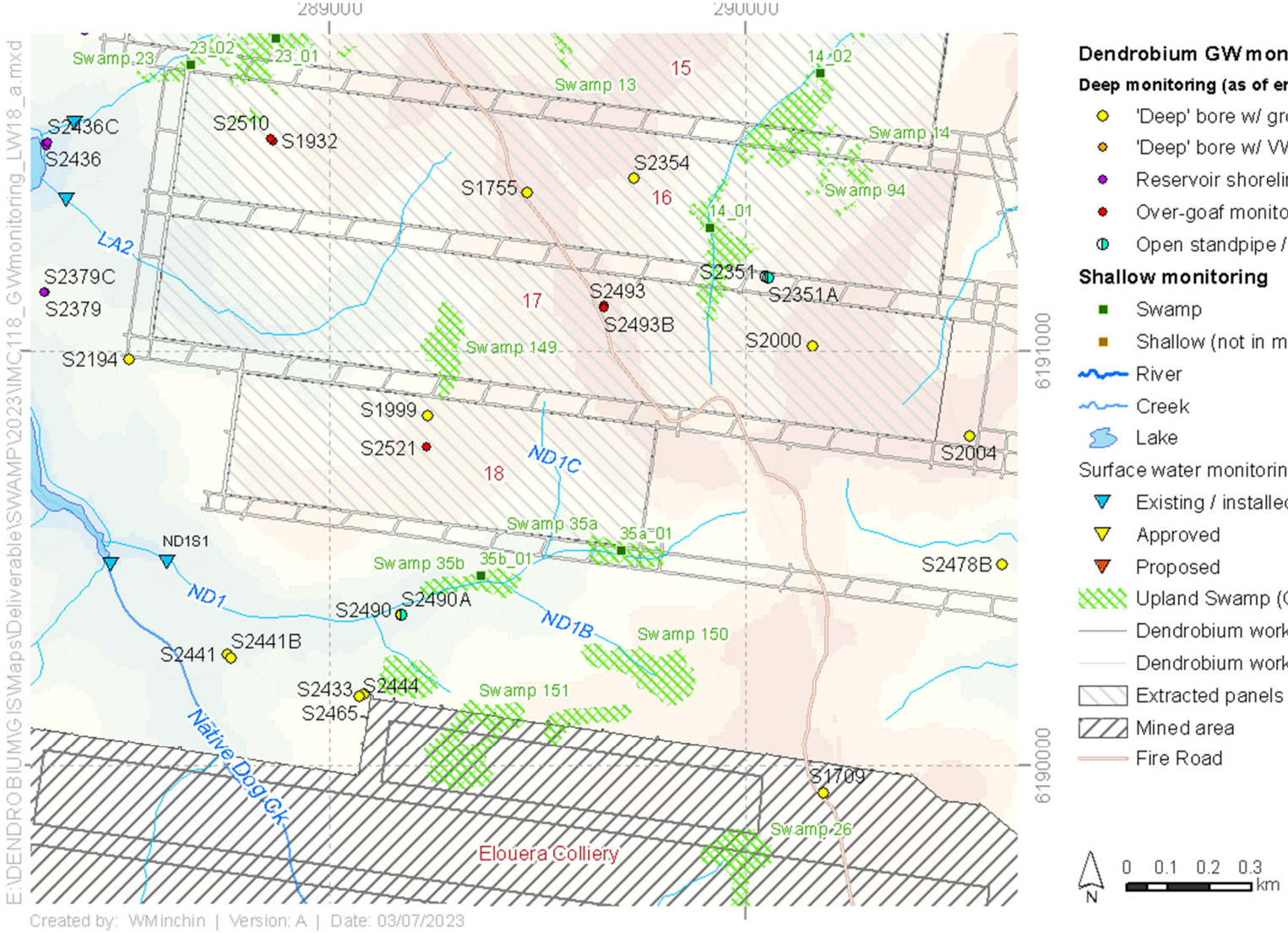

Figure 2-1 Location of Swamp 35b and relevant hydrological monitoring

2.1 Impact assessment of hydrology at 35b_01

This section presents a hydrograph of water table elevation at 35b_01 (**Figure 2-2**). This shows water levels for the period 2015-2021 ranging from 349.1 (dry piezometer) to 352.3 mAHD (fully saturated swamp sediments). The swamp dried out twice for a month or more in mid-2018 and Jan-2020, related to the extreme drought conditions that occurred in that period. Since Feb-2020, wetter conditions have caused the swamp to be saturated to 350.5-351 m for much of the time. In mid-2022 the water table receded to 350.3 mAHD, and then in the summer of 2022-23, it receded rapidly to the base of the piezometer, and has remained at that level since approximately Feb-2023.

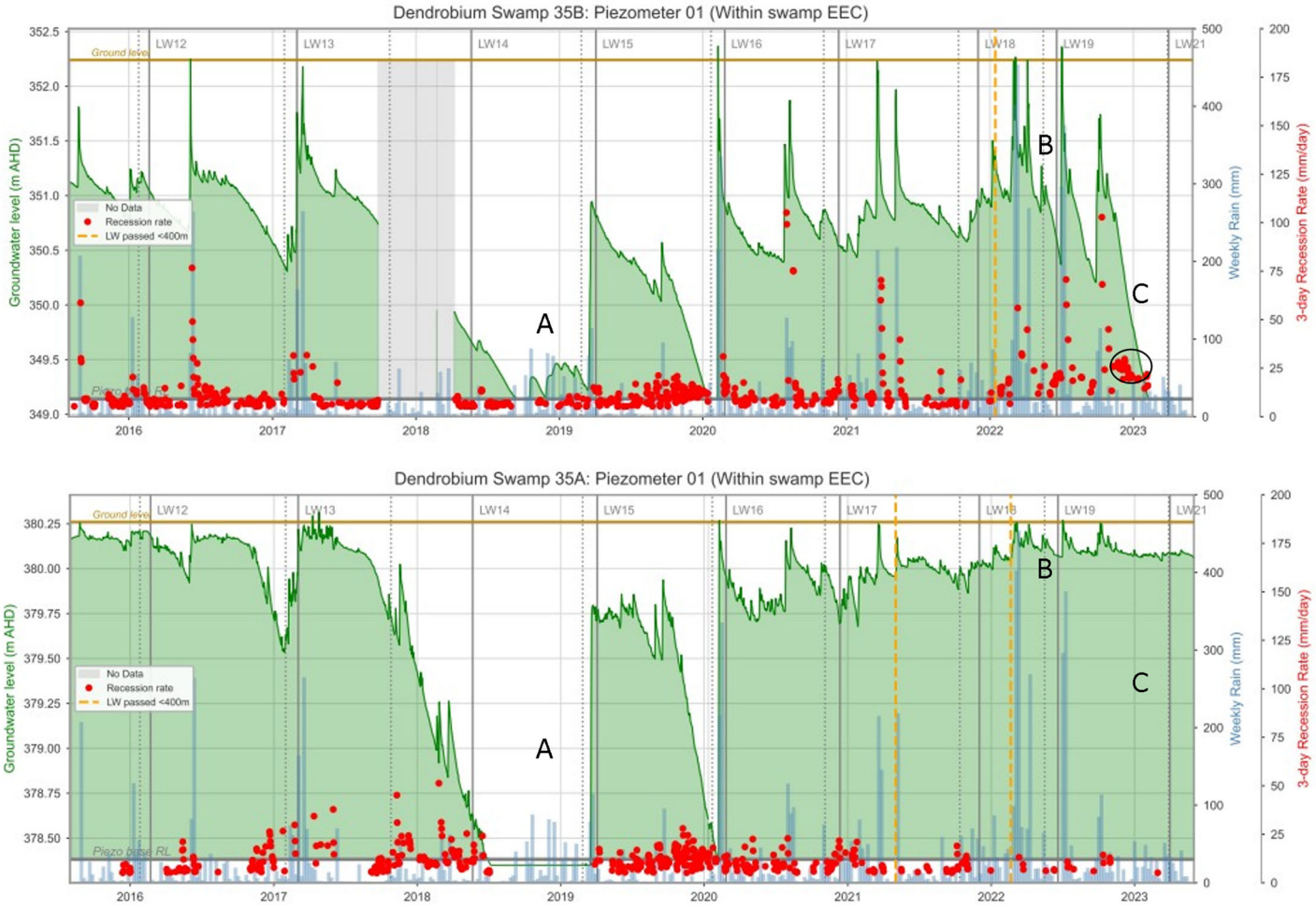

Figure 2-2 Water table hydrograph at 35b_01 and 35a_01

Figure 2-2 compares water levels at 35b_01 with the same data from nearby swamp piezometer 35a_01. The first thing to note is that water levels at 35a_01 have remained high during 2022-23, and show no sign of accelerated recession. This suggests that there is no impact leading to lower water levels at this piezometer, despite being within 5 m of the edge of the terminating end of Longwall 18.

The comparison of the two piezometers on **Figure 2-2** shows that:

- 35a_01 water table declined faster, and was at baseline levels for longer, than 35b_01 in the extreme drought of 2017-20 (see **A** on **Figure 2-2**).
- In contrast, the water table at 35b_01 declined rapidly, but for short periods, in mid- to late-2022 while the levels in 35a_01 remained high (saturated) in that time (see **B**).

- A more significant decline occurred in the summer of 2022-23 at 35b_01, but while at 35a_01 no decline is observed (see **C**).

This is strong evidence for a mining-related impact at this site. With the benefit of hindsight, it is likely that this impact first occurred in the last few weeks of Longwall 18 (see **B** on **Figure 2-2**), but was too short-lived at that time to be detected in the Longwall 18 End of Panel Report (but is identified, as it is here, in the Longwall 19 End of Panel Report).

2.1.1 Secondary evidence

In terms of recession rate (the red symbols on **Figure 2-2**, there is a possible increase in the recession rate in late 2022, however this effect is not as clear or definitive as the water table elevation response.

Two "Saturation plots" (by HGEO) are included in Appendix A. The first is for Area 3B, showing the monthly saturation as a % of maximum swamp thickness, first for the Reference Sites, and then for the impact assessment sites in Area 3B. This shows that 35b_01 behaves similarly to 35a_01, and also to Reference Sites 84_01 and 07_05, in terms of saturation through the 2017-20 drought, and the wetter period since early 2020. Then in the late 2022, the 35b_01 plot changes to pink (low saturation), while the others remain blue (saturated). [note this analysis is hampered by a lack of recent data at 84_01].

2.2 Review of other environmental data

To better understand the processes that might result in an impact to swamp hydrology, data review of landscape impacts, groundwater levels and baseflow has been undertaken.

Landscape impacts

IMC's Environment Field Team (IMCEFT) routinely inspect and record 'landscape' impacts such as instances of surface cracking. These surveys are conducted weekly while the longwall face is within 400 m. IMCEFT provided the following image (**Figure 2-3**), showing mapped landscape impacts around Longwall 18.

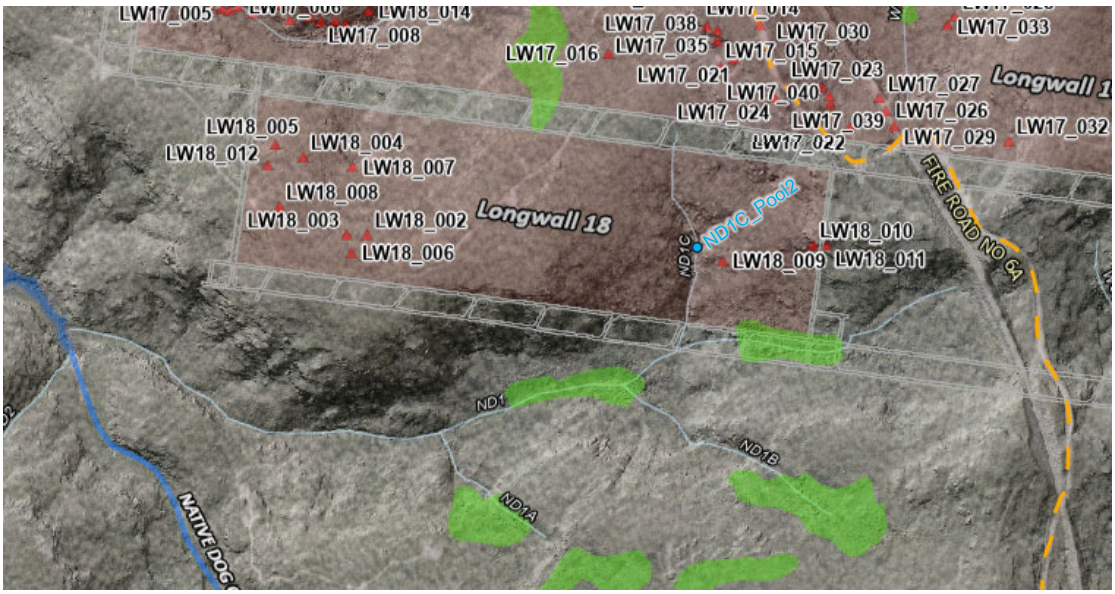

Figure 2-3 Mapped landscape impacts at Longwall 18

Figure 2-3 shows that there are no recorded landscape impacts along ND1 upstream or downstream of Swamp 35b. It is possible that impacts have occurred, but are not mapped despite the repeated surveys of this area while mining is occurring nearby.

Groundwater levels

Groundwater levels have been reviewed at a number of nearby 'deep' groundwater monitoring bores (locations on **Figure 2-1**). When reviewing these, the context is that the water table elevation at 35b_01 is 349-352 mAHD.

- **S2521** – this bore was decommissioned (for mine safety purposes) prior to Longwall 18 passing, but shows that Longwall 17 and early Longwall 18 effects resulted in the 70 m piezometer (at a similar elevation to 35b_01) going dry, meaning that drawdown was 1.5 m or more (**Figure 2-4**). It is highly likely that following the completion of Longwall 18, this effect would have been more widespread (i.e. extensive to the south).

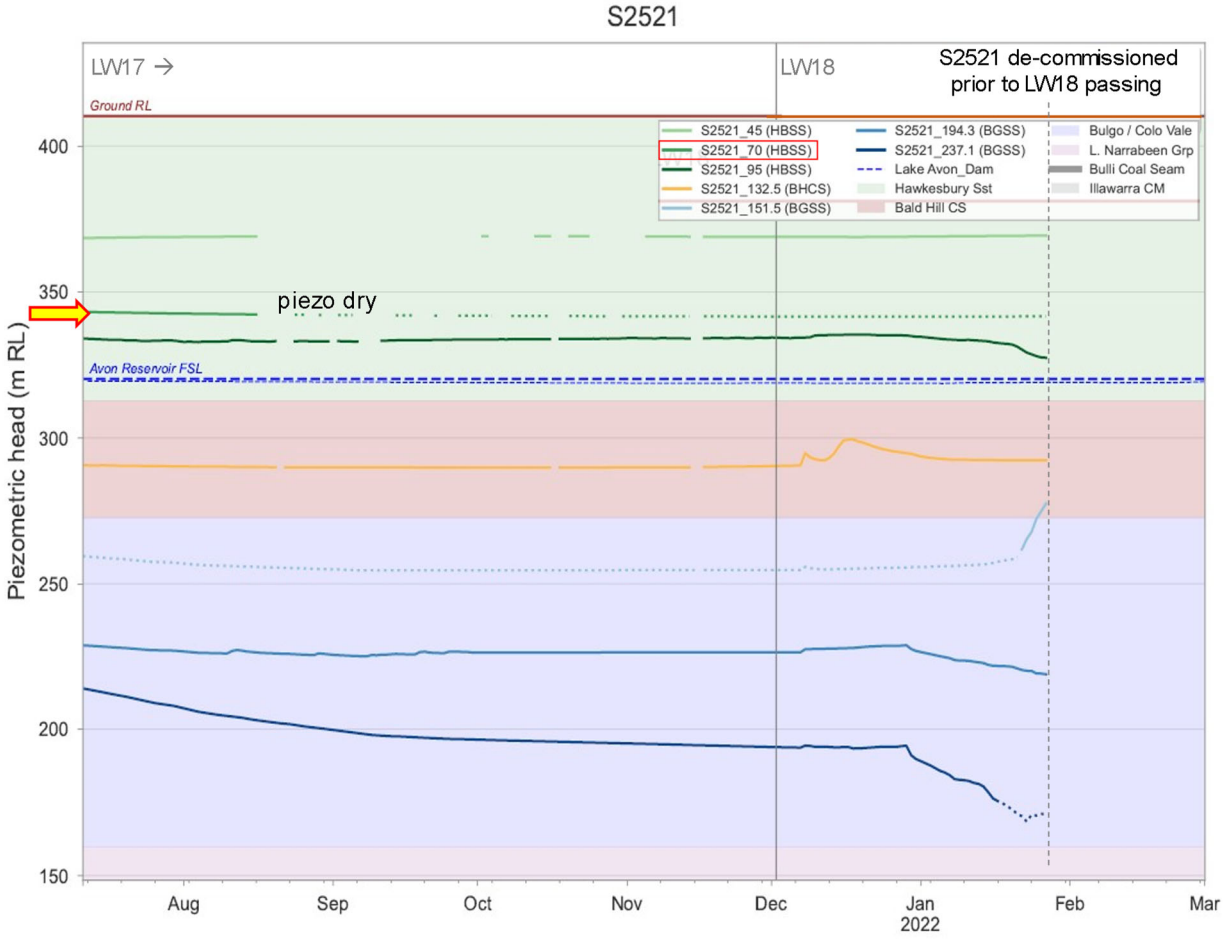

Figure 2-4 Groundwater level hydrograph of S2521

- **S1999** – this bore only measures coal seam pressures.
- **S2194** – this ceased monitoring in 2018.
- **S2379** – this bore is located to the west of Longwall 17, however the pressures in the shallowest horizon remain stable (partially saturated).
- **S2490 / S2490A**– this site is the closest of the groundwater monitoring bores to 35b_01, and the key instrument at this site is the shallowest piezometer (10m piezometer, installed as S2490A). The hydrograph to the end of 2022 (and extended here to 2023) does not suggest a clear mining effect (drawdown), although 10-15 m drawdown is clearly evident in deeper horizons (e.g. 85m piezometer). (**Figure 2-5**).

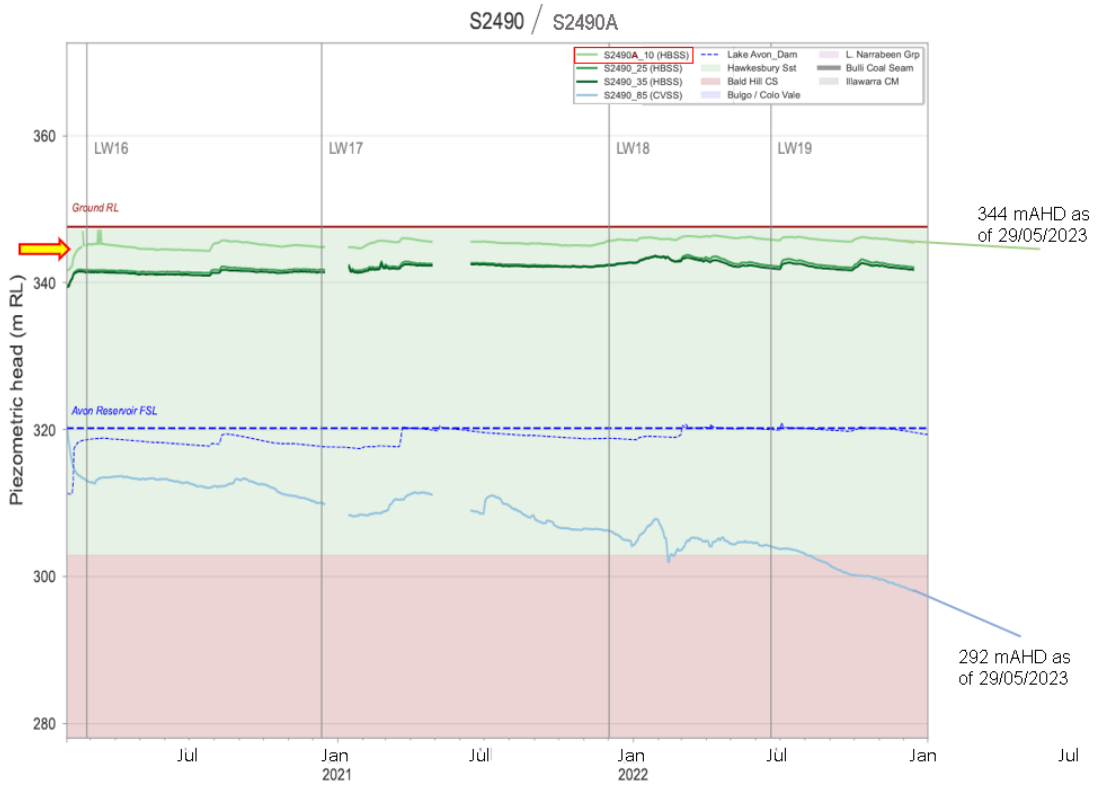

Figure 2-5 Groundwater level hydrograph of S2490/S2490A

- **S2478** – this bore is located to the east of Longwall 18, and approximately 200 m south of Longwall 17. The 43m piezometer showed a response to Longwall 17 in Aug-2021 (**Figure 2-6**), with groundwater pressures declining from approximately 343 to 340 mAHD, and remaining depressed.

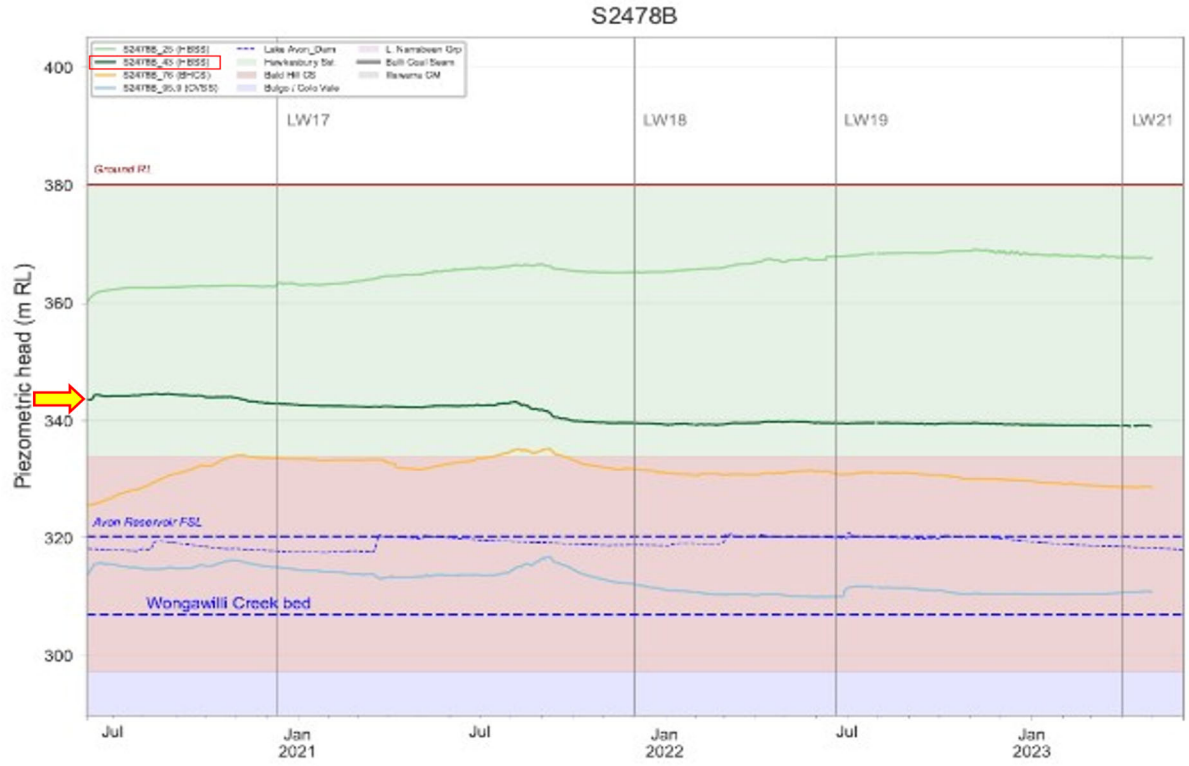

Figure 2-6 Groundwater level hydrograph of S2478

- **S2433** – this site is further from Longwall 18 than S2490. The 30m piezometer is most relevant to potential effects at 35b_01, and does not show any sign of drawdown. It remains very consistent at 349-350 mAHD.

Based on location, the actual groundwater response at (beneath) Swamp 35b is likely to be somewhere between the response at S2521 and 2490, and similar to S2478 (similar offset from a longwall). That is, drawdown of at least 1.5 m (minimum observed at S2521), more likely in the order of 3 m (as at S2478), would have occurred in the strata at the same height/elevation as Swamp 35b. Such a decline may cause a reduction in hydraulic (groundwater) gradient (naturally this would occur from north to south, from above Longwall 18 toward ND1), even to the point of zero gradient or reversed gradient (from around ND1 toward the extracted longwall/goaf).

Baseflow

Empirically, there is very likely a reduction in flow in watercourses overlying a panel. In the case of the headwater reaches of ND1C, this is evidenced by persistent water level reduction in ND1C_Pool2 (location on **Figure 2-3**), as reported in the Longwall 18 End of Panel. Loss of flow may be transmitted downstream to the gauging station ND1S1, but based on experience at other sites at Dendrobium, they may not be.

A review of pool water levels at ND1_Pool28, which is just downstream of Swamp35b (location on **Figure 2-3)** suggests that water levels have declined in 2023 from the previous year, however that is consistent with rainfall trends, and does not confirm a mining effect. A review of pool outflow status for all the pools in the ND1 catchment (shown on **Figure 2-7**) confirms the mining-related effect at ND1C_Pool2, indicates a possible effect at ND1_Pool30, but is consistent with the finding from pool levels for ND1_Pool28, i.e. a mining effect is not obvious over the rainfall trend (although a reduction in baseflow is considered likely).

An assessment of change in surface water flow was recently made as part of the Longwall 19 End of Panel report (HGEO, 2023 – in prep). This will show that four assessments were conducted regarding flows at downstream site ND1S1 (located approximately 700 m downstream of Swamp 35b):

- The 3 assessments comparing flows at ND1S1 with flows from two Reference Sites did not indicate a change in baseflow at ND1S1.
- The assessment comparing flows at ND1S1 with flows from a rainfall-runoff model did suggest a change in baseflow at ND1S1.

This is not conclusive, but suggests that there might be a reduction in baseflow on ND1 (which was predicted in the Longwall 18 SMP Groundwater Assessment).

2.3 Conceptual model - Swamp 35b

In the absence of obvious landscape impacts (such as surface cracking), there is no evidence for subsidence cracking causing the change in hydrology at Swamp 35b.

Given the position of this swamp in the ND1 valley, baseflow from the Hawkesbury Sandstone (HBSS) is conceptualised as being more important to this swamp than swamps located on the elevated plateau directly above Area 3B. As such, a reduction in baseflow, caused by a reduction in groundwater levels in the HBSS to the north (above Longwall 18) is conceptualised as the likely cause of recent dry conditions at 35b_01.

This condition would be likely to persist for a number of years (approximately 3 years) until groundwater levels begin to recover, as has been observed in the mid-HBSS above Longwalls 9-17.

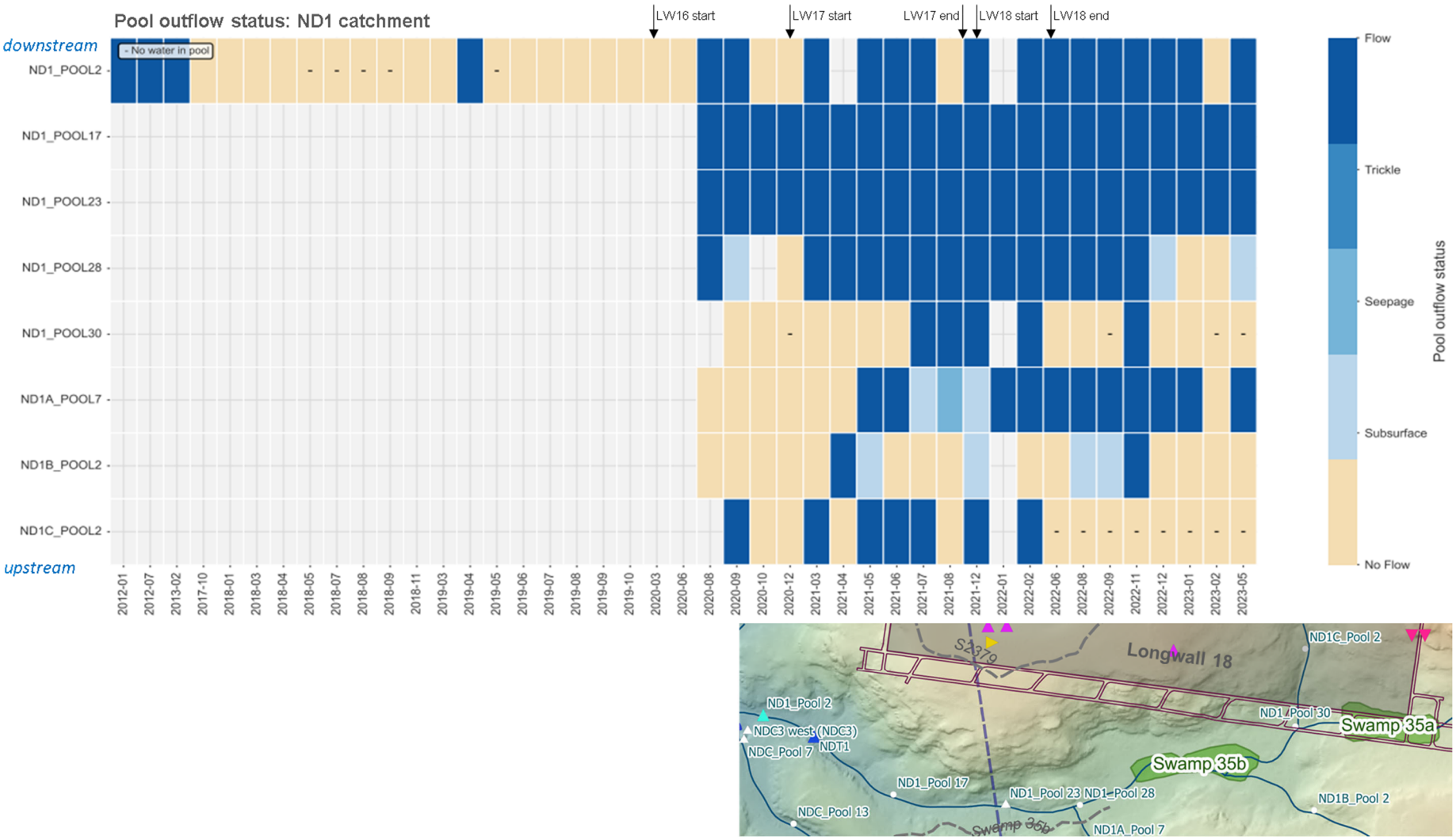

Figure 2-7 Pool outflow status for sites in the ND1 catchment

3 Swamp 15a - piezometer 19

The northern edges of Swamp 15a are located approximately 0-80 m south of Area 3A Longwall 19 (**Figure 3-1**). The swamp extends along the valley of watercourse SC10, which is a tributary of Sandy Creek. Minor tributary SC10B flows across Longwall 19 before entering SC10 approximately 90 m upstream of piezometer 15a_19. Longwall 19 was extracted between 20/06/2022 and 29/03/2023.

Piezometer 15a_19 is the newest of the many piezometers in this swamp, and is 71 m from the edge of the longwall footprint. Monitoring commenced on 08/06/2022, so the true baseline is only 12 days long, possibly a month by the time subsidence effects have begun to propagate. This hampers analysis and development of definitive conclusions at this site.

3.1 Impact assessment of hydrology at 15a_19

Review of the relatively short hydrograph for 15a_19 (**Figure 3-2**) indicates that in the first two months of the record, the water table declined 0.3m (approx. 20% of the total piezometer depth), before recovering in Jul-2022. Two further short recessions occurred in Aug and Sep-2022, again with recovery to full saturation. In Nov-2022, the water table declined and by 2023, the piezometer was dry, and has remained dry since then (until May-2023).

The main problem with the lack of baseline data is that it is difficult to compare pre-mining behaviour at this site to other sites, assign a specific Reference Site for Before-After-Control-Impact (BACI)-style analysis, and then compare the post-mining period. As a result, only inferences or non-definitive statements about the potential for mining impact to have occurred can be made. For transparency, the following points document the different lines of evidence.

Water level trends

When comparing water level elevation and behaviour to some other piezometers (15a_15 - **Figure 3-2**), it seems likely that a mining-related impact has occurred.

When comparing to 34_01 (**Figure 3-2**) and 95_01 (not shown), it seems that rainfall deficits are the primary cause of the recession in the summer of 2022-23, rather than a mining effect. However the duration of the dry conditions at 15a_19 is suggestive of some mining effect, although that is not definitive because both 34_01 only shows short-lived water level peaks during Jan-May 2023.

When comparing against water levels in 144_01 (not shown), it is plausible to attribute the behaviour in 15a_19 almost entirely to rainfall trends.

Recession rates

When comparing transient recession rate in the pre- and post-mining periods at this site to one another, the inference is that a mining effect has occurred (post-mining recession rates are 2-3 times those in the pre-mining period for similar water table elevations - **Figure 3-2**).

Saturation plots

Two “Saturation plots” (by HGEO) are included in Appendix A. The second is for Area 3A, showing the monthly saturation as a % of maximum swamp thickness, first for the Reference Sites, and then for the impact assessment sites in Area 3A. This shows that 15a_19 behaves most similarly to other swamps that have been mined under or near, and is quite different to Reference Swamps (and to 144_01 – although that is due in part to 144_01 being a thinner swamp (0.9 m thick, compared to 1.5 m at 15a_19).

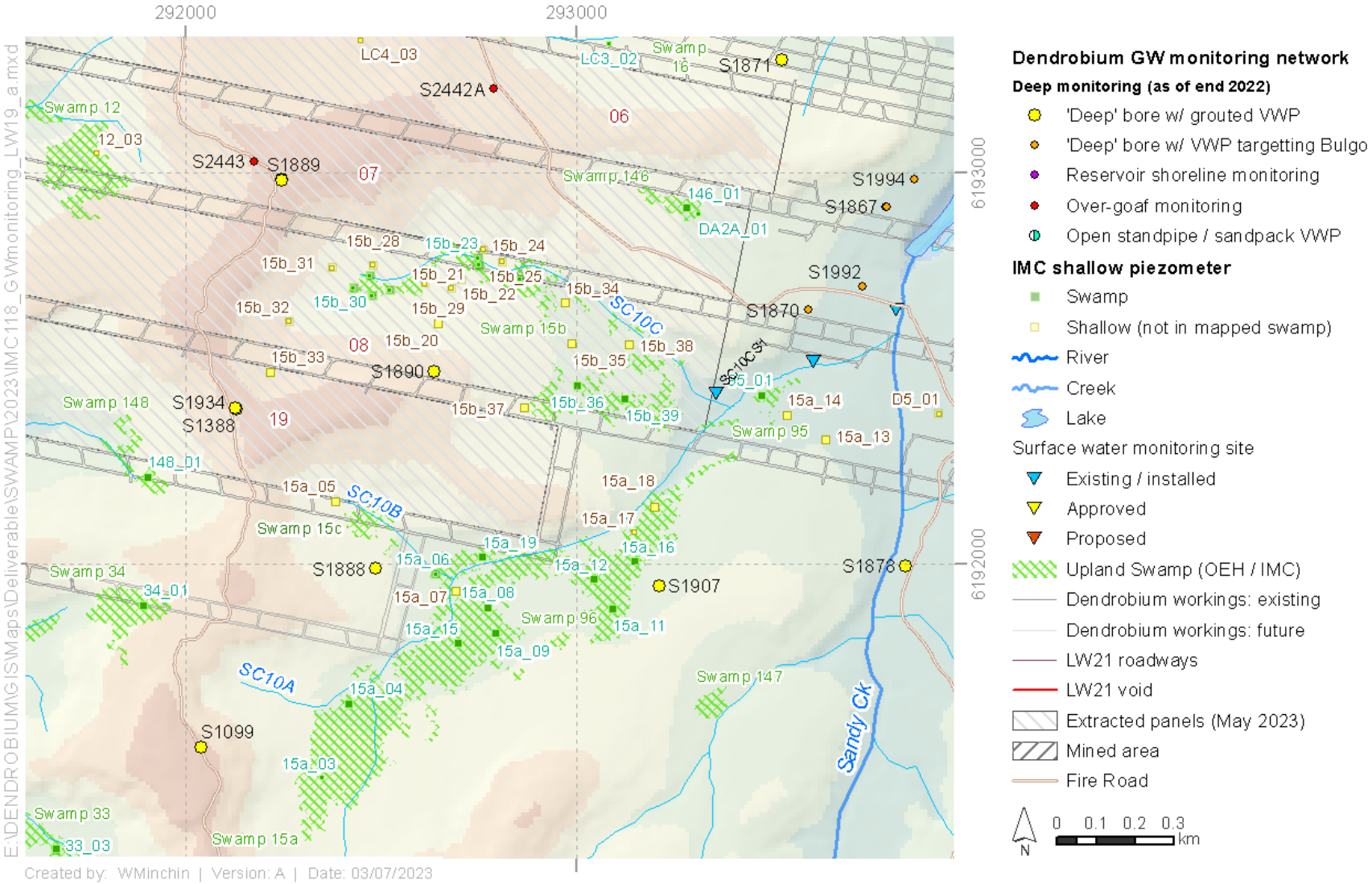

Figure 3-1 Location of Swamp 15a and 15b and relevant hydrological monitoring

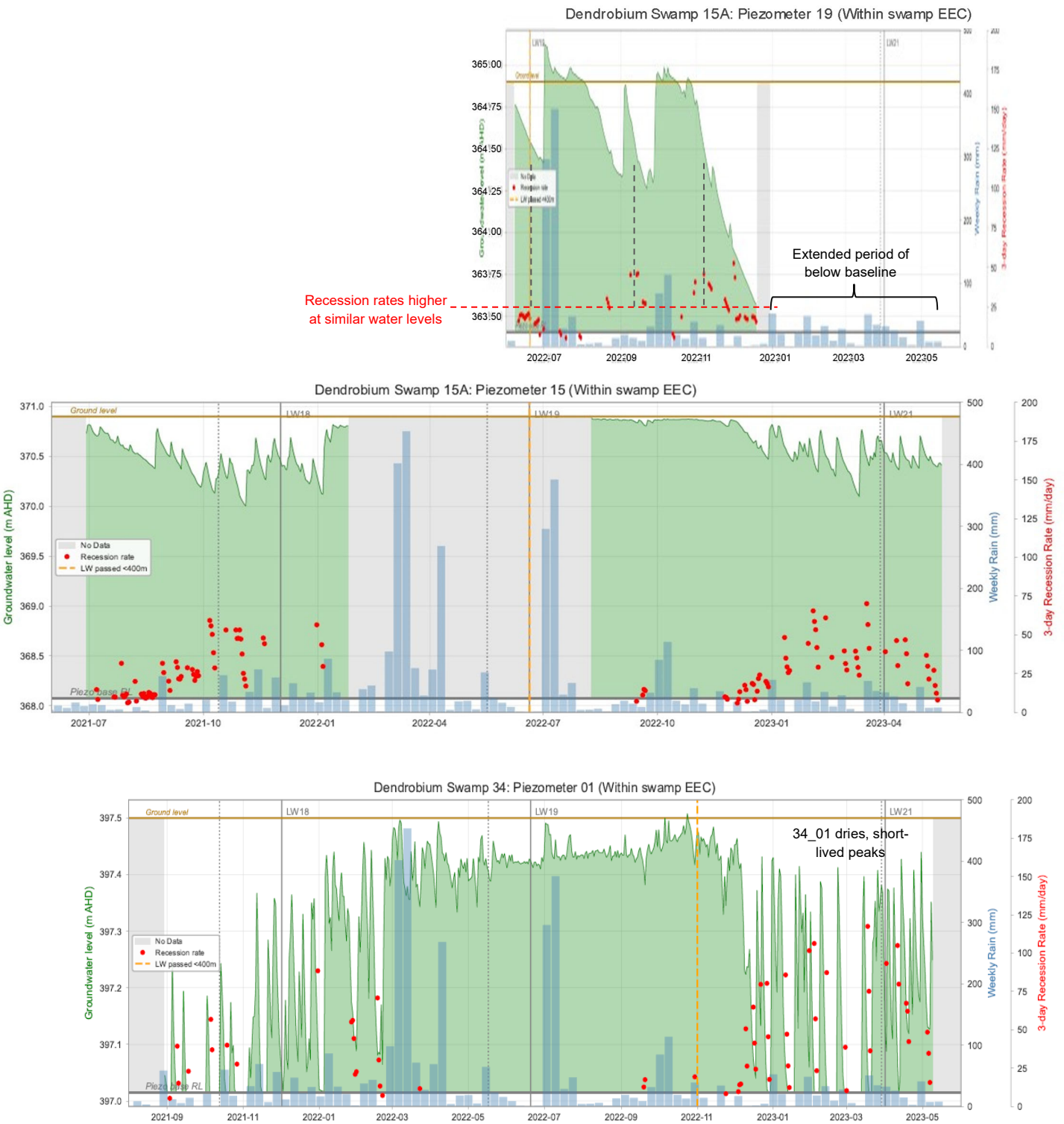

Figure 3-2 Water table hydrograph at 15a_19, compared to 15a_15 and 34_01

Summary

The following finding is non-definitive due to lack of baseline data, however it is considered likely that a mining effect is partially responsible for the water level recession in the summer of 2022-23 and extended duration of low water levels (below the base of the piezometer) occurring through to May-2023 at 15a_19.

3.2 Review of other environmental data

To better understand the processes that might result in an impact to swamp hydrology, data review of landscape impacts, groundwater levels and pool water levels has been undertaken.

Landscape impacts

IMCEFT routinely inspect and record 'landscape' impacts such as instances of surface cracking. IMC (2023b) presents the following image (**Figure 3-3**), showing mapped landscape impacts around Longwall 19. The impacts shown are the nearest recorded impacts to 15a_19 (noting that the main map does not cover 15a_19, but the piezometer is marked on the inset).

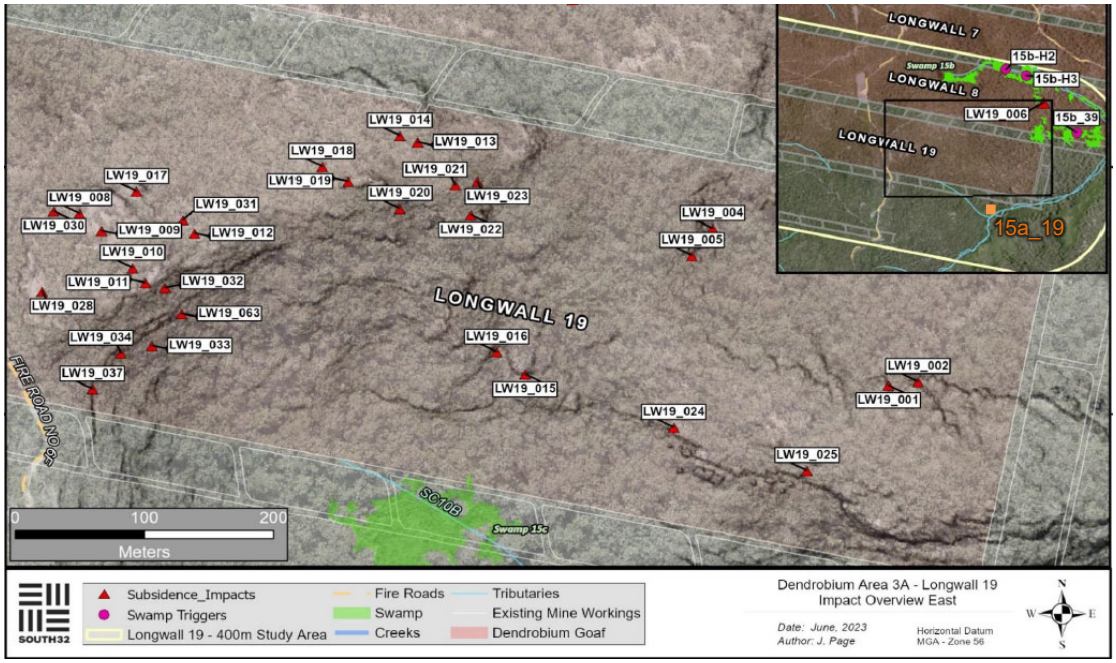

Figure 3-3 Mapped landscape impacts at the eastern end of Longwall 19

Figure 2-3**Figure 3-3** shows that there are no recorded landscape impacts along SC10B near to Swamp 15a or 15c. It is possible that impacts have occurred in the SC10B valley, but are not mapped (due to concealment by vegetation, etc). The nearest recorded impacts are LW19_024 and LW19_025, occurring on the cliff line above the SC10B valley.

Groundwater levels

A long-term monitoring site S1888 is located near to Longwall 19 (location on **Figure 3-1**). The hydrograph is shown on **Figure 3-4**.

Groundwater levels in the lower HBSS at S1888 (48m piezometer) declined by 18 m as a result of extraction of Longwall 19, falling to approximately 341 mAHD (i.e. below the creek/swamp elevation).

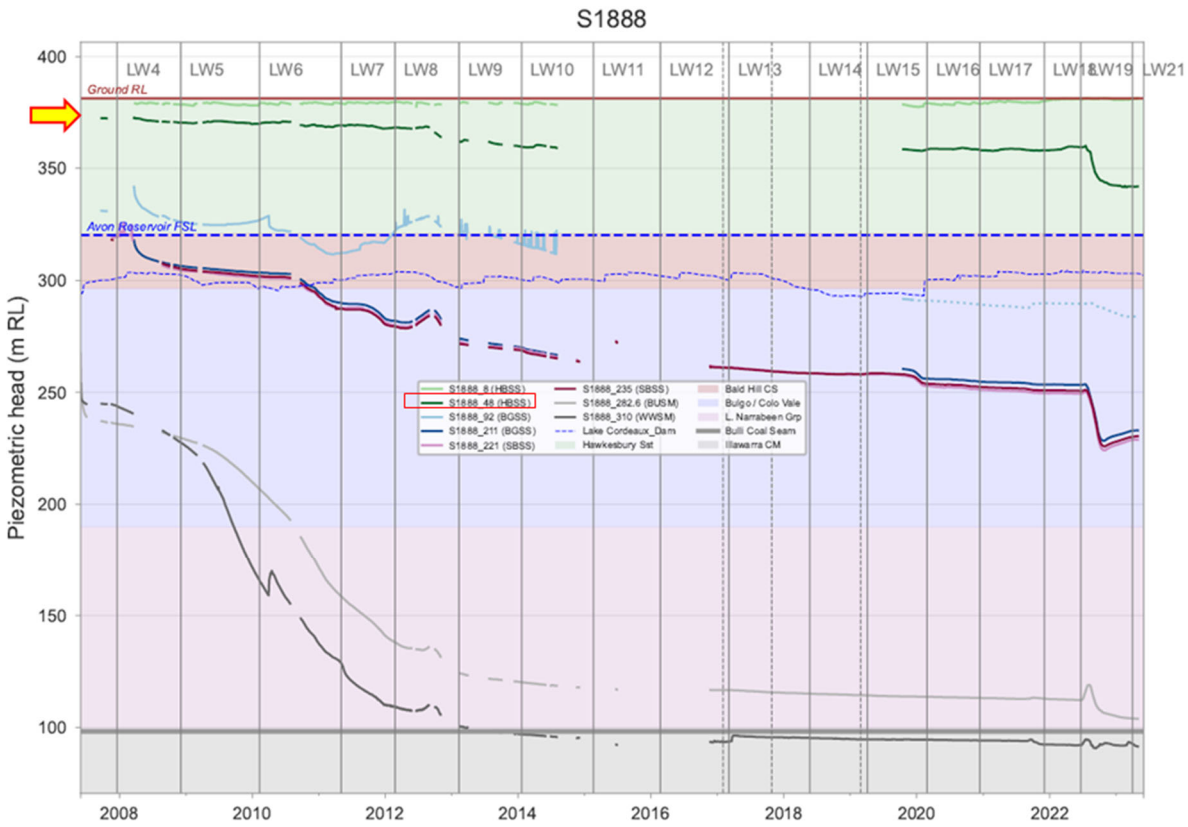

Figure 3-4 Groundwater level hydrograph of S1888

Pool levels

Pool water levels along SC10 have been reviewed in the Longwall 19 End of Panel (HGEO, 2023 – in prep). Of these, only two showed potentially anomalous behaviour. These were reviewed to investigate whether a wider effect on baseflow was evident.

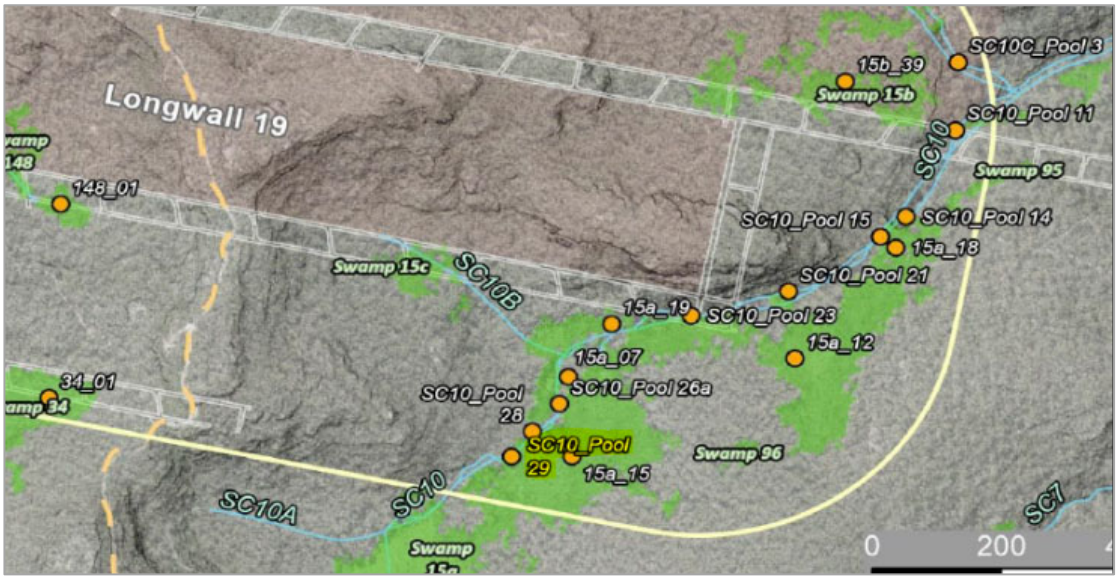

Figure 3-5 Pool level and shallow piezometer monitoring sites around Swamp 15a

HGEO (2023) reported that SC10_Pool26a “showed erratic declines in water level and increased recession rate compared with the other three pools, from late 2022”. However that

behaviour is very similar to the observed water table hydrograph for piezometer 144_01 (which is distant from mining), and consistent with rainfall trends in 2022-23.

SC10_Pool29 (**Figure 3-6**) showed a decline to in water level in December 2022, and then recovered. As noted above, there is no cracking observed in this area. Given the sporadic frequency of the historical monitoring data and the previous range in water levels, including the subsequent and rapid recovery of water levels in this pool, we do not consider there to be mining effect.

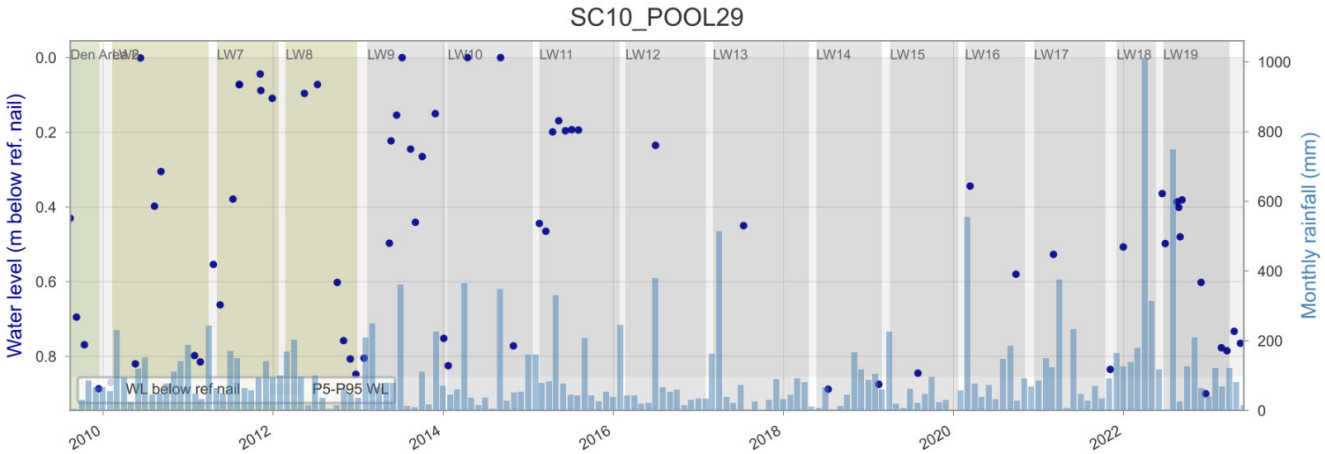

Figure 3-6 **Pool level measurements for SC10_Pool29** (from HGEO)

3.3 Conceptual model - Swamp 15a

HBSS groundwater drawdown in the HBSS has occurred in the vicinity of piezometer 15a_19, and this has likely resulted in a reduction in baseflow to the creeks (SC10 and SC10B) and the swamp. Cracking at the surface has been recorded above Longwall 19, but the closest impacts are approx. 175 m away, and elevated well above the creek/swamp level. It is likely that sub-surface cracking would have occurred above the panel footprint.

Reduction in groundwater levels, with or without cracking, is very likely to have reduced the baseflow discharge to the swamp in the vicinity of 15a_19, and sub-surface cracking at this distance (71 m) could also have a role to play in causing swamp water tables at 15a_19 to decline.

4 Conclusion

Based on the analysis in the preceding sections, with respect to swamp piezometer 35b_01, a mining effect is considered to have occurred at this site, resulting in water table levels falling below the base of the piezometer for an extended period. This effect is a result of Longwall 18 extraction, which passed 110 m to the north of this site in mid-2022. An impact, via a reduction in baseflow, at this was predicted by numerical modelling presented in Watershed HydroGeo (2020).

At piezometer 15a_19, a mining effect could have caused or exacerbated the water table recession in the first half of 2023. There is some evidence from comparison against swamp water tables at piezometers 144_01 and 34_01 that rainfall deficits have caused swamp water tables to recede significantly in 2023, however it is considered probable that a mining effect is a contributing factor at 15a_19. Any effect at this piezometer would have been caused by the passing of Longwall 19. Analysis of pool water levels in watercourse SC10, which runs through Swamp 15A shows no evidence of impact due to Longwall 19 (HGEO, 2023 in-prep), so the effect appears to be quite local, even though it is possibly related to the groundwater level drawdown observed in bore S1888.

In response to this, and to the broader analysis of swamp impacts in the last two End of Panel Reports (by HGEO), the empirical model of distance versus impact at swamp piezometers will be reviewed and revised in the near future.

Please contact me if further clarification is required.

Yours sincerely,

Will Minchin

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5 References

HGEO, 2023 (in prep). End of Panel Surface Water and Shallow Groundwater Assessment: Longwall 19 (Area 3A). Report D23215.

IMC, 2023a. Impact update report (Swamp 35b). 14/03/2023.

IMC, 2023b. Dendrobium Area 3A: Longwall 19 End of Panel Landscape Report. June 2023.

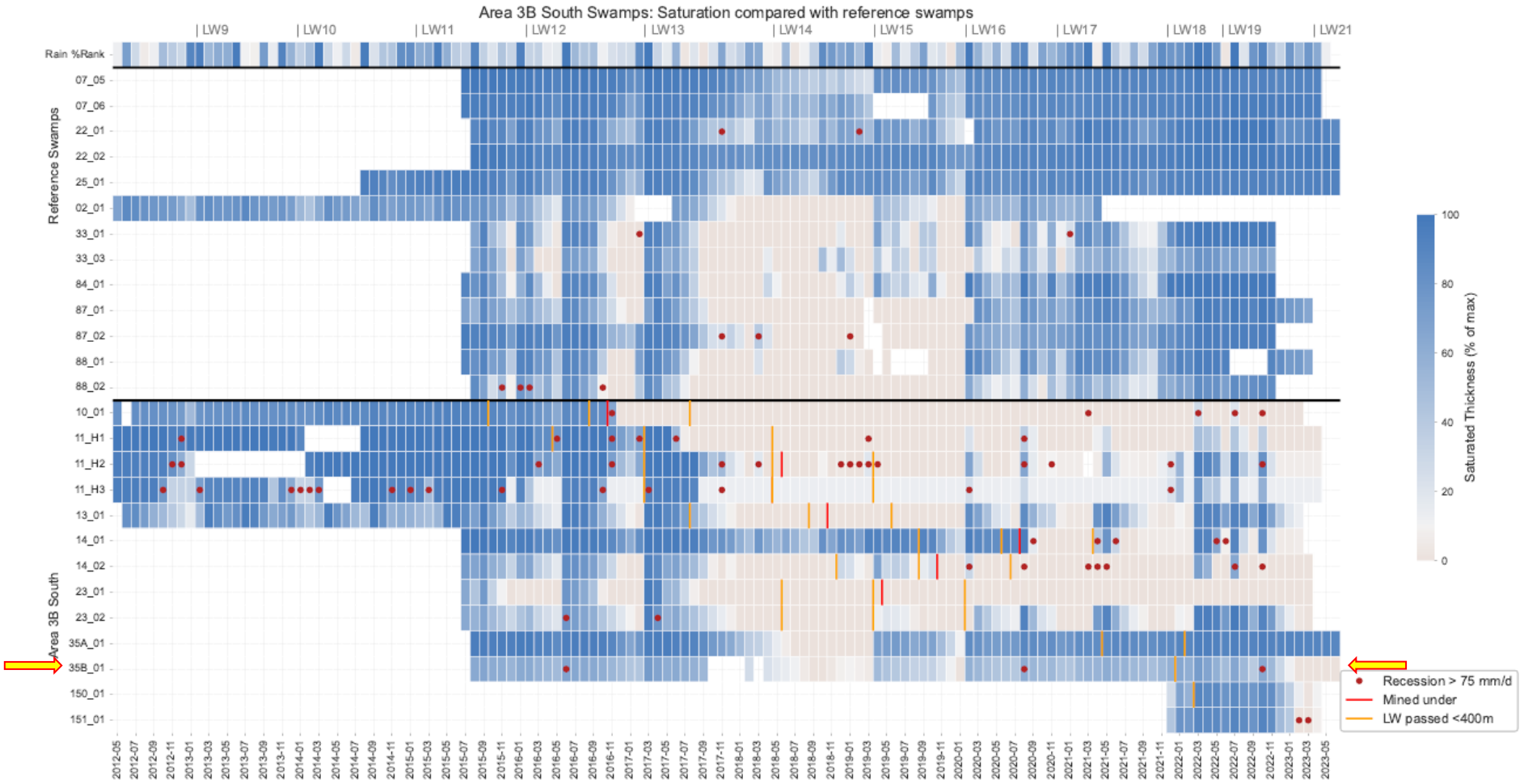
WaterNSW, 2023. Subsidence Impact Report – Swamp 35b. Letter D2023/31806, 11/04/2023.

Watershed HydroGeo, 2020. Longwall 18 Groundwater Assessment. DocR014i4, submitted to inform Area 3B SMP application.

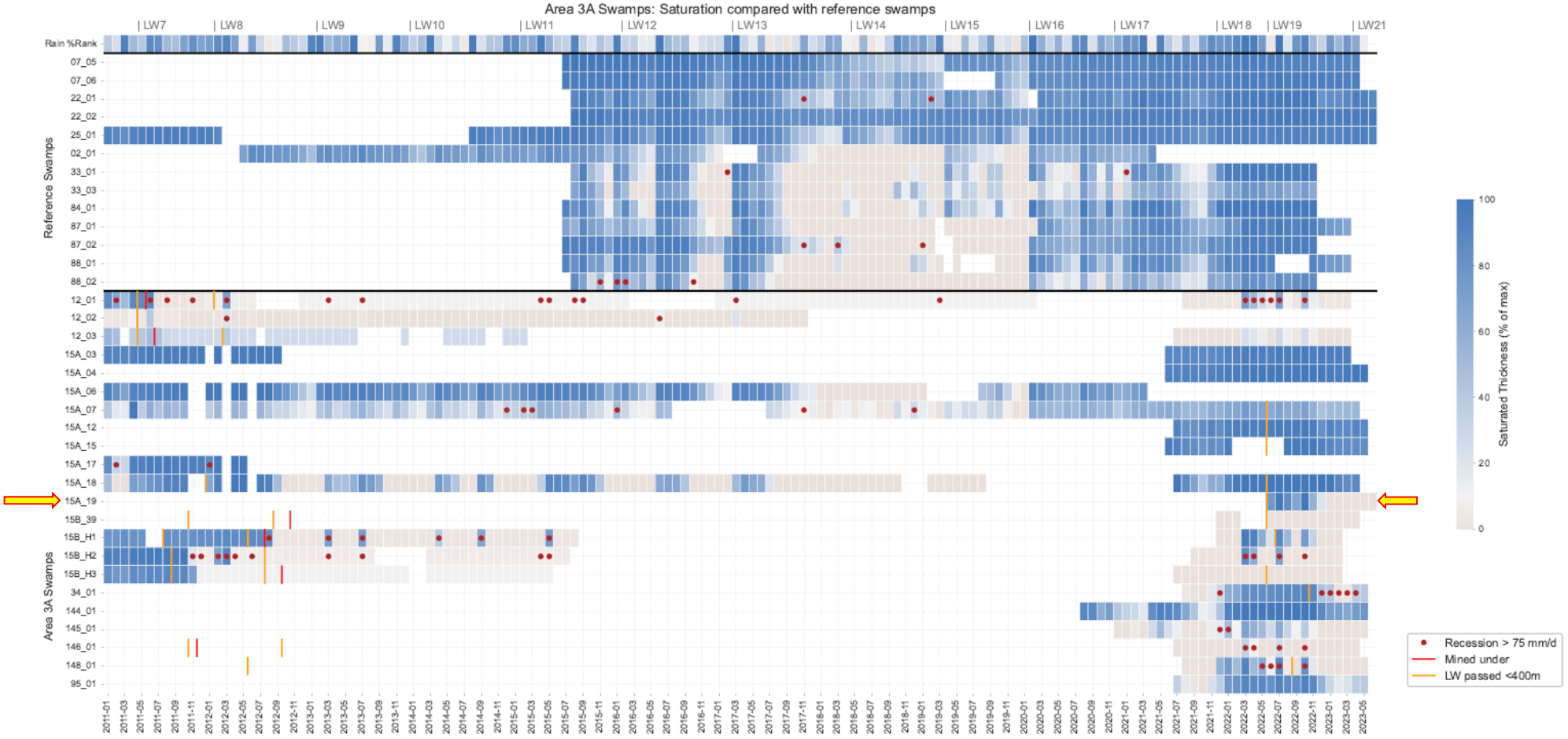
Appendix A: Swamp Saturation plots

The following plots are produced by HGEO, and illustrate the % of saturated sediment thickness at swamp sites around Dendrobium.

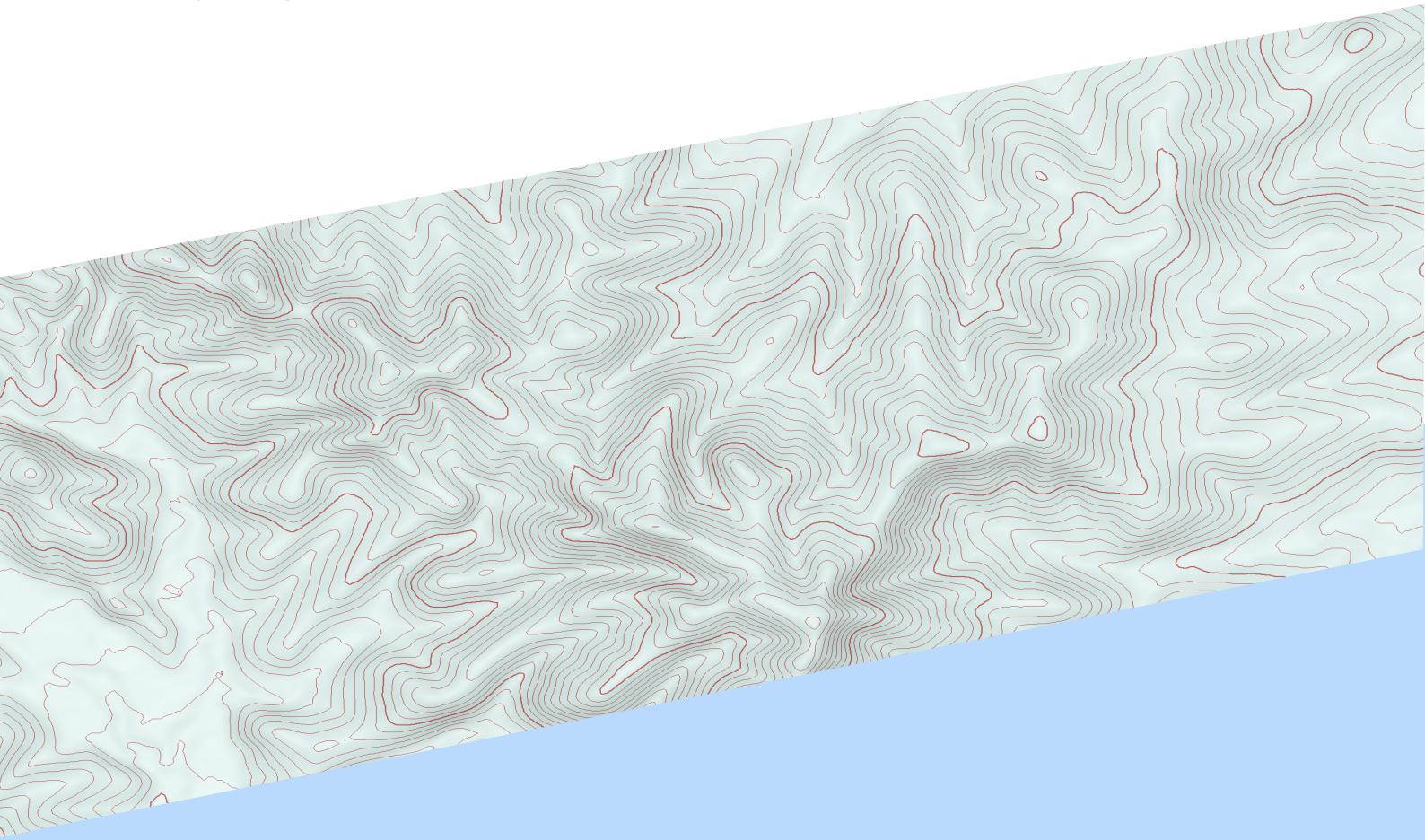
Swamp Saturation: Area 3B



Swamp Saturation: Area 3A



WATERSHED HYDROGEO



South32 Illawarra Metallurgical Coal

Dendrobium Mine

Update to geographic review of mining effects on Upland Swamps at the Dendrobium Mine (data to June 2023)

September 2023

DOCUMENT REGISTER

Rev/Issue	Date	Comments
A	05/08/2023	First draft. Updated review following previous study (r028b, Sept 2021)
B	05/09/2023	Revised following IMC review
C	07/09/2023	Revised following IMC review

FILE

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QUALITY CONTROL

Function	Staff	Signature	Date
Author(s)	Will Minchin		07/09/2023
Approved	Will Minchin		

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ABBREVIATIONS

Abbreviation/Term	Meaning
DPE	NSW Department of Planning and Environment
DPE-Water	DPE-Water division
EPA	NSW Environment Protection Authority
GIS	Geographic Information Systems
IMC	Illawarra Metallurgical Coal
IMCEFT	IMC's Environmental Field Team
IAPUM	Independent Advisory Panel for Underground Mining (formerly IEPMC)
IEAPM	Independent Expert Advisory Panel for Mining ("The Panel") (formerly IAPUM)
IEPMC	Independent Expert Panel for Mining in the Catchment (advising DPE)
km	kilometre
m	metre
mAHD	metres above Australian Height Datum (effectively elevation as metres above sea level)
mBG	metres below ground
ML/d	megalitres per day
MSEC	Mine Subsidence Engineering Consultants
NSW	New South Wales
OEH	Office of Environment and Heritage
PSM	Pells Sullivan Meynink
SIMMCP	Swamp Impact Monitoring, Management and Contingency Plan

1 Introduction

Dendrobium Mine is located 10 kilometres (km) west of Wollongong within the Sydney Basin, and specifically within the Southern Coalfield of New South Wales (NSW). The Dendrobium Mine is operated by Illawarra Metallurgical Coal ('IMC'), and mining is done using longwall methods. The Dendrobium Mine workings are located approximately 200-400 metres (m) beneath a plateau located inland (west) of the Illawarra Escarpment. **Figure 1** shows the location of Areas 2, 3A, 3B and 3C at the Dendrobium Mine.

The shallow geology of the area around the Dendrobium Mine is primarily outcropping Triassic Hawkesbury Sandstone, with some exposures of older Narrabeen Formation units. Isolated deposits of unconsolidated sediments have accumulated in some areas, and this different geology has led to the development of specific ecological communities, known as Coastal Upland Swamps. These swamps typically capture water from direct rainfall infiltration or runoff from upgradient.

Longwall mining is known to affect the ability of these shallow swamps to hold or store water. As a longwall is extracted, the strata above it subside, causing vertical movement as well as lateral movement, including valley closure. "*The mining-induced compression due to valley closure effects can also result in dilation and the development of bed separation in the topmost bedrock, as it is less confined. This valley-related dilation is expected to develop predominately within the top 10 m to 20 m of the bedrock. Compression can also result in buckling of the topmost bedrock resulting in heaving in the overlying surface soils.*" (Mine Subsidence Engineering Consultants [MSEC], 2021). These processes may crack the rock base of the swamp features, resulting in more rapid drainage of the swamps and/or modifying the ability to store water.

NSW Office of Environment and Heritage's (OEH, 2016) *Addendum to NSW Biodiversity Offsets Policy for Major Projects Upland Swamps impacted by longwall mining subsidence* (Swamp Offset Policy) used 400 m as the specific distance to which effects on swamp hydrology are likely or possible.

PSM Consulting (PSM) (2017) concluded that mining-related effects on swamp hydrology have occurred at the Dendrobium Mine at distances of up to 900 m. The Independent Expert Panel for Mining in the Catchment (IEPMC) (2018) note that at the Springvale Mine in the Western Coalfield, swamps have been observed to be affected at distances of 700-1,200 m from longwalls in cases where a lineament intersects the relevant panel and the swamp.

End of Panel reports prepared to date for Areas 2, 3A and 3B (the most recent of which is HGEO Pty Ltd [HGEO], 2023 [for Area 3A Longwall 19]) have assessed when piezometers monitoring swamp water tables at the Dendrobium Mine show an effect of mining, in line with the *relevant Swamp Impact, Monitoring, Management and Contingency Plans* (SIMMCP) for Areas 3A and 3B.

1.1 Scope

In 2018, IMC requested that Watershed HydroGeo review the complete Dendrobium Mine shallow piezometer water level dataset and previous assessments of impacts at piezometers falling within IMC's latest mapping of Upland Swamps[1]. This included consideration and documentation of the distance to the previous or concurrent longwall(s) either causing an impact at a piezometer, as noted

[1] Swamps_Master.shp (provided by IMC, dated 01/09/2021) – upland swamp features extracted from Vegetation Map for the Woronora, O'Hares and Metropolitan Catchments. Derived from API and Survey Points. Consultants Biosis and Niche have refined this data for selected swamps.

in **Section 1.2** (below), or where no environmental effect is discerned. That analysis was documented in Watershed HydroGeo (2019).

Since that analysis was carried out, it has been used to define the distance to which hydrological impacts are likely to be discerned at swamp sites in a short timeframe following longwall extraction. IEPMC (2021) noted that despite other water features (creeks, pools) showing impacts to longwall mining at greater distances than 60 m, "*The Panel considers that the (Watershed HydroGeo, 2019) report (which concluded that no changes to swamp hydrology have been observed greater than 60 m horizontal distance from a longwall panel in the Dendrobium mining area) is the most relevant available evidence regarding potential hydrological impacts to*" swamps.

In 2021, IMC considered that the earlier study (Watershed HydroGeo, 2019) should be updated because three additional longwalls had been extracted near several more Upland Swamps. That study found no evidence or reason to update the finding of no observed impacts to swamp piezometers at distances greater than 60 m.

In 2023, following completion of Longwalls 17, 18 and 19 since the 2021 study was completed, IMC and government agencies requested that the analysis be updated.

1.1.1 Content of this report.

This report documents updated analysis, using swamp piezometer data that typically extends to May or June-2023 (although the end date is earlier for some sites).

This report is based on Watershed HydroGeo (2019, 2021), however the identification of impacts has been updated to reflect mine progression, the analysis of the number of impacted sites revised and the previous findings have been reviewed.

In light of IEPMC (2019a and 2019b) comments about the role of geological structures, specifically lineaments, in transmitting effects at greater distances from mine workings to water features such as swamps, the position of lineaments in relation to groundwater monitoring sites was reviewed in a specific study for IMC (HGEO, 2020). The findings of that study, and the position of lineaments in relation to shallow (swamp) piezometers, have been considered in this current study.

1.2 Impact definition

The definition of an 'impact' due to mining that is "minor changes in ecosystem functionality of the swamps" was defined in terms of hydrological changes in the relevant SIMMCP's using two primary classifications or modes of behaviour:

1. A shallow groundwater level within swamp sediments lower than the (historical, pre-mining) baseline level at any monitoring site within a swamp. Further to this, a related mode of impact is included:
2. A rate of shallow groundwater level reduction post-mining that exceeds the rate of shallow groundwater level reduction during the baseline period at any monitoring site (measured as average millimetres per day during the recession curve).

In addition, and related to impact mode #1 (above), an additional model of impact is:

1a) The duration that a groundwater level is at (or below) baseline level may indicate a mining effect, even in cases where the post-mining groundwater level is not clearly lower than the pre-mining baseline. This effect is assessed in comparison to control swamps.

In some instances, more than one of the above modes of impact may be observed at a single site, and in others, just one might be identified from the water level record.

2 Method

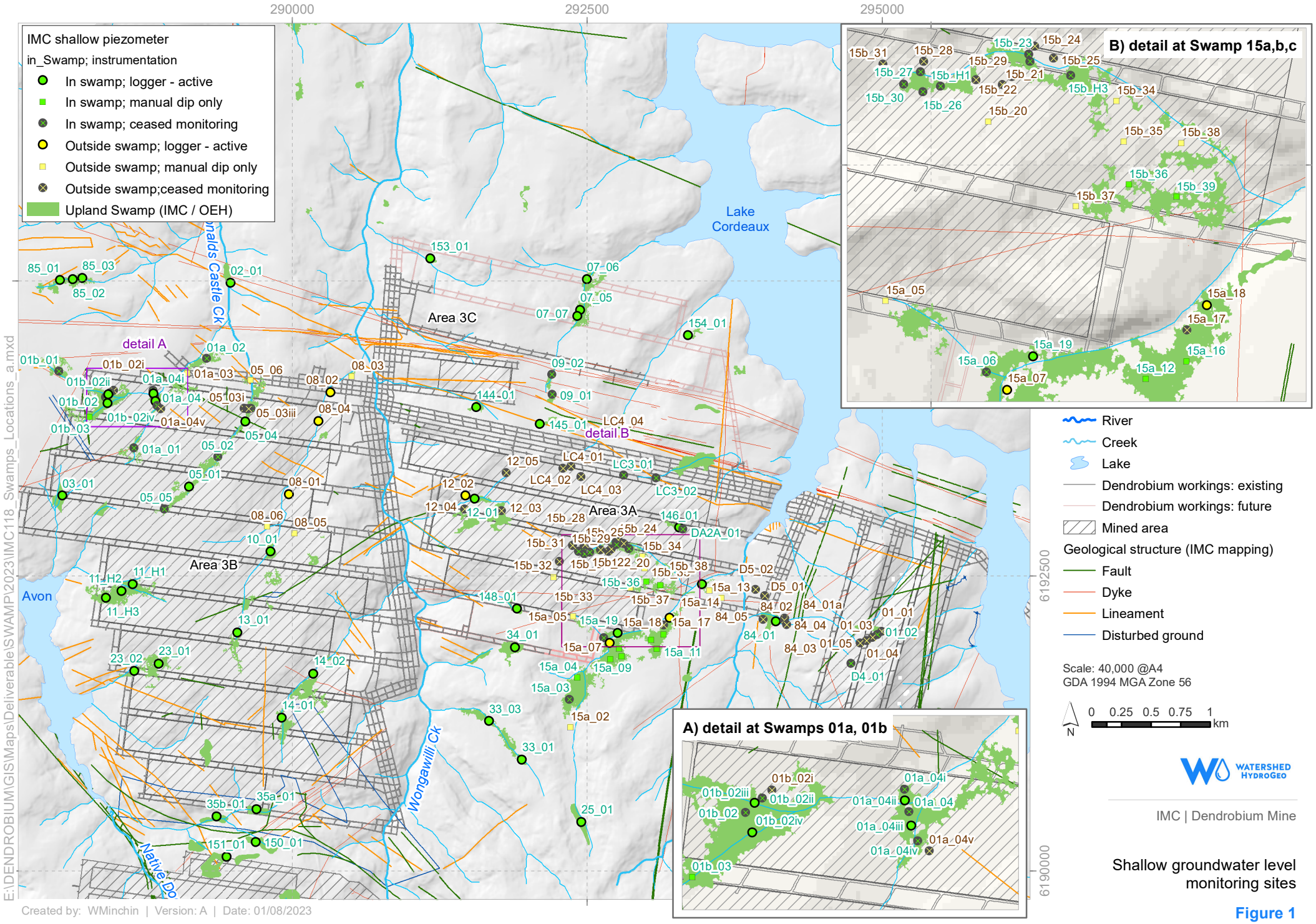
For this review, Watershed HydroGeo completed the following:

- Reviewed the dataset of shallow piezometers installed around Areas 2, 3A, 3B and 3C (**Appendix A** and **Figure 1**), identifying those that are within the boundaries of the latest mapping of Upland Swamp vegetation at the Dendrobium Mine.
- Review of the *Dendrobium Mine End of Panel Surface Water and Shallow Groundwater Assessment: Longwall 19 (Area 3A)* HGEO (2023), recent Impact Reports by IMCEFT and Watershed HydroGeo, and IMC's shallow piezometer data to confirm or identify impacts on swamps within and around Areas 2, 3A and 3B. Hydrographs, as used in HGEO's End of Panel reporting have been updated with recent data from IMC and reproduced in **Appendix B**.
- Impact date identified: reviewed piezometer data to identify impact (i.e. change in recession curve and water level dropping lower than observed during baseline conditions). Noted longwall number that caused this impact.
- Watershed HydroGeo obtained spatial data to compare piezometer position with mine layout and weekly longwall face position. GIS was used to measure and record minimum distances between relevant piezometers and longwalls where no impact was recorded or inferred. Measurement is to the inside edge of the relevant pillar or gate road, i.e. to the edge of the longwall void.
- Used GIS to measure and record distance from monitoring sites to longwalls at the time of the identified impact (for both changes in recession curve and drop in water level). This included reviewing the position of the longwall face at the time of impact, although the position of the nearest part of an extracted longwall was used, which may or may not have been the position of the face at the time, or some other part of the longwall.
- For sites where impacts are not easily or definitively identified ("unclear", as per HGEO, 2021), additional analysis was undertaken, which compared water table records and recession curves with reference or unaffected sites. The selection or appropriateness of 'Reference sites' depends on the similarity of their hydrograph to the pre-mining hydrograph of sites being assessed.
- Identification of piezometers that fall within 100 m of IMC's mapping of lineaments (shown on **Figure 1**). The orientation of the lineaments in relation to the mine footprint and whether these lineaments are correlated with other structures identified in the underground mine has not been considered further.

3 Discussion

The following sections discuss the spatial distribution of piezometers where impacts have been identified and those where no effect from historical mining has been discerned.

This then leads to the development of a conceptual or empirical model of impacts in relation to distance (Section 4), which also considers the relative position from the long and short edge of longwalls, and the difference in rapid or more moderate rates of impact at sites where a mining effect has been identified.



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Shallow groundwater level monitoring sites

Figure 1

The effects of mining on some piezometers remains unclear, e.g. 05_05 (between Longwalls 11 and 12, which had a very short baseline record), and at other site impacts could not be clearly identified until after the severe drought conditions of 2018-19 had eased with the onset of wetter conditions in 2020-21, as well as the likely but not yet definitive impacts at 15a_19 that occurred in 2023. This is in addition to piezometers that have not been instrumented with loggers and the record of periodic manual dips can make identification of effects uncertain.

3.1 Upland Swamp piezometers

There were 83 shallow piezometers located within the updated Upland Swamp mapping assessed in this review, of which 29 were directly mined under by longwalls. 42 of these were considered to show one or both of the modes of impact (as defined in **Section 1.2**). 21 showed effects as water levels falling below pre-mining baseline, while 33 showed increased recession rates (**Table 2**).

The results have been summarised and charted on **Figure 5**. This shows distances between piezometers and the nearest longwall when an impact occurred (based on inspection of the hydrograph). The date on which an impact is detected is recorded in **Appendix A**. More importantly, **Figure 5** shows distances to longwalls at the time an impact was observed, noting that two series are presented for the two primary modes of impact (**Section 1.2**).

Of note from recent data are:

- one piezometer within 5 m of the Longwall 18 goaf edge has remained unaffected (35a_01), and the non-impact has persisted for 14 months since Longwall 18 passed.
- one new piezometer (15a_19) installed at a location nominated in the 2021 review to improve definition of the 60-80 m buffer is very likely to be affected (at 71 m from the goaf).
- one piezometer (35b_01) has shown a clear effect at 110 m. This is beyond the 60 m buffer from the 2019/2021 reviews, yet numerical groundwater modelling and subsidence modelling for LW18 both indicated likely effects.
- one piezometer (144_01) has shown an effect at 113 m. This is beyond the 60 m buffer.

Each of these have had a number of parameters inspected; the distance from goaf, the degree of valley incisions (measured as the elevation of the piezometer below the maximum topographic elevation within a nominal distance of 100 m) and predicted valley closure from previous subsidence modelling (in various MSEC reports). These latter two parameters had been identified as possible influences on swamp impacts in addition to the distance from goaf.

Table 1 Recent and significant unaffected and impacted swamp piezometers

Piezometer	Distance to goaf (m)	Status	Predicted closure [mm] (MSEC)	Valley incision (m)
35a_01	4	No effect	200mm	12
15a_19	71	Likely impact	175mm (at 15a_19)	20
35b_01	110	Impact	425mm	35
144_01	113	Impact	225mm	15

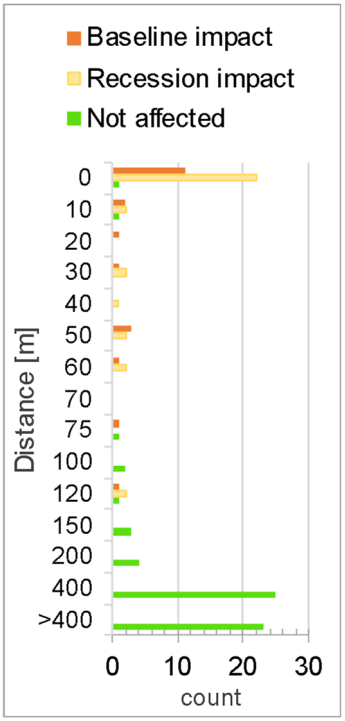
Based on this review of recent effects, there is no clear correlation between impact and predicted closure or valley incision and impacts or the distance to an impact, and there is also a limited number of examples to consider which would reduce the certainty of any conclusions formed. Therefore, a detailed review is not considered warranted.

Figure 5 and **Table 2** illustrate that the majority of the impacts (shown in orange and purple on **Figure** 5) occur at piezometers that are undermined by a longwall. The green series shows the distance to

the nearest longwall where no impact was observed. Some sites have both no-impact and impact information populated, e.g. **Figure 5** shows that piezometer 05_01 was approached to 180 m by Longwall 10 without effect and then subsequently mined under and impacted by Longwall 11.

Table 2 Frequency of impacts by distance: swamp piezometers

Distance [m] from longwall panel when impact first observed	No. of swamp piezometers affected			No. of swamp piezometers unaffected
	Impact: baseline water level	Impact: recession rate	Total	
0 (impact occurred above mined goaf)	11	22	28	1
0-10 m	2	2	2	1
10-20 m	1	0	0	0
20-30 m	1	2	2	0
30-40 m	0	1	1	0
40-50 m	3	2	4	0
50-60 m	1	2	2	0
60-70 m	0	0	0	0
70-75 m	1	0	1	1
75-100	0	0	0	2
100-120 m	1	2	2	1
120-150 m	0	0	0	3
150-200 m	0	0	0	4
200-400 m	0	0	0	25
>400 m	0	0	0	23
Total	**21**	**33**	**42**	**61**



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Of the impacted sites within mapped Upland Swamps, most of the effects occur following the passing of a longwall, either directly beneath the site or just offset (i.e. within 60 m, as shown in **Table 2**). Only two sites within 70 m of an extracted panel at the Dendrobium Mine showed no effects (15b_37 and 35a_01) (**Figure 5**).

Between 70 m and 120 m, there is cluster of both unaffected and impacted sites. As of this 2023 review, the maximum distance at which an impact has been observed at a piezometer within a mapped Upland Swamp area is 113 m.

The empirical model developed previously based on data available to that time essentially had a boundary at 60 m between affected and unaffected sites. The results above show the need to update this model (Section 4.1).

3.2 Piezometers in non-swamp sediments

This section has only been minimally updated since 2021 given the secondary importance of these sites, and the greater attention by IMCEFT (since 2019) in installing new piezometers only in mapped swamp sediments.

Watershed HydroGeo carried out the same analysis for piezometers that are located outside of mapped Upland Swamp communities (shown as yellow symbols on **Figure 1**). Not all the shallow piezometers have geological logs available. Of those that do, many of these piezometers are installed

in weathered rock or regolith, however some are either in or likely to be in shallow deposits of unconsolidated sediments.

Table 3 summarises the distance at which effects were observed. **Table 3** and **Figure 6** show most non-swamp piezometers located between 60-400 m from longwalls are unaffected, with the exception of four piezometers.

The most distant site for which an effect was observed was 08_01. As Longwall 10 passed to the north, water levels in this piezometer did not initially show any effect (hydrograph in **Appendix B**). However, as Longwall 11 approached (but before reaching the piezometer) water levels showed an impact, with the previously extracted Longwall 10 being 125 m to the north. This is a similar distance to the most distant impact at a swamp piezometer (113 m) as described in Section 3.1.

Similarly, an impact at piezometer 08_04 was observed at 95 m as Longwall 9 approached (see hydrograph in **Appendix B**). No geological log is available for this piezometer, which is also outside mapped Upland Swamp areas.

Table 3 Frequency of impacts by distance: non-swamp piezometers

Distance [m] from longwall panel when impact first observed	No. of shallow piezometers affected		No. of shallow piezometers unaffected
	Impact: baseline water level	Impact: recession rate	
0-10 m	3	17	1
10-20 m	1	0	0
20-30 m	0	1	0
30-40 m	0	0	1
40-50 m	1	1	0
50-60 m	0	0	0
60-70 m	0	1	0
70-75 m	1	0	0
75-100	0	1	0
100-120 m	0	1	4
120-150 m	0	0	2
150-200 m	1	0	3
200-400 m	0	0	3
>400 m	0	0	17
Total	**7**	**22**	**13**

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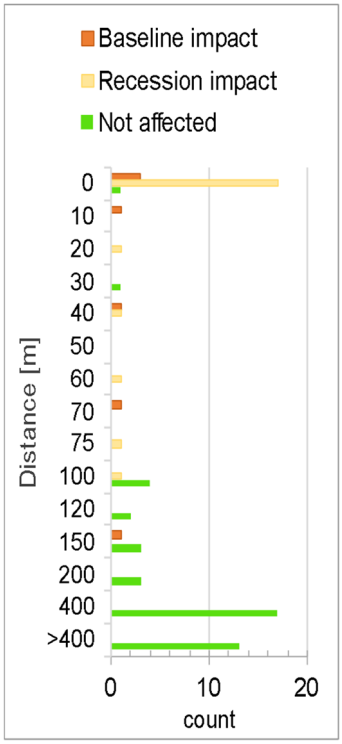


Figure 6 shows that of the piezometers outside mapped Upland Swamp communities there are 12 that did not show an impact from mining while mining was at 100-200 m (and a total of 29 at 100-400 m), compared to one such piezometer (08_01, described above) that was impacted at that distance (125 m). There were 3 sites that did not show an impact at 120-150 m (1 in 4 impacted in the range 120-150 m).

3.3 Role of geological structures

A total of 14 shallow piezometers were identified as falling within 100 m of mapped lineaments. For conservatism, piezometers have been selected within 100 m of a mapped lineament, no matter whether that lineament is mapped as potentially connecting the piezometer location to the mine

footprint. Of these, 2 have not been assessed due to a lack of data (they are within Area 5). These piezometers have been circled on **Figure 5** and **Figure 6**. The small number of piezometers associated with lineaments means that definitive conclusions are difficult to make, however the shallow piezometers 01a_02, 01b_01 and 05_06 have had no impact recorded at distances of 270, 275 and 140 m to the nearest panel respectively. Further, considering piezometers slightly further away, piezometer LC4_04 had no impact recorded at a distance of 340 m from the nearest panel.

Piezometer 23_02 shows an impact, and this was at a distance of 45 m from Longwall 15. Of the recently affected sites, 35b_01 was affected at a distance of 110 m with no lineament mapped within 100 m, while 144_01 was impacted at a similar distance (113 m) and does not have a lineament nearby.

The lack of impacts at most of the piezometers listed above suggests that lineaments do not provide either a pathway or responsive medium that can exacerbate the distance or occurrence of impacts compared to sites which are >100 m from lineaments, or at least have a similar effect to strata where lineaments are not present. In addition, this suggests that ground movement or transmission of drawdown to these features has not occurred at distances of up to 385 m, which is less than half the 700 m or more at Springvale Mine (as noted in IEPMC, 2019). This finding is consistent with SRK (2020) and MSEC (2019).

The implication of this is that the governing factor for impacts on shallow piezometers at Areas 2, 3A 3B and 3C has been the distance to the panel footprint, not the presence of lineaments.

Further analysis of the potential correlation of geological structures and observed groundwater drawdown has been carried out at the Dendrobium Mine (HGEO, 2020), considering both shallow piezometers (as in this study) and ‘deep’ groundwater monitoring in hard-rock strata. HGEO (2020) concluded “analysis of piezometric responses indicates that anomalous drawdown responses are not correlated with mapped structural features”.

4 Empirical model and conclusions

Watershed HydroGeo carried out a review of effects on shallow piezometers at the Dendrobium Mine around Areas 2, 3A and 3B to late 2018, and this has been updated twice, including this report which covers data to June-2023 and sites in Areas 2, 3A, 3B and 3C. This is based on historical mine geometry (panel widths, cutting heights and depth of cover) and geological conditions. The spatial distribution of impacted piezometers is shown on **Figure 7**.

4.1 Empirical model of impact to swamp piezometers

Based on the assessments of water levels and recession rates around existing mining, the previously developed model of impacts versus distance has been updated.

The model is summarised in the following text and **Figure 2**.

Hydrographs from the majority (approximately 85-95%) of Upland Swamp piezometers within 70 m are likely to exhibit a response to mining (i.e. hydrogeological response), be that through a reduction in the water table to below pre-mining levels and/or increased recession (drainage) rate.

Outside the goaf, the overwhelming evidence is that the probability of an impact declines with distance from the goaf. The model is empirical, and short of introducing more parameters (other than distance from the edge of the goaf), expressing the current data as a probability might be more useful, rather than just a 'hard' boundary at 60/75 m (or 400 m as per other literature).

Four main zones are identified from the data:

A. piezometers above the goaf - essentially certain to be impacted (97%);

B. piezometers within 1 to 75 m from goaf also highly likely to be impacted (~86-95%) (11 in 12 to 60 m or 12 in 14 for distances to 75 m);

C. piezometers between 75-120 m from goaf have a 40% probability of being affected. This is based on 2 out of 5 showing an impact at 75-120 m); and

D. no swamp piezometers observed as impacted beyond 120m (0 out of 32 to 400m thus far).

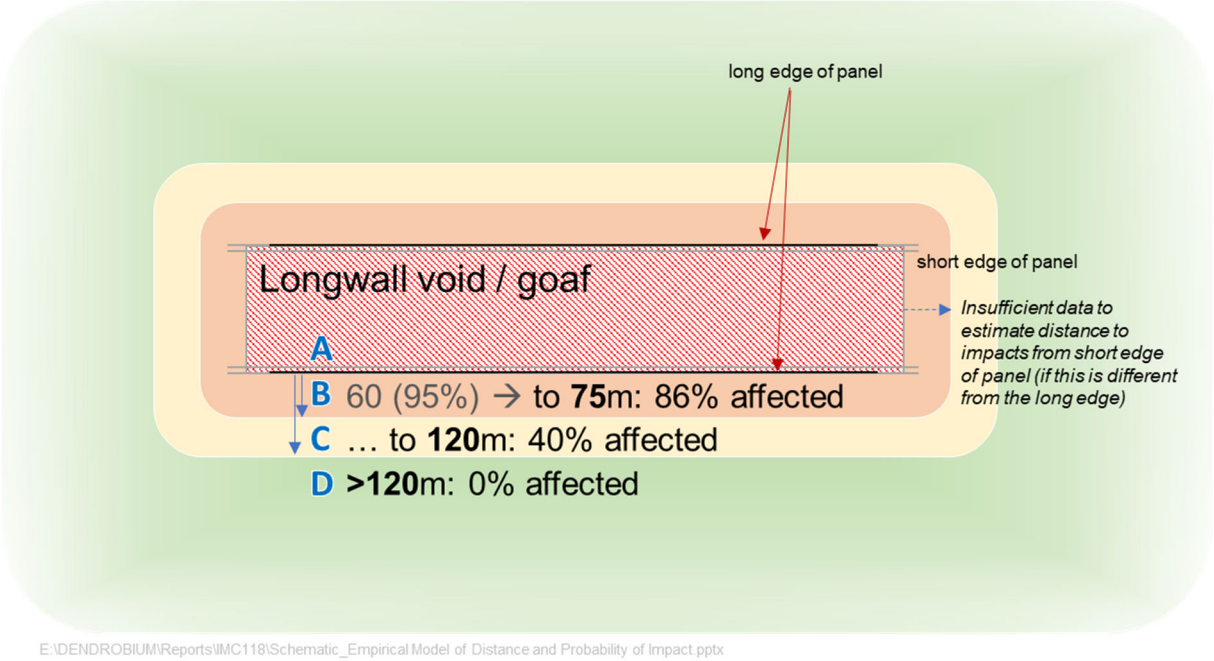


Figure 2 Schematic representation of empirical model of probability of hydrological impact

Further to distance, the potential for effects to be transmitted further from the long edge of a longwall compared to from a short edge or end have been considered in the following section.

4.1.1 Review of short and long edge effects

The available data is not sufficient to allow there to be clear evidence for sites off the short edge of a longwall being affected at shorter distances than those from long edges, but all 3 sites that are impacted at 60-120 m are more than 100 m along the long edge (away from the corner of the panel).

Based on the data, the greatest distance to an impact from the short edge of a panel is likely to be ~25-50 m (exact timing is unknown).

Of the 2 piezometers unaffected at <60 m:

- one is located off the short edge; and
- one is off the long edge, but within 50 m of the corner.

Of the 3 piezometers unaffected at 60-113 m:

- one is located off the short edge;
- one is off the long edge but only 60 m from the corner; and
- one is off the long edge and 950 m from the corner.

Of the 2 piezometers unaffected at 113-130 m:

- one is located off the short edge;
- one is off the long edge and 1300 m from the corner.

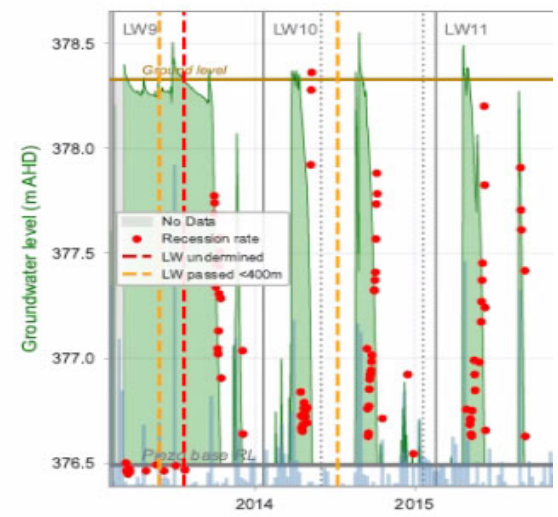
Based on this, there is likely a difference between the distance to which groundwater effects propagate from the long edge compared to from the short edge (which is accepted in regard to subsidence movement), but there is not enough quantitative data to be definitive in regard to shallow groundwater response.

When considering piezometers that are screened in weathered rock or regolith, but lying outside of mapped Upland Swamp communities, impacts have been observed at 95 and 125 m in two piezometers in Area 3B. Most other such shallow piezometers within that distance (i.e. <125 m) have continued to record without showing effects.

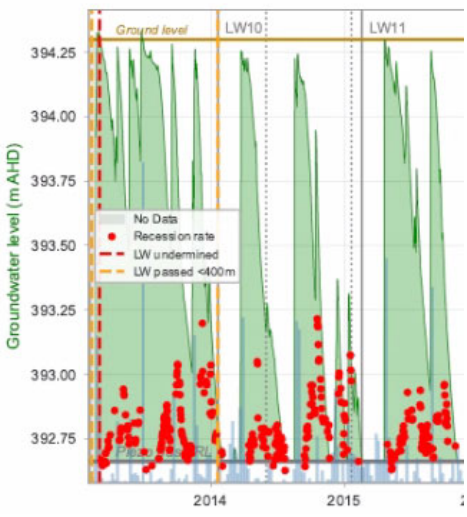
The role of geological structures, specifically lineaments, in transmitting effects over greater distances (as noted in IEPMC, 2019a with respect to effects observed near the Springvale Mine) has not been evident at the Dendrobium Mine, but on-going review of this is recommended, i.e. considered in the placement of piezometers and in future End of Panel reports.

4.1.2 Difference in impact recession rate

Impacts at many swamp piezometers are characterised by increases to recession rates that result in swamp piezometers only being wet or saturated for very short periods of time, while other piezometers show more moderate recession rates following impact. Examples of these are illustrated in **Figure 3.**



Rapid recession effect at piezometer 05-03ii



Moderate recession effect at 01b_02iii

Figure 3 Examples of differing rates of water level recession following mining impact

A classification of impact rate (“rapid” or “moderate”) was assigned for all impacted sites, noting that some sites could not be classified due to lack of adequate baseline data, and some where the qualitative “rapid” or “moderate” description was unclear and so the “rapid to moderate” descriptor was used. A summary of the number of such sites, and the distances at which impacts occurred is presented on **Figure 4**.

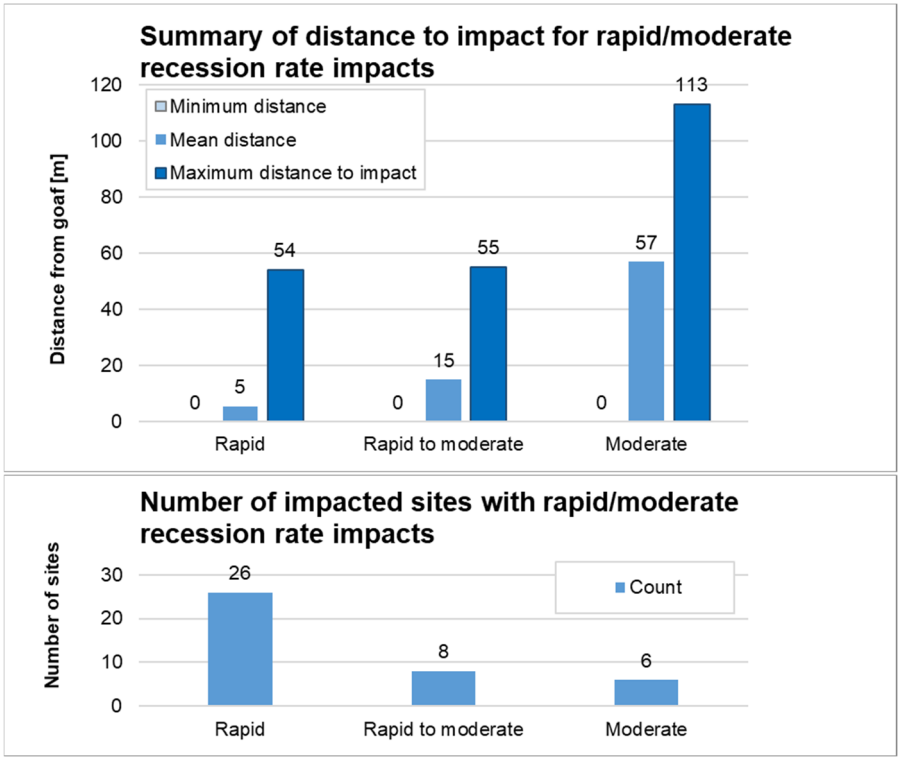


Figure 4 Count and distance to impact for sites with differing rates of water level recession

The analysis shows that more sites (26) that are affected experience the rapid recession impact with only short periods of saturation, and fewer have moderate recession rates (6), with 8 sites in the middle of these categories.

Furthermore, the summary of the distance to impact at these sites shows that those sites with a moderate rate of impact are more likely to be located at greater distances from the goaf, suggesting that surface cracking causing rapid responses is more likely to occur closer to the goaf, while the moderate impact sites are more likely to be affected by a reduction in baseflow or by a lower degree of fracturing because of the increased distance.

4.2 Recommendations

Sufficient baseline monitoring before mining approaches a swamp/piezometer improves the confidence in the identification of an impact or no impact. The NSW *Aquifer Interference Policy* (NSW Government, 2012) recommends 2 years of baseline data for groundwater monitoring prior to an activity commencing, and this is recommended for future swamp monitoring at the Dendrobium Mine.

It is recommended that IMC commission studies of hydrological and ecological responses to better understand medium- and long-term effects, including the extent to which ecological effects might lag hydrological effects, and the potential for hydrological recovery of previously impacted swamps, considering the position of swamps above and at varying distances outside the goaf. It is understood that IMC has commenced this.

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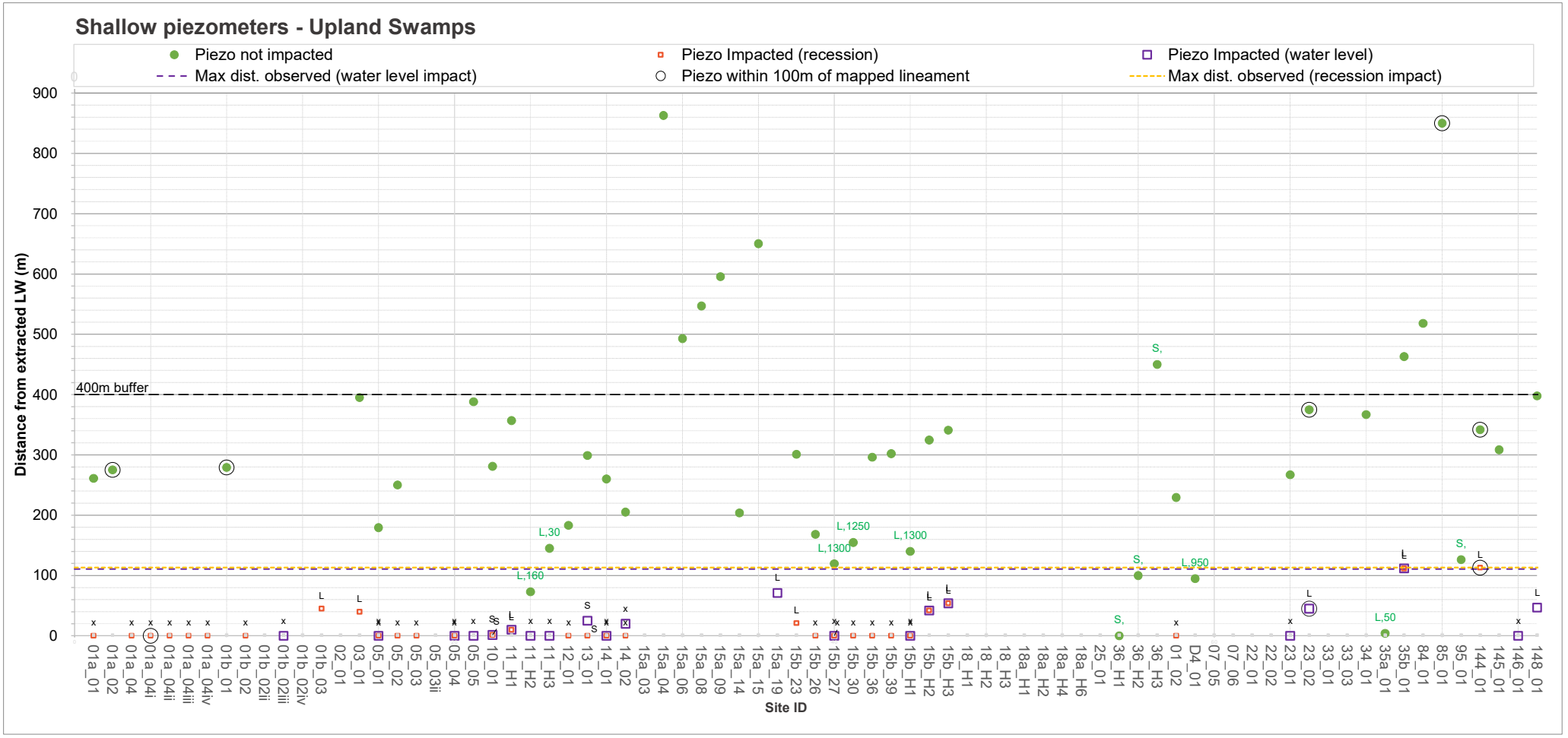

Figure 5 Summary of distances from longwall mining for impacts and unaffected piezometers within mapped Upland Swamps

On the chart, labelling of “L” means the piezometer is located off the long edge of a longwall, “X” is above the goaf, and “S” is the short edge. The numbers that follow an “L” are the distance from the corner of the panel.

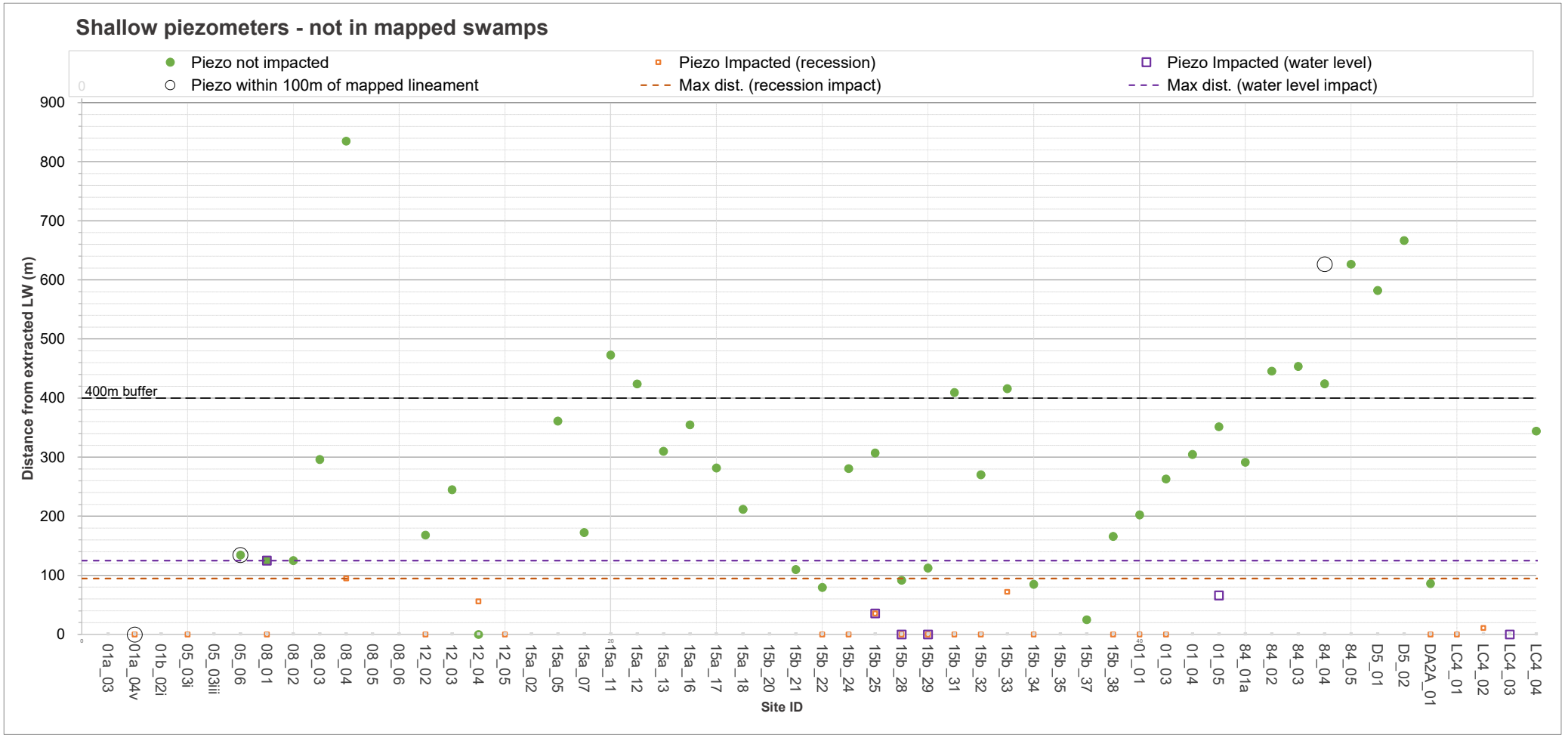

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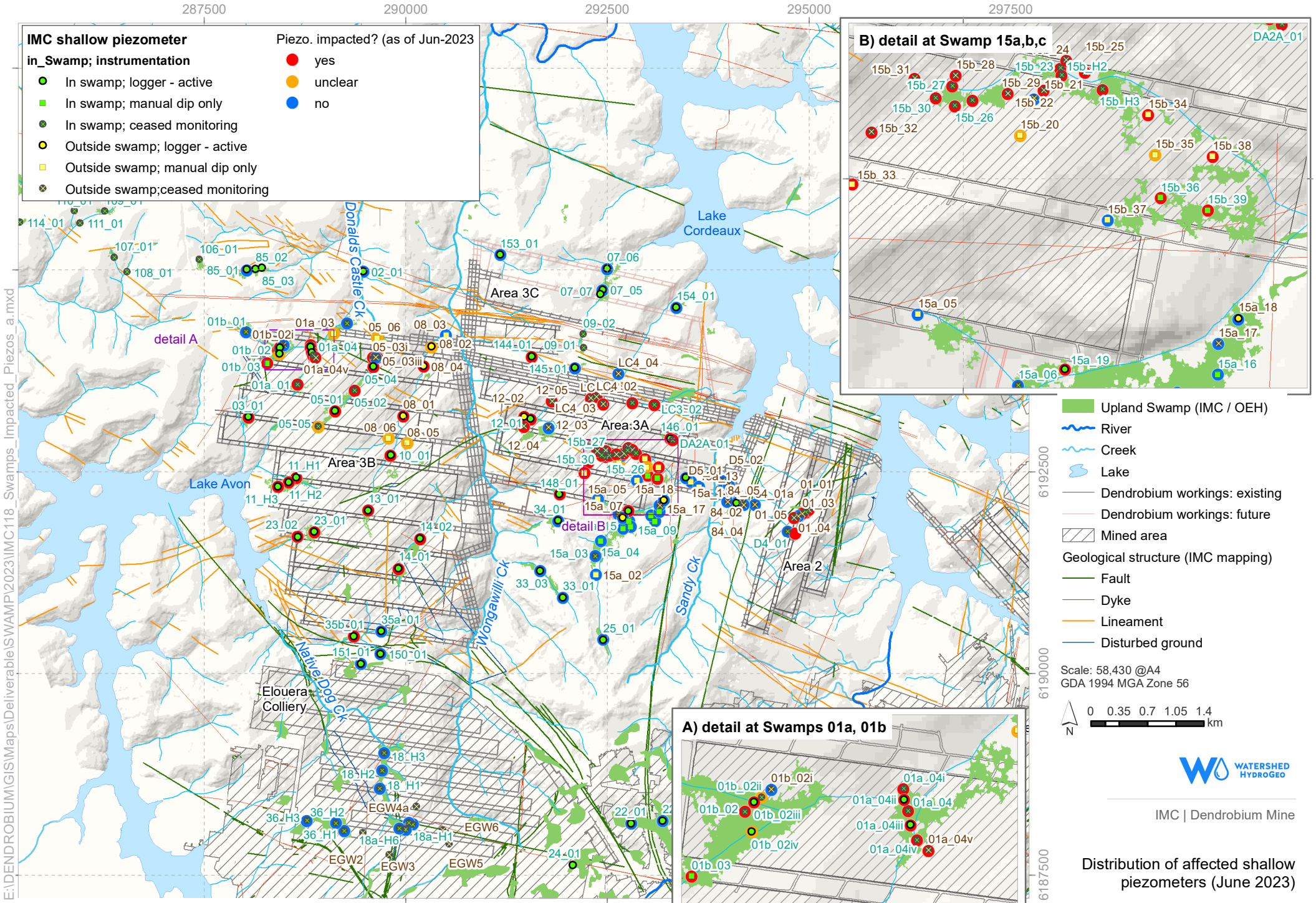
Figure 6 Summary of distances from longwall mining for impacts and unaffected piezometers: sites outside mapped swamps

This is unchanged from the 2021 report.



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Distribution of affected shallow piezometers (June 2023)

Figure 7

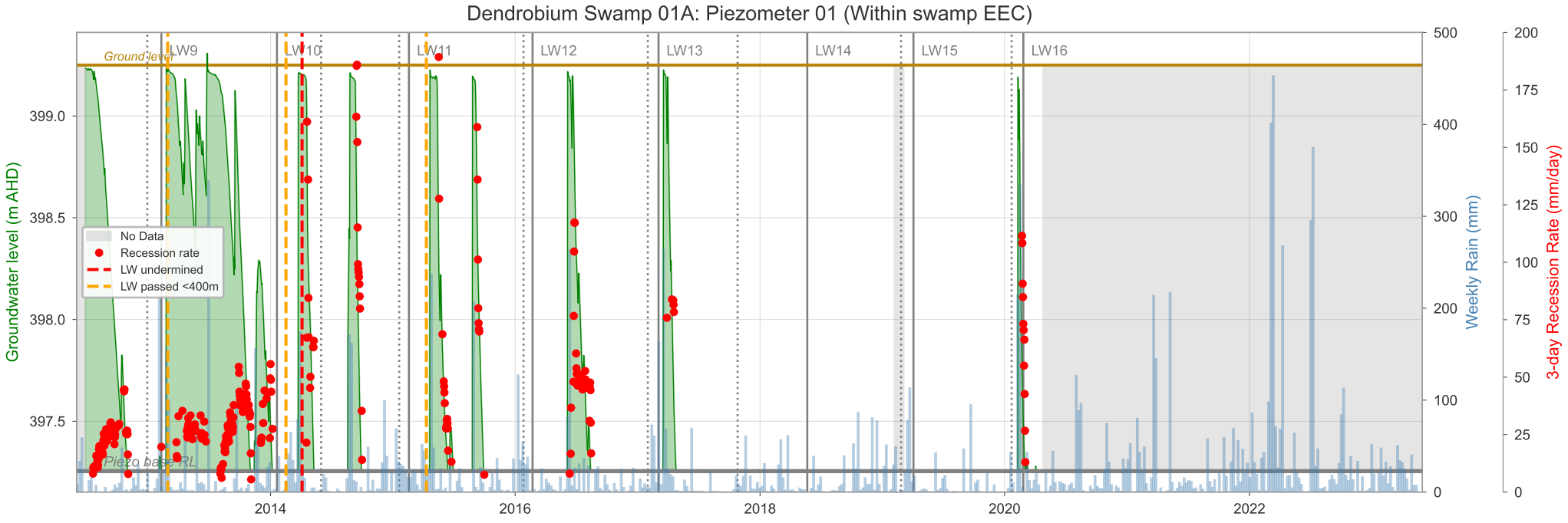
Appendix A – Piezometer sites

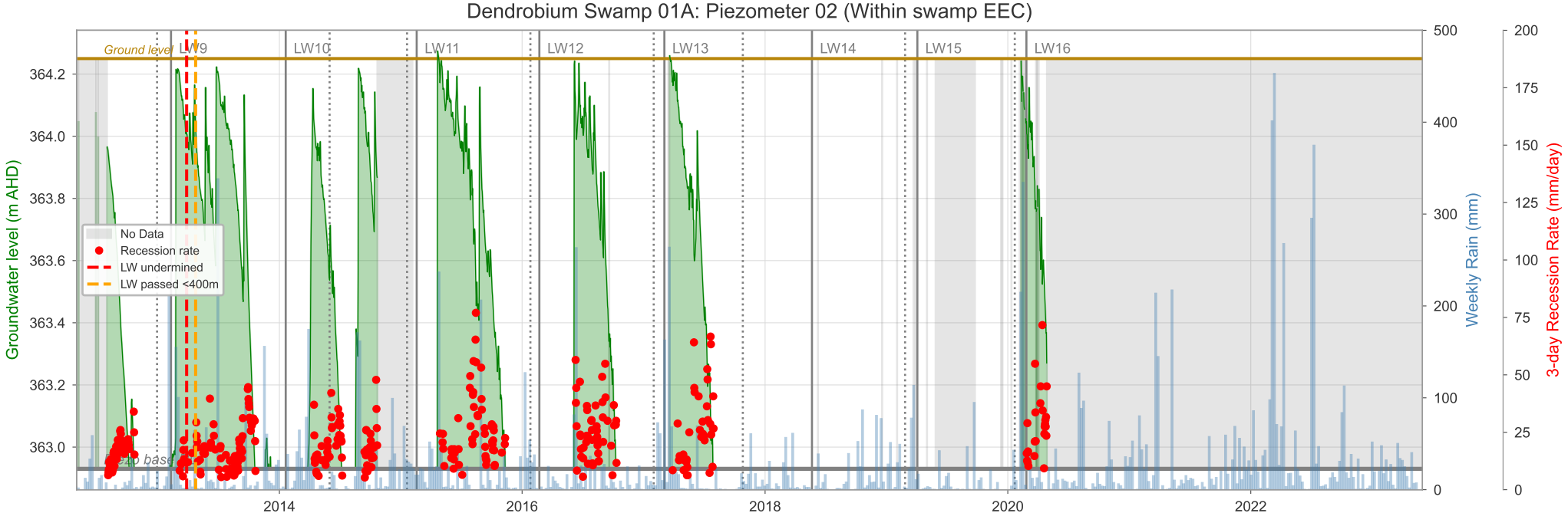
Site ID	Swamp	MGA_E	MGA_N	Elev (m)	Depth (m)	RL Bottom (m)	Total Casing (m)	Screen (m)	Stick-up (m)	Piezo RL(m)	Monitoring status
01a_01	Swamp 1a	288659.0	6193580.0	399.25	2.16	397.09	2.70	1.45	0.55	397.26	active
01a_02	Swamp 1a	289274.0	6194338.0	364.25	1.66	362.59	2.30	1.40	0.78	362.93	active
01a_03	Swamp 1a	289113.0	6194218.0	370.40	1.15	369.25	1.71	0.97	0.58	-	no instrumentation
01a_04	Swamp 1a	288834.0	6194013.0	381.70	1.37	380.33	2.00	1.01	0.70	380.53	active
01a_04i	Swamp 1a	288822.2	6194069.5	380.90	1.98	378.92	2.70	1.41	0.75	379.15	active
01a_04ii	Swamp 1a	288823.8	6194041.7	380.95	1.10	379.85	1.80	0.73	0.70	380.00	active
01a_04iii	Swamp 1a	288840.3	6193977.1	383.17	1.21	381.96	1.90	0.76	0.69	382.11	active
01a_04iv	Swamp 1a	288856.2	6193938.6	384.00	1.36	382.64	2.02	0.66	0.67	382.81	active
01a_04v	Swamp 1a	288885.6	6193912.9	385.66	1.44	384.22	2.26	0.69	0.86	384.42	active
01b_01	Swamp 1b	288021.0	6194231.0	406.00	1.76	404.24	2.40	0.82	0.70	404.47	active
01b_02	Swamp 1b	288418.0	6194011.0	394.50	1.80	392.70	2.29	1.50	0.51	392.86	active
01b_02i	Swamp 1b	288485.5	6194068.0	394.10	0.97	393.14	1.70	0.80	0.74	393.26	active
01b_02ii	Swamp 1b	288460.3	6194047.9	394.00	1.42	392.58	2.32	0.77	0.90	392.71	active
01b_02iii	Swamp 1b	288441.3	6194035.5	394.30	1.90	392.40	2.61	1.42	0.82	392.66	active
01b_02iv	Swamp 1b	288435.5	6193960.4	393.43	1.43	392.00	2.23	0.66	0.82	392.16	active
01b_03	Swamp 1b	288282.6	6193847.7	398.60	1.40	397.20	2.00	1.02	0.63	-	no instrumentation
02_01	Swamp 2	289477.0	6194981.0	334.00	1.85	332.15	2.10	1.33	0.39	332.44	active
03_01	Swamp 3	288052.0	6193177.0	396.05	1.51	394.54	2.11	1.00	0.60	394.70	active
05_01	Swamp 5	289125.4	6193253.3	398.80	2.60	396.20	3.02	1.43	0.53	396.43	active
05_02	Swamp 5	289370.3	6193505.1	391.30	1.87	389.43	2.50	1.48	0.73	389.56	active
05_03	Swamp 5	289651.0	6193915.4	379.50	1.77	377.73	2.40	1.27	0.83	378.04	active
05_03i	Swamp 5	289594.2	6193915.6	379.80	1.62	378.18	2.42	1.45	0.82	378.34	active
05_03ii	Swamp 5	289617.0	6193914.5	378.33	2.06	376.27	2.76	1.42	0.76	376.49	active
05_03iii	Swamp 5	289630.0	6193914.1	377.83	1.31	376.52	1.93	1.11	0.62	376.65	active
05_04	Swamp 5	289602.1	6193803.9	380.70	1.57	379.13	2.13	1.00	0.81	379.52	active
05_05	Swamp 5	288916.2	6193061.5	403.30	1.17	402.13	1.81	0.92	0.81	402.46	active
05_06	Swamp 5	289647.9	6194159.2	366.40	1.65	364.75	2.30	1.44	0.66	-	no instrumentation
08_01	Swamp 8	289973.0	6193188.0	341.20	2.31	338.89	2.98	1.41	0.66	339.07	active
08_02	Swamp 8	290323.3	6194051.3	308.60	1.02	307.59	1.60	0.86	0.59	307.79	active
08_03	Swamp 8	290503.5	6194193.4	296.80	1.59	295.21	2.20	1.25	0.61	-	no instrumentation
08_04	Swamp 8	290223.1	6193808.9	323.90	1.93	321.98	2.50	1.40	0.58	322.18	active
08_05	Swamp 8	290021.3	6192859.4	358.10	1.32	356.78	2.20	1.31	0.88	-	no instrumentation
08_06	Swamp 8	289788.7	6192918.7	358.80	1.07	357.73	1.70	1.00	0.63	-	no instrumentation
10_01	Swamp 10	289816.0	6192702.3	364.80	1.51	363.29	2.40	1.22	0.89	363.49	active
11_H1	Swamp 11	288647.0	6192427.6	393.28	1.82	391.47	3.10	n/a	1.29	391.47	active
11_H2	Swamp 11	288554.1	6192367.7	389.41	1.29	388.12	2.21	n/a	1.03	388.14	active
11_H3	Swamp 11	288420.2	6192311.1	382.40	0.55	381.85	1.58	n/a	1.05	381.85	active
12_01	Swamp12	291548.5	6193151.9	368.00	1.61	366.40	2.14	1.00	0.53	366.73	active
12_02	Swamp12	291470.9	6193177.5	366.45	1.08	365.37	1.53	0.50	0.46	365.56	active
12_03	Swamp12	291774.3	6193048.2	390.70	0.53	390.17	1.02	0.50	0.49	390.43	end monitoring 25/02/2015
12_04	Swamp12	291464.1	6193062.8	365.40	0.84	364.56	1.32	0.50	0.50	364.75	end monitoring 10/01/2013
12_05	Swamp12	291814.5	6193372.6	398.50	1.57	396.93	2.01	0.50	0.52	397.27	end monitoring 22/06/2014
13_01	Swamp 13	289535.0	6192016.0	403.30	2.60	400.70	3.25	1.50	0.65	400.95	active
15a_02	Swamp 15a	292360.3	6191218.6	382.61	3.63	378.98	4.04	1.00	0.90	-	no instrumentation
15a_03	Swamp 15a	292348.9	6191451.1	378.00	2.12	375.88	2.49	1.00	0.45	376.15	end monitoring 22/09/2012
15a_04	Swamp 15a	292418.5	6191638.5	373.05	1.93	371.12	2.53	1.00	0.60	-	no instrumentation
15a_05	Swamp 15a	292384.3	6192154.9	387.70	1.45	386.25	1.85	1.00	0.40	-	no instrumentation
15a_06	Swamp 15a	292639.8	6191972.9	366.83	2.64	364.19	3.11	1.00	0.75	364.60	active
15a_07	Swamp 15a	292692.9	6191927.0	365.77	2.21	363.56	2.50	1.00	0.70	364.10	active
15a_08	Swamp 15a	292773.0	6191885.6	368.76	2.75	366.01	3.30	1.00	0.85	-	no instrumentation
15a_09	Swamp 15a	292793.5	6191818.0	371.13	2.39	368.75	3.26	1.00	0.88	-	no instrumentation
15a_11	Swamp 15a	293092.2	6191882.4	371.15	1.13	370.03	1.49	0.55	0.37	-	no instrumentation
15a_12	Swamp 15a	293045.3	6191956.5	367.33	1.50	365.84	1.99	0.50	0.50	-	no instrumentation
15a_13	Swamp 15a	293639.6	6192312.7	349.30	0.68	348.62	1.20	0.50	0.52	-	no instrumentation
15a_14	Swamp 15a	293540.2	6192376.3	343.70	0.79	342.91	1.39	0.50	0.62	-	no instrumentation
15a_15	Swamp 15a	292698.6	6191792.9	370.90	3.17	367.73	3.70	1.20	0.60	-	no instrumentation
15a_16	Swamp 15a	293148.8	6192001.5	366.00	0.62	365.38	1.10	0.50	0.48	-	no instrumentation
15a_17	Swamp 15a	293150.0	6192079.5	360.90	1.00	359.90	1.75	0.50	0.75	360.15	end monitoring 27/02/2012
15a_18	Swamp 15a	293200.9	6192142.1	358.50	0.60	357.90	1.12	0.50	0.53	358.00	active
15a_19	Swamp 15a	292759.5	6192014.3	364.90	1.55	363.36	2.41	1.54	0.87	363.41	active
15b_20	Swamp 15b	292645.4	6192610.5	393.30	0.92	392.38	1.45	0.50	0.55	-	no instrumentation
15b_21	Swamp 15b	292680.5	6192703.4	384.48	1.21	383.27	1.71	0.67	0.50	383.75	end monitoring 20/11/2012
15b_22	Swamp 15b	292705.0	6192723.9	383.21	2.12	381.09	2.51	1.00	0.43	381.34	active
15b_23	Swamp 15b	292747.6	6192780.7	380.96	2.65	378.31	3.07	1.00	0.42	378.44	active
15b_24	Swamp 15b	292762.5	6192801.0	382.37	3.22	379.15	3.52	1.00	0.73	379.69	active
15b_25	Swamp 15b	292810.5	6192770.2	381.10	3.19	377.91	3.03	1.00	0.74	378.99	active
15b_26	Swamp 15b	292478.4	6192685.0	390.50	1.56	388.94	2.03	0.50	0.50	389.17	active
15b_27	Swamp 15b	292472.2	6192735.4	390.65	3.23	387.42	3.75	1.50	0.52	387.67	active
15b_28	Swamp 15b	292480.9	6192761.8	391.40	3.73	387.67	4.31	1.50	0.74	388.04	active
15b_29	Swamp 15b	292613.5	6192715.9	386.53	2.00	384.53	2.51	1.00	0.52	384.72	active
15b_30	Swamp 15b	292429.6	6192704.6	391.86	1.83	390.03	2.49	0.50	0.68	390.24	active
15b_31	Swamp 15b	292376.6	6192754.5	395.20	1.36	393.84	2.05	1.00	0.75	394.05	active
15b_32	Swamp 15b	292266.3	6192618.3	399.80	1.24	398.56	1.72	1.00	0.48	398.73	end monitoring 10/12/2013
15b_33	Swamp 15b	292217.2	6192486.1	415.44	0.86	414.58	1.36	0.50	0.52	-	no instrumentation
15b_34	Swamp 15b	292971.2	6192662.6	369.60	1.06	368.54	1.60	1.00	0.57	-	no instrumentation
15b_35	Swamp 15b	292989.1	6192560.3	371.32	0.70	370.62	1.14	0.50	0.49	-	no instrumentation
15b_36	Swamp 15b	293003.0	6192450.9	369.37	0.71	368.66	1.20	0.50	0.55	-	no instrumentation
15b_37	Swamp 15b	292867.9	6192395.0	380.90	2.39	378.51	2.93	1.00	0.54	-	no instrumentation
15b_38	Swamp 15b	293135.5	6192556.4	360.85	1.93	358.92	2.51	1.00	0.58	-	no instrumentation
15b_39	Swamp 15b	293123.4	6192419.4	361.89	0.70	361.19	1.17	0.50	0.47	-	no instrumentation
15b_H1	Swamp 15b	292523.3	6192698.8	388.72	1.30	387.42	2.35	n/a	1.05	387.65	end monitoring 05/08/2015
15b_H2	Swamp 15b	292750.5	6192762.3	380.69	1.74	378.95	2.77	n/a	1.03	379.12	end monitoring 05/07/2015
15b_H3	Swamp 15b	292854.6	6192726.5	379.03	0.86	378.17	1.70	n/a	0.84	378.32	end monitoring 24/05/2015
18_H1	Swamp 18	289681.0	6188572.0	392.70	0.32	392.39	1.30	n/a	0.98	392.48	end monitoring 09/10/2012
18_H2	Swamp 18	289708.0	6188795.0	387.18	1.55	385.64	2.51	n/a	0.96	385.74	end monitoring 18/01/2013
18_H3	Swamp 18	289734.0	6189012.0	381.55	1.17	380.38	2.15	n/a	0.98	380.44	end monitoring 12/04/2011
18a_H1	Swamp 18a	290090.4	6188128.4	425.16	1.18	423.98	2.30	n/a	1.12	424.08	end monitoring 23/02/2012
18a_H2	Swamp 18a	290042.1	6188146.8	423.19	1.80	421.39	2.87	n/a	1.07	421.49	end monitoring 16/06/2012
18a_H4	Swamp 18a	290000.9	6188066.3	422.20	1.48	420.72	2.60	n/a	1.13	420.82	end monitoring 07/06/2012
18a_H6	Swamp 18a	289922.9	6188075.8	418.80	1.80	417.00	2.90	n/a	1.10	417.10	end monitoring 21/10/2011
25_01	Swamp 25	292451.3	6190412.5	415.80	2.46	413.34	3.02	1.50	0.75	413.65	active
36_H1	Swamp 36	289239.7	6188048.2	432.41	1.02	431.39	1.56	n/a	0.55	431.50	end monitoring 16/05/2012
36_H2	Swamp 36	289135.3	6188144.3	423.06	0.24	422.82	1.21	n/a	0.97	422.93	end monitoring 19/04/2011
36_H3	Swamp 36	288776.8	6188174.7	404.44	0.74	403.70	1.77	n/a	1.03	403.87	end monitoring 29/12/2011
01_01	Swamp 1	294996.9	6192027.6	437.24	1.32	435.92	n/a	n/a	0.56	436.05	end monitoring 11/10/2014
01_02	Swamp 1	294961.5	6191998.2	437.42	0.84	436.58	n/a	n/a	0.50	436.72	end monitoring 12/10/2014
01_03	Swamp 1	294919.7	6191975.9	437.42	0.62	436.80	n/a	n/a	0.44	436.91	end monitoring 17/07/2014
01_04	Swamp 1	294869.4	6191947.9	438.44	0.32	438.12	n/a	n/a	0.29	438.19	end monitoring 03/09/2014
01_05	Swamp 1	294814.7	6191928.1	435.31	1.65	433.66	n/a	n/a	0.24	433.90	end monitoring 04/09/2014
84_01a	Swamp 84	294330.3	6192090.0	367.55	0.80	366.75	n/a	n/a	0.43	366.88	end monitoring 12/09/2011
84_02	Swamp 84	294175.3	6192139.3	352.42	1.83	350.59	n/a	n/a	0.59	351.01	end monitoring 07/08/2012
84_03	Swamp 84	294170.5	6192120.2	352.44	1.80	350.64	n/a	n/a	0.63	351.06	end monitoring 17/05/2012
84_04	Swamp 84	294190.9	6192085.8	353.90	1.27	352.63	n/a	n/a	0.33	352.78	end monitoring 17/05/2012
84_05	Swamp 84	293991.1	6192126.8	340.27	0.66	339.61	n/a	n/a	0.41	339.73	end monitoring 20/07/2012
D4_01	n/a	294737.5	6191757.0	442.88	1.21	441.67	n/a	n/a	0.20	441.83	end monitoring 19/02/2013
D5_01	n/a	293928.0	6192382.8	338.88	0.80	338.08	n/a	n/a	0.34	338.24	end monitoring 14/01/2012
D5_02	n/a	294006.6	6192328.0	345.27	1.00	344.27	n/a	n/a	0.30	344.42	end monitoring 08/08/2012
DA2A_01	n/a	293311.9	6192892.6	373.00	1.97	371.03	2.51	1.00	0.66	371.26	end monitoring 30/08/2012
EDEN87	n/a	294163.4	6192426.2	363.86	155.80	208.06	1.00	n/a	n/a	214.06	end monitoring 06/08/2012

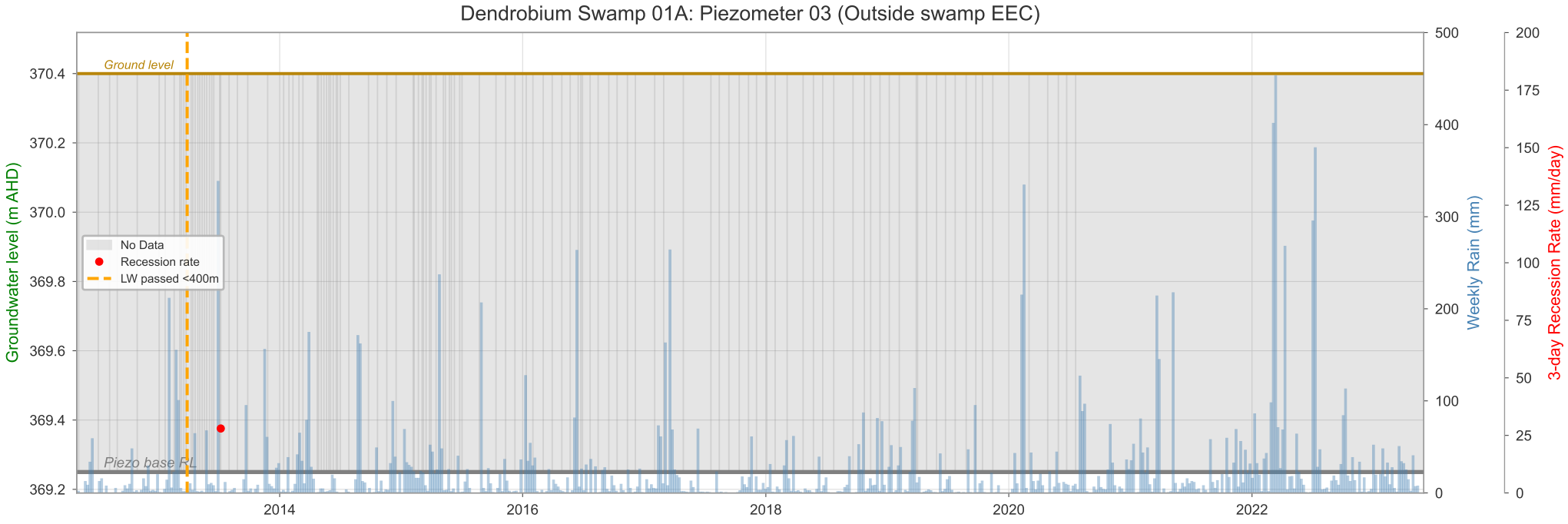
Site ID	Swamp	MGA_E	MGA_N	Elev (m)	Depth (m)	RL Bottom (m)	Total Casing (m)	Screen (m)	Stick-up (m)	Piezo RL(m)	Monitoring status
EDEN87a	n/a	294167.4	6192427.9	363.96	9.60	354.36	7.00	n/a	0.37	-	no instrumentation
EDEN87b	n/a	294158.5	6192420.5	363.46	26.00	337.46	22.00	n/a	0.29	-	no instrumentation
EDEN88	n/a	294391.7	6192283.7	377.93	155.60	222.33	1.10	n/a	n/a	247.93	end monitoring 23/11/2009
EDEN88a	n/a	294389.6	6192275.6	378.43	10.00	368.43	7.00	n/a	0.22	-	no instrumentation
EDEN88b	n/a	294392.3	6192279.3	378.13	28.00	350.13	26.00	n/a	0.21	-	no instrumentation
EDEN89	n/a	294835.1	6191721.9	455.46	165.10	290.36	2.70	n/a	n/a	332.46	end monitoring 18/06/2008
EDEN89a	n/a	294839.7	6191727.4	455.46	9.70	445.76	7.00	n/a	0.31	-	no instrumentation
EDEN89b	n/a	294836.8	6191719.2	455.46	41.50	413.96	38.00	n/a	0.35	-	no instrumentation
EDEN89c	n/a	294829.3	6191731.0	454.71	1.12	453.59	1.69	n/a	0.62	453.75	end monitoring 19/02/2013
EDEN90	n/a	294886.8	6193033.8	386.30	141.00	245.30	2.00	n/a	n/a	250.50	end monitoring 28/08/2012
EDEN90a	n/a	294882.9	6193038.8	386.30	5.20	381.10	2.50	n/a	0.37	-	no instrumentation
EDEN90b	n/a	294891.3	6193024.3	386.70	11.00	375.70	9.00	n/a	0.19	-	no instrumentation
EGW2	n/a	289473.6	6188026.0	452.80	45.67	407.13	n/a	n/a	0.54	411.07	end monitoring 15/08/2011
EGW3	n/a	289796.7	6187751.7	450.23	35.10	415.13	n/a	n/a	0.37	418.42	end monitoring 04/09/2012
EGW4a	n/a	290132.9	6188351.6	462.22	48.45	413.77	n/a	n/a	0.58	415.34	end monitoring 20/03/2011
EGW5	n/a	290541.1	6187884.7	475.58	51.51	424.07	n/a	n/a	0.69	425.80	end monitoring 04/09/2012
EGW6	n/a	290460.0	6188056.6	463.39	39.55	423.84	n/a	n/a	0.64	425.67	end monitoring 04/09/2012
LC3_01	n/a	292809.4	6193350.1	401.40	1.67	399.73	2.24	1.00	0.57	399.94	end monitoring 13/09/2012
LC3_02	n/a	293084.2	6193327.4	384.80	1.58	383.22	2.08	1.00	0.51	383.41	end monitoring 14/05/2012
LC4_01	n/a	292297.0	6193409.0	402.90	1.85	401.05	2.55	0.50	0.93	401.49	end monitoring 22/05/2012
LC4_02	n/a	292364.0	6193425.1	401.00	2.34	398.66	3.03	0.50	0.77	398.96	end monitoring 26/01/2012
LC4_03	n/a	292449.3	6193336.9	406.10	1.76	404.34	2.32	0.50	0.60	404.48	end monitoring 27/08/2012
LC4_04	n/a	292638.3	6193713.7	381.90	3.00	378.90	3.52	1.00	0.53	379.13	end monitoring 13/09/2012
07_05	Swamp 7	292442.8	6194750.6	351.03	2.82	348.21	3.69	1.42	0.87	348.35	active
07_06	Swamp 7	292498.6	6195011.8	340.82	2.65	338.17	3.02	1.60	0.50	338.42	active
14_01	Swamp 14	289911.7	6191296.7	393.72	2.28	391.44	2.60	1.06	0.73	391.95	active
14_02	Swamp 14	290178.6	6191668.0	375.44	1.64	373.80	2.33	0.84	0.72	373.96	active
22_01	Swamp 22	292796.3	6188139.5	457.92	1.98	455.94	2.93	1.36	1.00	456.12	active
22_02	Swamp 22	293188.7	6188171.8	450.04	2.93	447.11	3.71	1.41	0.78	447.22	active
23_01	Swamp 23	288867.1	6191751.8	392.43	1.22	391.21	2.02	0.50	0.80	391.33	active
23_02	Swamp 23	288663.2	6191690.4	368.89	2.57	366.33	3.00	1.50	0.60	366.64	active
33_01	Swamp 33	291948.8	6190939.7	389.28	1.19	388.09	2.01	0.49	0.82	388.25	active
33_03	Swamp 33	291668.1	6191267.1	365.13	1.10	364.03	1.98	0.50	1.10	364.33	active
34_01	Swamp 34	291891	6191891.0	397.50	0.62	396.88	1.467	0.55	0.875	397.02	active
35a_01	Swamp 35a	289698.4	6190520.1	380.26	2.18	378.08	3.00	1.50	0.98	378.35	active
35b_01	Swamp 35b	289359.8	6190458.7	352.24	3.66	348.58	4.02	1.47	0.80	349.14	active
84_01	Swamp 84	294101.0	6192112.0	348.54	1.82	346.72	2.20	0.75	0.63	347.07	active
85_01	Swamp 85	288032.8	6195001.8	395.70	1.26	394.44	2.00	0.50	0.76	394.56	active
85_02	Swamp 85	288140.6	6195011.3	391.19	1.22	389.97	2.17	0.72	0.99	390.13	active
86_01	Swamp 86	286624.9	6196836.4	383.66	1.64	382.02	2.52	1.00	0.89	382.15	active
86_02	Swamp 86	286534.0	6196551.6	389.58	3.80	385.78	4.54	1.50	0.75	385.93	active
87_01	Swamp 87	290857.0	6180951.6	539.65	2.97	536.68	3.82	0.80	0.99	536.94	active
87_02	Swamp 87	290879.3	6181182.7	535.52	1.85	533.67	2.48	0.96	0.68	533.85	active
88_01	Swamp 88	289219.0	6180106.7	537.99	1.64	536.35	2.30	0.74	0.86	536.60	active
88_02	Swamp 88	289368.4	6180460.6	527.25	1.20	526.05	1.87	0.90	0.87	526.37	active
95_01	Swamp 95	293473.5	6192428.4	338.70	0.97	337.74	1.91	0.90	0.99	337.89	active
97_01	Swamp 97	286797.5	6197576.4	373.74	1.17	372.58	1.92	0.90	0.75	372.69	terminated
98_01	Swamp 98	289280.5	6196489.4	328.45	1.03	327.42	1.80	0.80	0.86	328.31	terminated
99_01	Swamp 99	285082.5	6196188.4	390.81	1.71	389.10	2.50	1.50	0.80	389.24	terminated
144_01	Swamp 144	291562.5	6193927.4	378.00	1.30	376.70	2.00	1.00	0.95	377.06	active
145_01	Swamp 145	292099.0	6193785.0	405.00	0.93	404.07	1.52	1.52	0.69	404.26	active
146_01	Swamp 146	293281.0	6192906.0	373.90	1.65	372.25	2.46	1.57	1.00	372.44	active
147_01	Swamp 147	293347.0	6191663.0								
148_01	Swamp 148	291909.0	6192213.9	380.50	0.91	379.59	1.93	0.79	1.02	379.70	active
149_01	Swamp 149	289240.1	6190987.0								
150_01	Swamp 150	289690.5	6190242.4	401.60	1.23	400.37	1.85	1.10	0.68	400.53	active
151_01	Swamp 151	289446.5	6190118.4	401.40	0.88	400.52	1.64	0.83	0.76	400.53	active
153_01	Swamp 153	291171.5	6195186.4	310.10	1.12	308.99	1.85	0.70	0.73	309.04	active
154_01	Swamp 154	293358.0	6194537.0	346.40	1.20	345.20	1.90	n/a	0.70	345.30	active

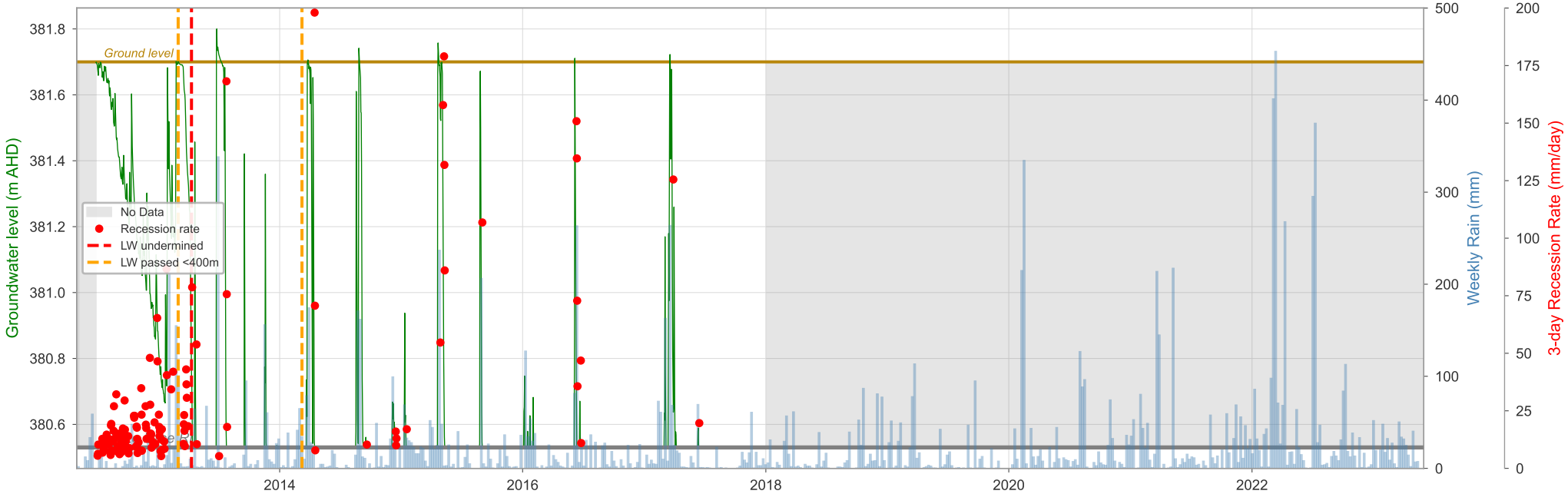
Appendix B – Piezometer hydrographs

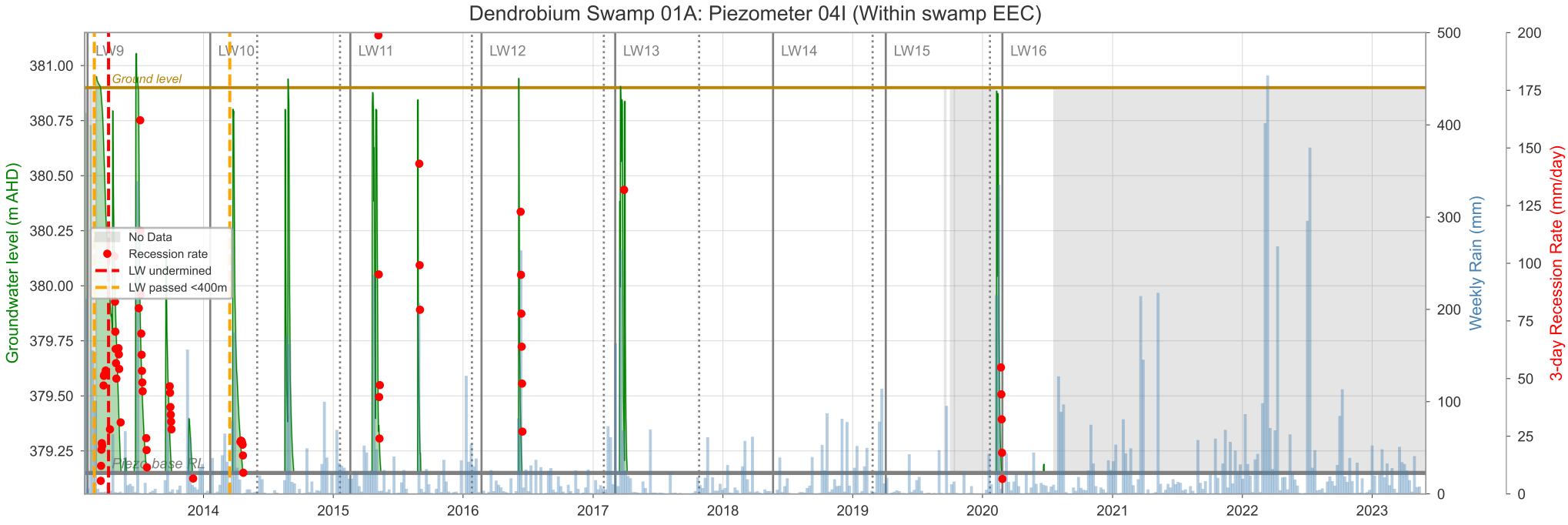
Hydrographs for all logged shallow piezometer sites presented on following pages (by HGEO).

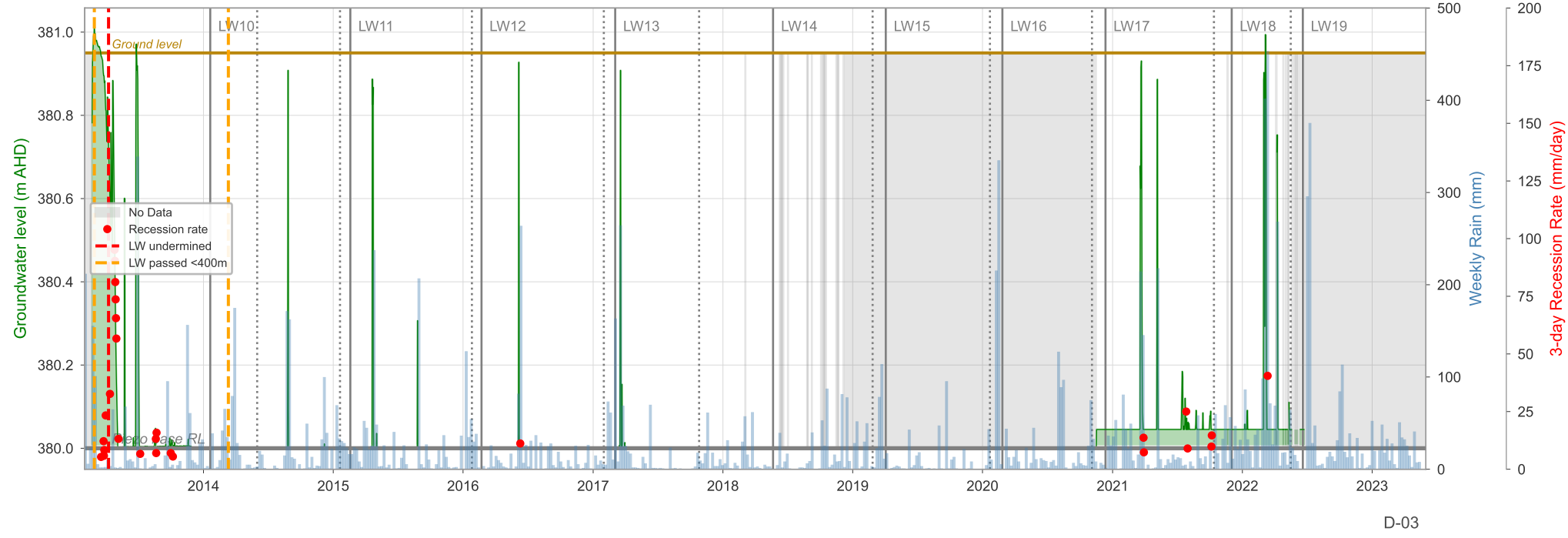

Dendrobium Swamp 01A: Piezometer 01 (Within swamp EEC)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
399.0
398.5
398.0
397.5
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

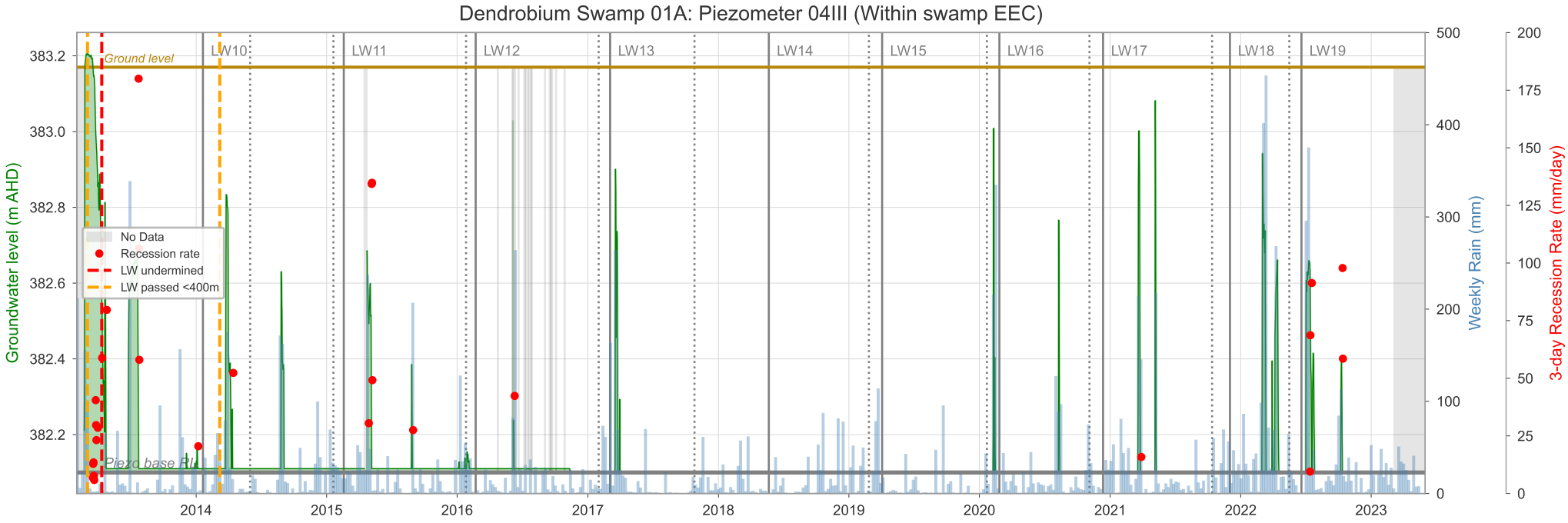

Dendrobium Swamp 01A: Piezometer 02 (Within swamp EEC)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
364.2
364.0
363.8
363.6
363.4
363.2
363.0
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

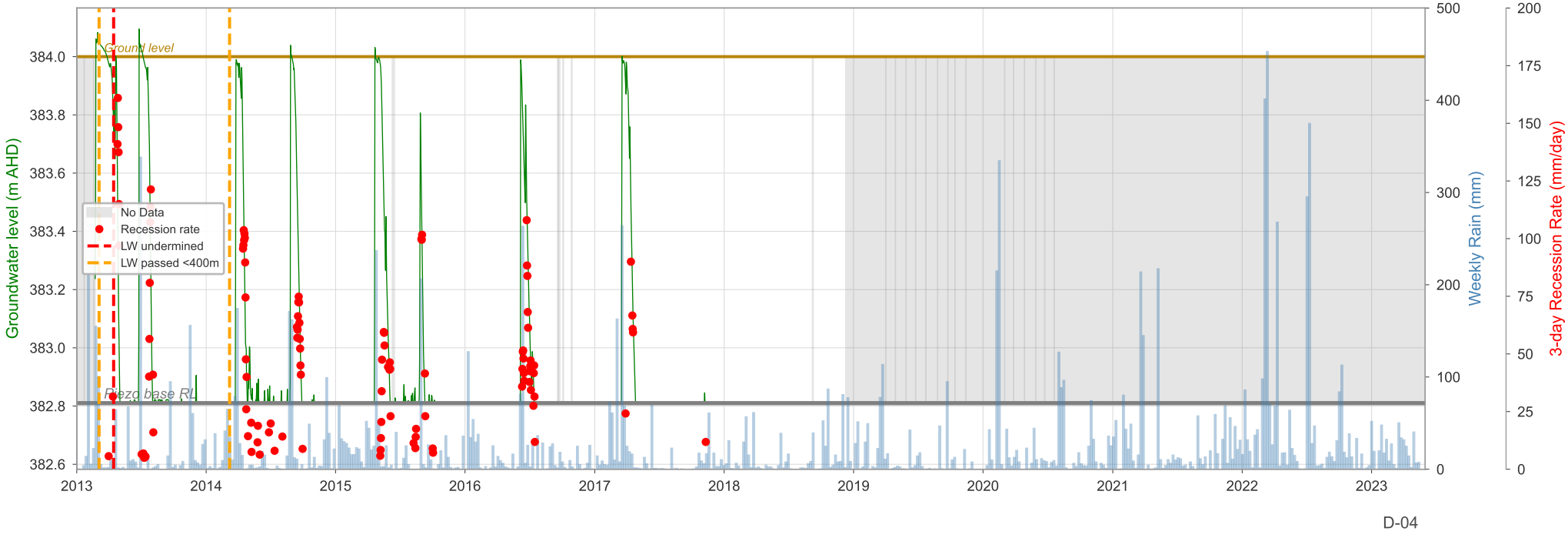

Dendrobium Swamp 01A: Piezometer 03 (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW passed <400m
370.4
370.2
370.0
369.8
369.6
369.4
369.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

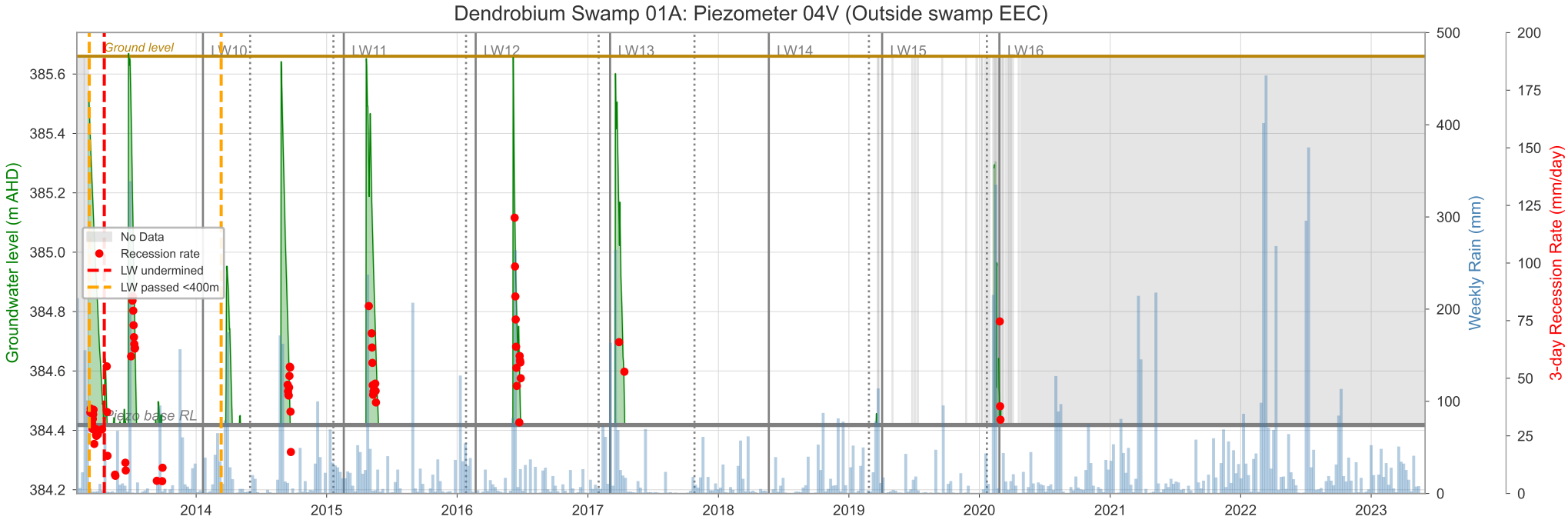

Dendrobium Swamp 01A: Piezometer 04 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
381.8
381.6
381.4
381.2
381.0
380.8
380.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

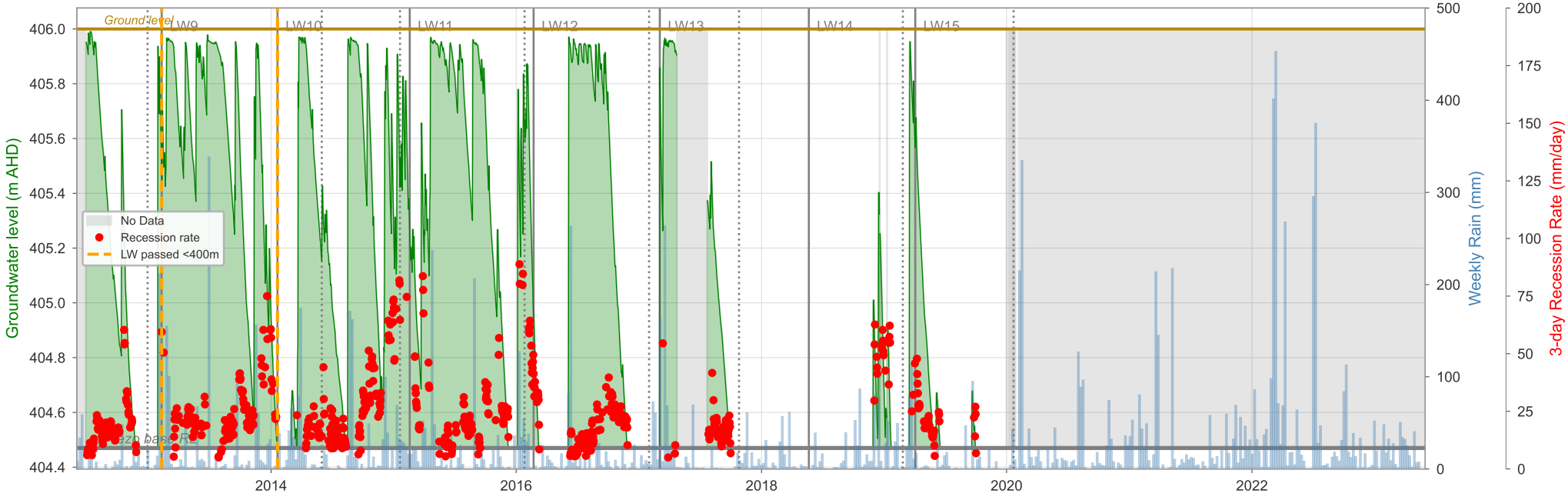

Dendrobium Swamp 01A: Piezometer 04I (Within swamp EEC)
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
381.00
380.75
380.50
380.25
380.00
379.75
379.50
379.25
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

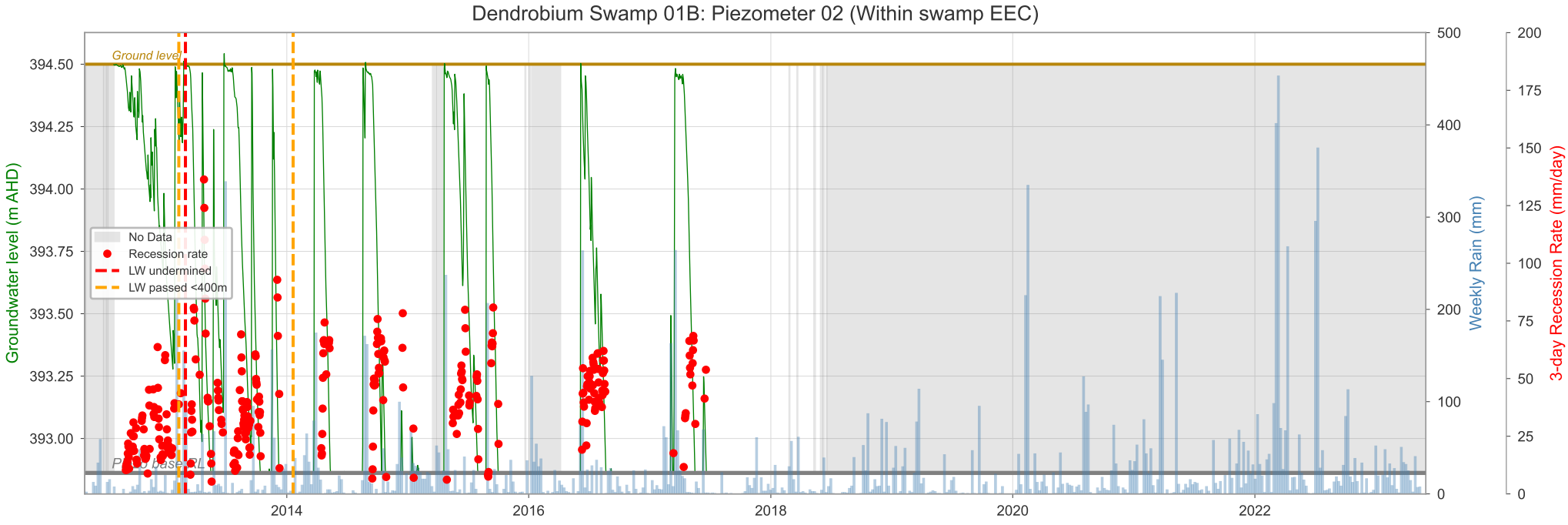

Dendrobium Swamp 01A: Piezometer 04II (Within swamp EEC)
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
381.0
380.8
380.6
380.4
380.2
380.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

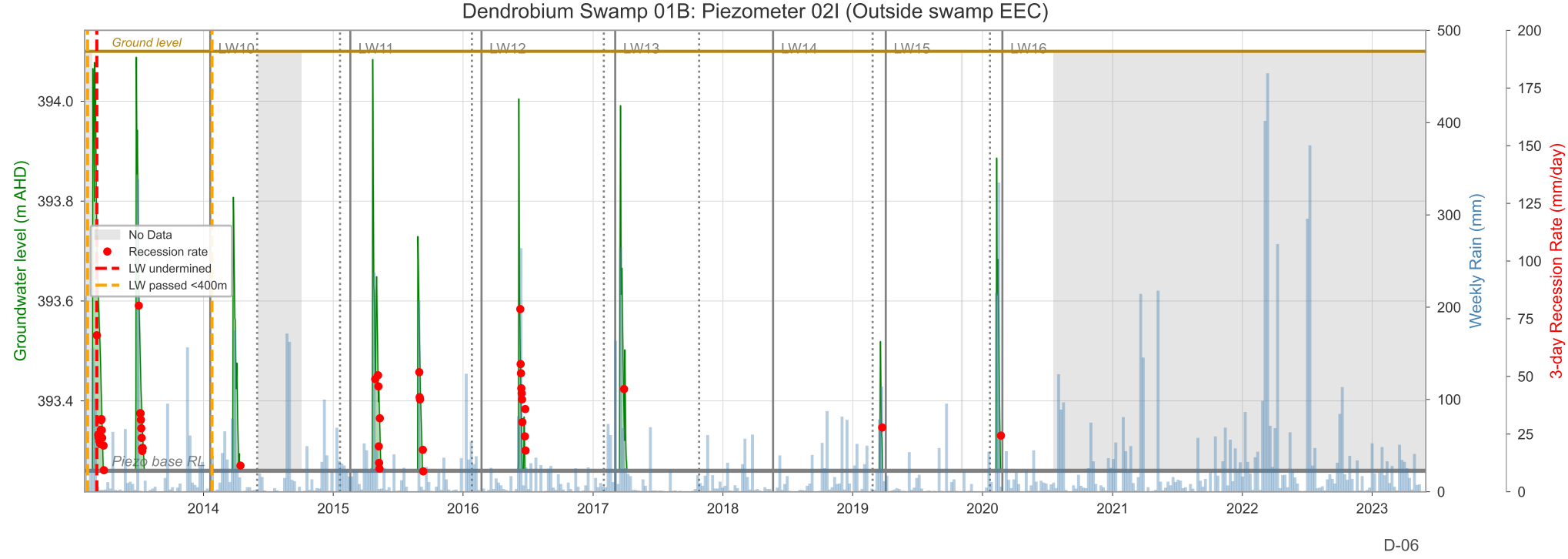

Dendrobium Swamp 01A: Piezometer 04III (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
383.2
383.0
382.8
382.6
382.4
382.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

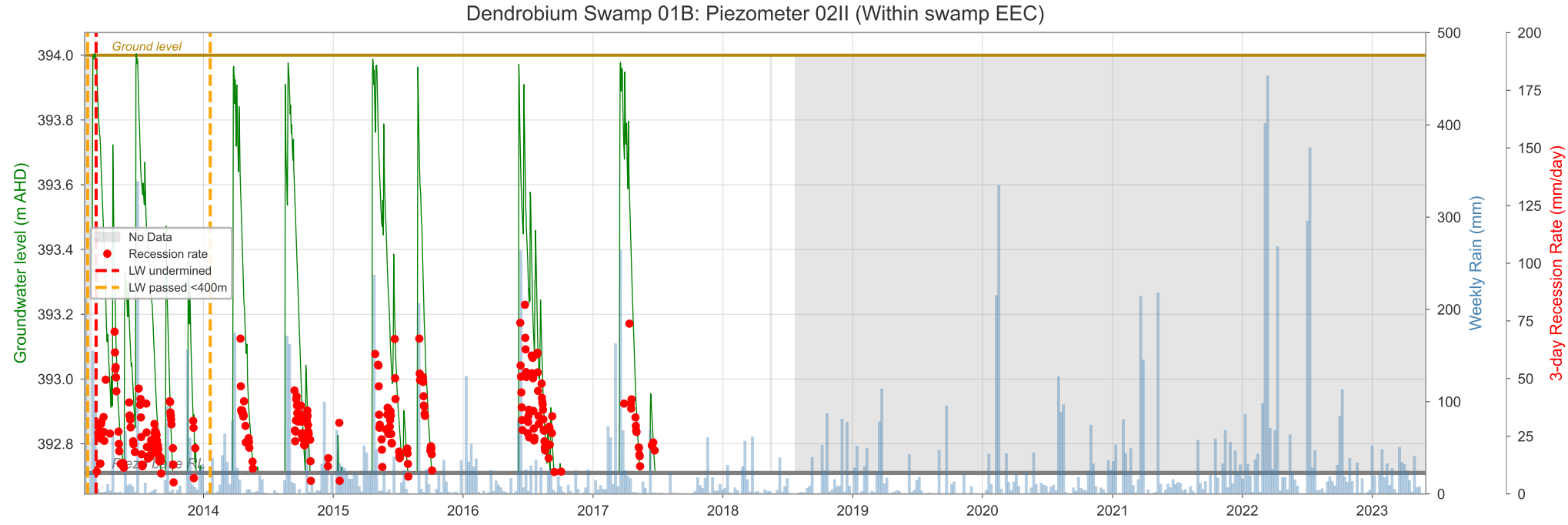

Dendrobium Swamp 01A: Piezometer 04IV (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
384.0
383.8
383.6
383.4
383.2
383.0
382.8
382.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

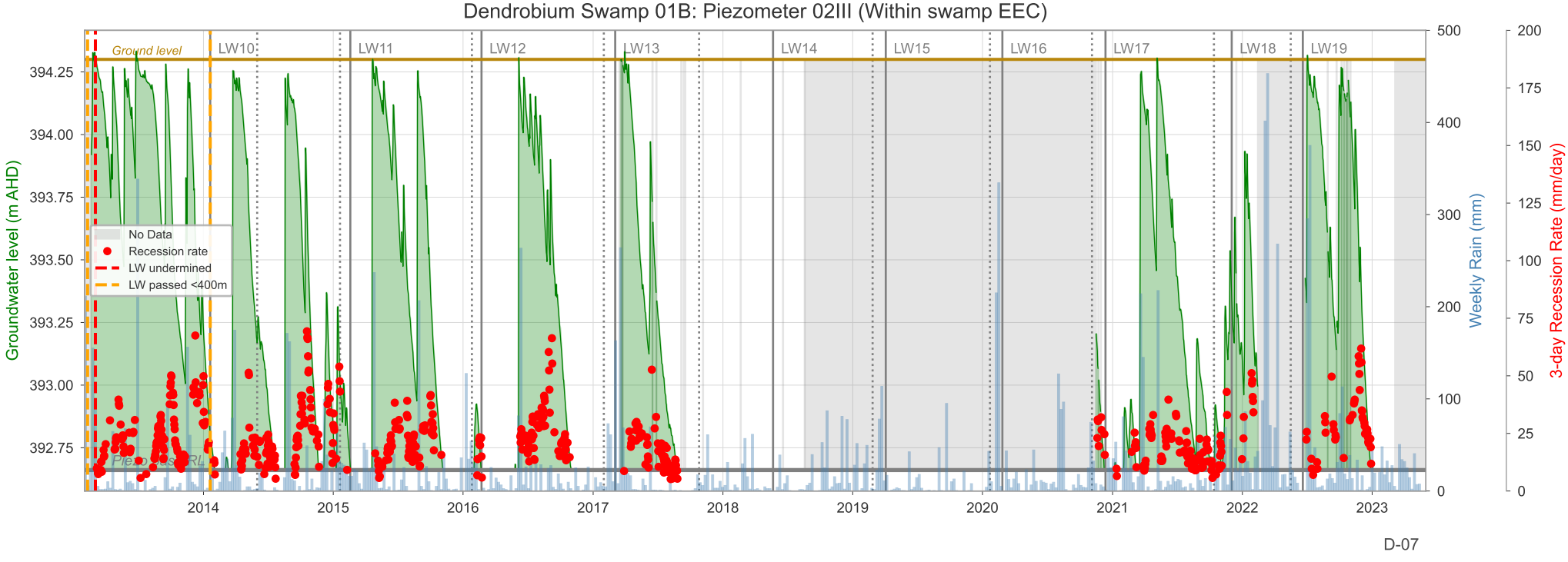

Dendrobium Swamp 01A: Piezometer 04V (Outside swamp EEC)
Ground level
LW10
LW11
LW12
LW13
LW14
LW15
LW16
No Data
Recession rate
LW undermined
LW passed <400m
Piezo base RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
385.6
385.4
385.2
385.0
384.8
384.6
384.4
384.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

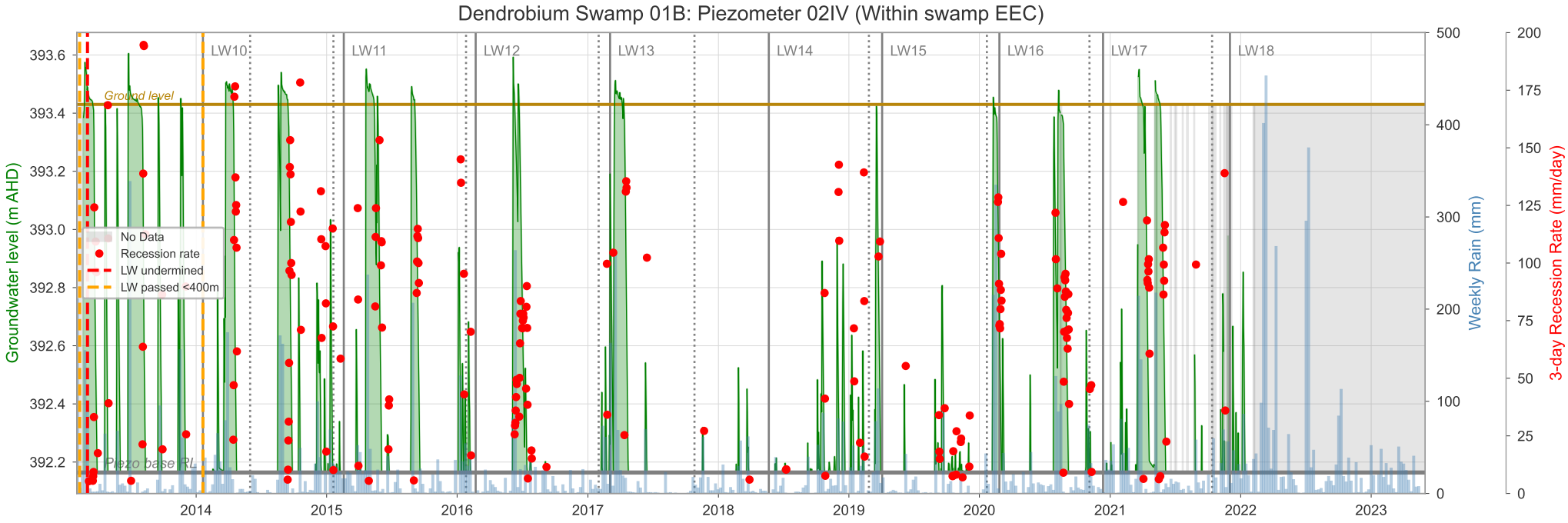

Dendrobium Swamp 01B: Piezometer 01 (Within swamp EEC)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
No Data
Recession rate
LW passed <400m
Piezo base RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
406.0
405.8
405.6
405.4
405.2
405.0
404.8
404.6
404.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

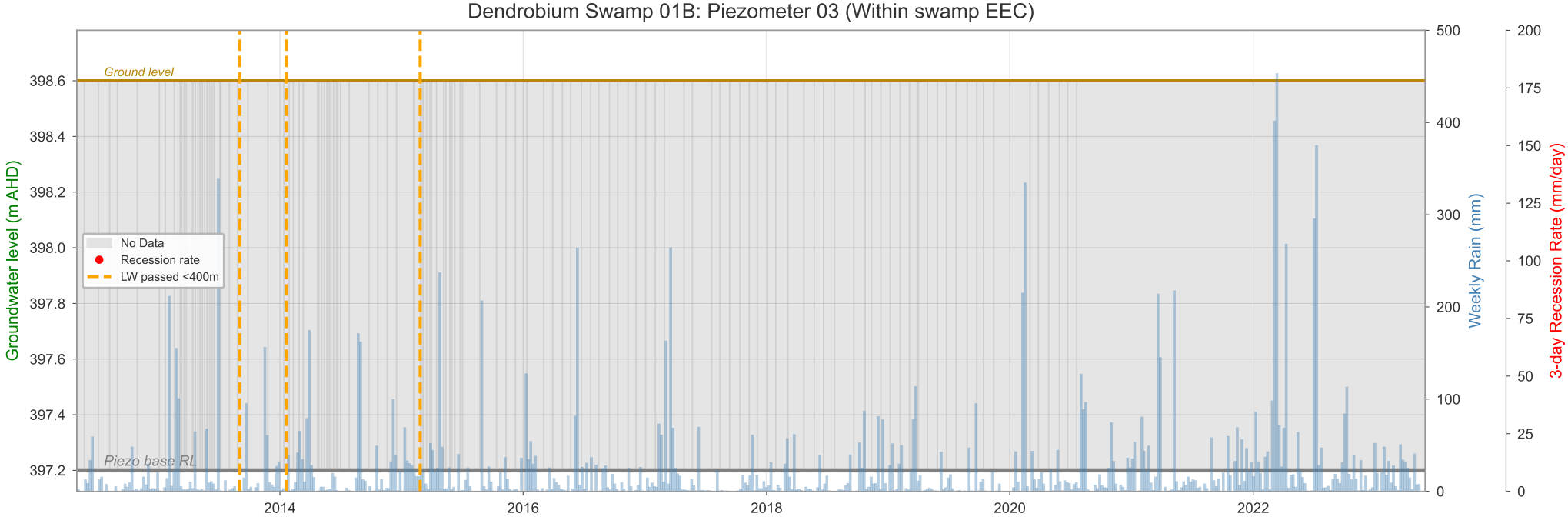

Dendrobium Swamp 01B: Piezometer 02 (Within swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
394.50
394.25
394.00
393.75
393.50
393.25
393.00
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

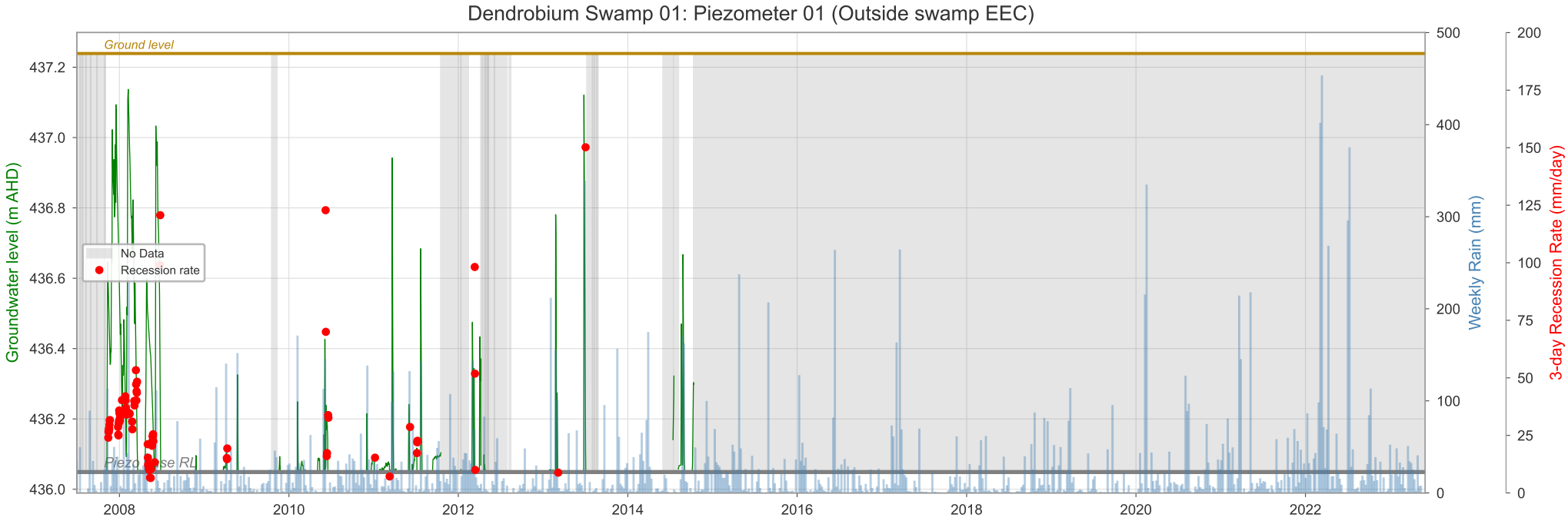

Dendrobium Swamp 01B: Piezometer 02I (Outside swamp EEC)
Ground level
LW10
LW11
LW12
LW13
LW14
LW15
LW16
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
394.0
393.8
393.6
393.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

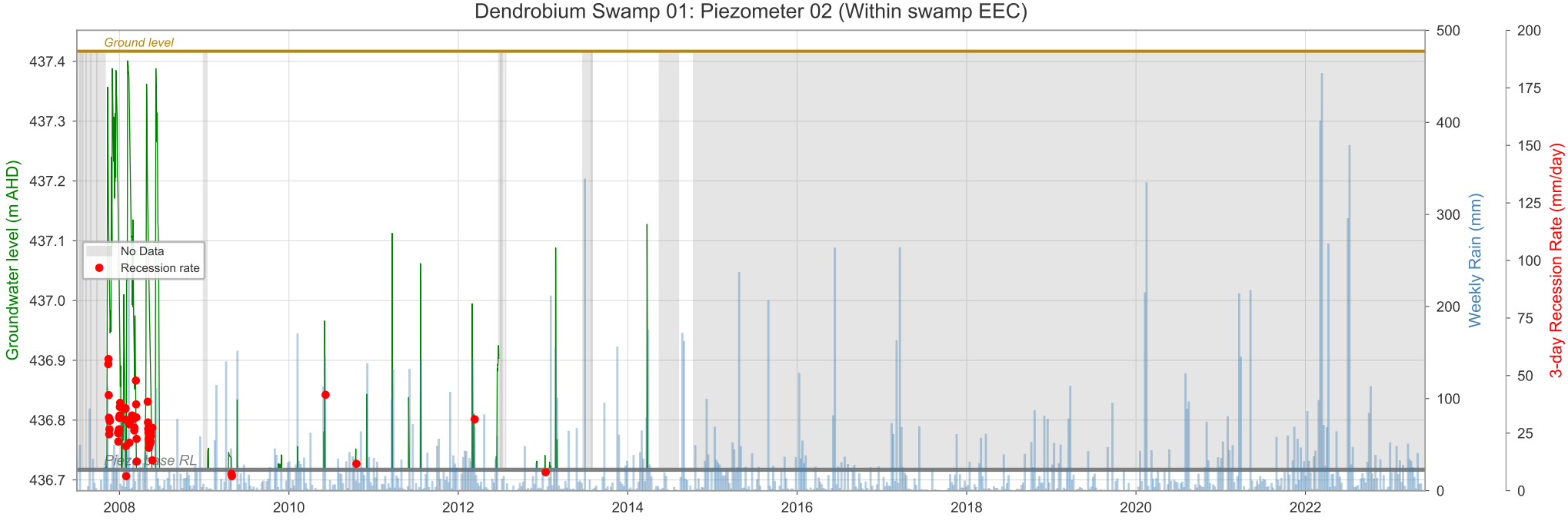

Dendrobium Swamp 01B: Piezometer 02II (Within swamp EEC)
Ground level
Piezometer RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
394.0
393.8
393.6
393.4
393.2
393.0
392.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

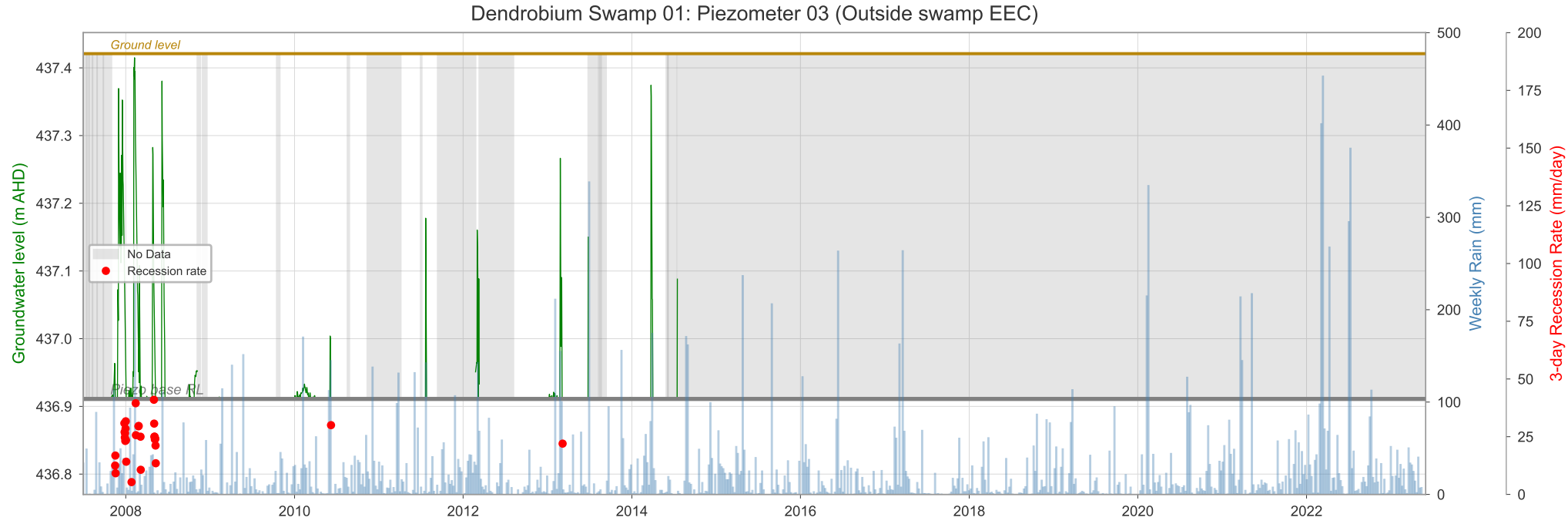

Dendrobium Swamp 01B: Piezometer 02III (Within swamp EEC)
Ground level
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
Piezometer RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
394.25
394.00
393.75
393.50
393.25
393.00
392.75
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

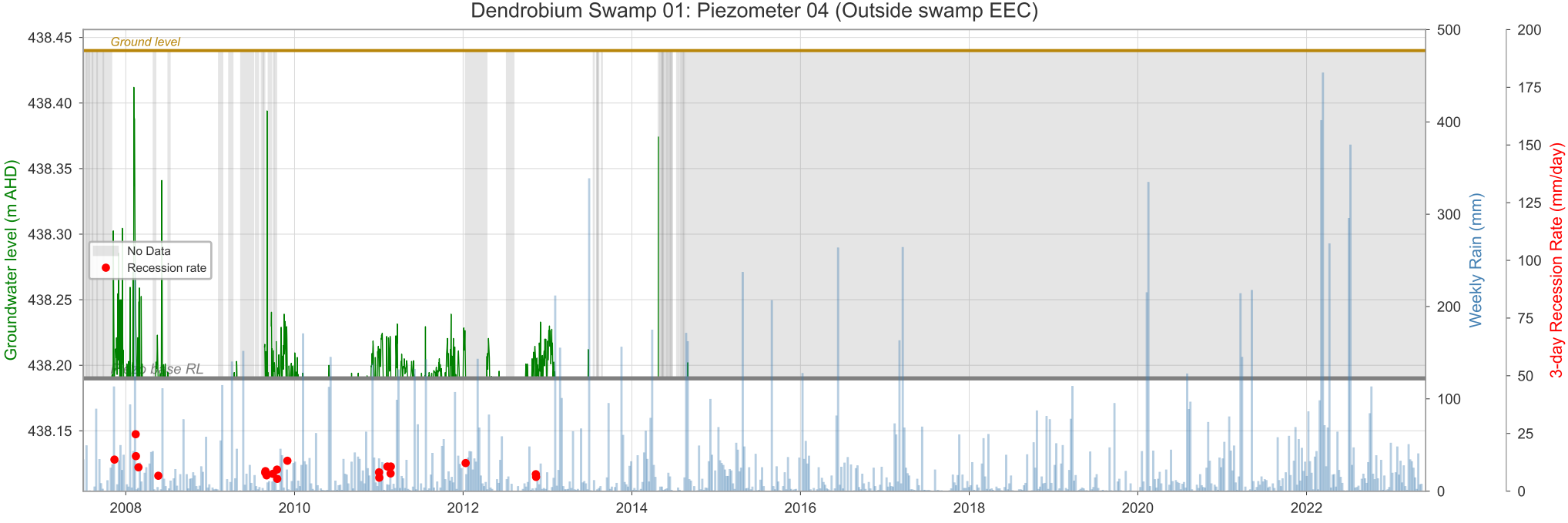

Dendrobium Swamp 01B: Piezometer 02IV (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
No Data
Recession rate
LW undermined
LW passed <400m
393.6
393.4
393.2
393.0
392.8
392.6
392.4
392.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

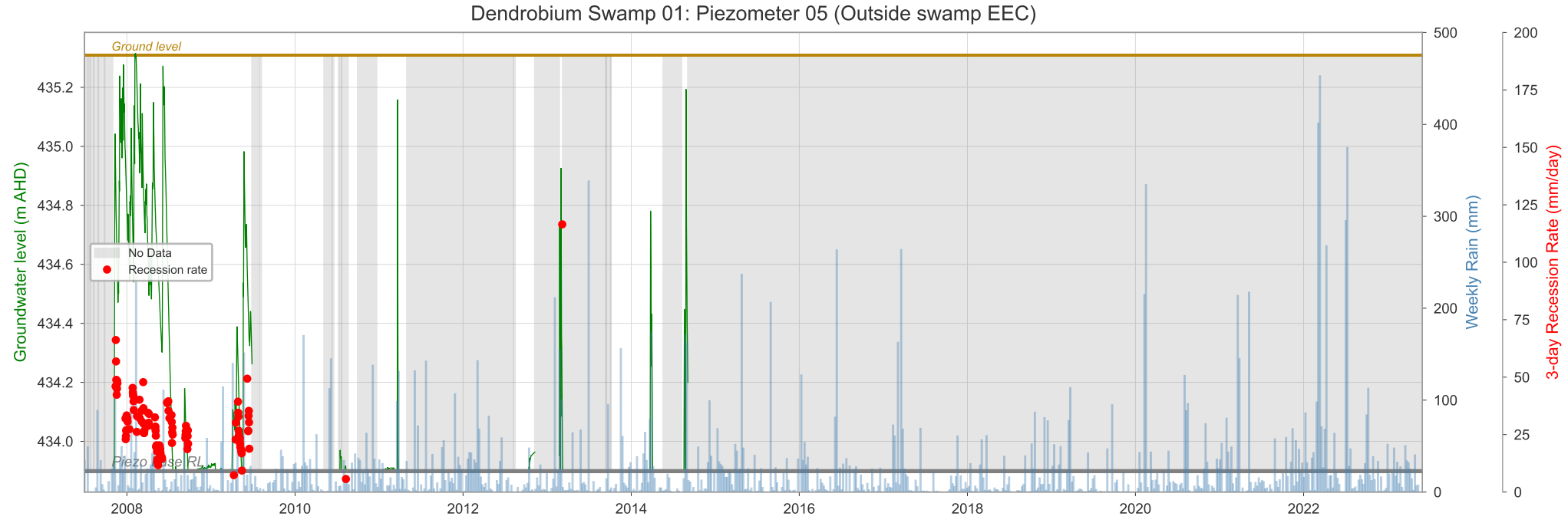

Dendrobium Swamp 01B: Piezometer 03 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW passed <400m
398.6
398.4
398.2
398.0
397.8
397.6
397.4
397.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

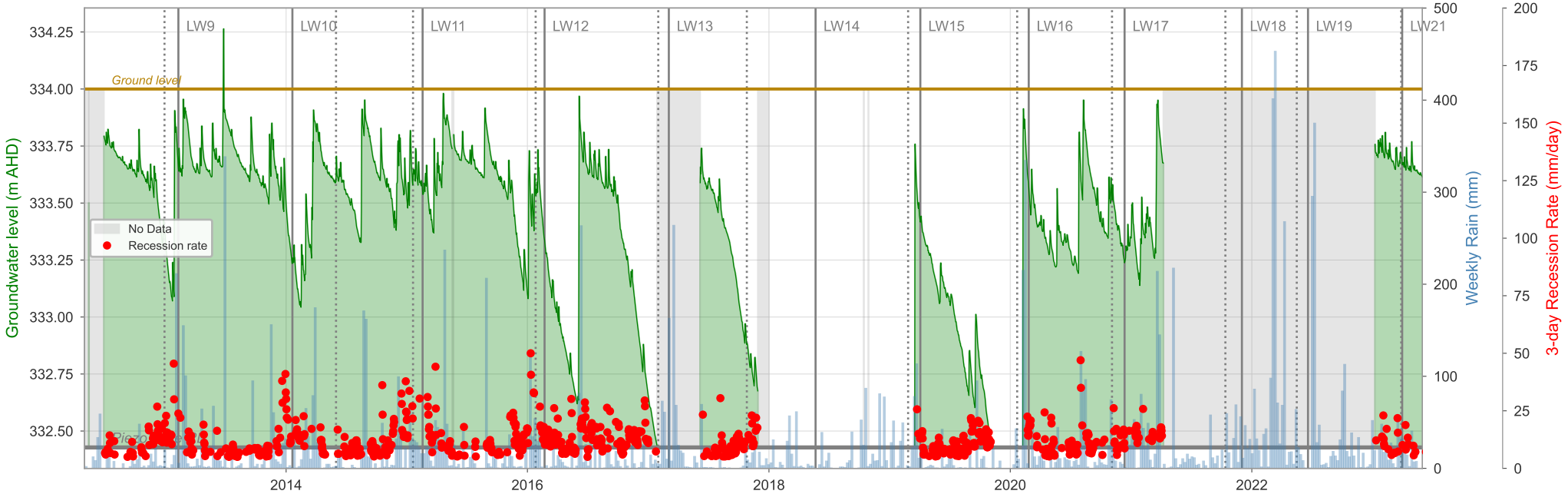

Dendrobium Swamp 01: Piezometer 01 (Outside swamp EEC)
Ground level
Piezometer RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
437.2
437.0
436.8
436.6
436.4
436.2
436.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

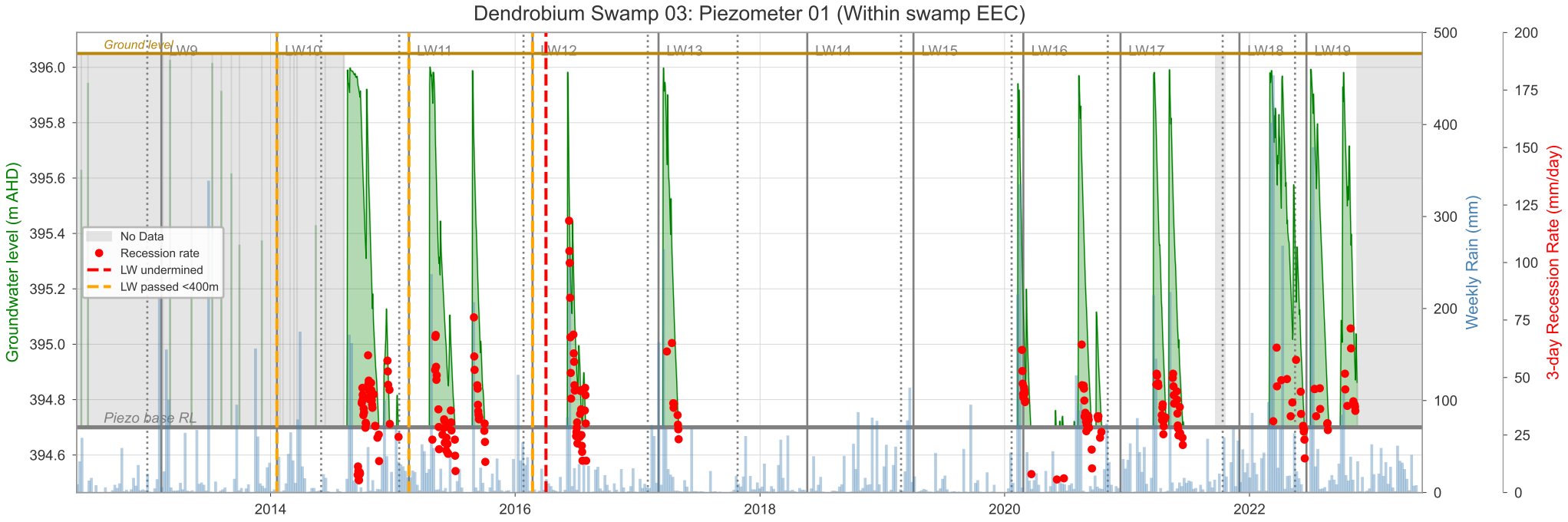

Dendrobium Swamp 01: Piezometer 02 (Within swamp EEC)
Ground level
Piezometer RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
437.4
437.3
437.2
437.1
437.0
436.9
436.8
436.7
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

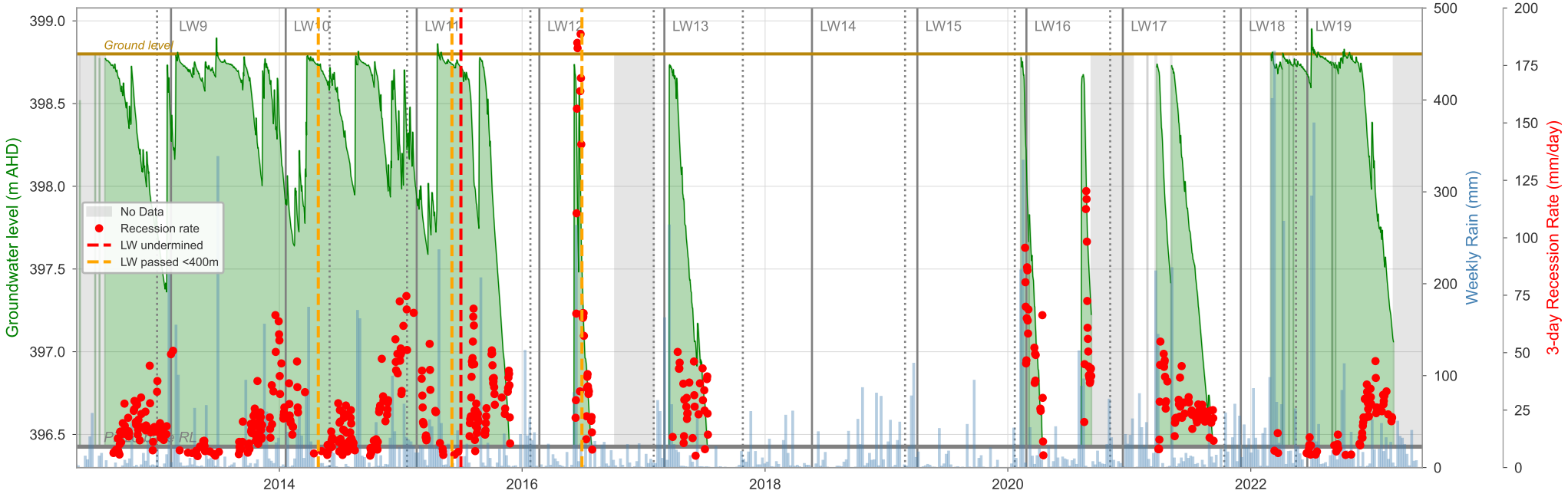

Dendrobium Swamp 01: Piezometer 03 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
437.4
437.3
437.2
437.1
437.0
436.9
436.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

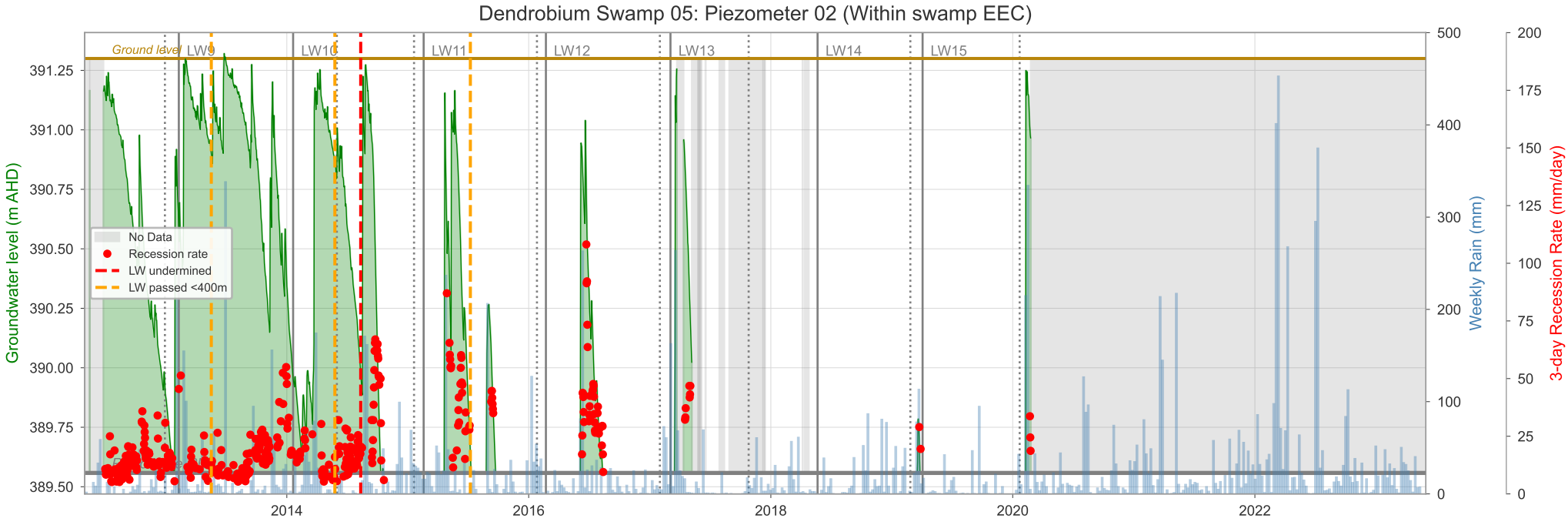

Dendrobium Swamp 01: Piezometer 04 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
438.45
438.40
438.35
438.30
438.25
438.20
438.15
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

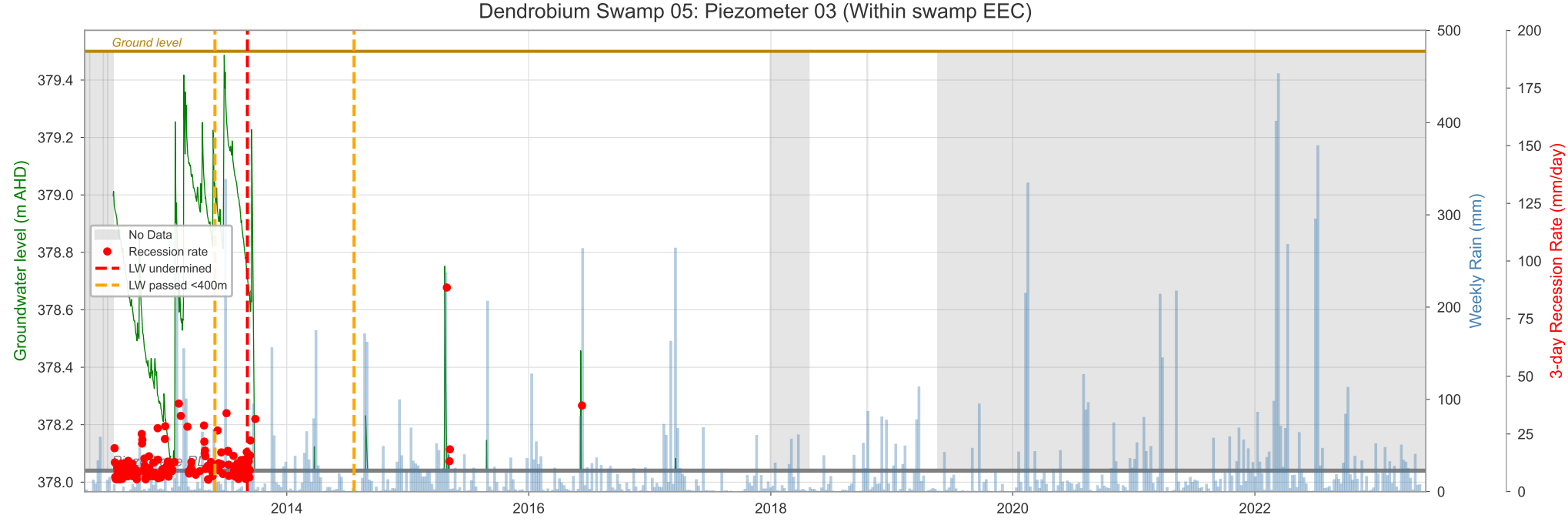

Dendrobium Swamp 01: Piezometer 05 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
435.2
435.0
434.8
434.6
434.4
434.2
434.0
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

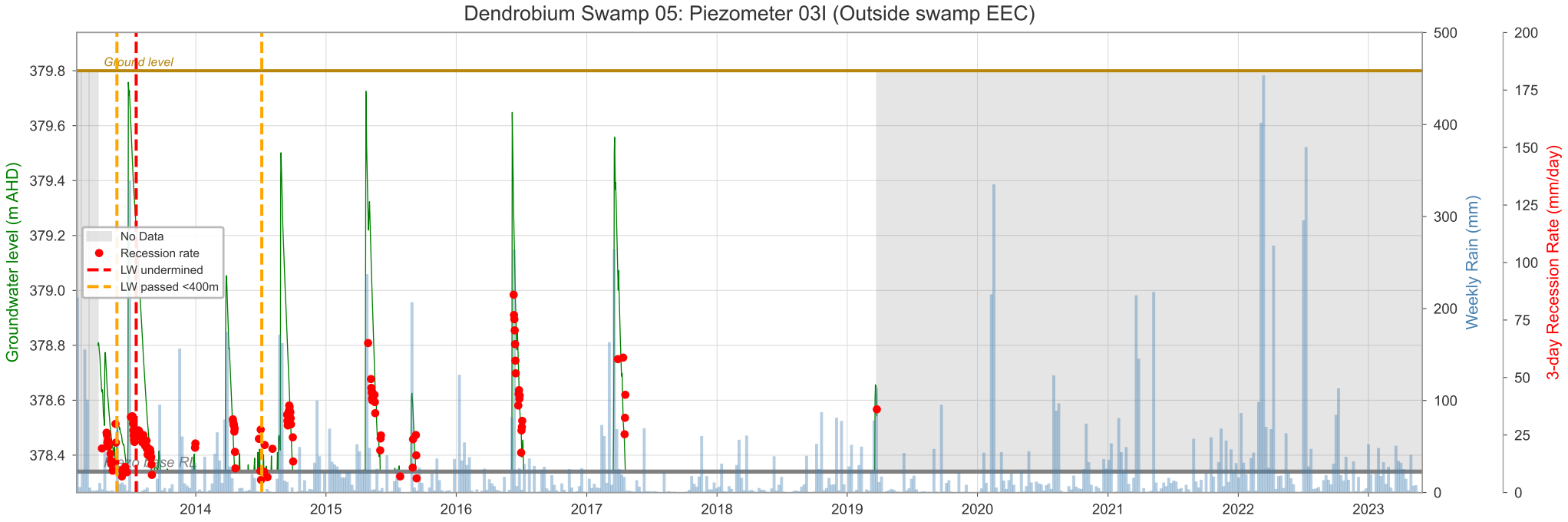

Dendrobium Swamp 02: Piezometer 01 (Within swamp EEC)
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
No Data
Recession rate
Groundwater level (m AHD)
334.25
334.00
333.75
333.50
333.25
333.00
332.75
332.50
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

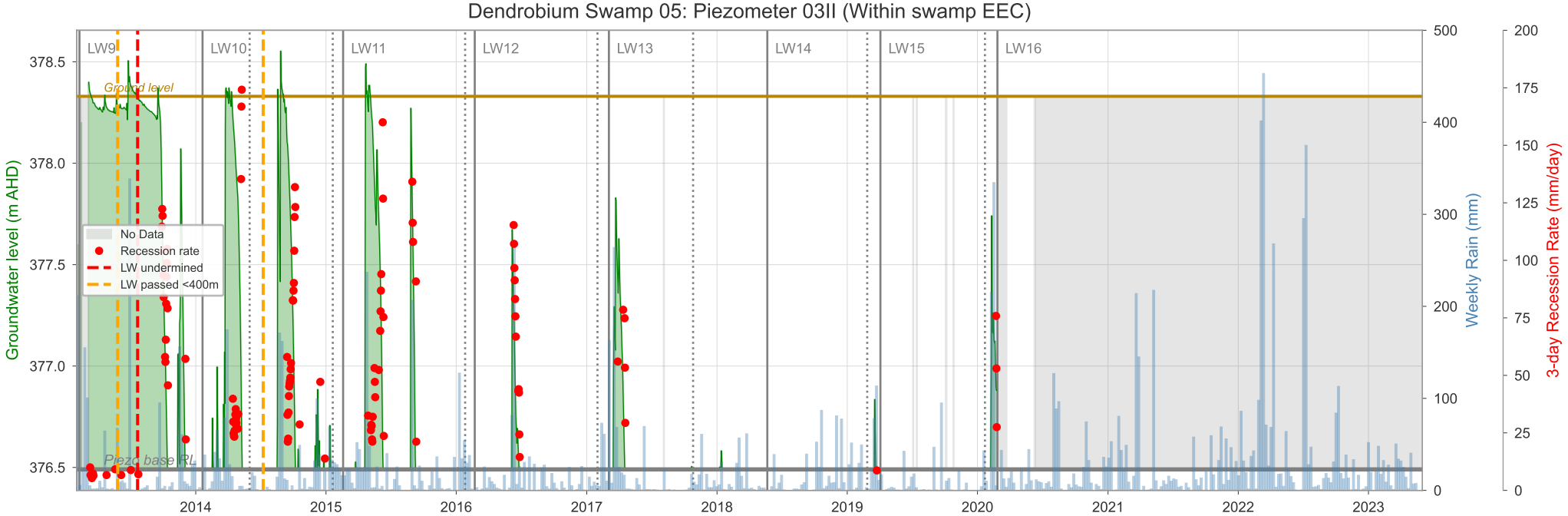

Dendrobium Swamp 03: Piezometer 01 (Within swamp EEC)
Ground level
Piezo base RL
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
396.0
395.8
395.6
395.4
395.2
395.0
394.8
394.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

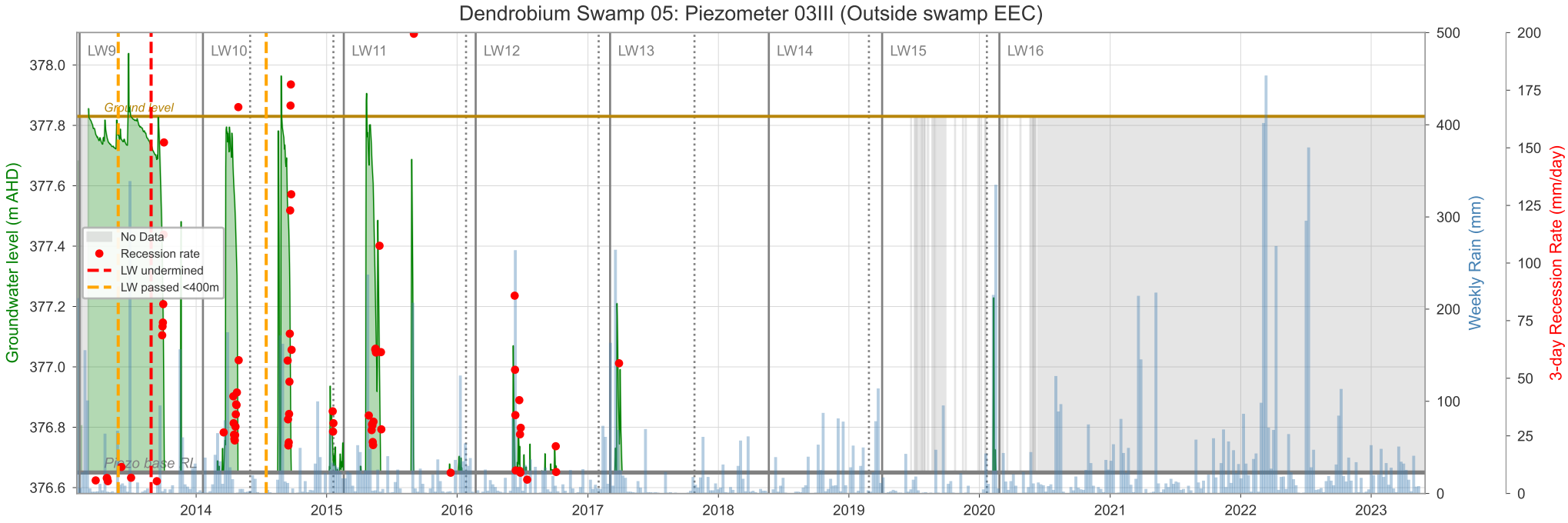

Dendrobium Swamp 05: Piezometer 01 (Within swamp EEC)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
399.0
398.5
398.0
397.5
397.0
396.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

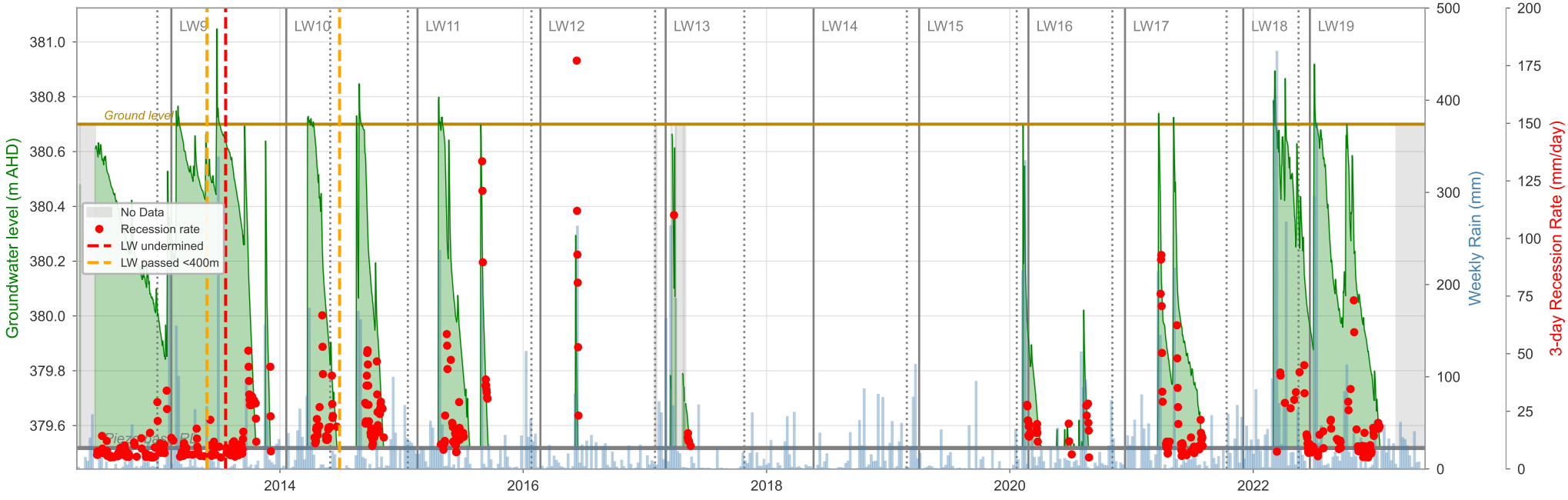

Dendrobium Swamp 05: Piezometer 02 (Within swamp EEC)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
391.25
391.00
390.75
390.50
390.25
390.00
389.75
389.50
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

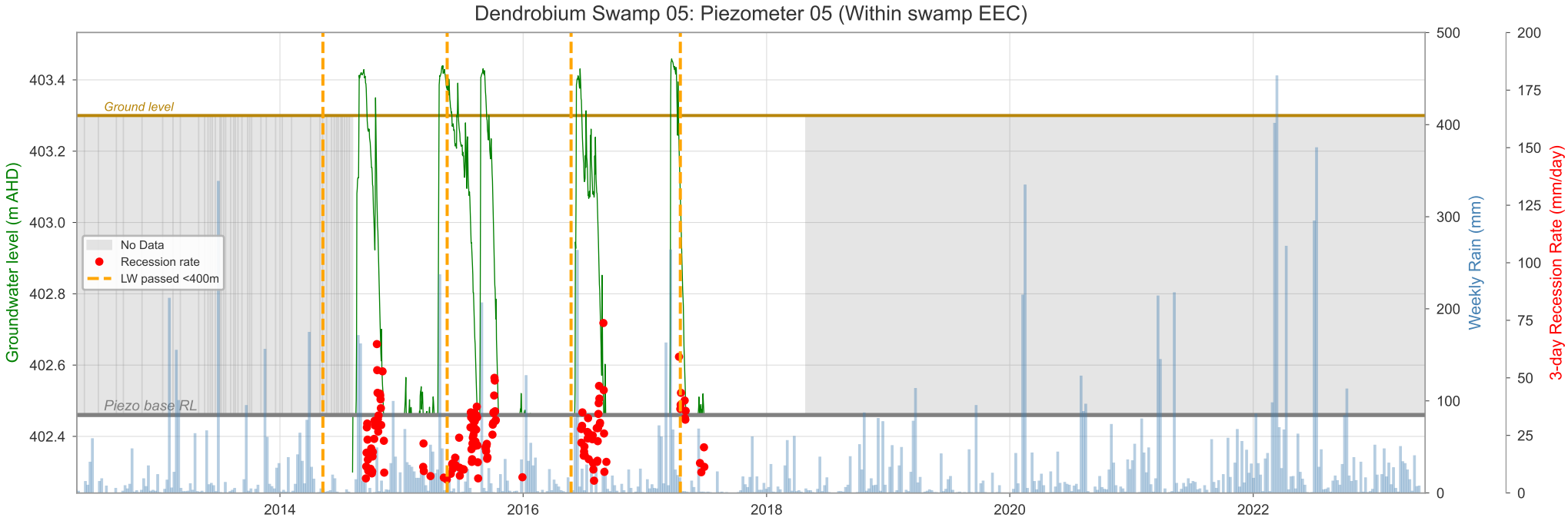

Dendrobium Swamp 05: Piezometer 03 (Within swamp EEC)
Ground level
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
379.4
379.2
379.0
378.8
378.6
378.4
378.2
378.0
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

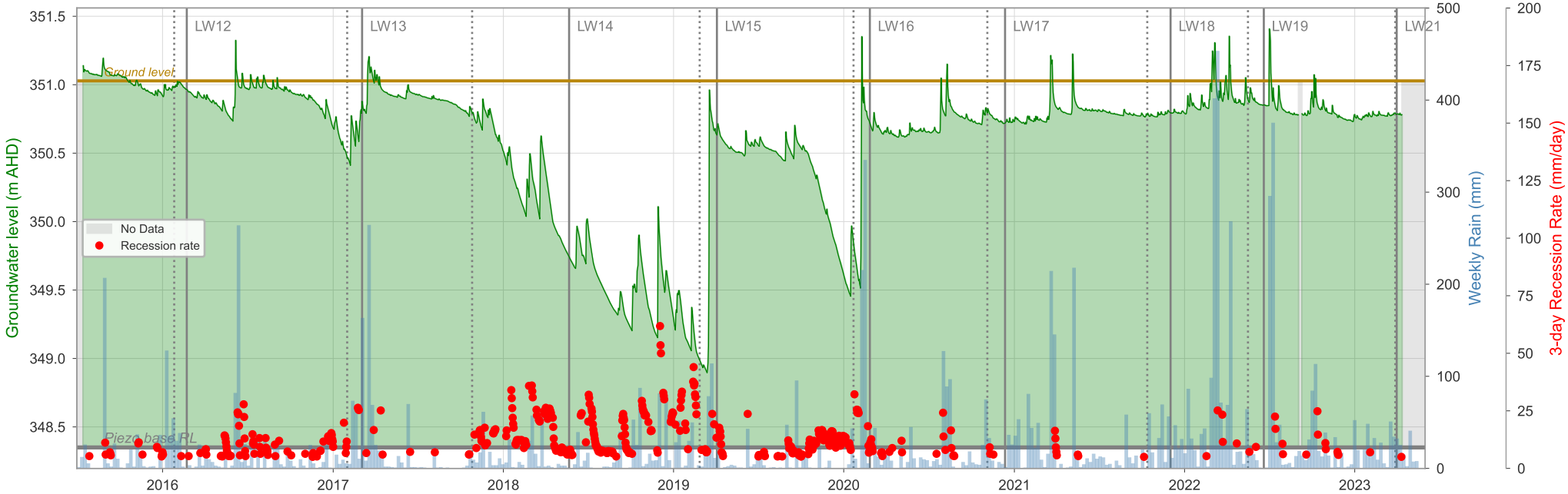

Dendrobium Swamp 05: Piezometer 03I (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
379.8
379.6
379.4
379.2
379.0
378.8
378.6
378.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

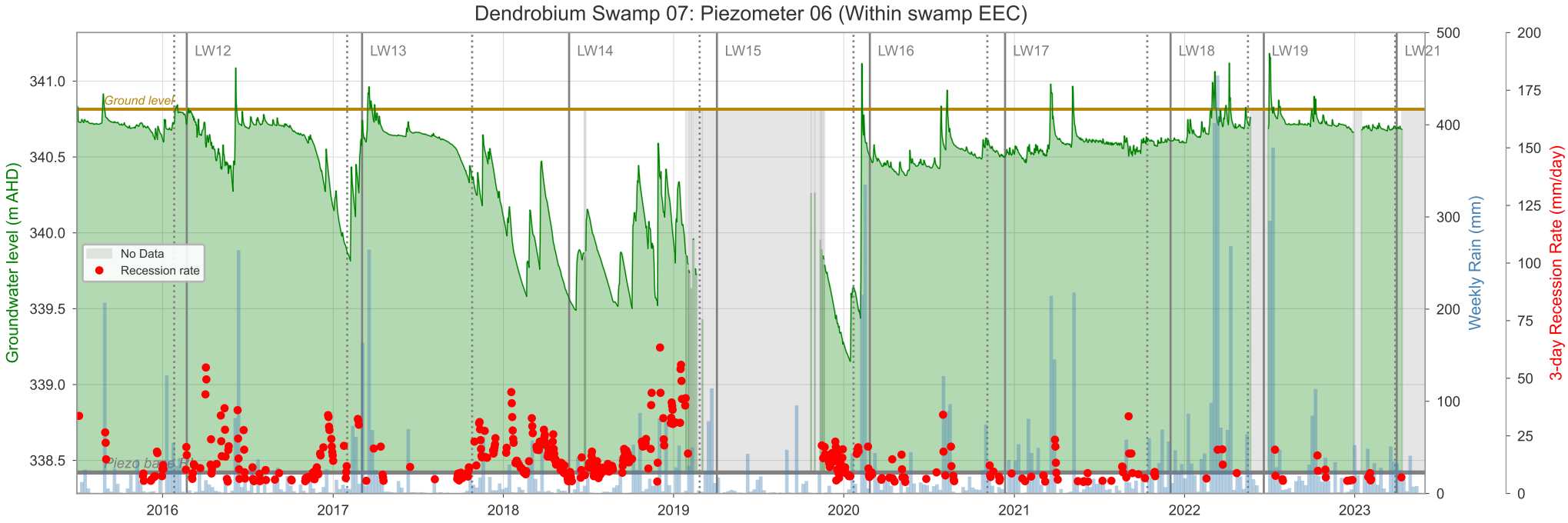

Dendrobium Swamp 05: Piezometer 03II (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
378.5
378.0
377.5
377.0
376.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

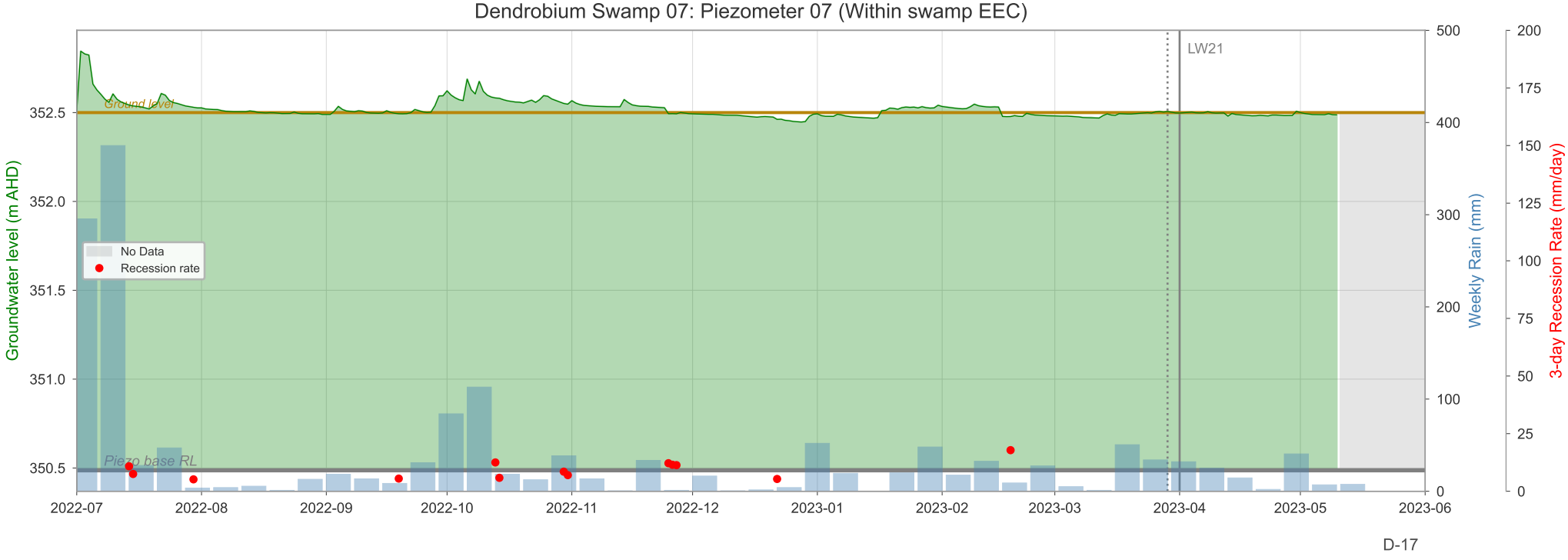

Dendrobium Swamp 05: Piezometer 03III (Outside swamp EEC)
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
378.0
377.8
377.6
377.4
377.2
377.0
376.8
376.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

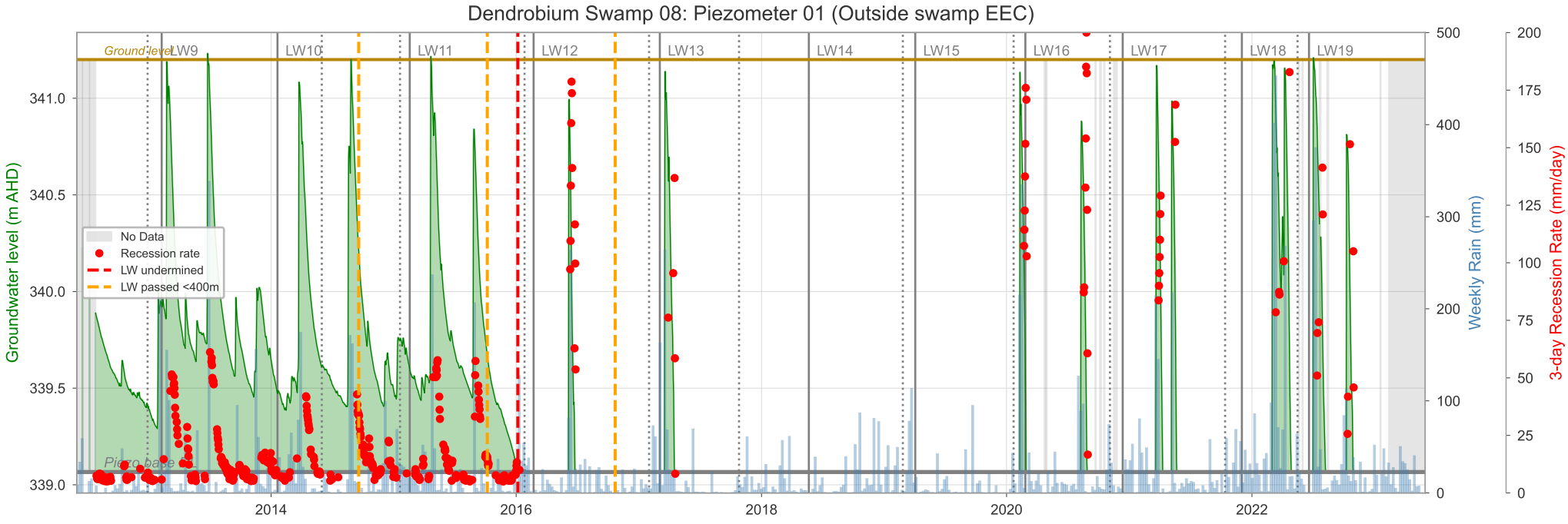

Dendrobium Swamp 05: Piezometer 04 (Within swamp EEC)
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
Ground level
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
381.0
380.8
380.6
380.4
380.2
380.0
379.8
379.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

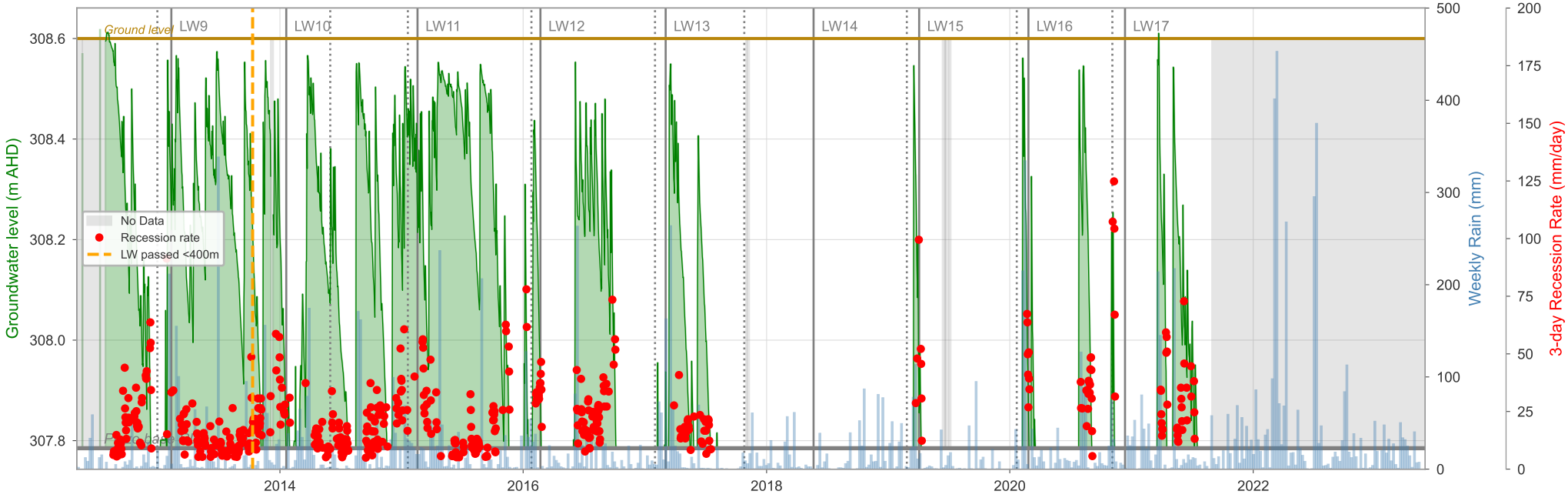

Dendrobium Swamp 05: Piezometer 05 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW passed <400m
403.4
403.2
403.0
402.8
402.6
402.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

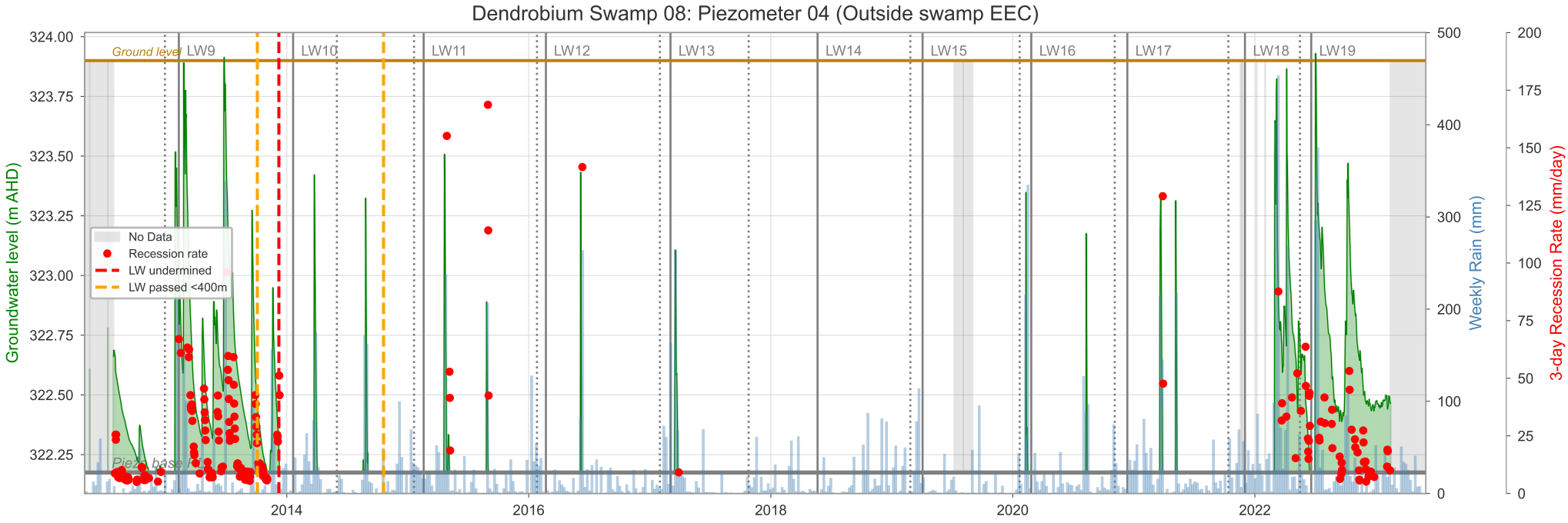

Dendrobium Swamp 07: Piezometer 05 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
Piezo base RL
No Data
Recession rate
351.5
351.0
350.5
350.0
349.5
349.0
348.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

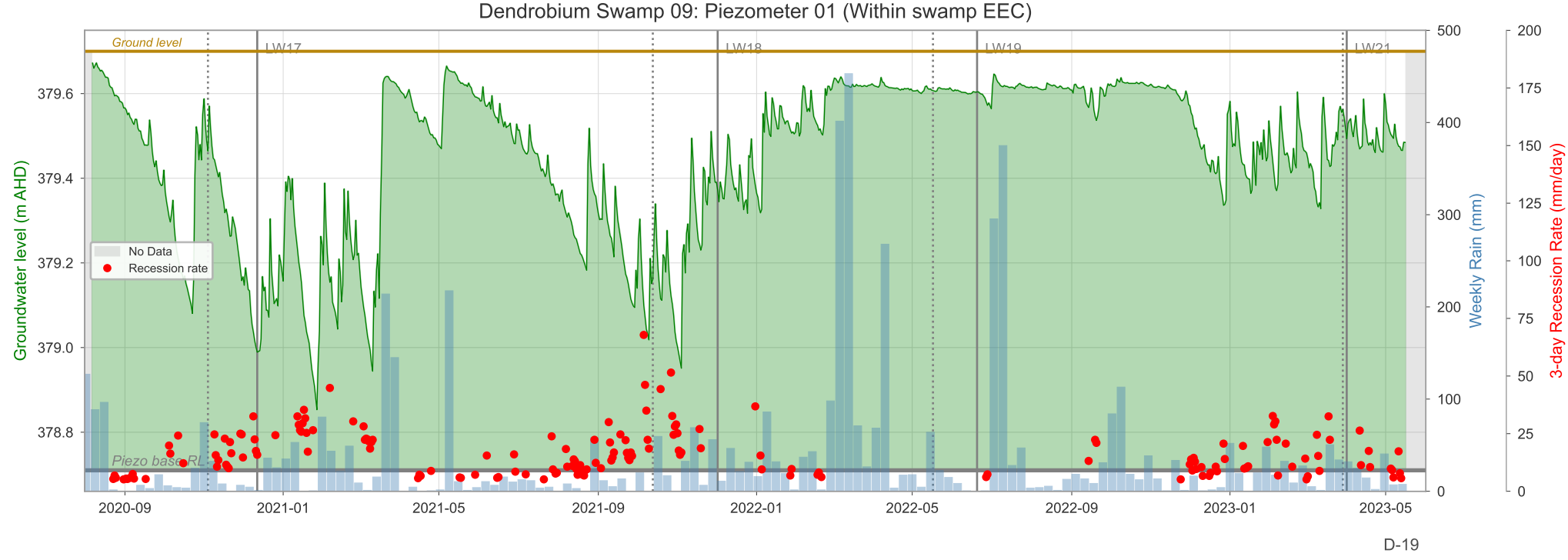

Dendrobium Swamp 07: Piezometer 06 (Within swamp EEC)
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
341.0
340.5
340.0
339.5
339.0
338.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

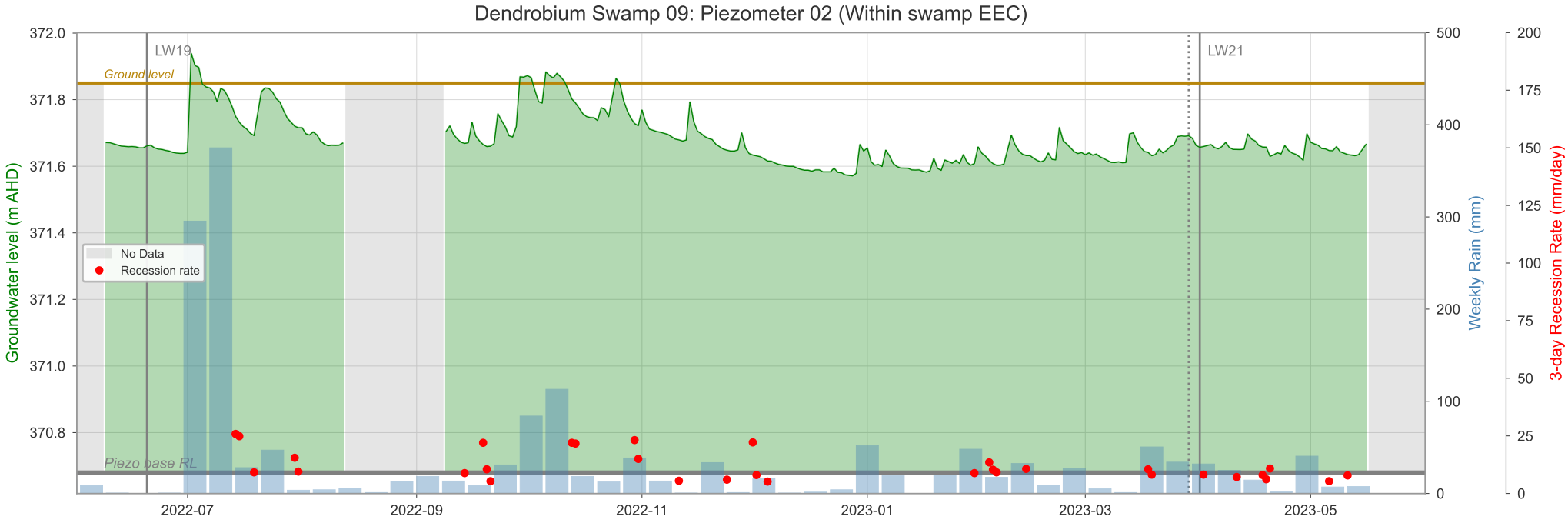

Dendrobium Swamp 07: Piezometer 07 (Within swamp EEC)
LW21
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
352.5
352.0
351.5
351.0
350.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-07
2022-08
2022-09
2022-10
2022-11
2022-12
2023-01
2023-02
2023-03
2023-04
2023-05
2023-06

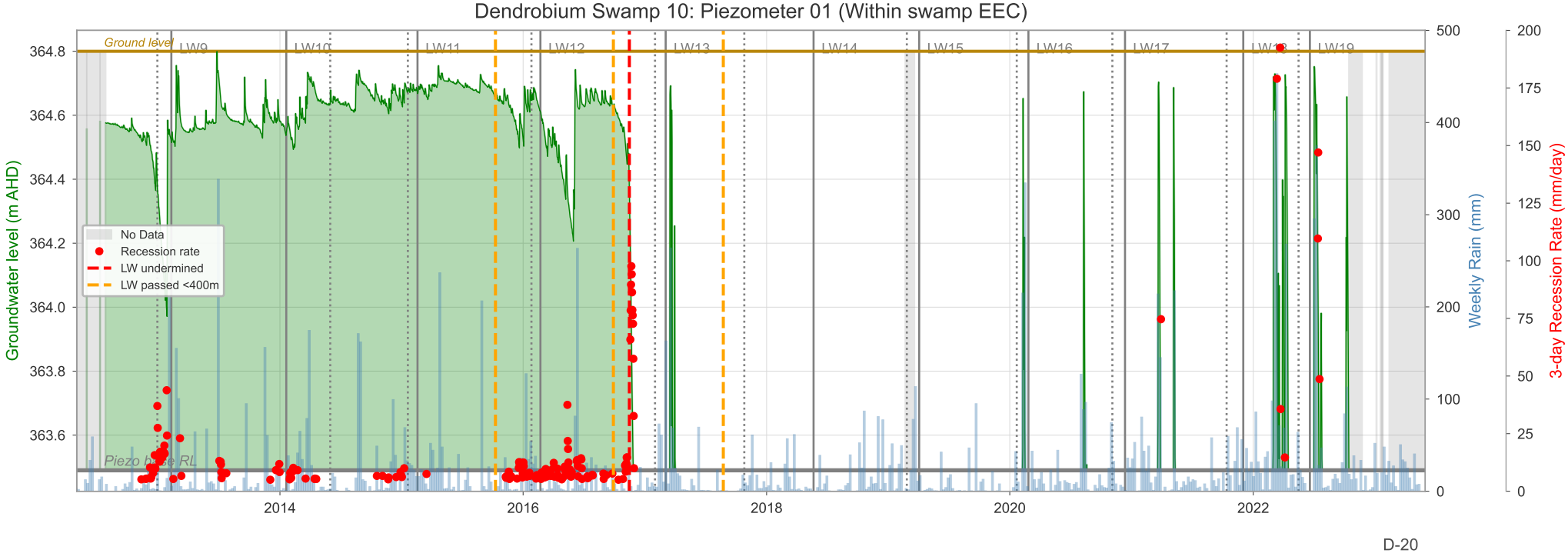

Dendrobium Swamp 08: Piezometer 01 (Outside swamp EEC)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
341.0
340.5
340.0
339.5
339.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

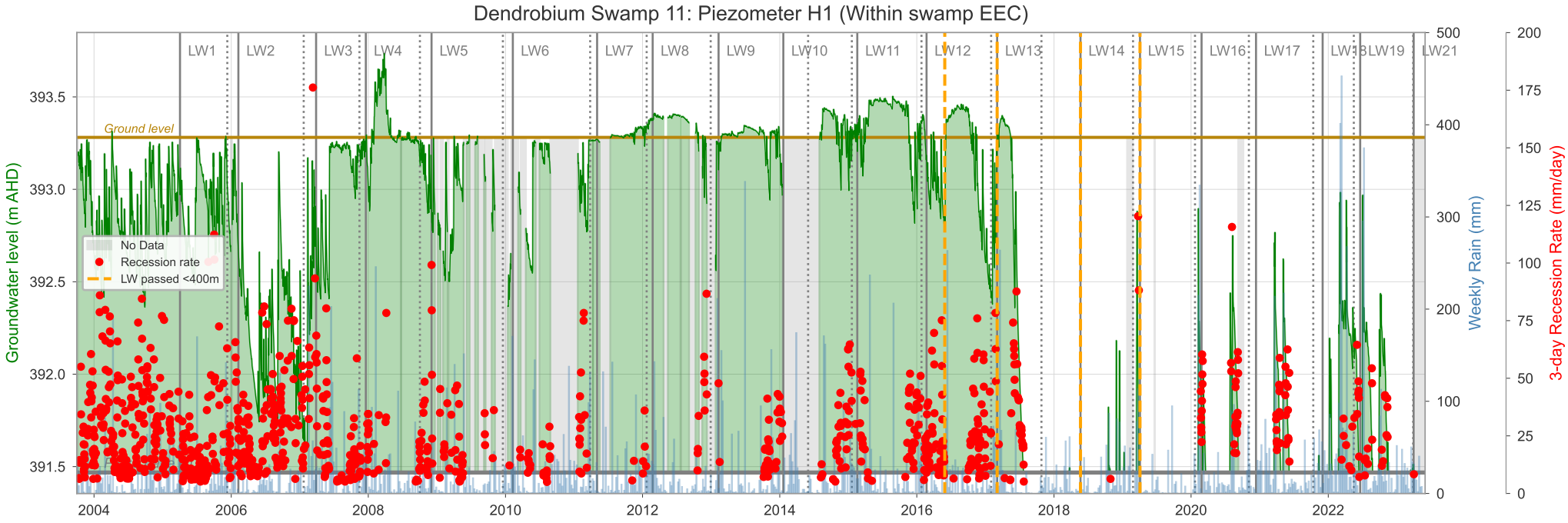

Dendrobium Swamp 08: Piezometer 02 (Outside swamp EEC)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
308.6
308.4
308.2
308.0
307.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

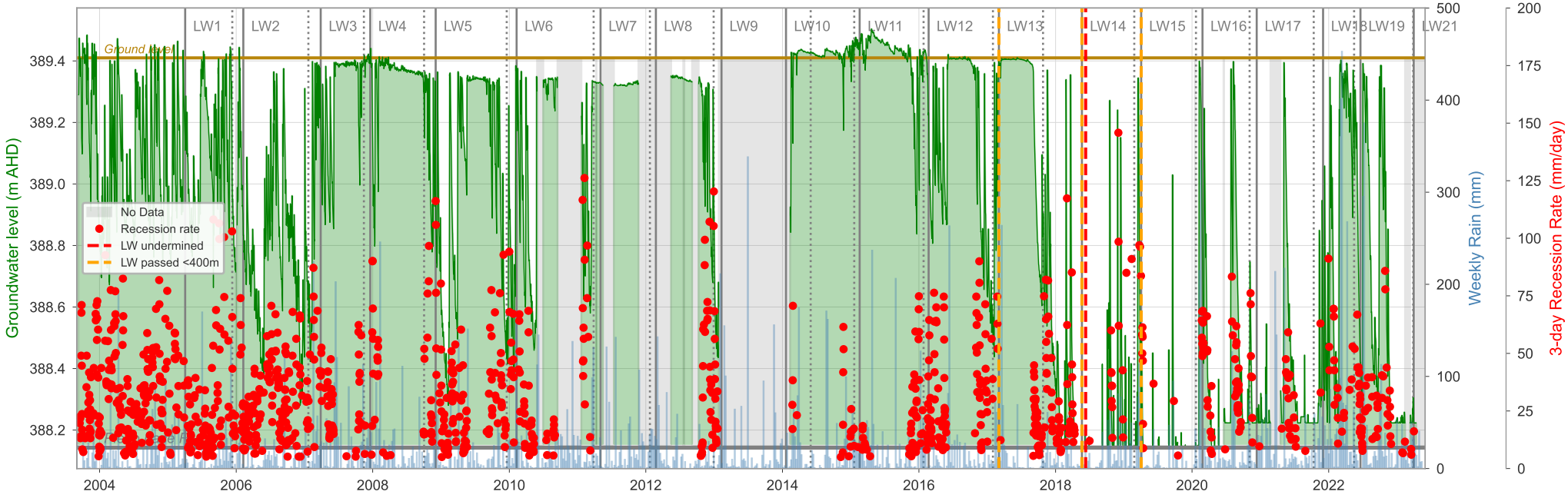

Dendrobium Swamp 08: Piezometer 04 (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
Piezo base RL
324.00
323.75
323.50
323.25
323.00
322.75
322.50
322.25
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

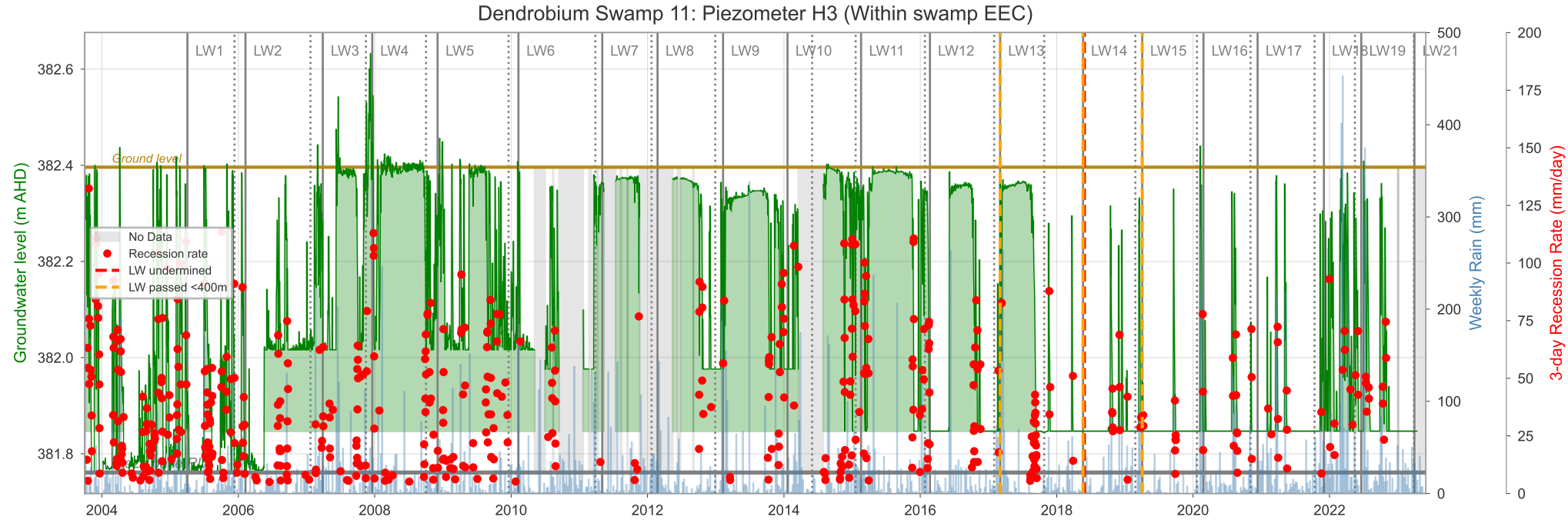

Dendrobium Swamp 09: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
LW17
LW18
LW19
LW21
No Data
Recession rate
Piezo base RL
379.6
379.4
379.2
379.0
378.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2020-09
2021-01
2021-05
2021-09
2022-01
2022-05
2022-09
2023-01
2023-05

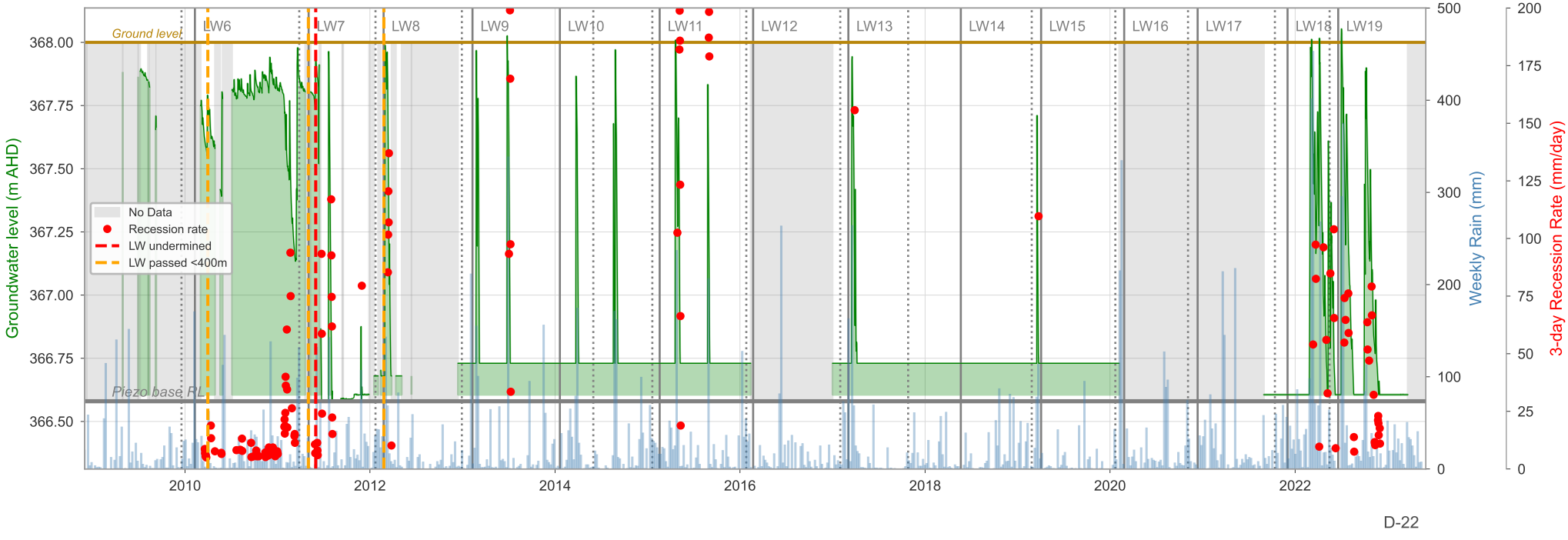

Dendrobium Swamp 09: Piezometer 02 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW19
LW21
No Data
Recession rate
372.0
371.8
371.6
371.4
371.2
371.0
370.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-07
2022-09
2022-11
2023-01
2023-03
2023-05

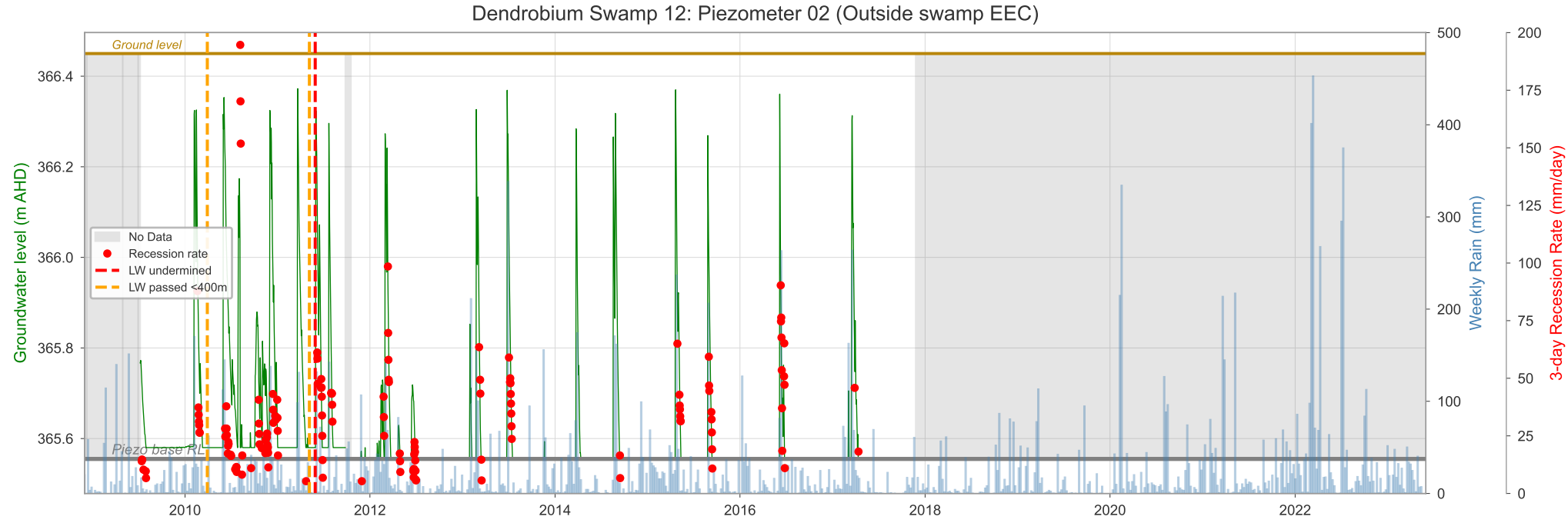

Dendrobium Swamp 10: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
364.8
364.6
364.4
364.2
364.0
363.8
363.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2014
2016
2018
2020
2022

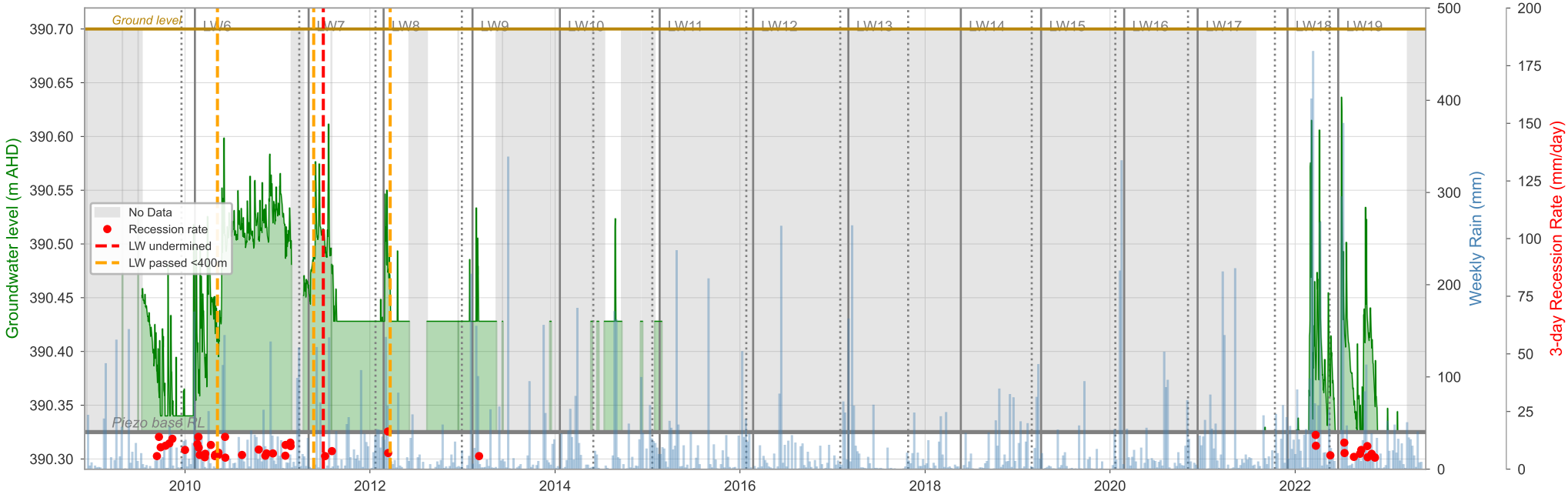

Dendrobium Swamp 11: Piezometer H1 (Within swamp EEC)
LW1
LW2
LW3
LW4
LW5
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
393.5
393.0
392.5
392.0
391.5
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

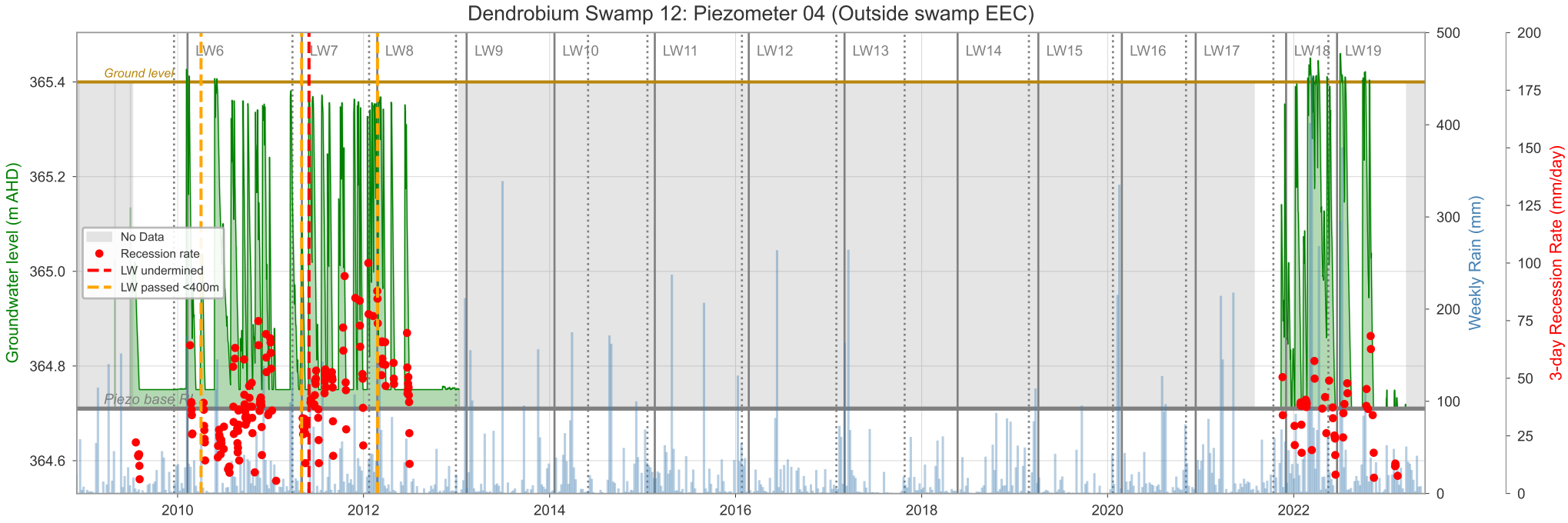

Dendrobium Swamp 11: Piezometer H2 (Within swamp EEC)
LW1
LW2
LW3
LW4
LW5
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
389.4
389.2
389.0
388.8
388.6
388.4
388.2
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

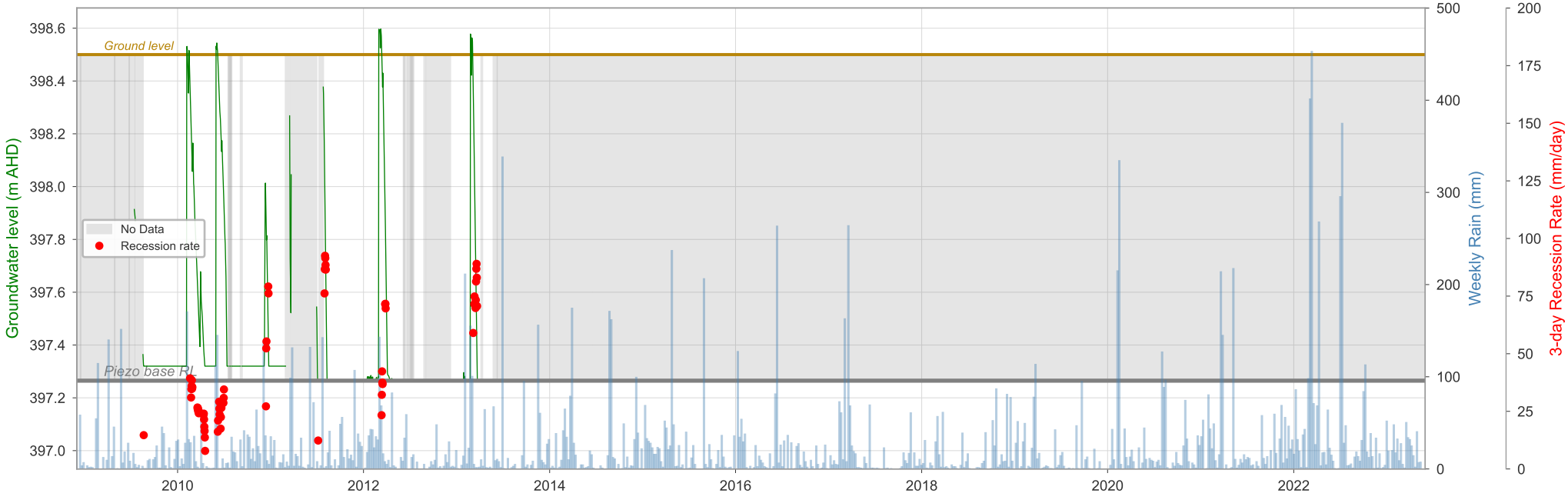

Dendrobium Swamp 11: Piezometer H3 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
LW1
LW2
LW3
LW4
LW5
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
382.6
382.4
382.2
382.0
381.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

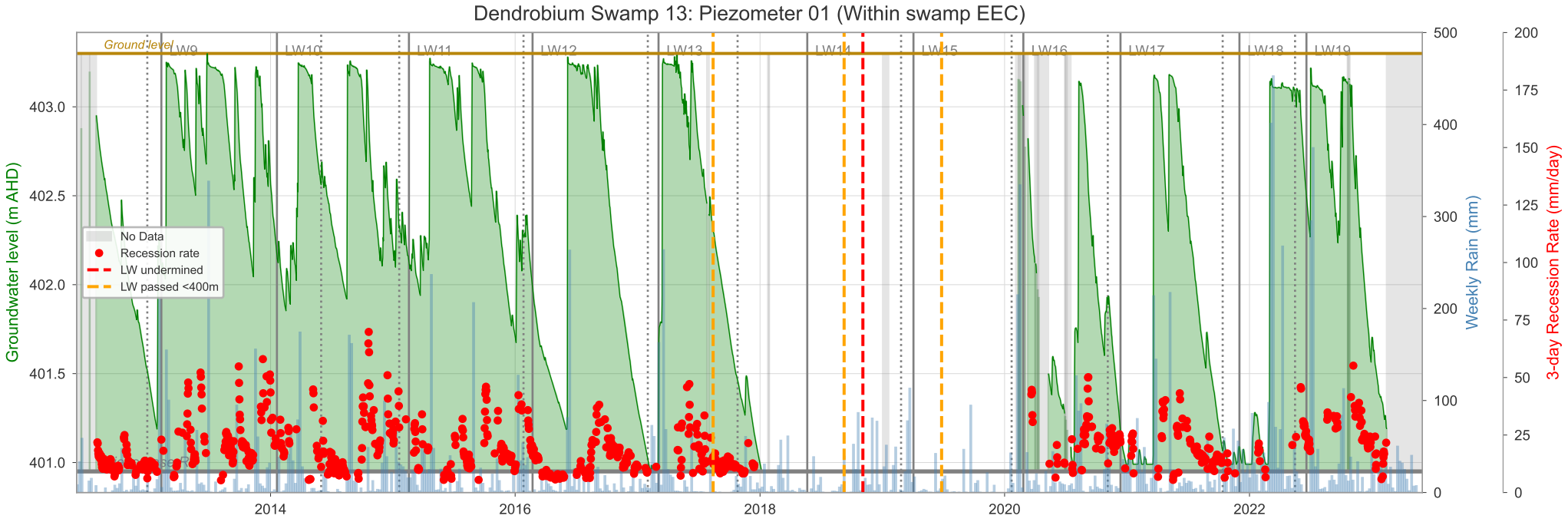

Dendrobium Swamp 12: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
368.00
367.75
367.50
367.25
367.00
366.75
366.50
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

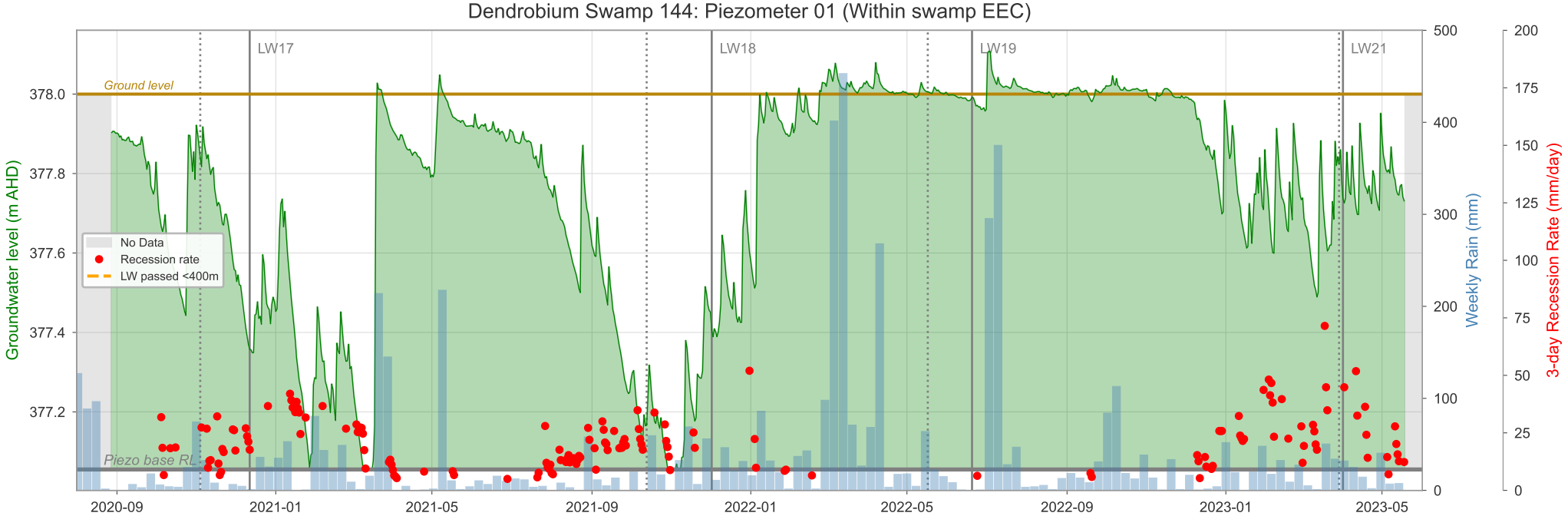

Dendrobium Swamp 12: Piezometer 02 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
366.4
366.2
366.0
365.8
365.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

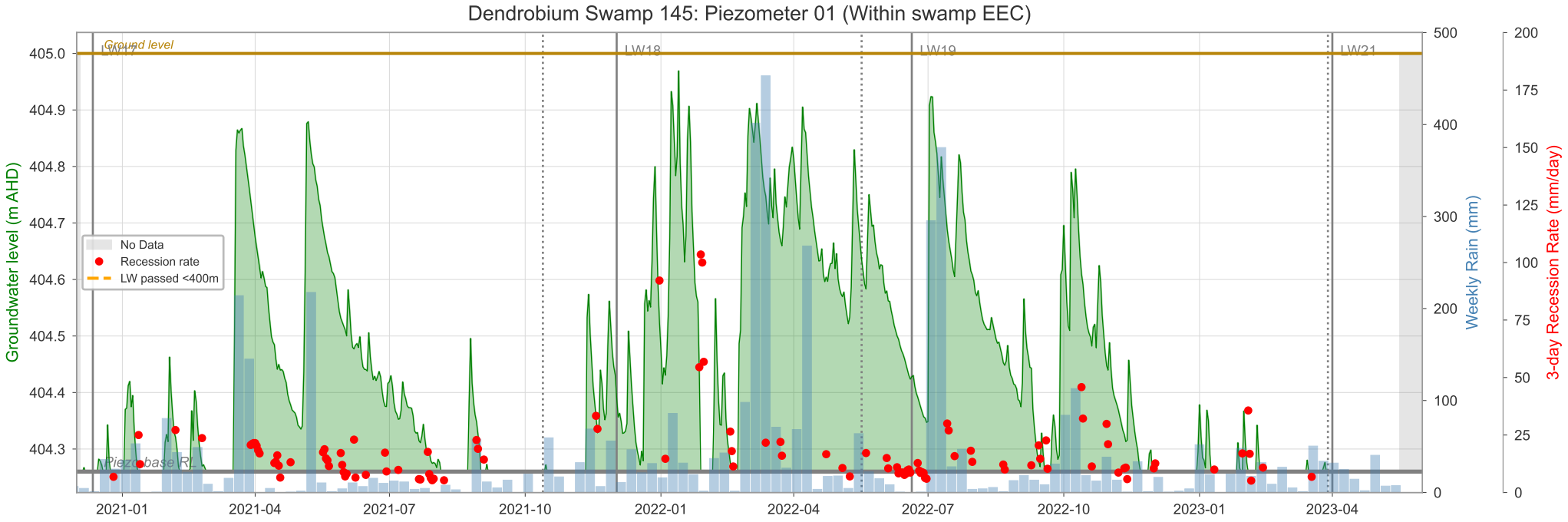

Dendrobium Swamp 12: Piezometer 03 (Outside swamp EEC)
Ground level
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
390.70
390.65
390.60
390.55
390.50
390.45
390.40
390.35
390.30
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

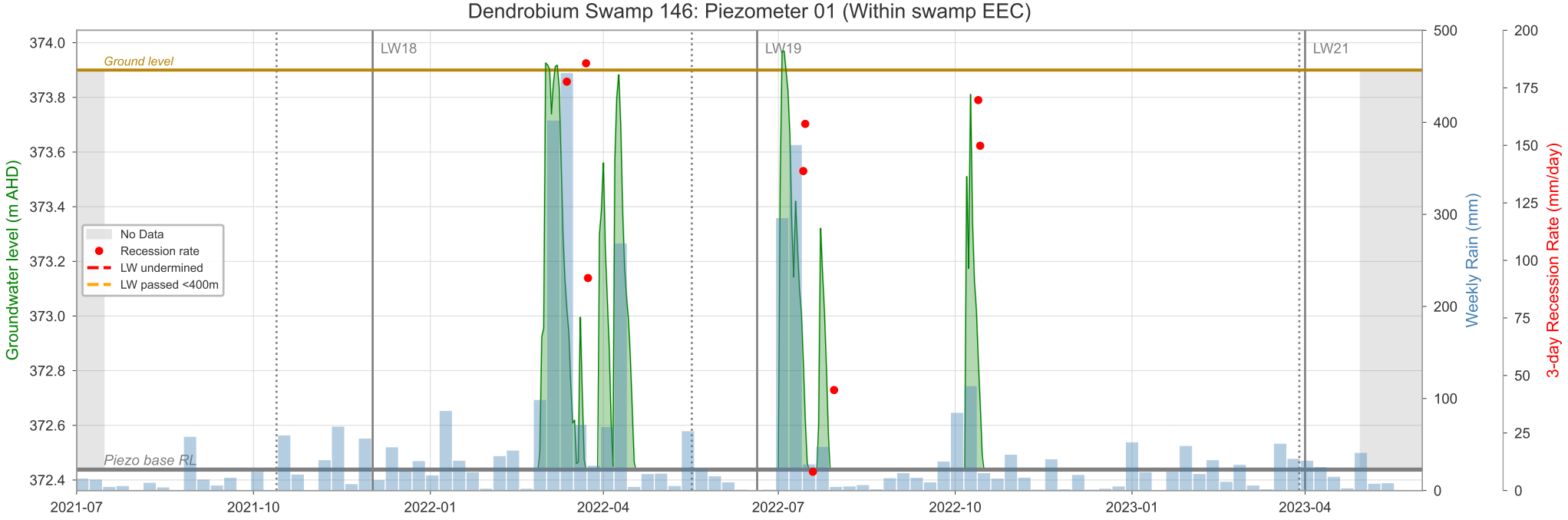

Dendrobium Swamp 12: Piezometer 04 (Outside swamp EEC)
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
365.4
365.2
365.0
364.8
364.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

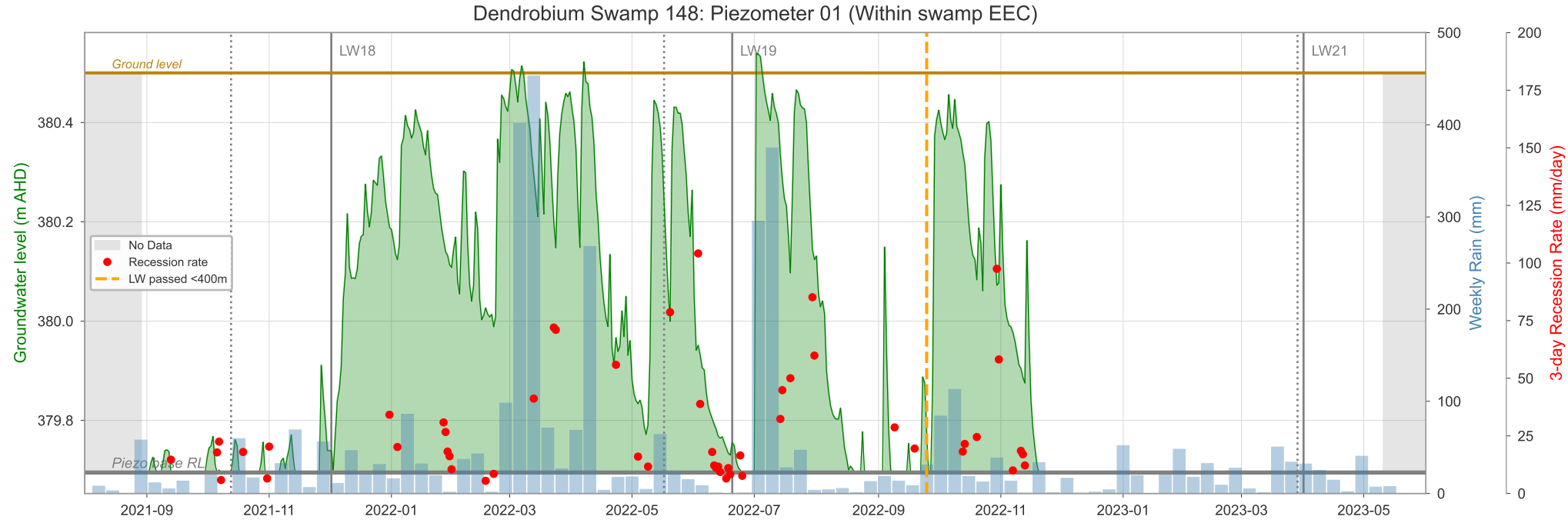

Dendrobium Swamp 12: Piezometer 05 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
398.6
398.4
398.2
398.0
397.8
397.6
397.4
397.2
397.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

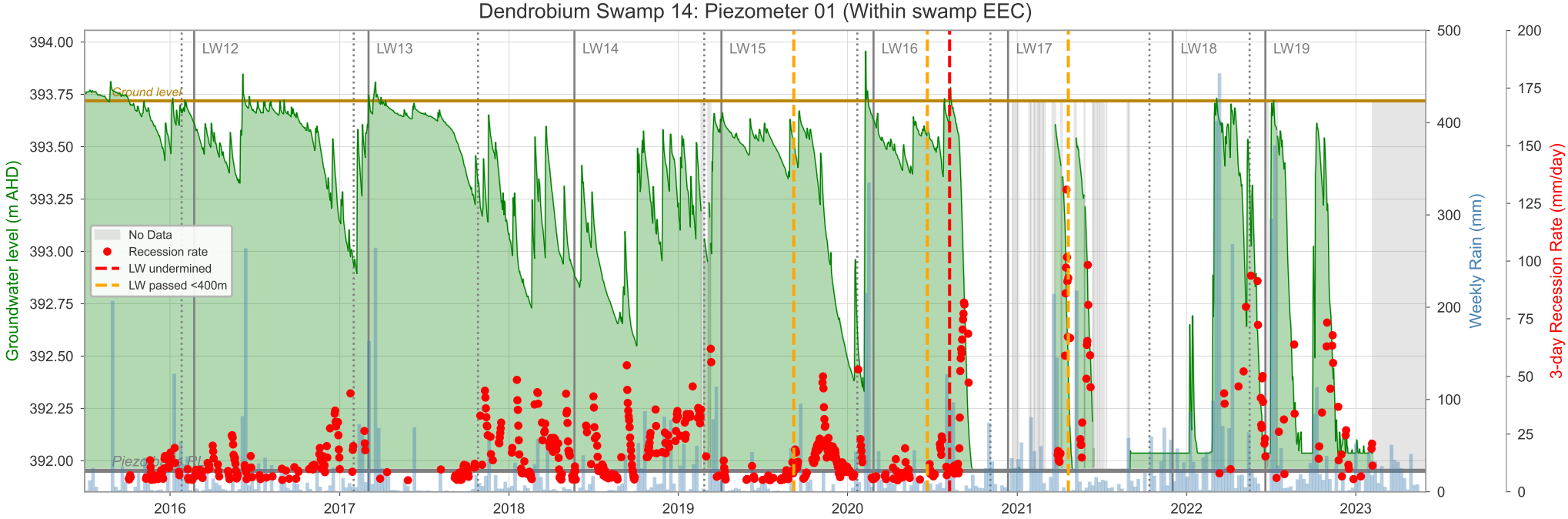

Dendrobium Swamp 13: Piezometer 01 (Within swamp EEC)
Ground level
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
403.0
402.5
402.0
401.5
401.0
2014
2016
2018
2020
2022
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0

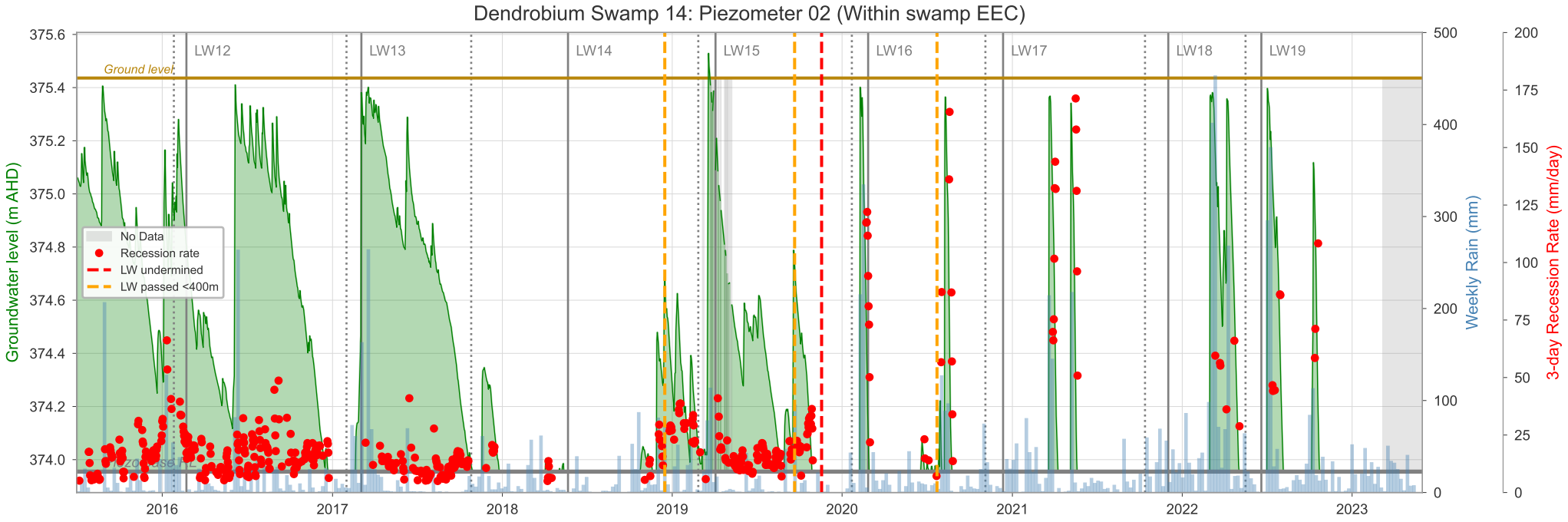

Dendrobium Swamp 144: Piezometer 01 (Within swamp EEC)
LW17
LW18
LW19
LW21
Ground level
Piezo base RL
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
378.0
377.8
377.6
377.4
377.2
2020-09
2021-01
2021-05
2021-09
2022-01
2022-05
2022-09
2023-01
2023-05
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0

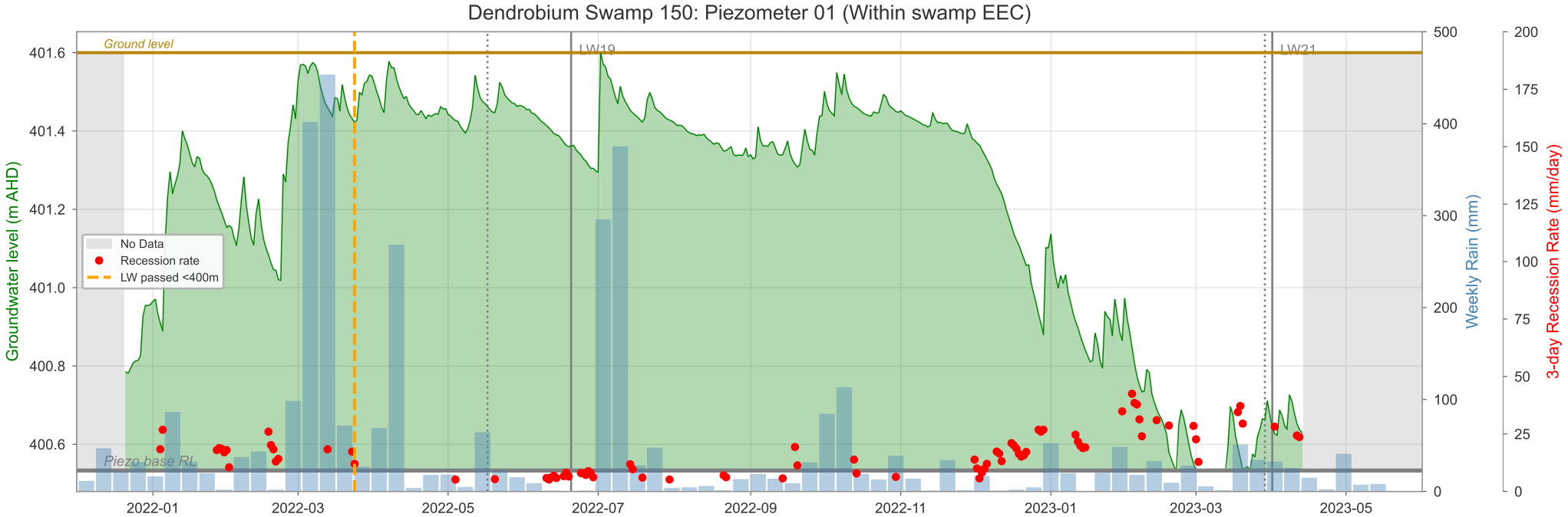

Dendrobium Swamp 145: Piezometer 01 (Within swamp EEC)
Ground level
LW17
LW18
LW19
LW21
Piezo base RL
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
405.0
404.9
404.8
404.7
404.6
404.5
404.4
404.3
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2021-01
2021-04
2021-07
2021-10
2022-01
2022-04
2022-07
2022-10
2023-01
2023-04

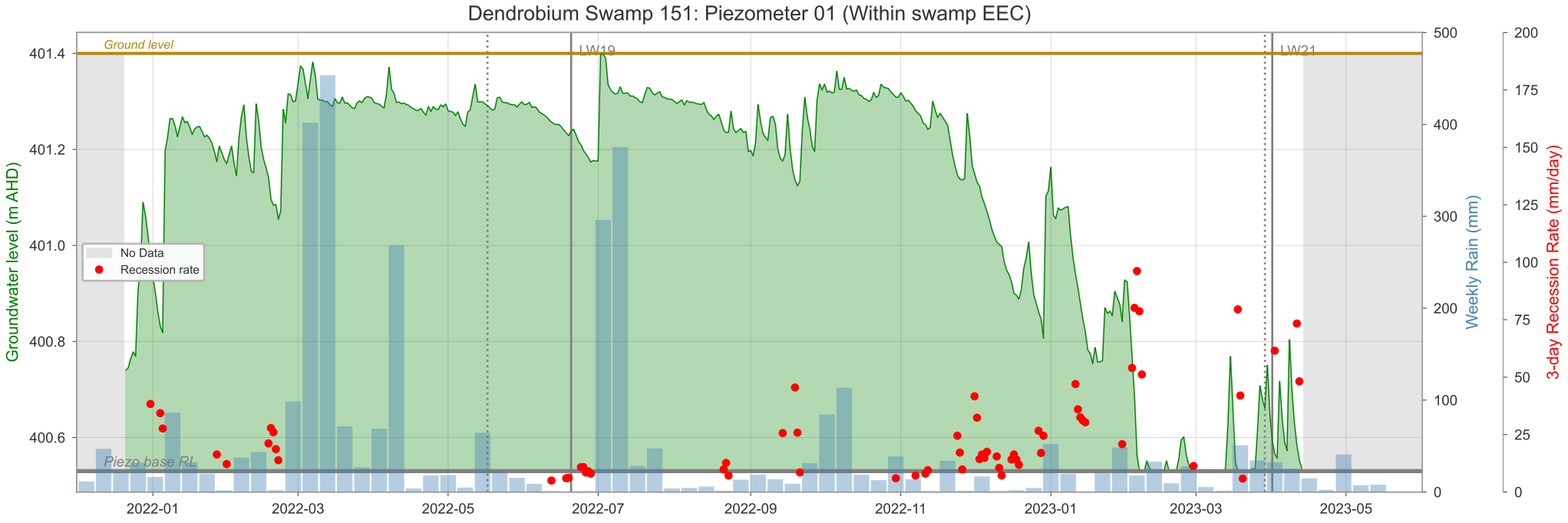

Dendrobium Swamp 146: Piezometer 01 (Within swamp EEC)
Ground level
LW18
LW19
LW21
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
374.0
373.8
373.6
373.4
373.2
373.0
372.8
372.6
372.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2021-07
2021-10
2022-01
2022-04
2022-07
2022-10
2023-01
2023-04

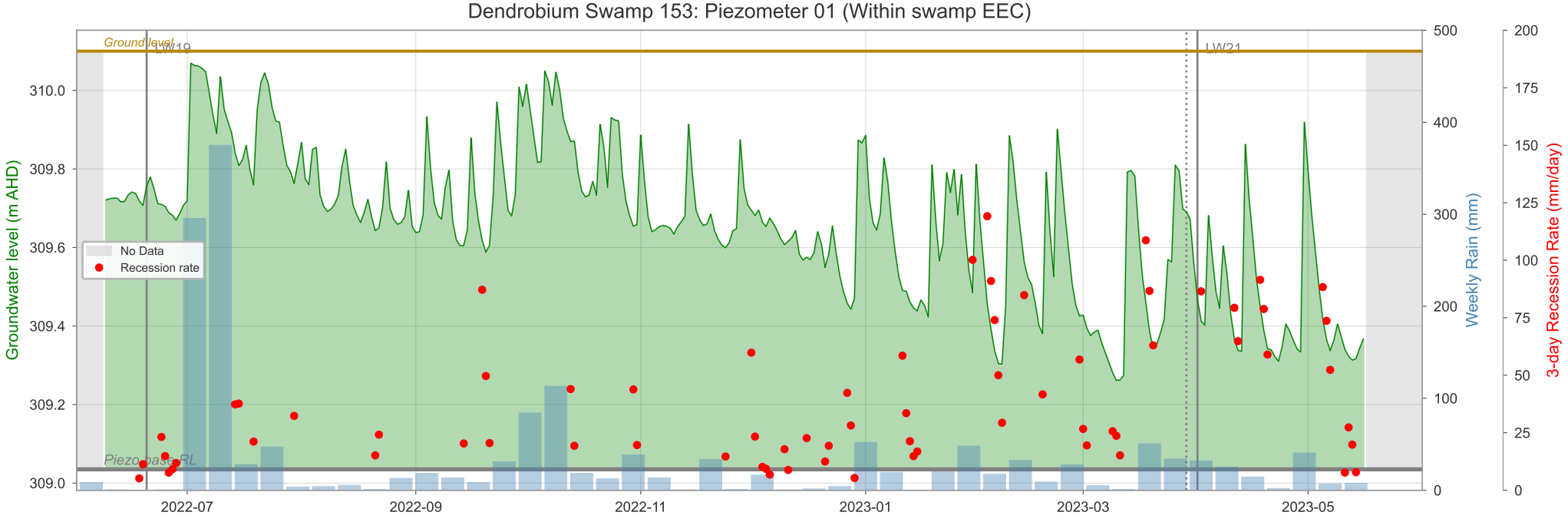

Dendrobium Swamp 148: Piezometer 01 (Within swamp EEC)
Ground level
LW18
LW19
LW21
No Data
Recession rate
LW passed <400m
Piezometer RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
380.4
380.2
380.0
379.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2021-09
2021-11
2022-01
2022-03
2022-05
2022-07
2022-09
2022-11
2023-01
2023-03
2023-05

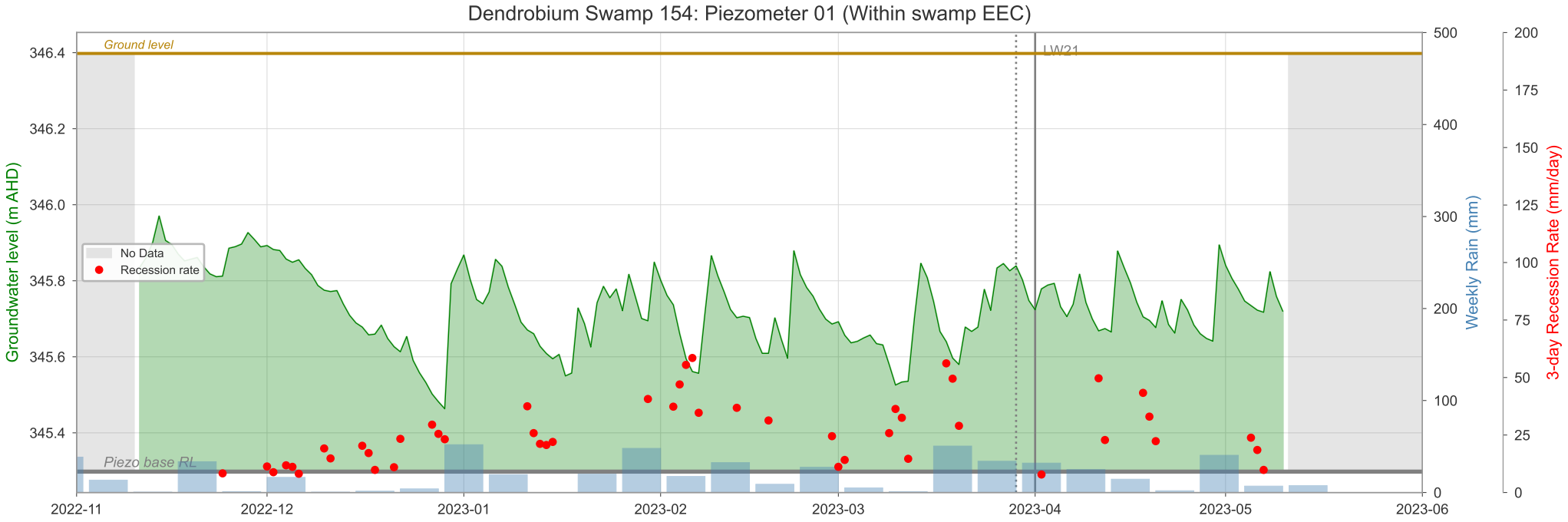

Dendrobium Swamp 14: Piezometer 01 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
Piezometer RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
394.00
393.75
393.50
393.25
393.00
392.75
392.50
392.25
392.00
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

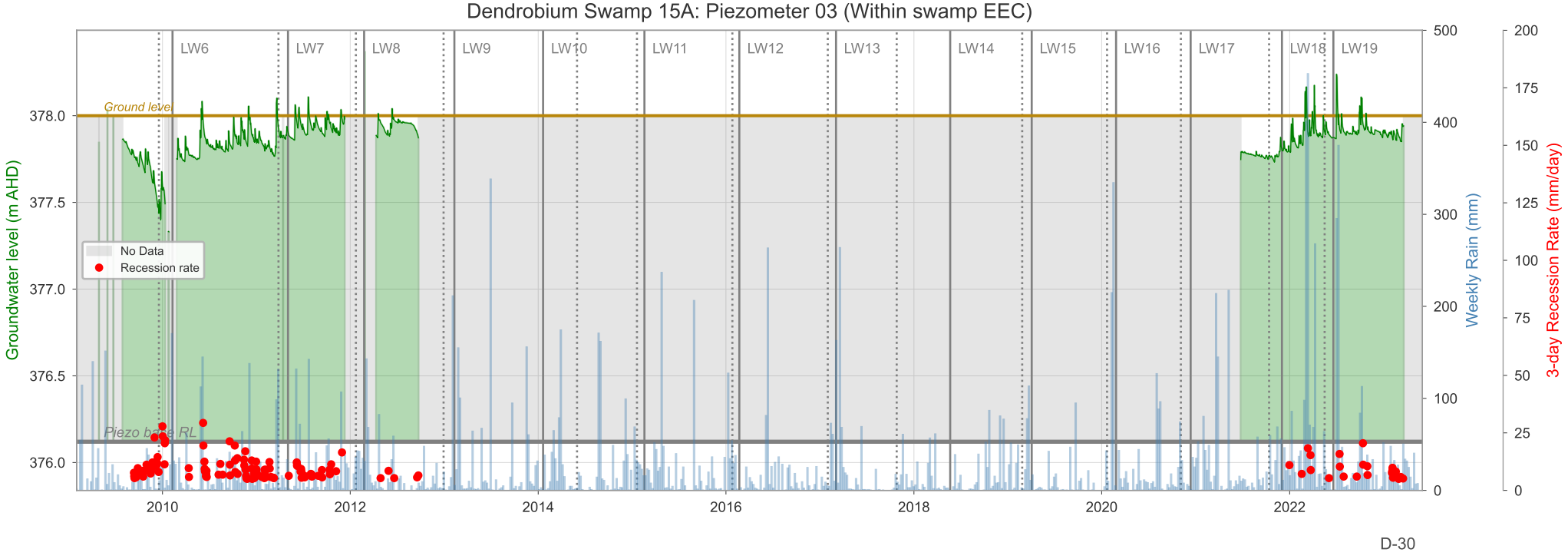

Dendrobium Swamp 14: Piezometer 02 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
375.6
375.4
375.2
375.0
374.8
374.6
374.4
374.2
374.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

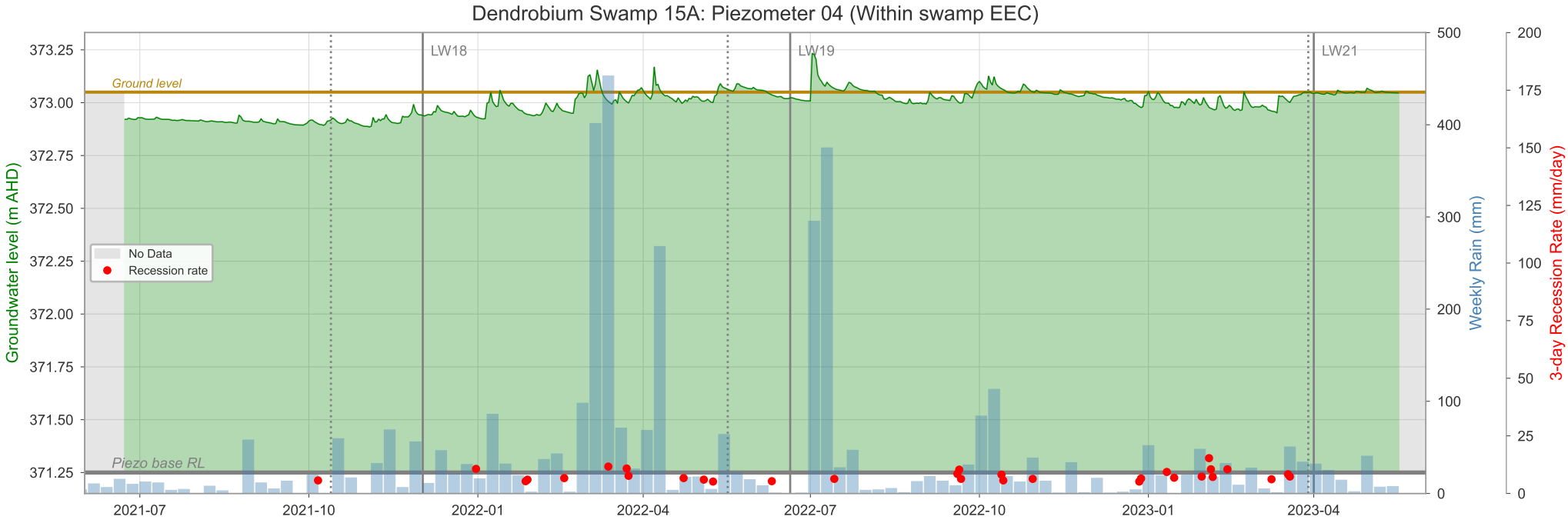

Dendrobium Swamp 150: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW19
LW21
No Data
Recession rate
LW passed <400m
401.6
401.4
401.2
401.0
400.8
400.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-01
2022-03
2022-05
2022-07
2022-09
2022-11
2023-01
2023-03
2023-05

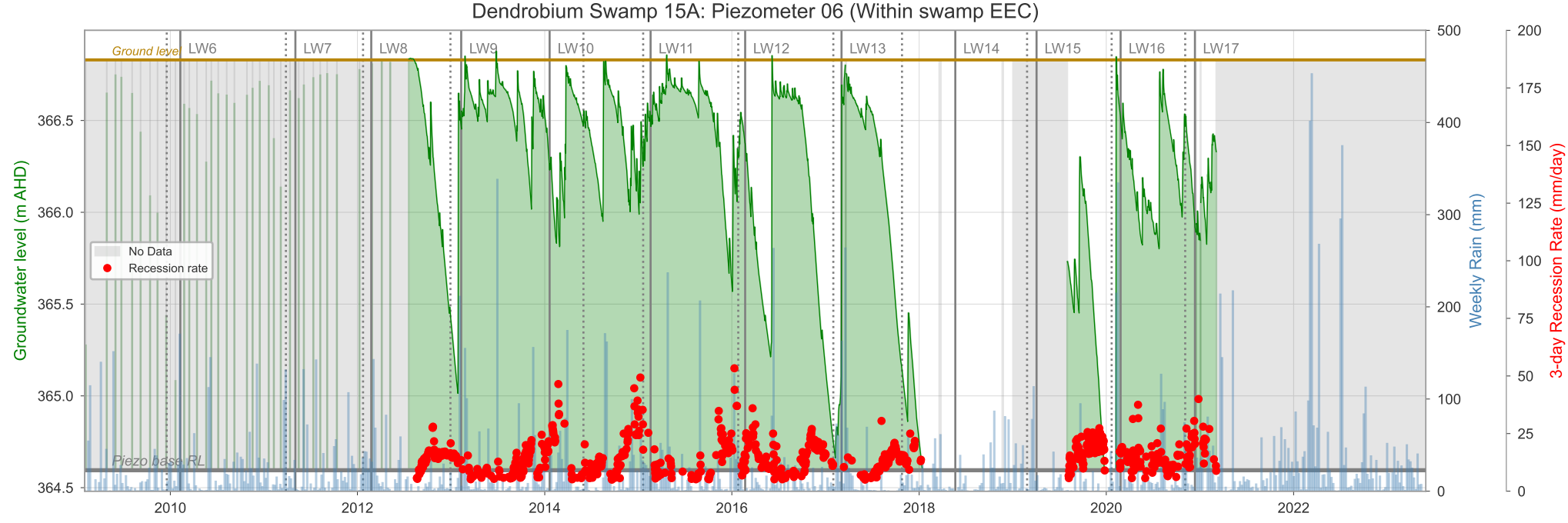

Dendrobium Swamp 151: Piezometer 01 (Within swamp EEC)
Ground level
LW19
LW21
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
401.4
401.2
401.0
400.8
400.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-01
2022-03
2022-05
2022-07
2022-09
2022-11
2023-01
2023-03
2023-05

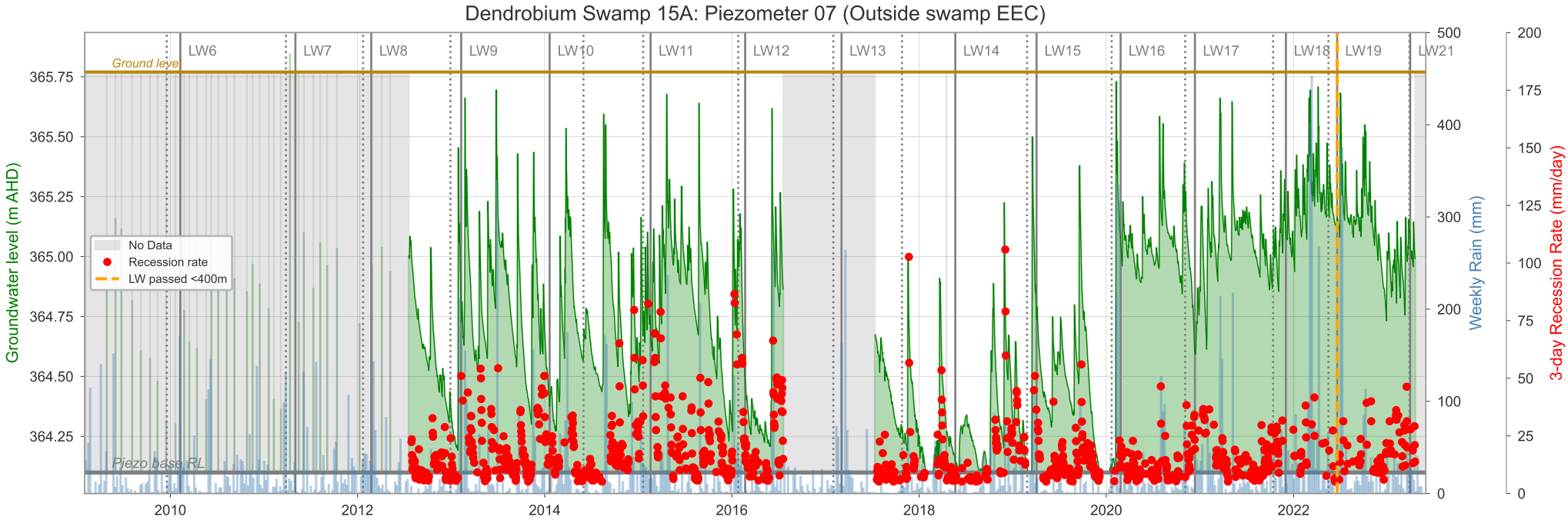

Dendrobium Swamp 153: Piezometer 01 (Within swamp EEC)
Ground level
LW19
LW21
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
310.0
309.8
309.6
309.4
309.2
309.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-07
2022-09
2022-11
2023-01
2023-03
2023-05

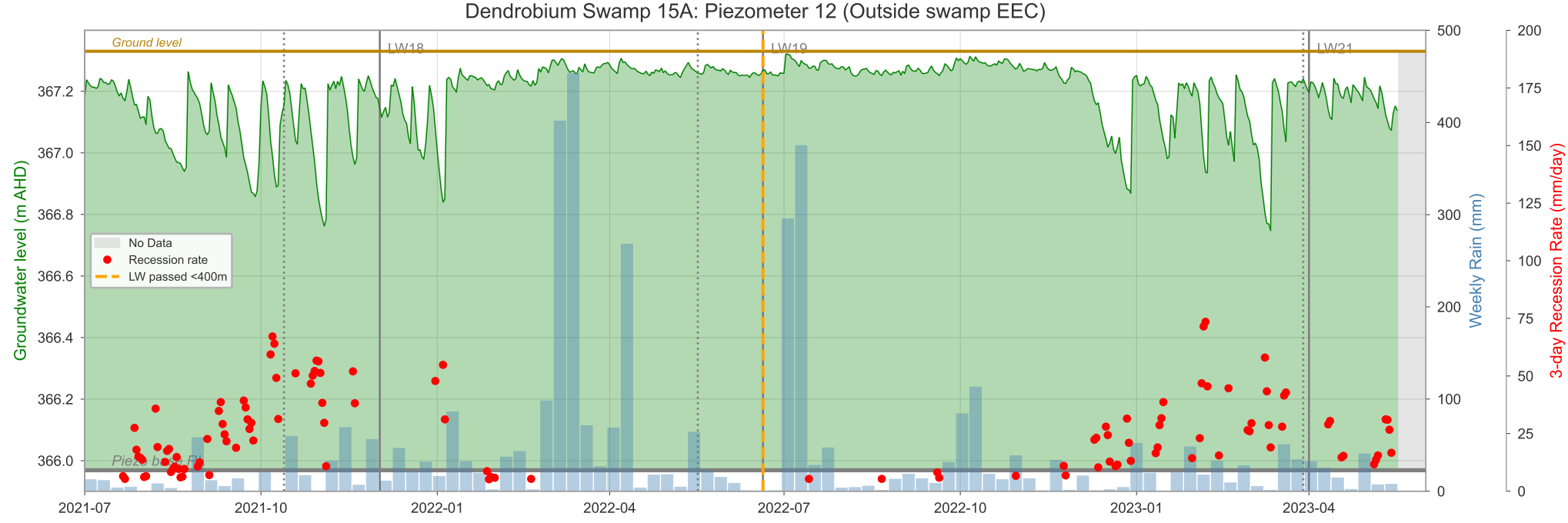

Dendrobium Swamp 154: Piezometer 01 (Within swamp EEC)
Ground level
LW21
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
346.4
346.2
346.0
345.8
345.6
345.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-11
2022-12
2023-01
2023-02
2023-03
2023-04
2023-05
2023-06

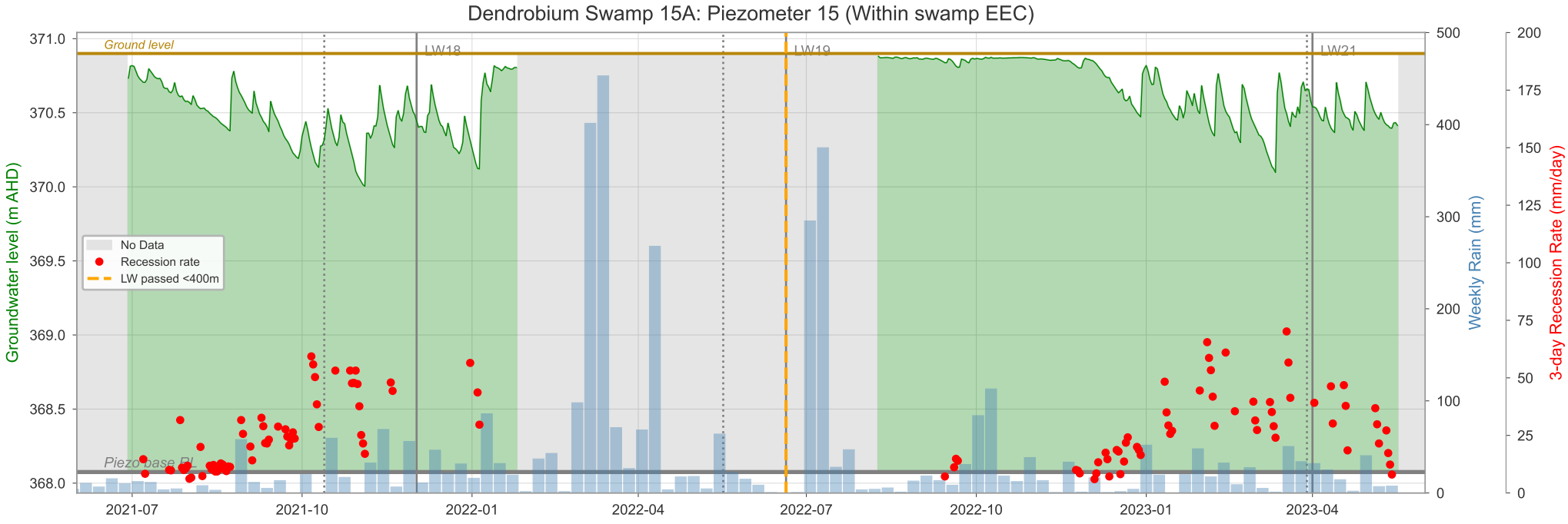

Dendrobium Swamp 15A: Piezometer 03 (Within swamp EEC)
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
378.0
377.5
377.0
376.5
376.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

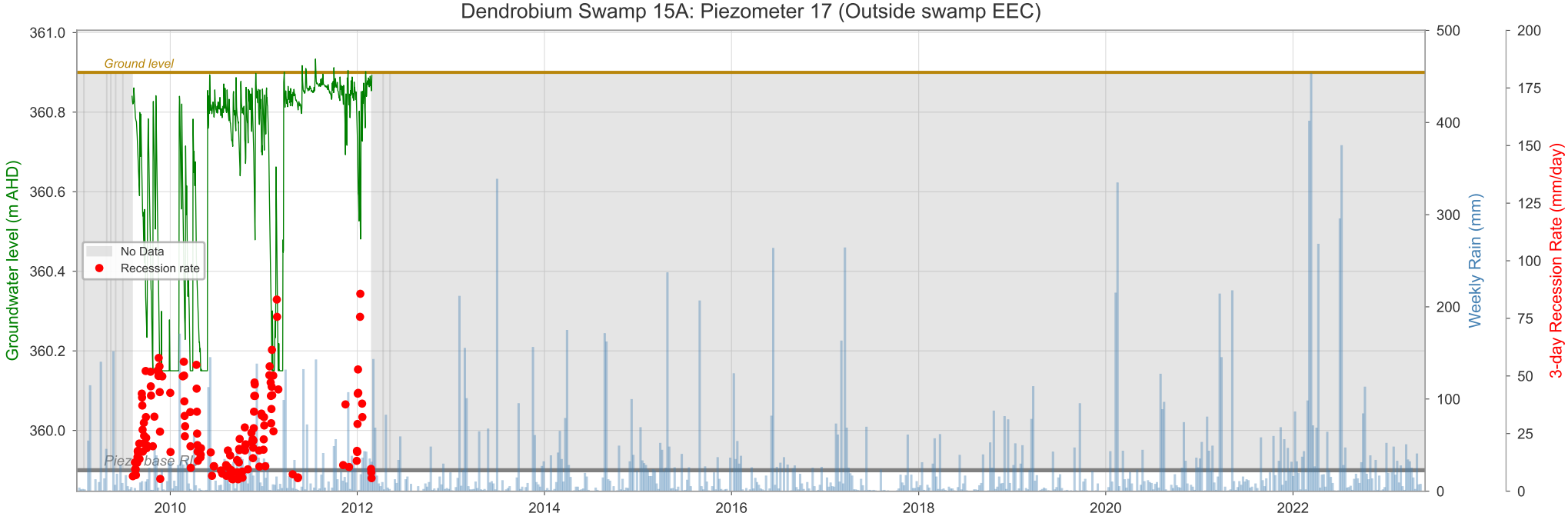

Dendrobium Swamp 15A: Piezometer 04 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW18
LW19
LW21
No Data
Recession rate
373.25
373.00
372.75
372.50
372.25
372.00
371.75
371.50
371.25
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2021-07
2021-10
2022-01
2022-04
2022-07
2022-10
2023-01
2023-04

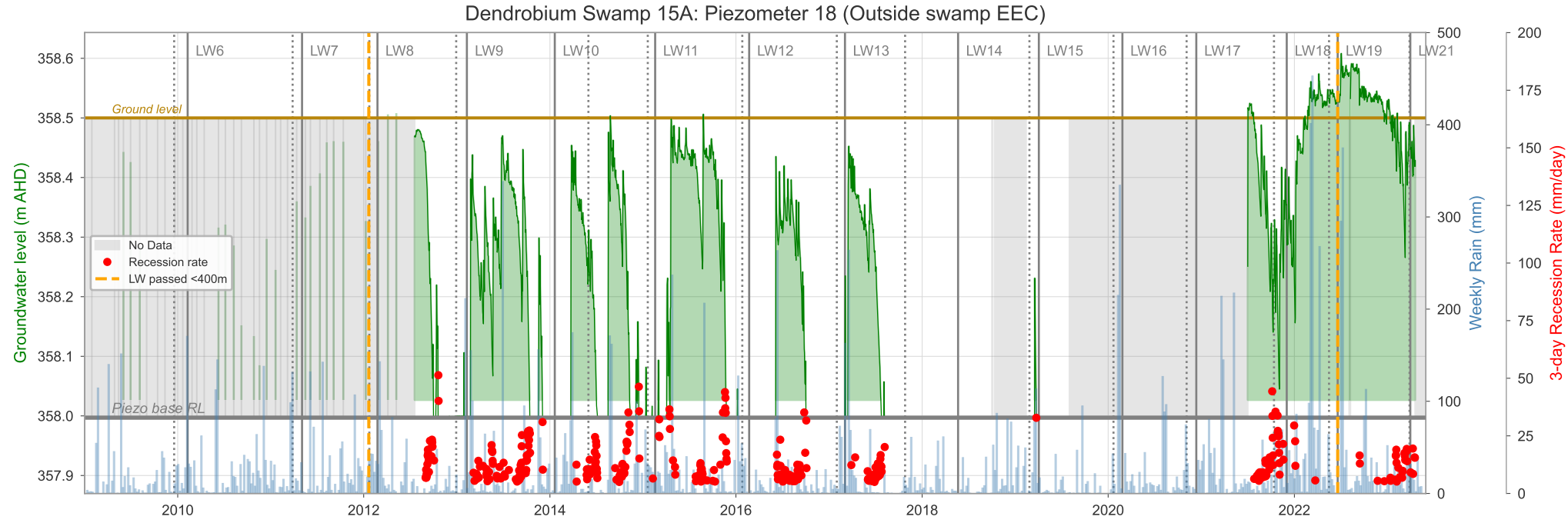

Dendrobium Swamp 15A: Piezometer 06 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
No Data
Recession rate
366.5
366.0
365.5
365.0
364.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

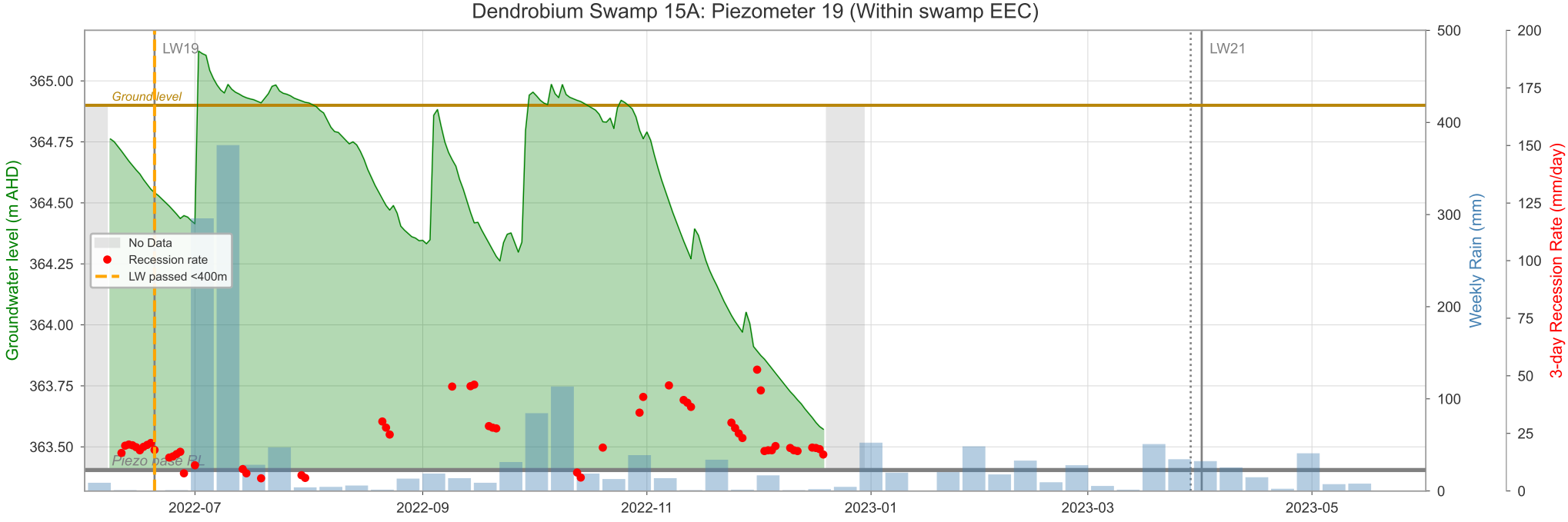

Dendrobium Swamp 15A: Piezometer 07 (Outside swamp EEC)
Ground level
Piezo base RL
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
365.75
365.50
365.25
365.00
364.75
364.50
364.25
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

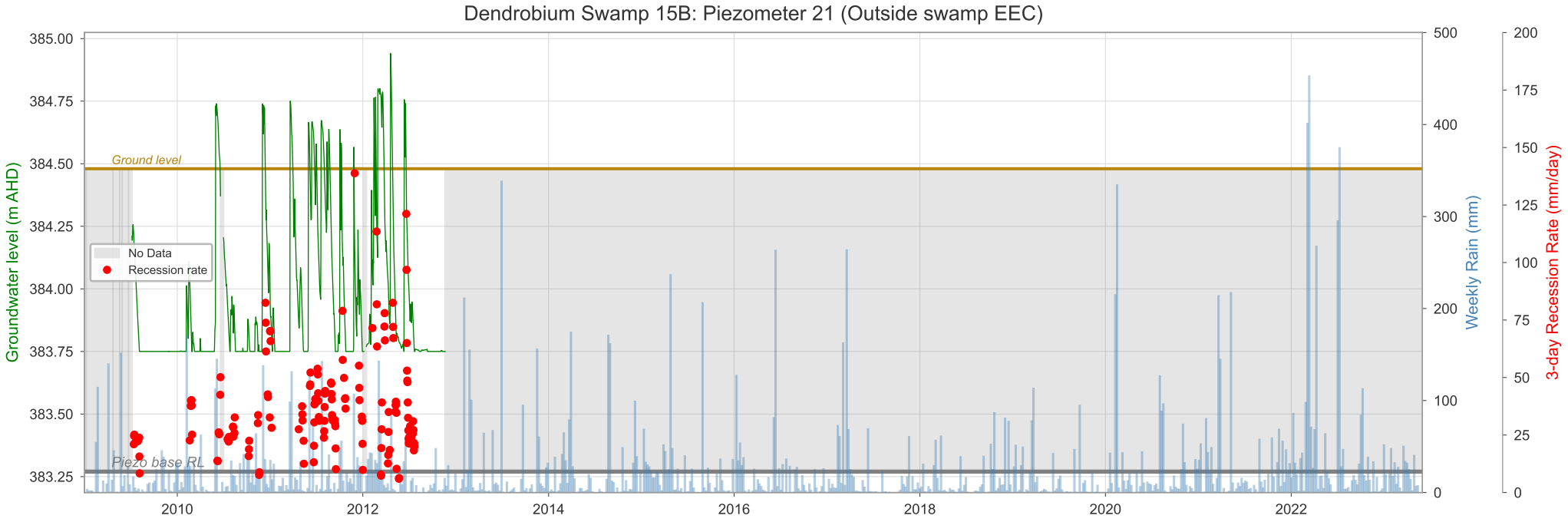

Dendrobium Swamp 15A: Piezometer 12 (Outside swamp EEC)
Ground level
Piezo base RL
LW18
LW19
LW21
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
367.2
367.0
366.8
366.6
366.4
366.2
366.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2021-07
2021-10
2022-01
2022-04
2022-07
2022-10
2023-01
2023-04

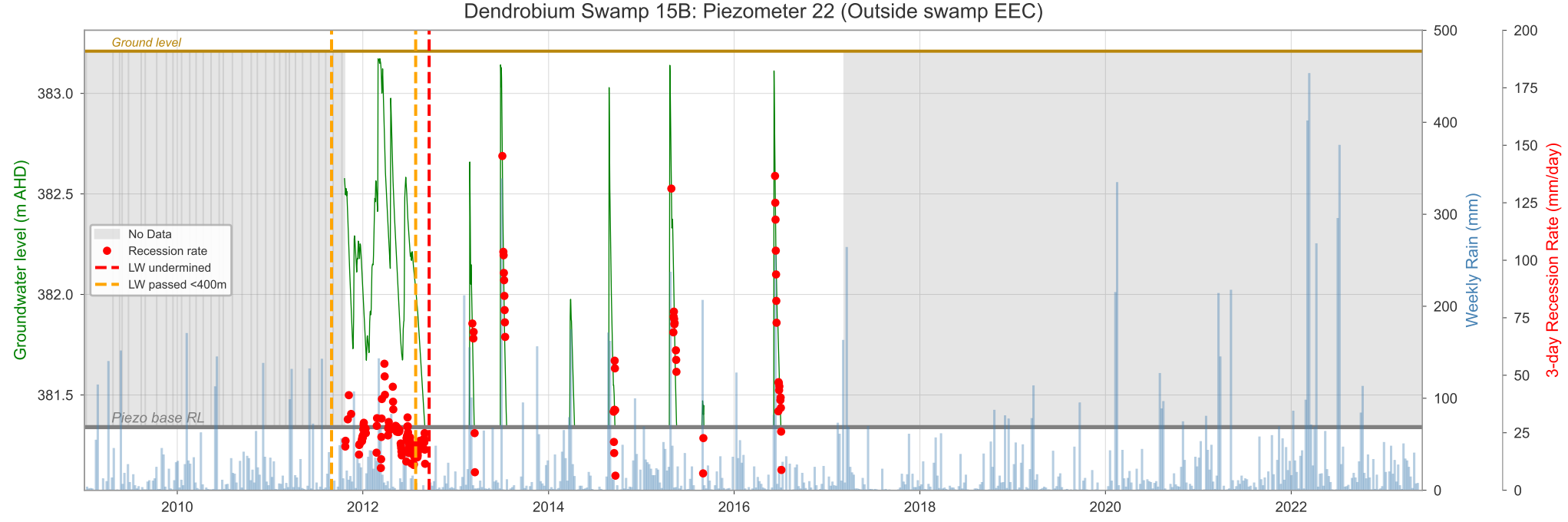

Dendrobium Swamp 15A: Piezometer 15 (Within swamp EEC)
Ground level
LW18
LW19
LW21
No Data
Recession rate
LW passed <400m
Piezo base RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
371.0
370.5
370.0
369.5
369.0
368.5
368.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2021-07
2021-10
2022-01
2022-04
2022-07
2022-10
2023-01
2023-04

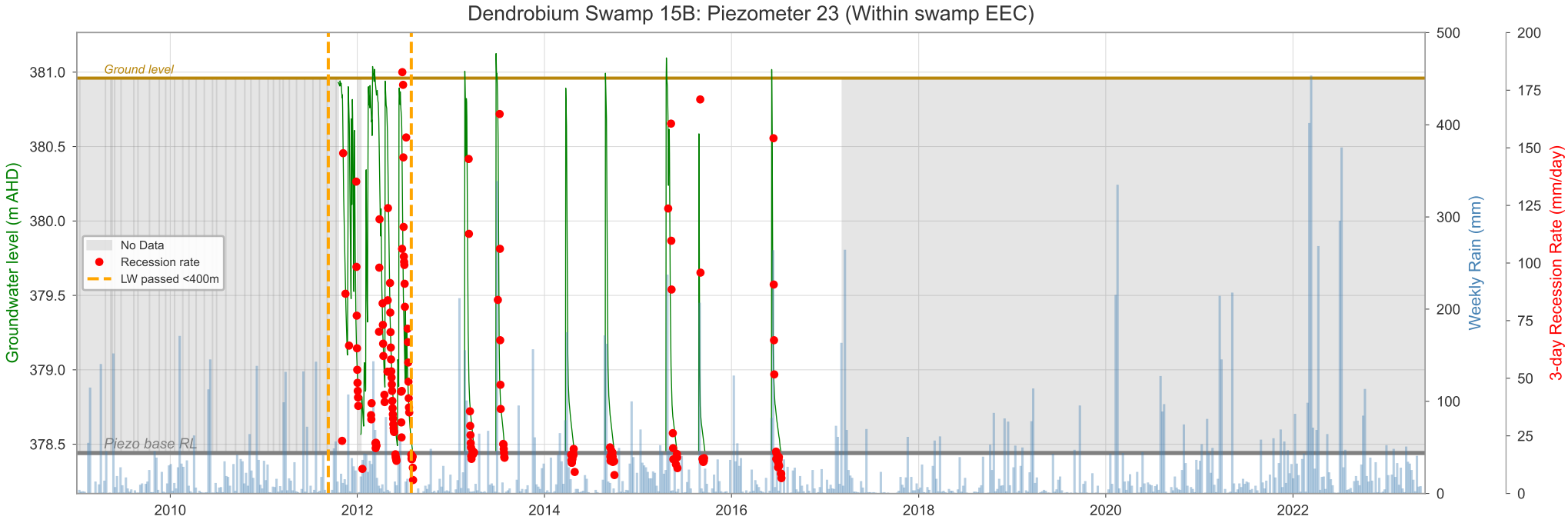

Dendrobium Swamp 15A: Piezometer 17 (Outside swamp EEC)
Ground level
No Data
Recession rate
Piezo base RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
361.0
360.8
360.6
360.4
360.2
360.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

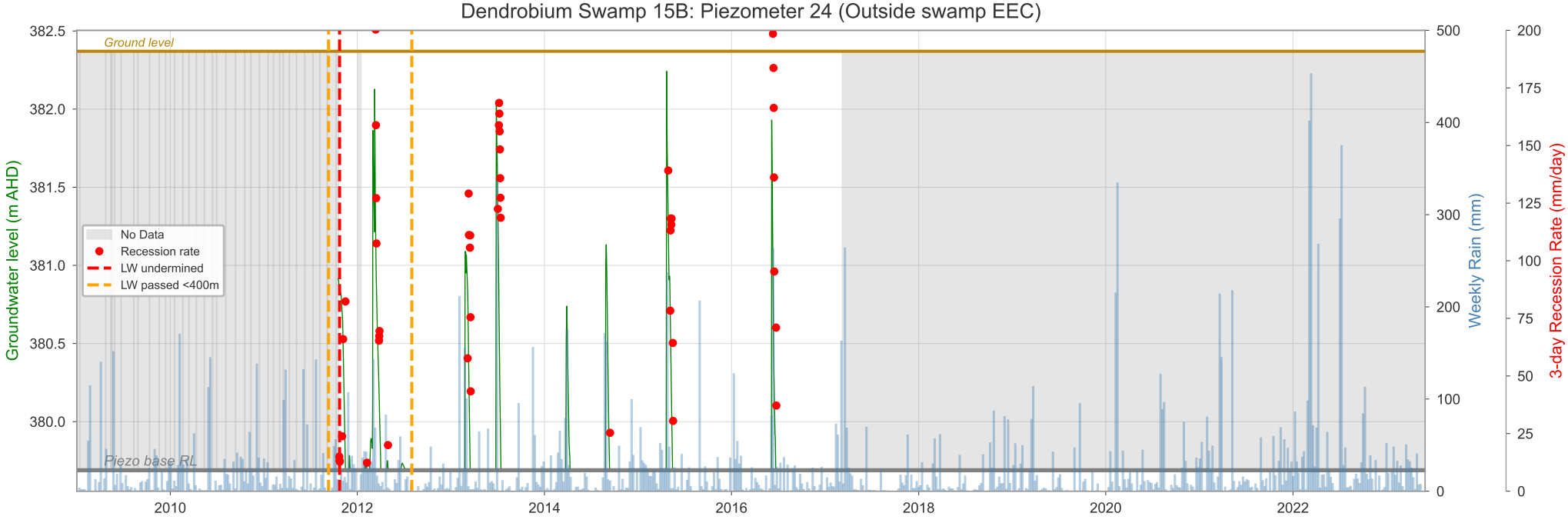

Dendrobium Swamp 15A: Piezometer 18 (Outside swamp EEC)
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
Piezo base RL
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
358.6
358.5
358.4
358.3
358.2
358.1
358.0
357.9
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

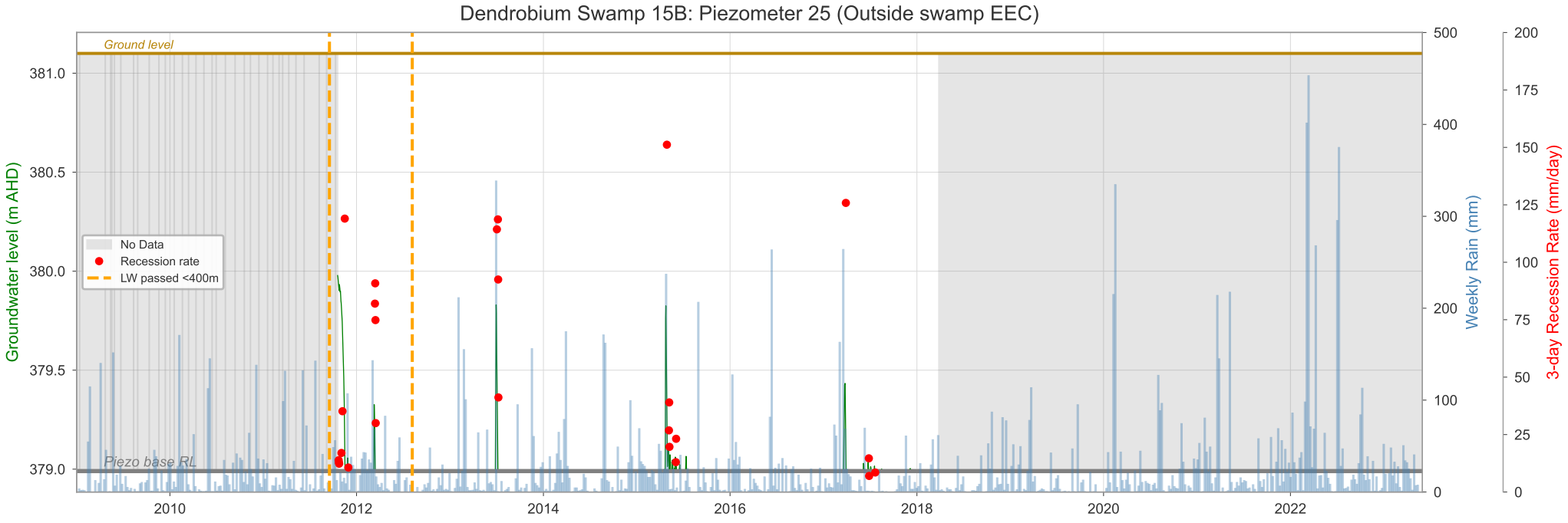

Dendrobium Swamp 15A: Piezometer 19 (Within swamp EEC)
LW19
LW21
Ground level
Piezo base RL
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
365.00
364.75
364.50
364.25
364.00
363.75
363.50
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-07
2022-09
2022-11
2023-01
2023-03
2023-05

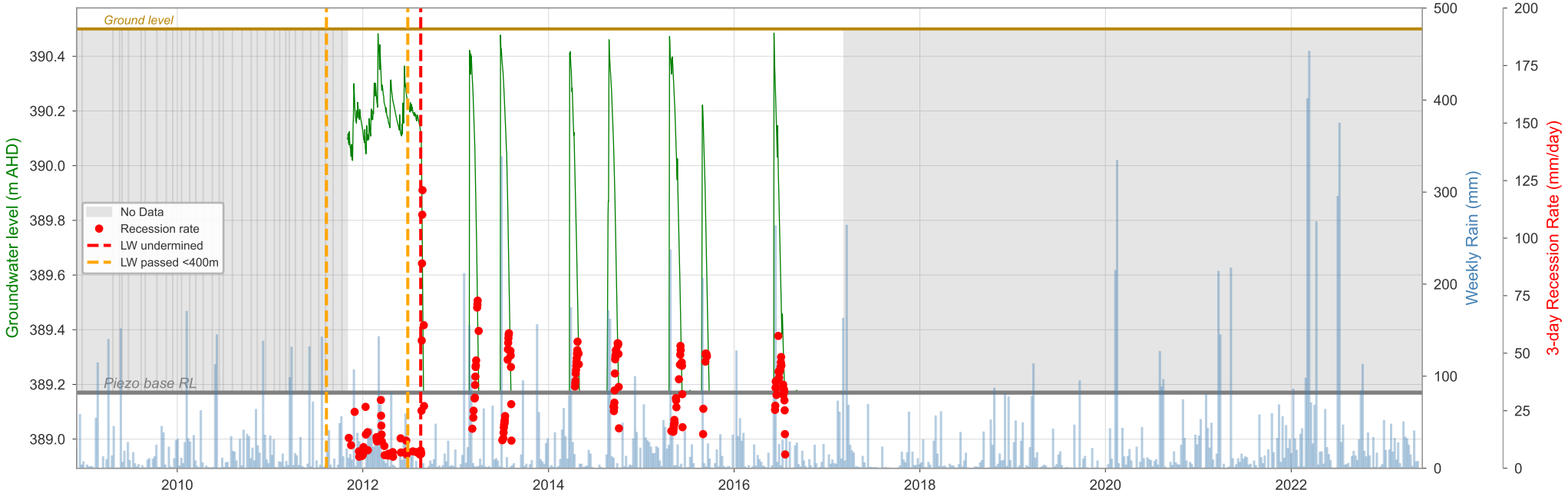

Dendrobium Swamp 15B: Piezometer 21 (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
385.00
384.75
384.50
384.25
384.00
383.75
383.50
383.25
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

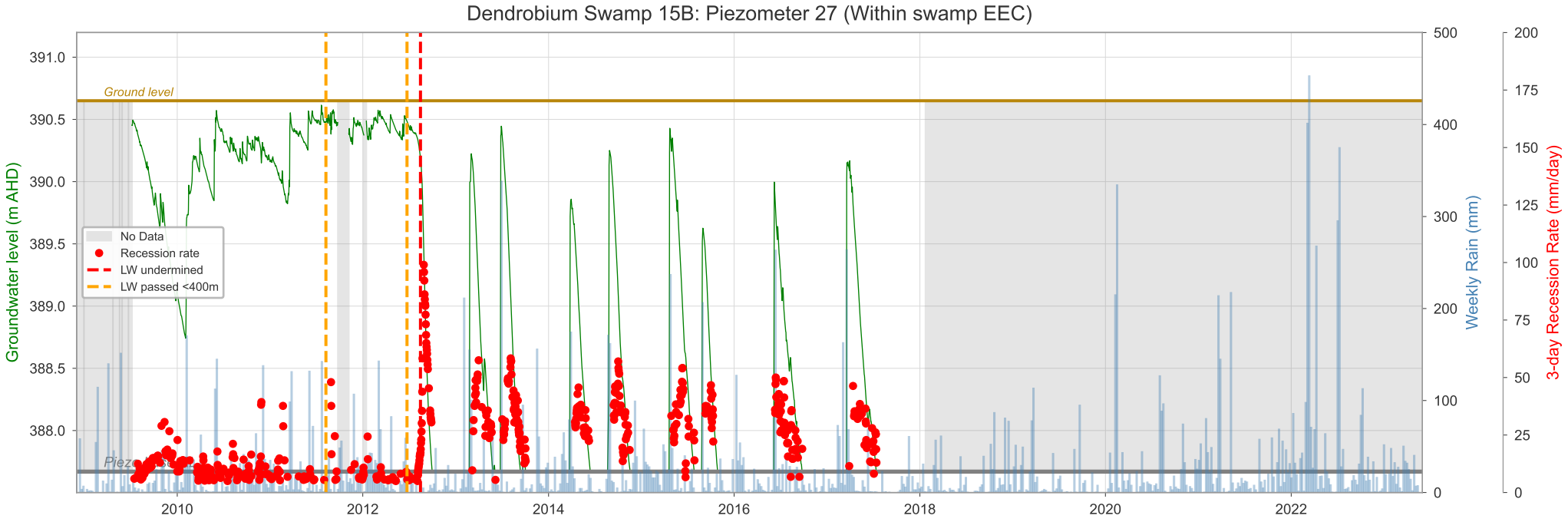

Dendrobium Swamp 15B: Piezometer 22 (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
383.0
382.5
382.0
381.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

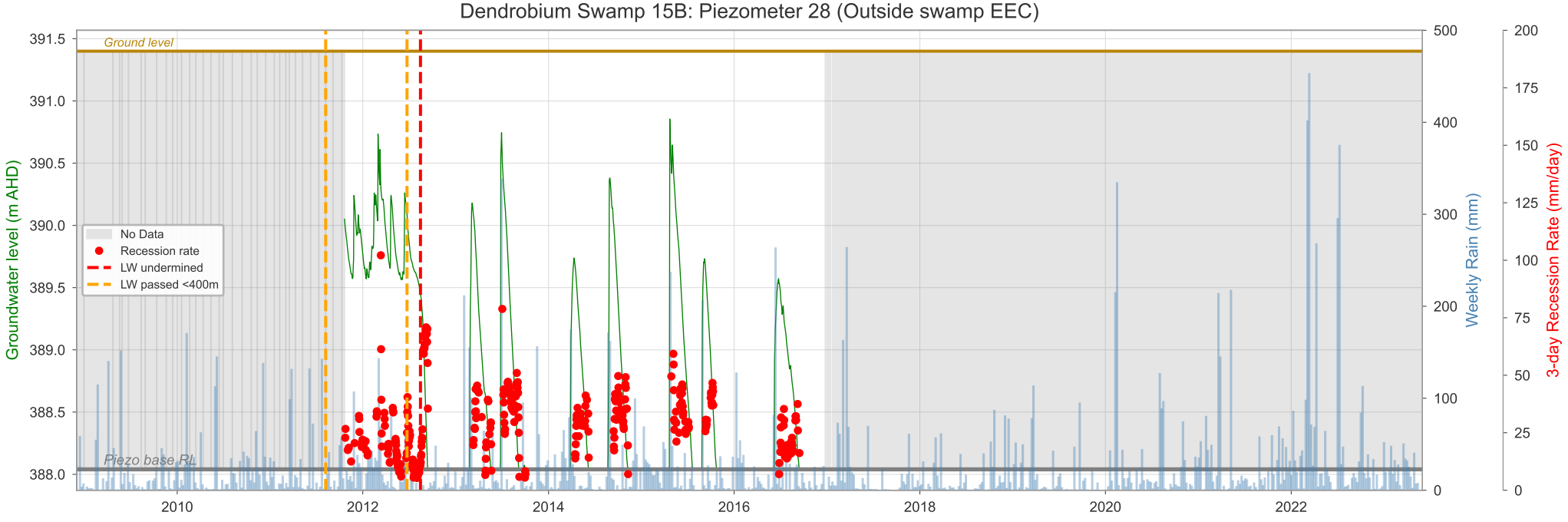

Dendrobium Swamp 15B: Piezometer 23 (Within swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
381.0
380.5
380.0
379.5
379.0
378.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

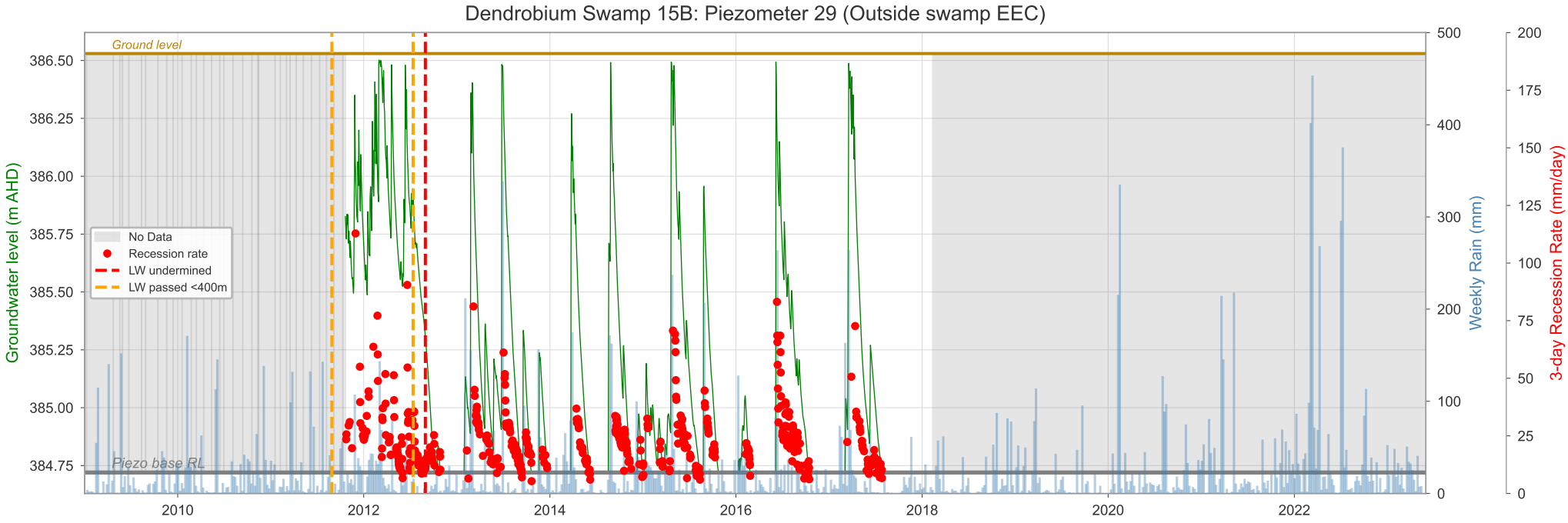

Dendrobium Swamp 15B: Piezometer 24 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
382.5
382.0
381.5
381.0
380.5
380.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

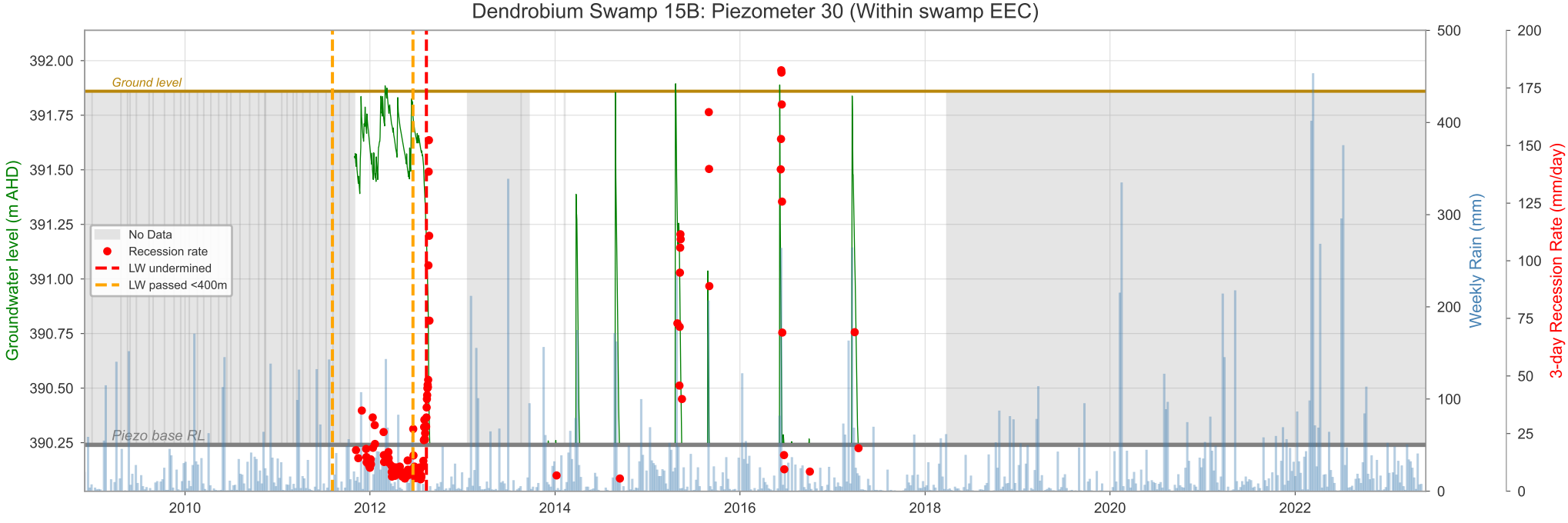

Dendrobium Swamp 15B: Piezometer 25 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
381.0
380.5
380.0
379.5
379.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

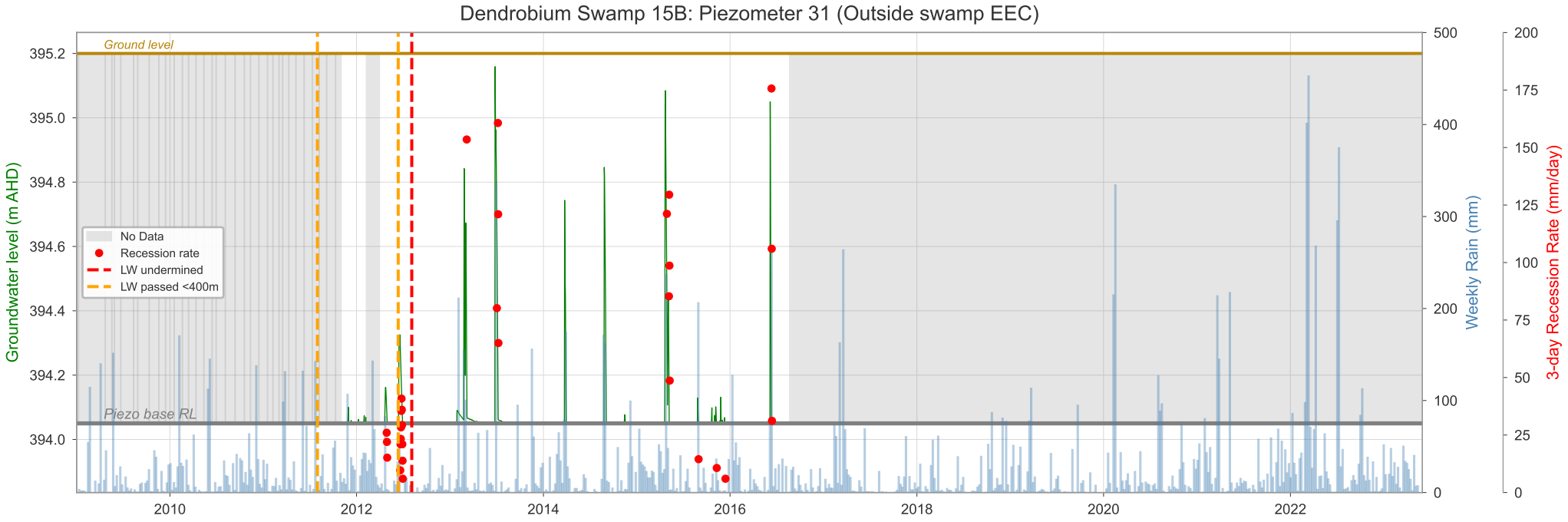

Dendrobium Swamp 15B: Piezometer 26 (Within swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
390.4
390.2
390.0
389.8
389.6
389.4
389.2
389.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

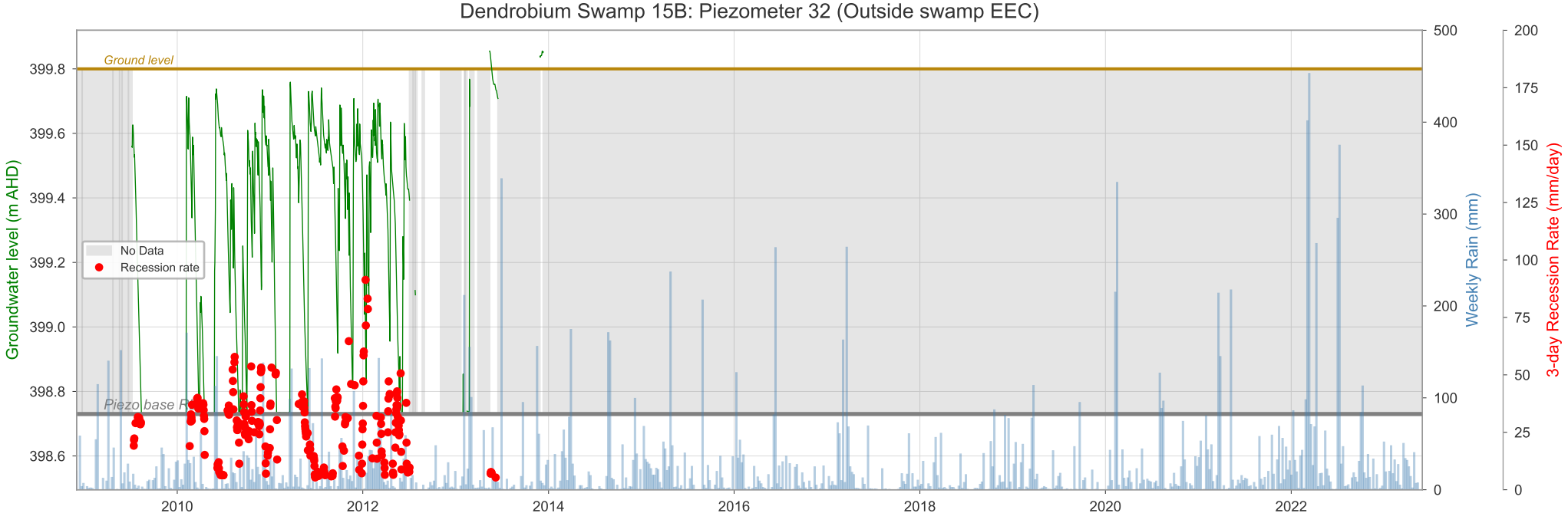

Dendrobium Swamp 15B: Piezometer 27 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
391.0
390.5
390.0
389.5
389.0
388.5
388.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

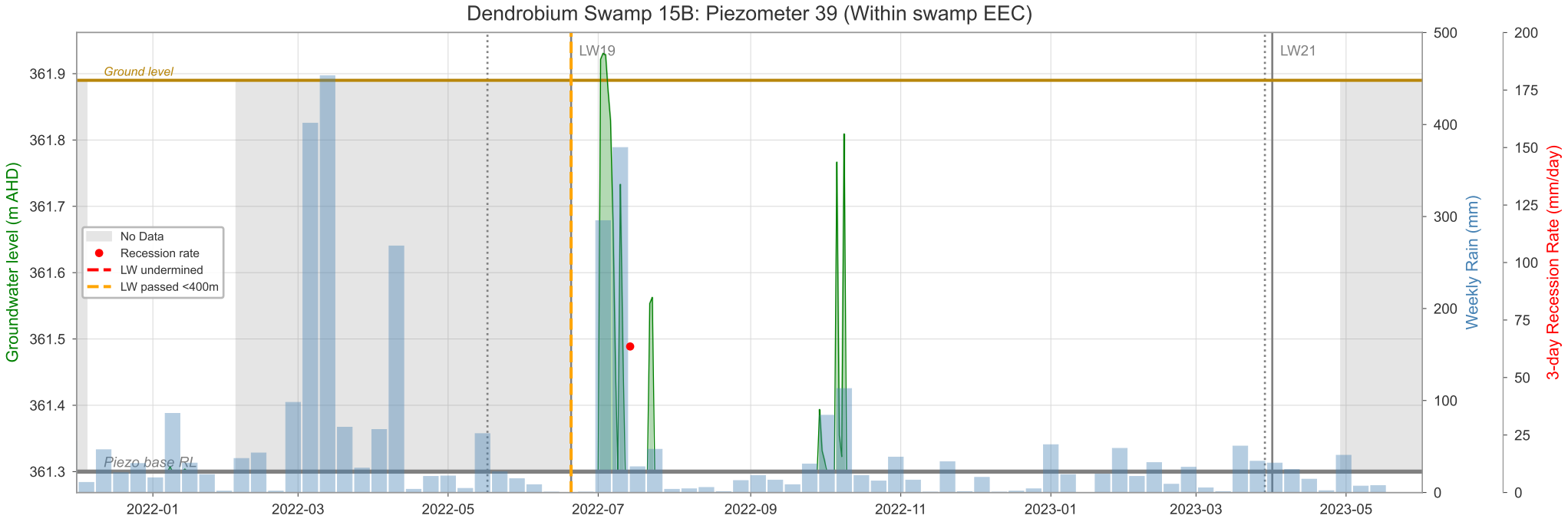

Dendrobium Swamp 15B: Piezometer 28 (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
391.5
391.0
390.5
390.0
389.5
389.0
388.5
388.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

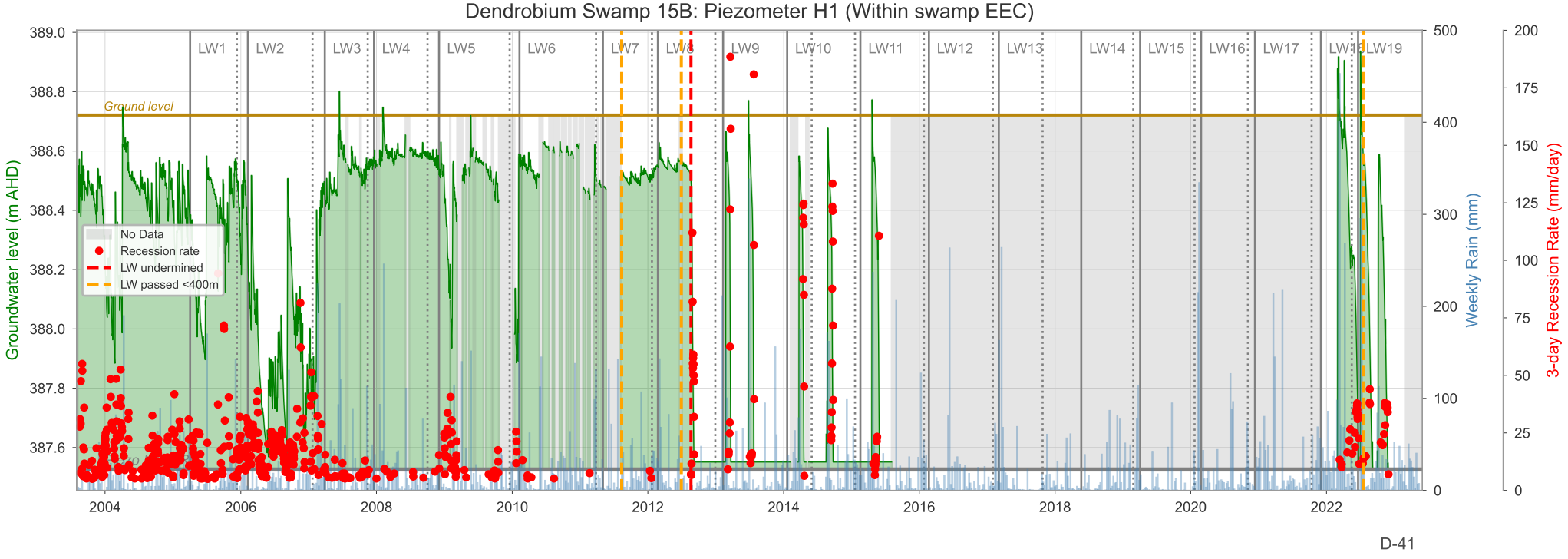

Dendrobium Swamp 15B: Piezometer 29 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
386.50
386.25
386.00
385.75
385.50
385.25
385.00
384.75
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

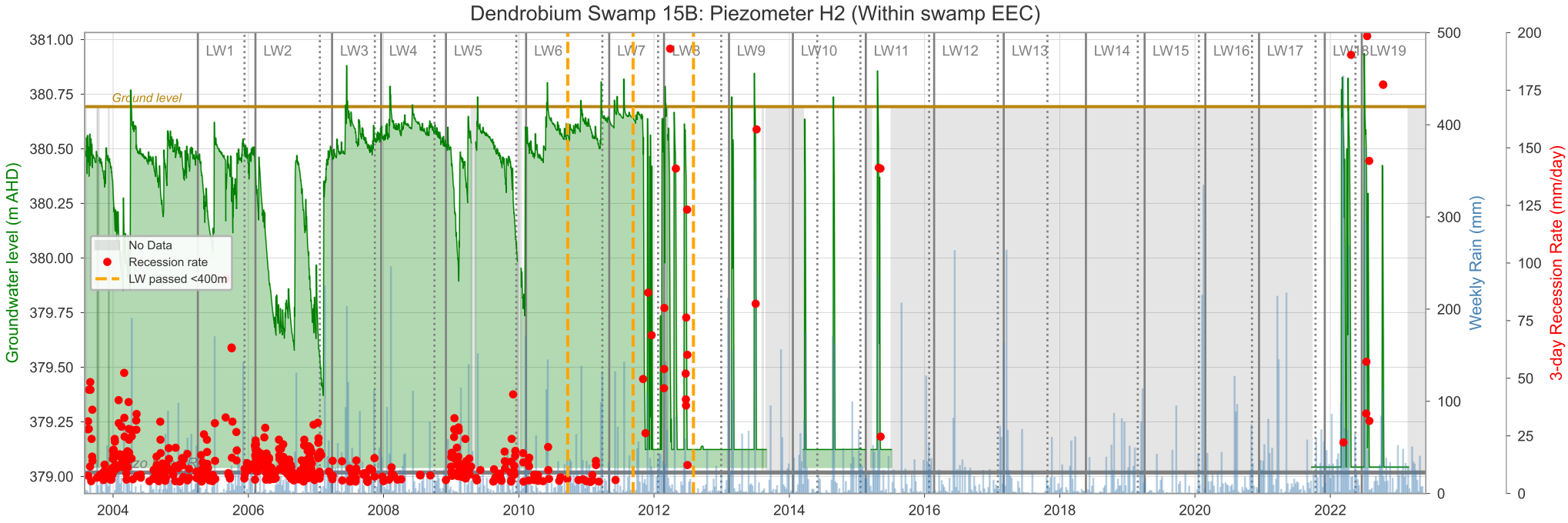

Dendrobium Swamp 15B: Piezometer 30 (Within swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
392.00
391.75
391.50
391.25
391.00
390.75
390.50
390.25
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

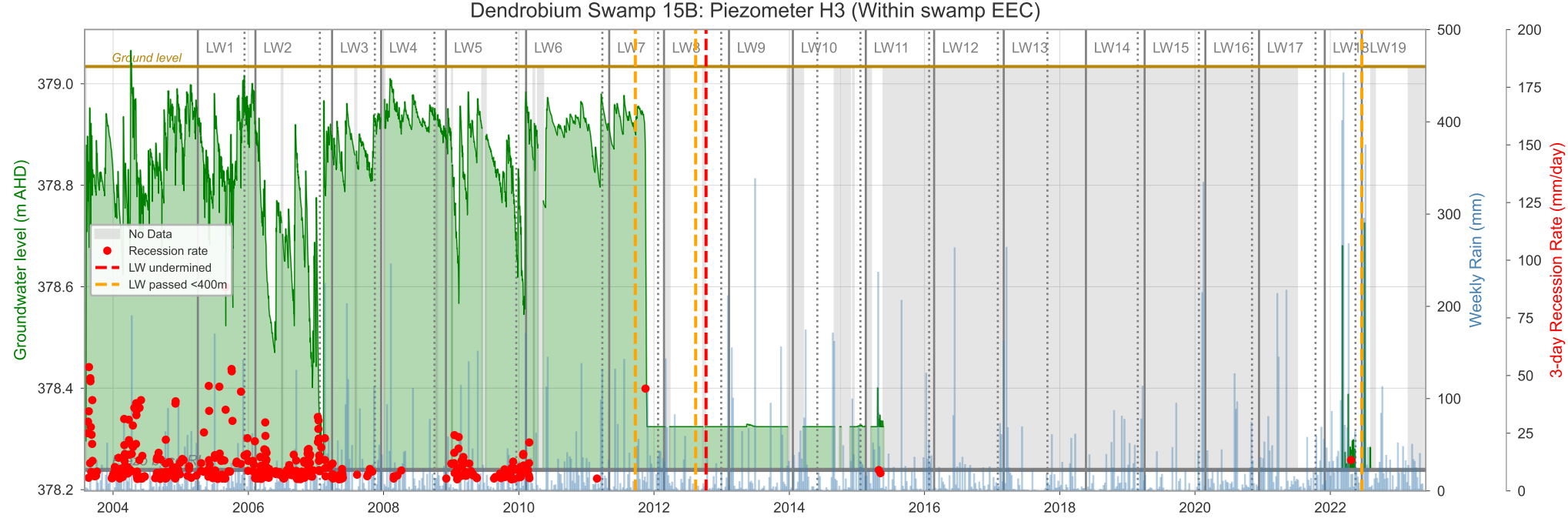

Dendrobium Swamp 15B: Piezometer 31 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
395.2
395.0
394.8
394.6
394.4
394.2
394.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

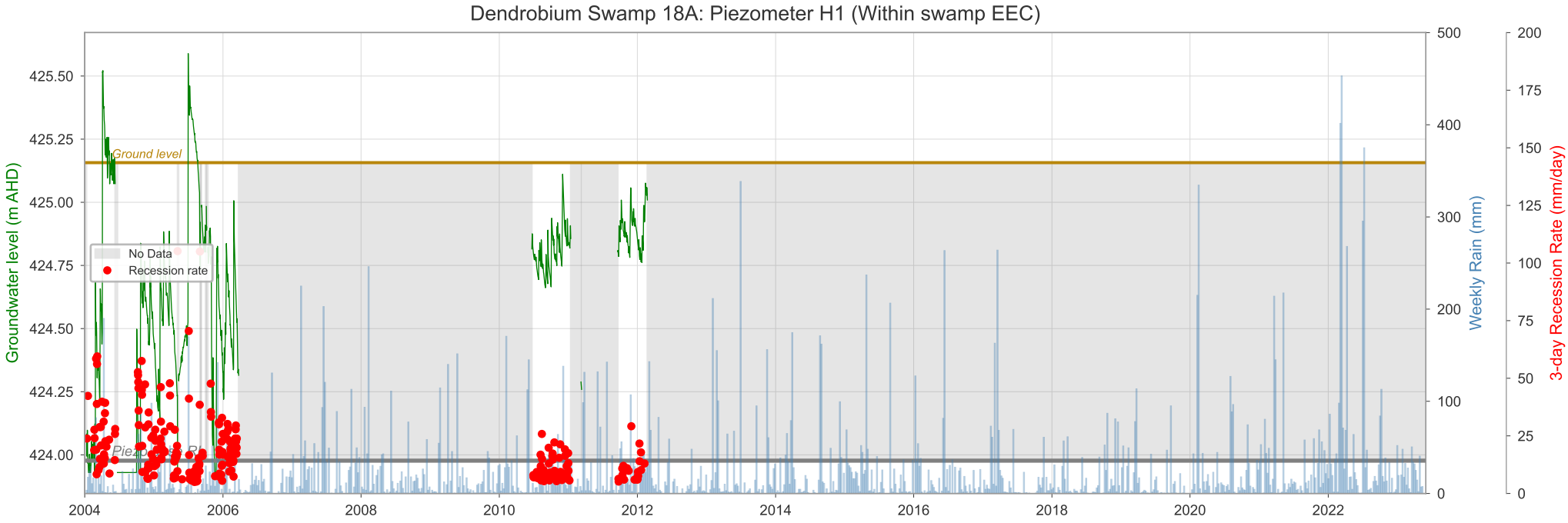

Dendrobium Swamp 15B: Piezometer 32 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
399.8
399.6
399.4
399.2
399.0
398.8
398.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

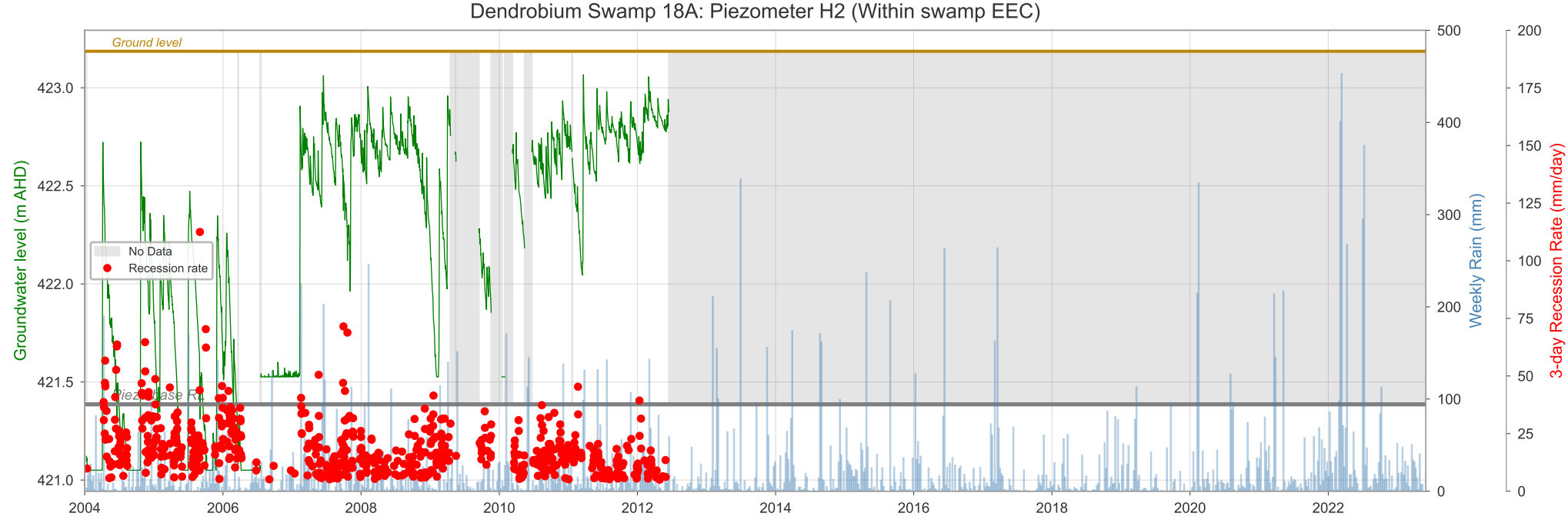

Dendrobium Swamp 15B: Piezometer 39 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW19
LW21
No Data
Recession rate
LW undermined
LW passed <400m
361.9
361.8
361.7
361.6
361.5
361.4
361.3
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-01
2022-03
2022-05
2022-07
2022-09
2022-11
2023-01
2023-03
2023-05

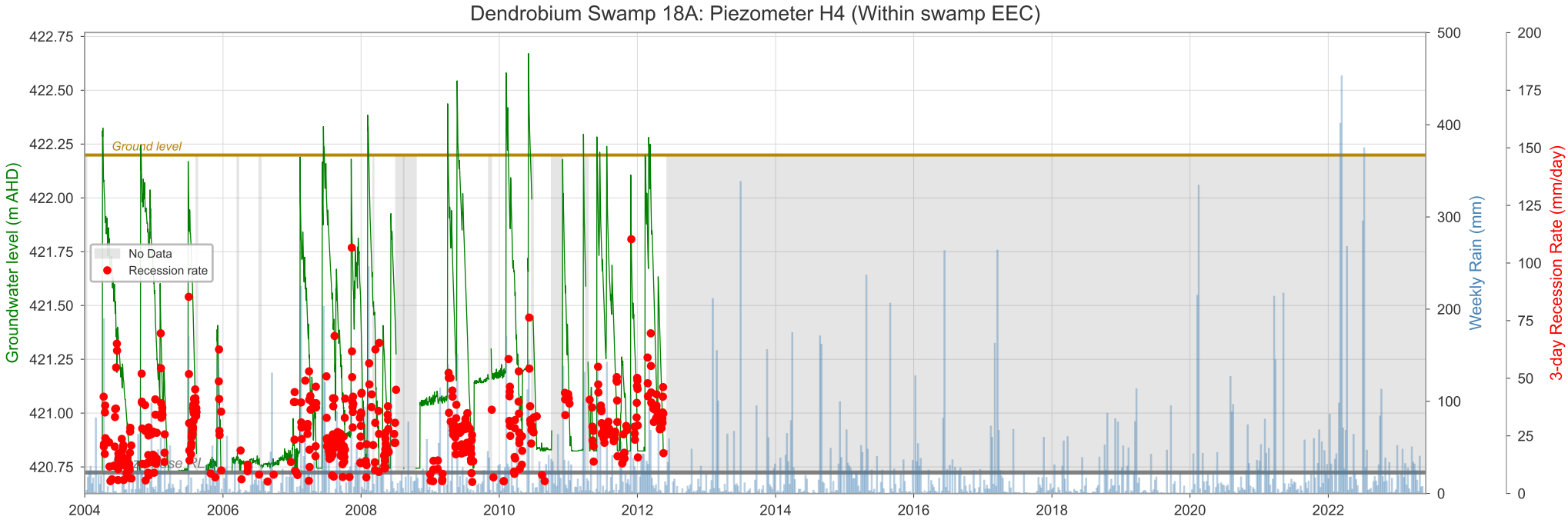

Dendrobium Swamp 15B: Piezometer H1 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
LW1
LW2
LW3
LW4
LW5
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
389.0
388.8
388.6
388.4
388.2
388.0
387.8
387.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

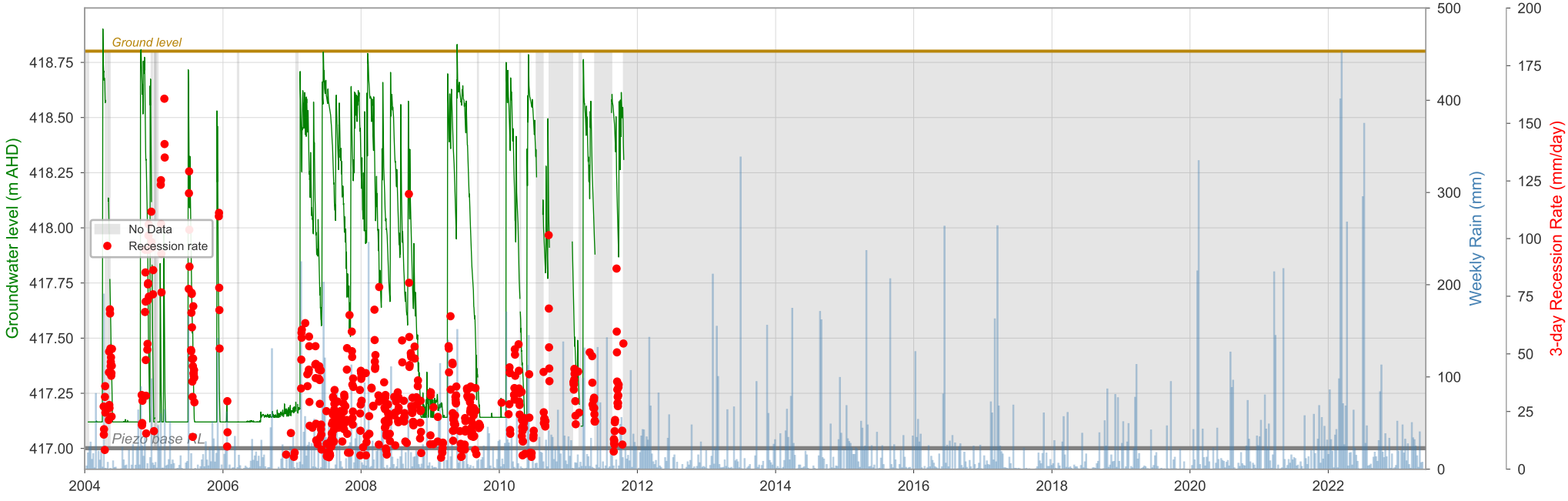

Dendrobium Swamp 15B: Piezometer H2 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
LW1
LW2
LW3
LW4
LW5
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW passed <400m
381.00
380.75
380.50
380.25
380.00
379.75
379.50
379.25
379.00
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

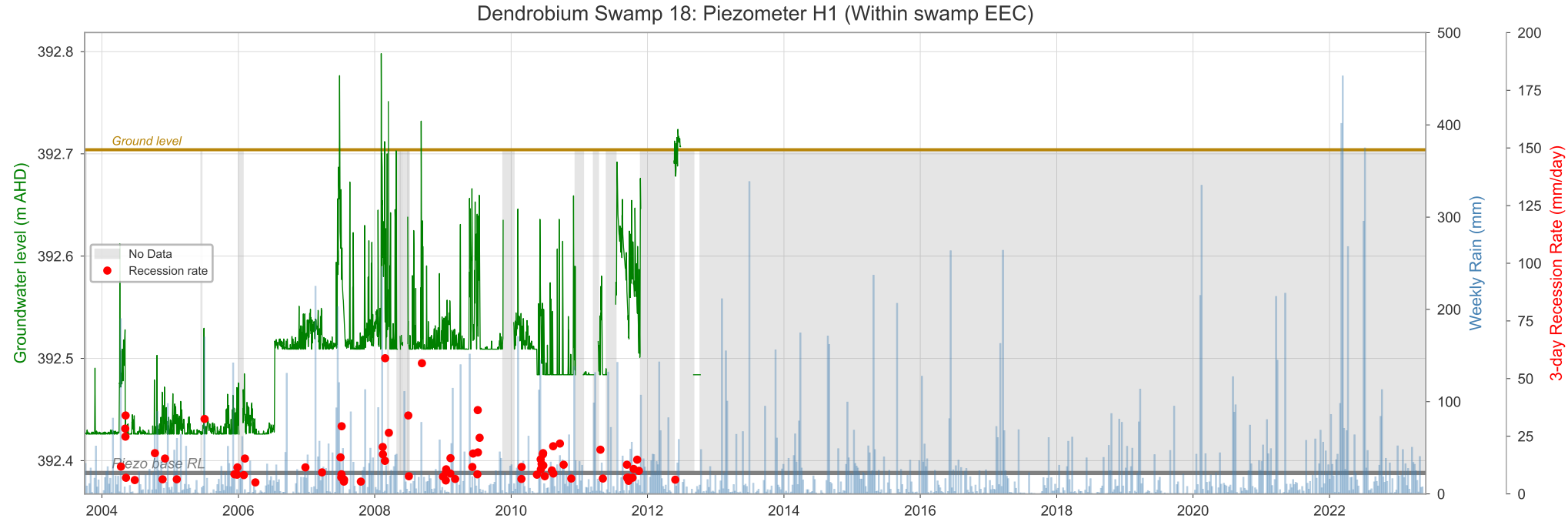

Dendrobium Swamp 15B: Piezometer H3 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
LW1
LW2
LW3
LW4
LW5
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
379.0
378.8
378.6
378.4
378.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

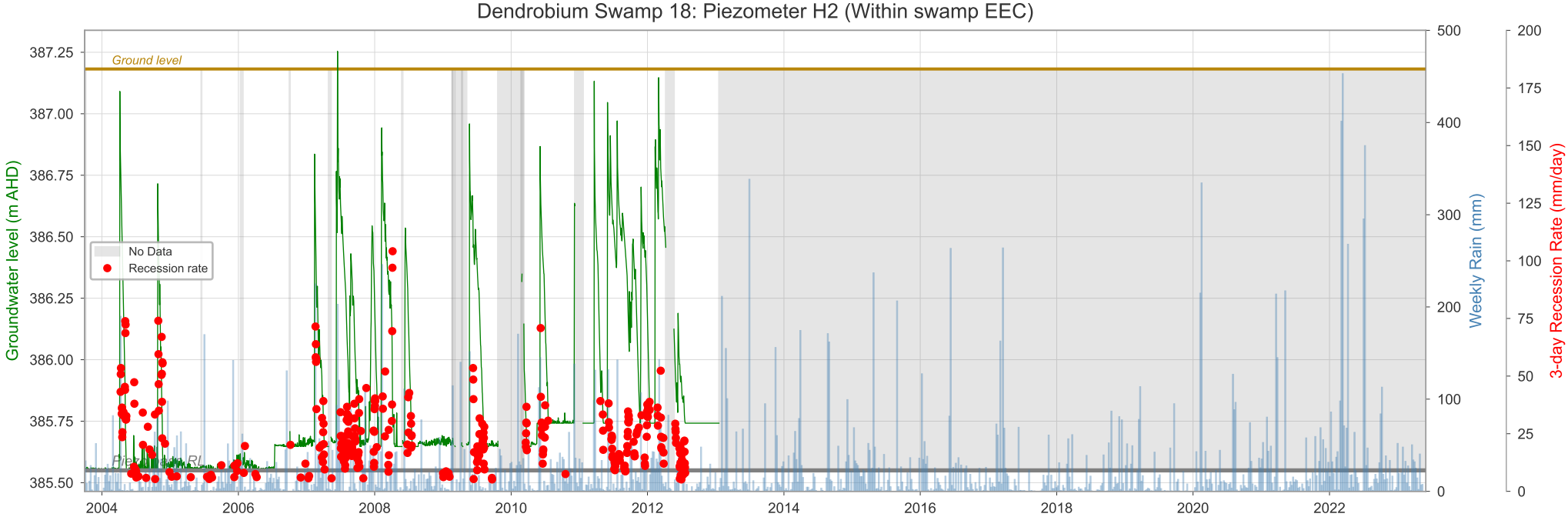

Dendrobium Swamp 18A: Piezometer H1 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
No Data
Recession rate
425.50
425.25
425.00
424.75
424.50
424.25
424.00
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

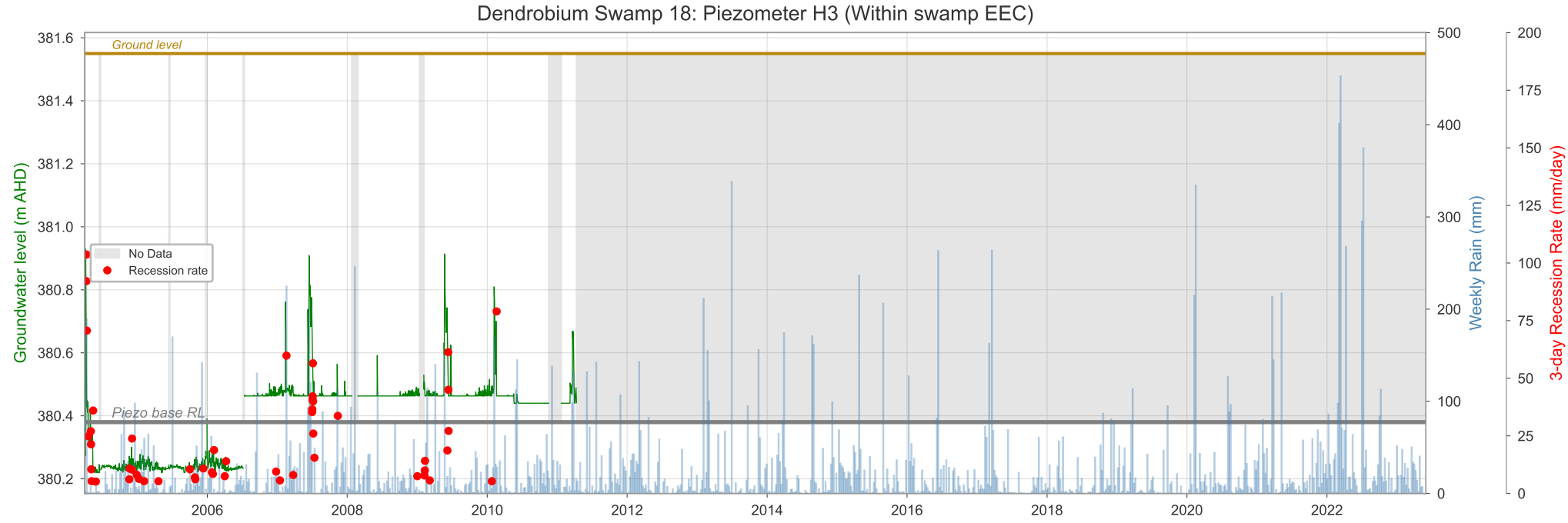

Dendrobium Swamp 18A: Piezometer H2 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
No Data
Recession rate
423.0
422.5
422.0
421.5
421.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

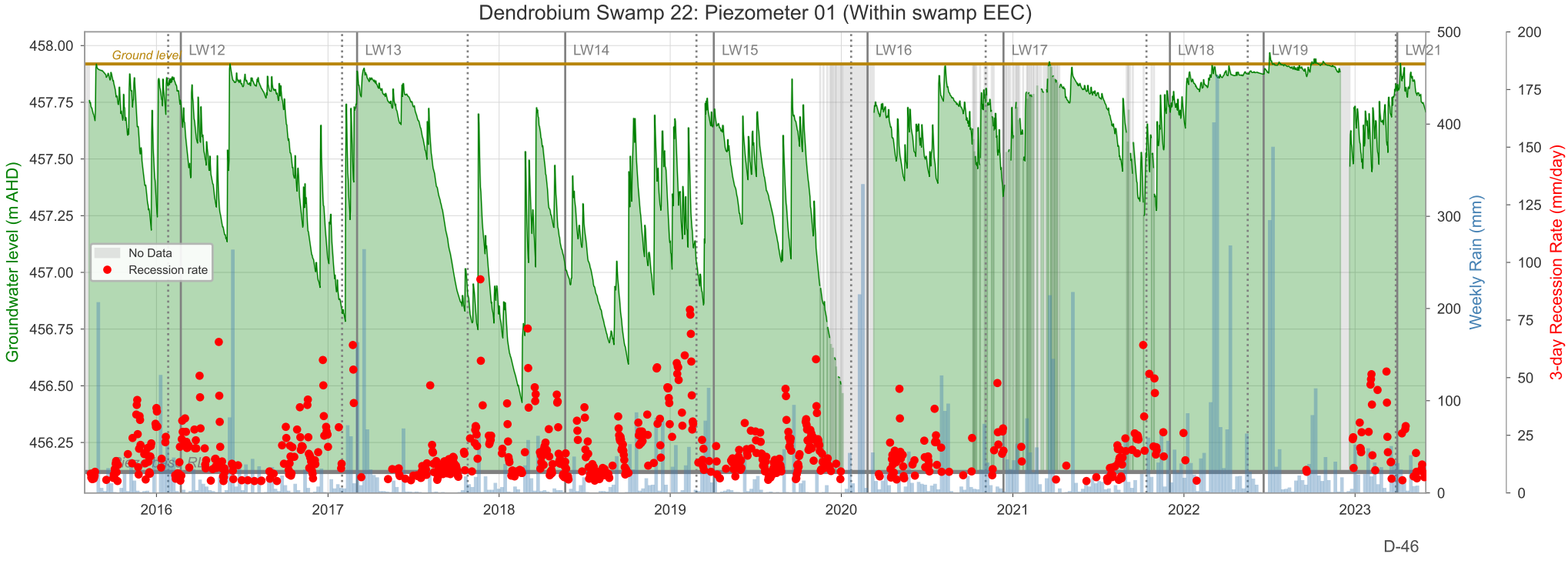

Dendrobium Swamp 18A: Piezometer H4 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
422.75
422.50
422.25
422.00
421.75
421.50
421.25
421.00
420.75
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

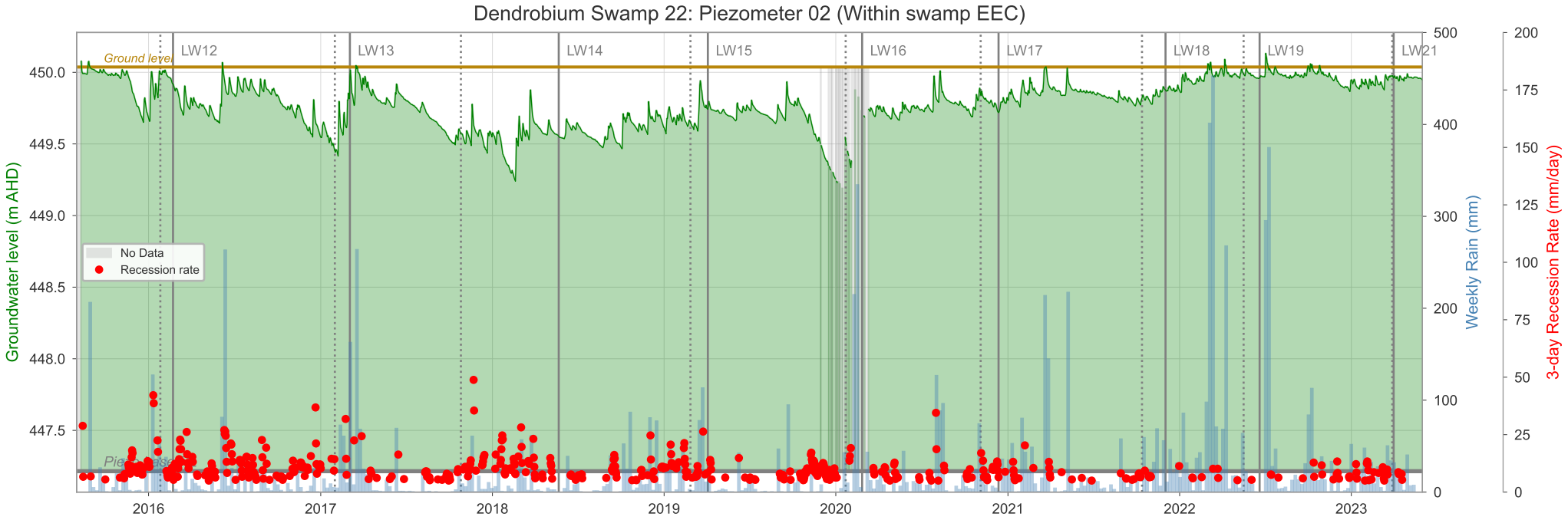

Dendrobium Swamp 18A: Piezometer H6 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
418.75
418.50
418.25
418.00
417.75
417.50
417.25
417.00
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

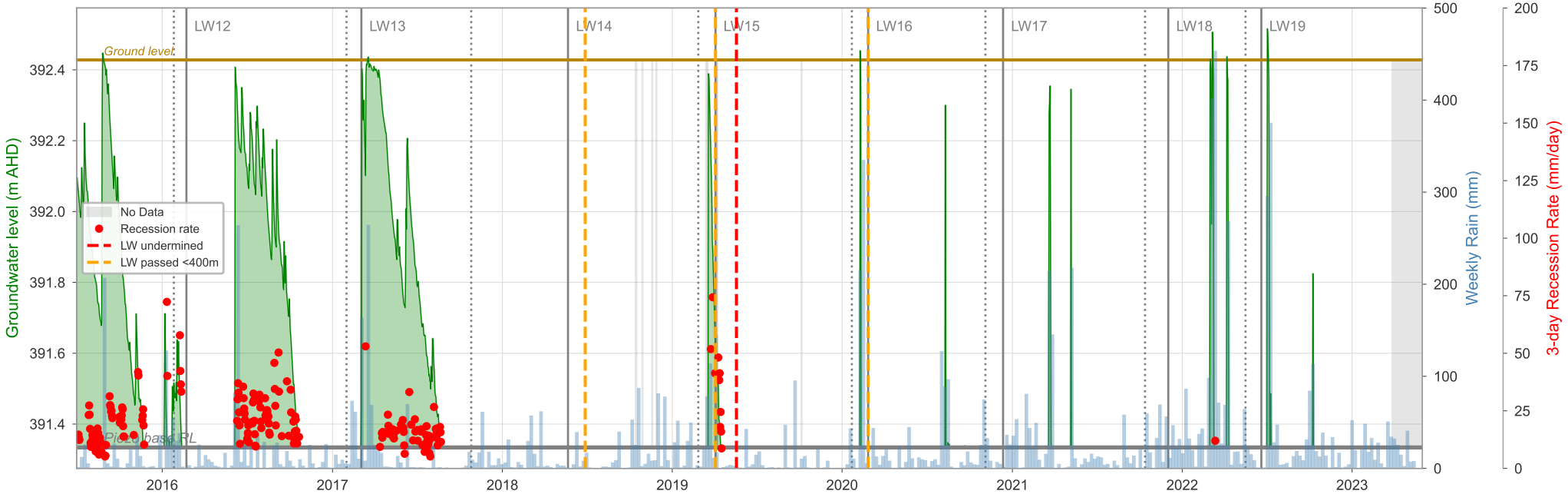

Dendrobium Swamp 18: Piezometer H1 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
392.8
392.7
392.6
392.5
392.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

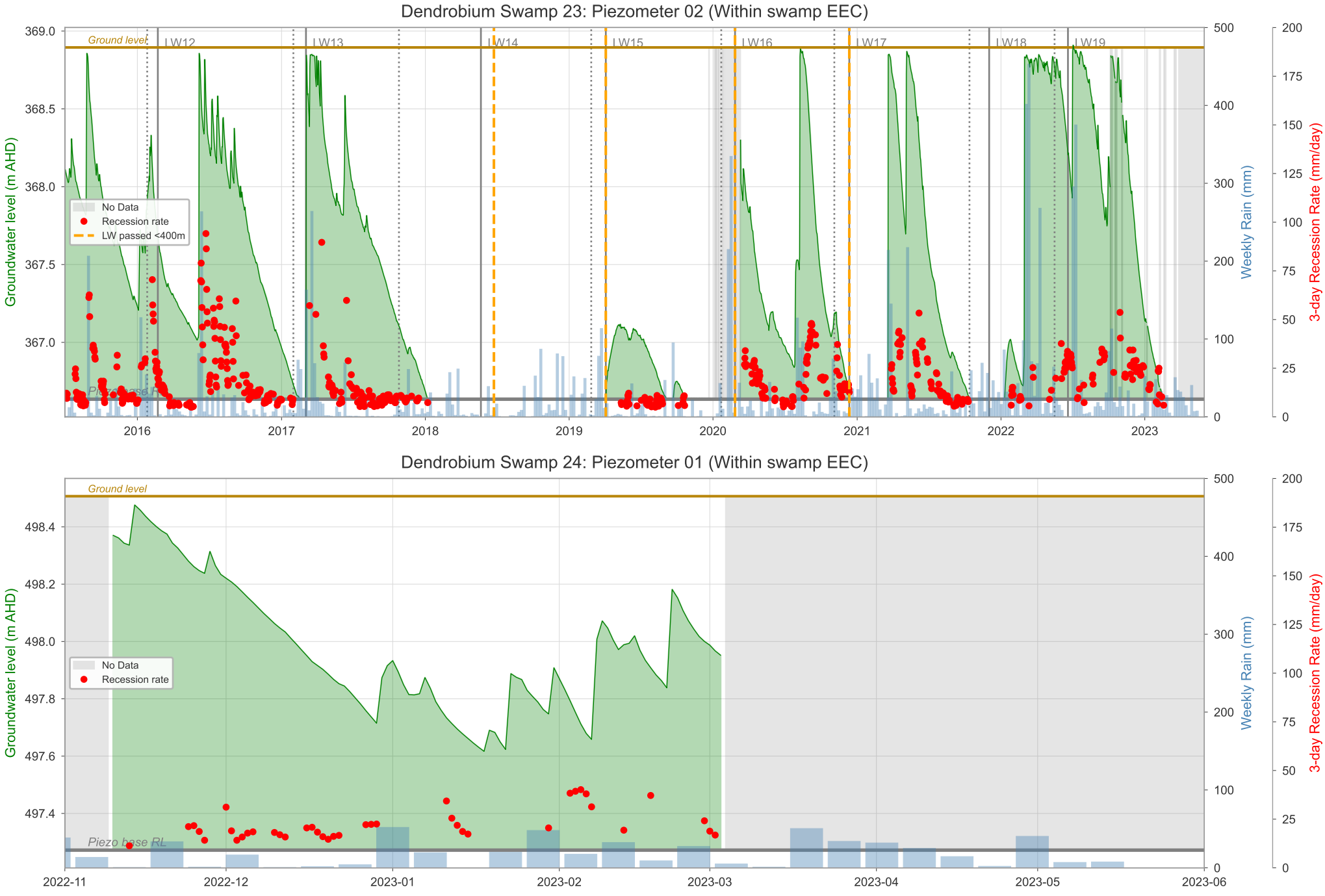

Dendrobium Swamp 18: Piezometer H2 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
No Data
Recession rate
387.25
387.00
386.75
386.50
386.25
386.00
385.75
385.50
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

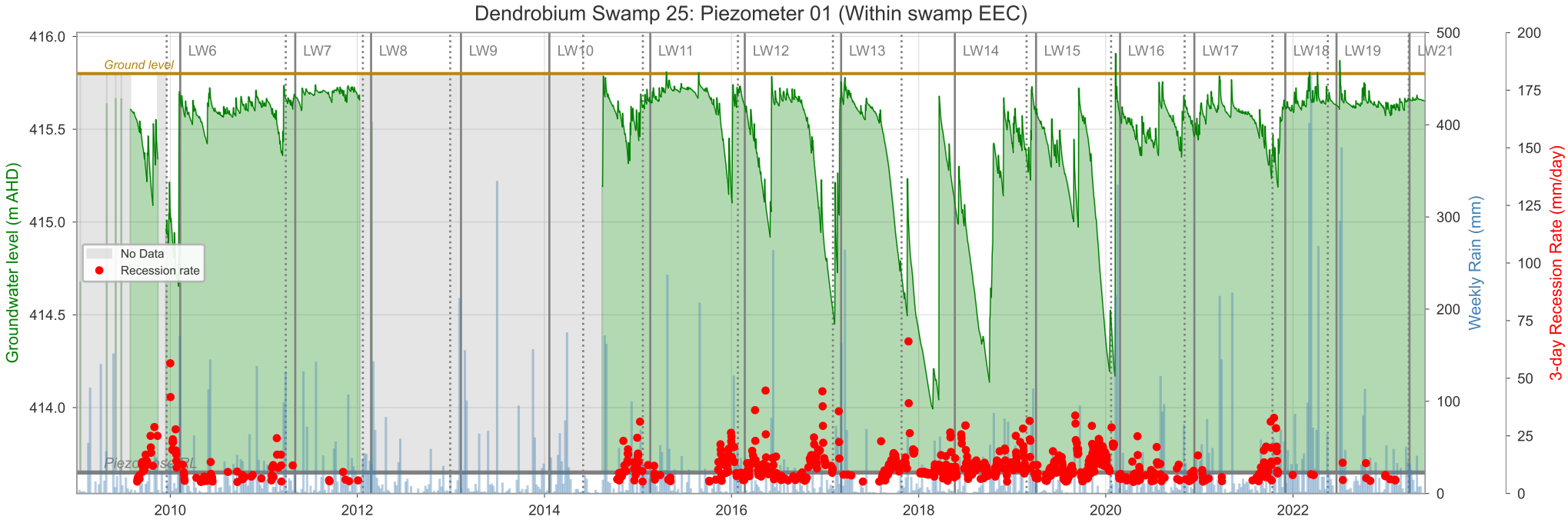

Dendrobium Swamp 18: Piezometer H3 (Within swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
381.6
381.4
381.2
381.0
380.8
380.6
380.4
380.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2006
2008
2010
2012
2014
2016
2018
2020
2022

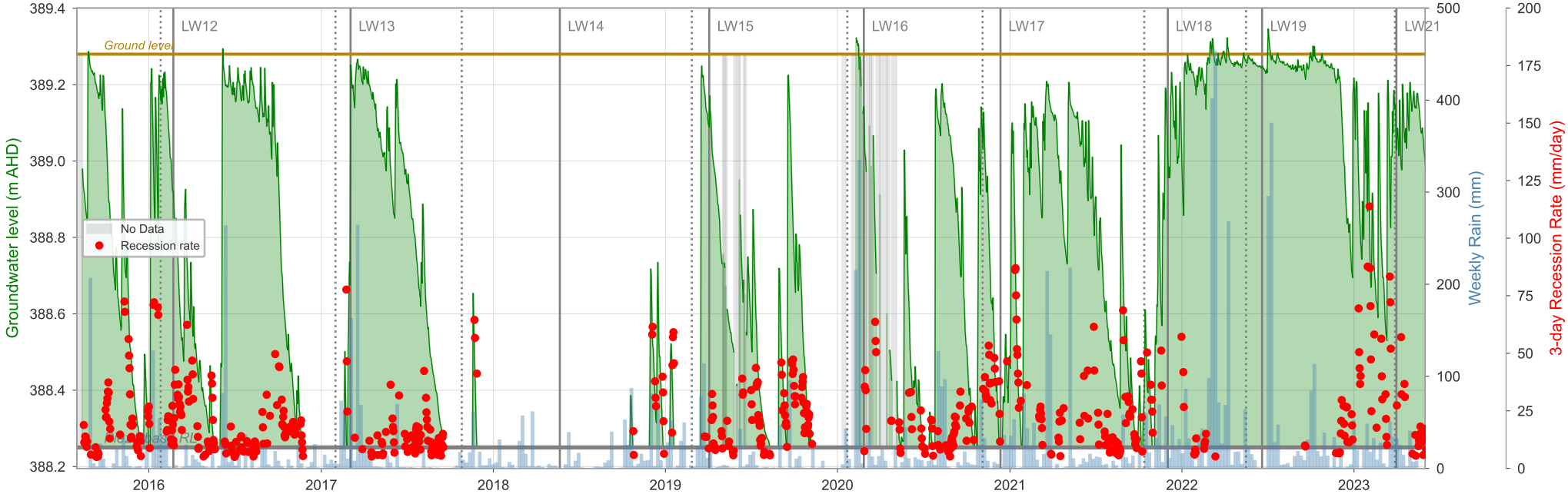

Dendrobium Swamp 22: Piezometer 01 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
458.00
457.75
457.50
457.25
457.00
456.75
456.50
456.25
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

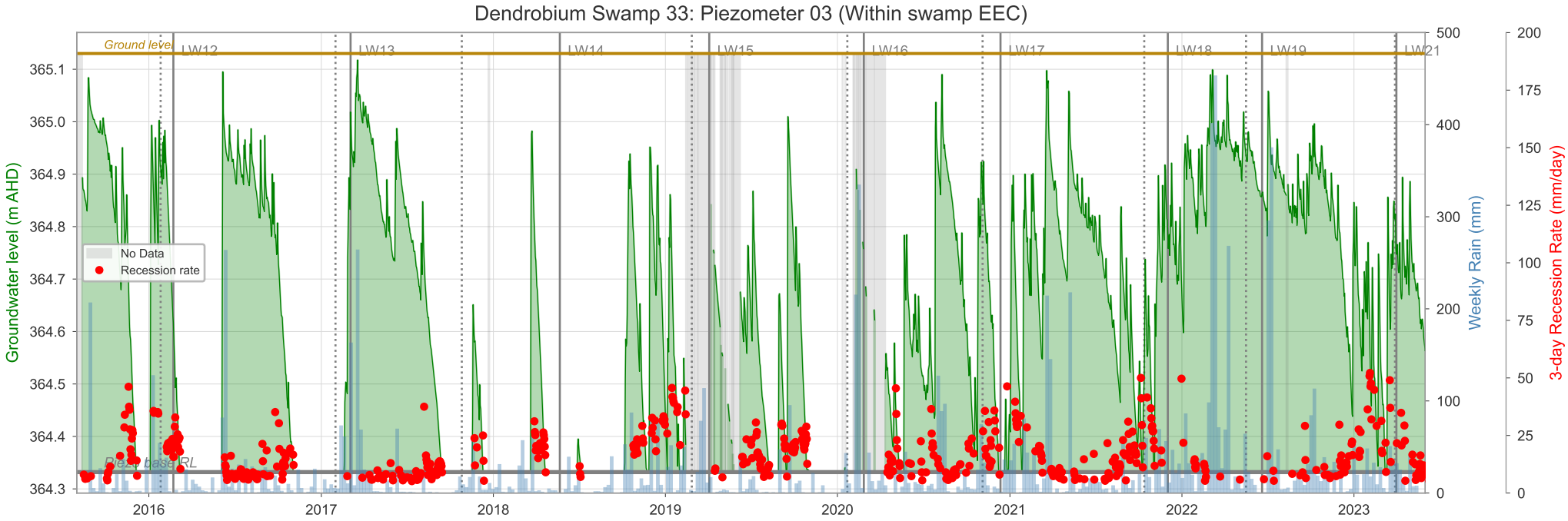

Dendrobium Swamp 22: Piezometer 02 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
450.0
449.5
449.0
448.5
448.0
447.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

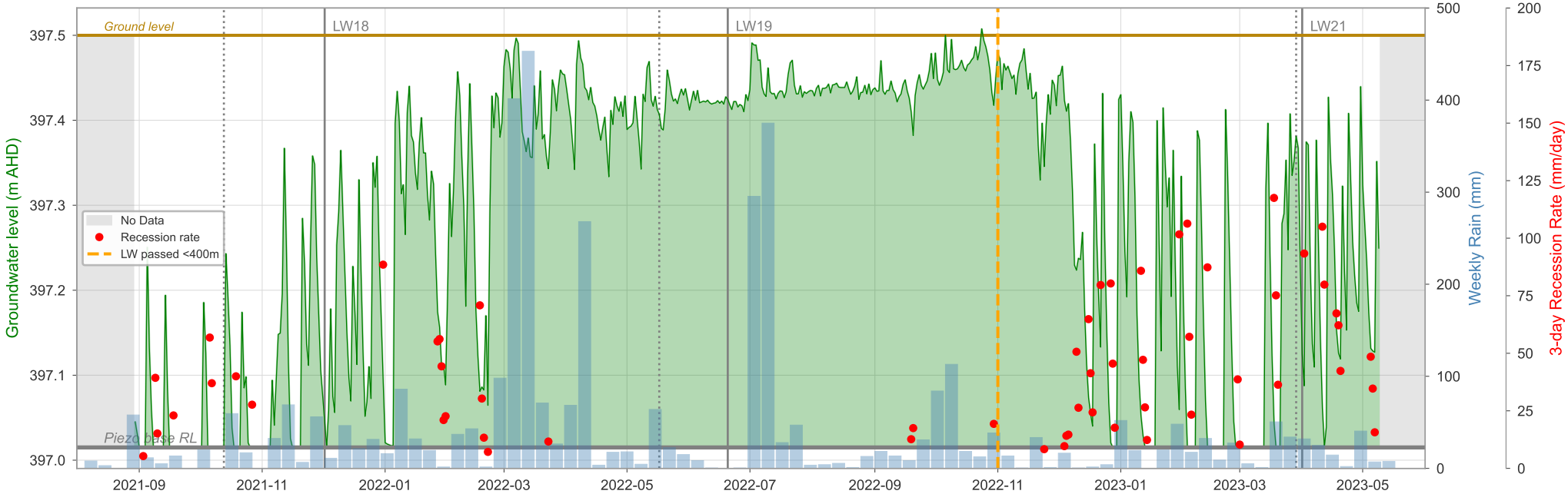

Dendrobium Swamp 23: Piezometer 01 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW undermined
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
392.4
392.2
392.0
391.8
391.6
391.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

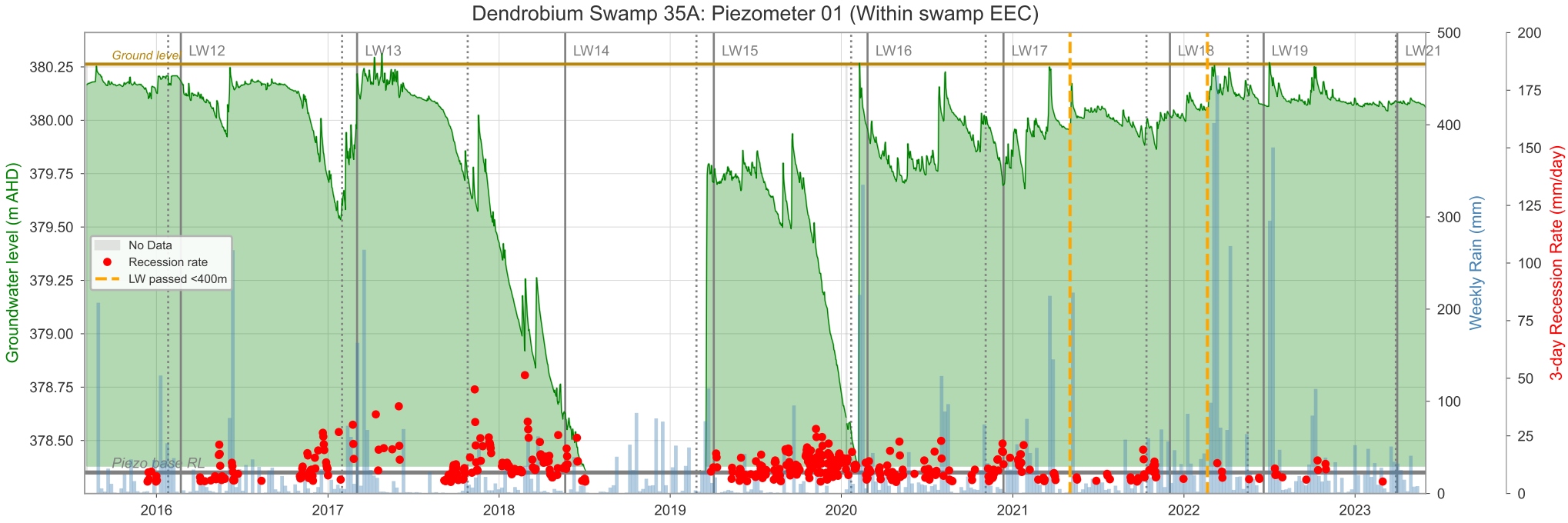

Dendrobium Swamp 23: Piezometer 02 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
LW passed <400m
Piezo base RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
369.0
368.5
368.0
367.5
367.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023
Dendrobium Swamp 24: Piezometer 01 (Within swamp EEC)
Ground level
No Data
Recession rate
Piezo base RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
498.4
498.2
498.0
497.8
497.6
497.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2022-11
2022-12
2023-01
2023-02
2023-03
2023-04
2023-05
2023-06

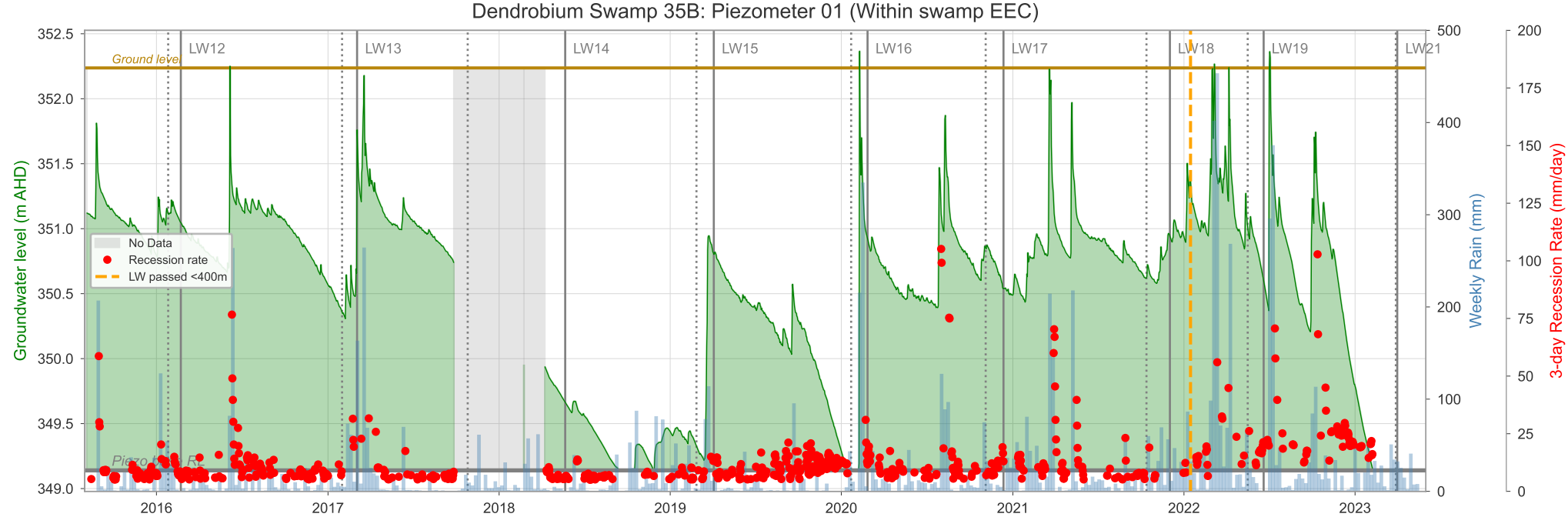

Dendrobium Swamp 25: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
LW6
LW7
LW8
LW9
LW10
LW11
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
416.0
415.5
415.0
414.5
414.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

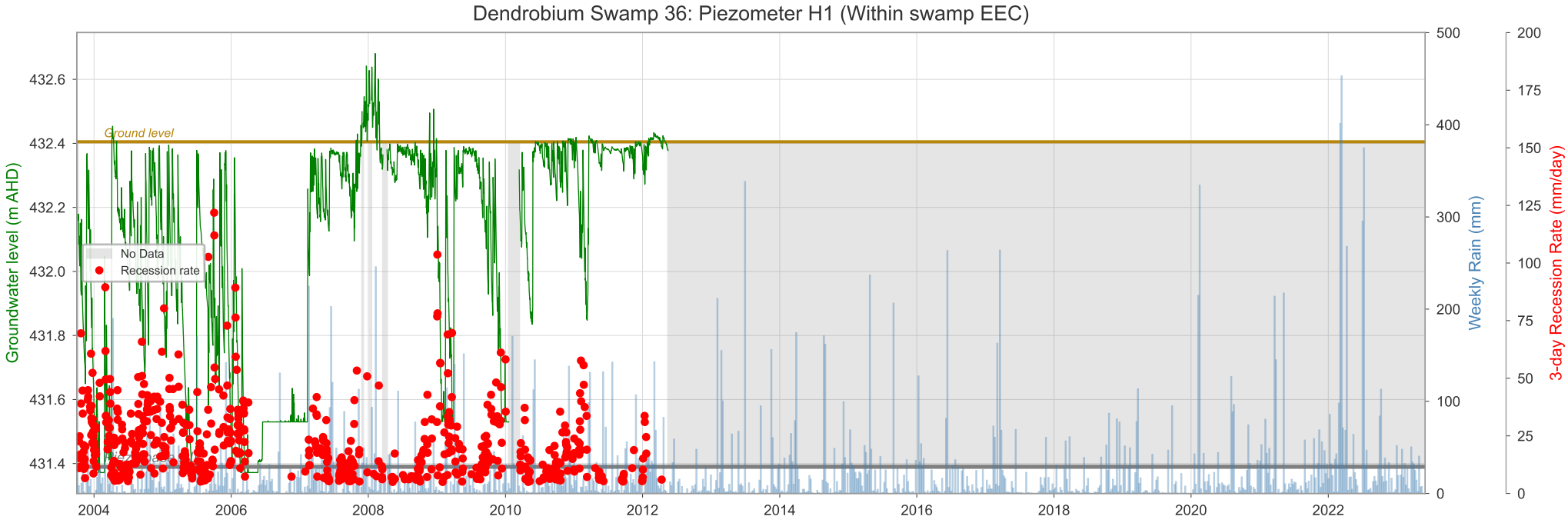

Dendrobium Swamp 33: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
389.4
389.2
389.0
388.8
388.6
388.4
388.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

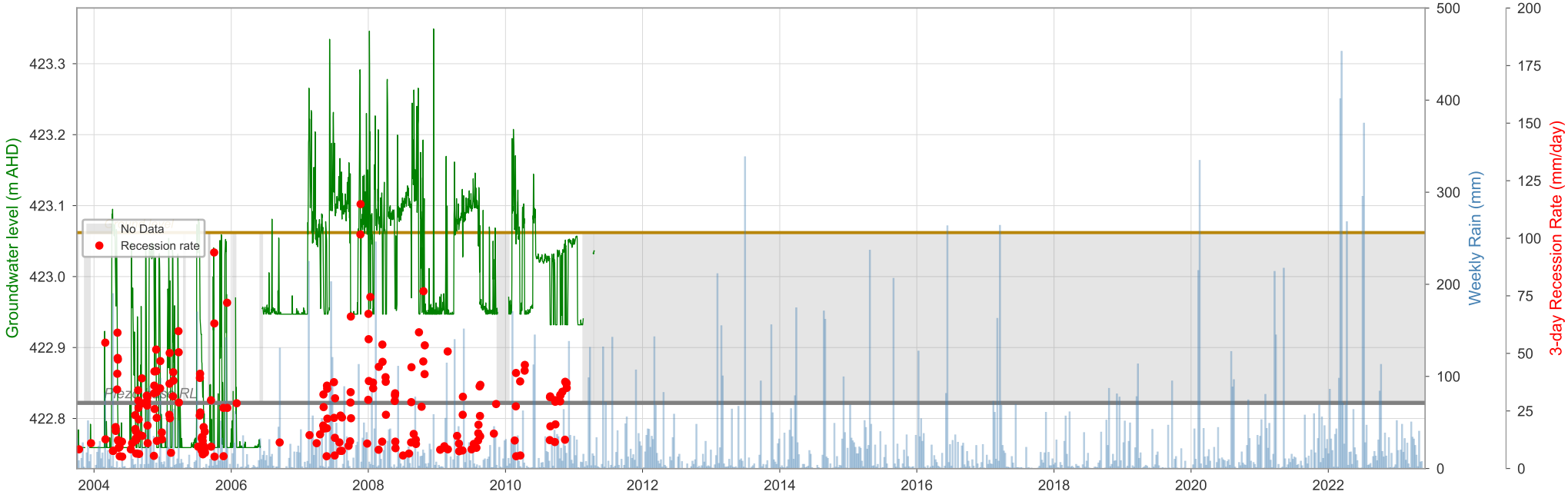

Dendrobium Swamp 33: Piezometer 03 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
Piezo base RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
365.1
365.0
364.9
364.8
364.7
364.6
364.5
364.4
364.3
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

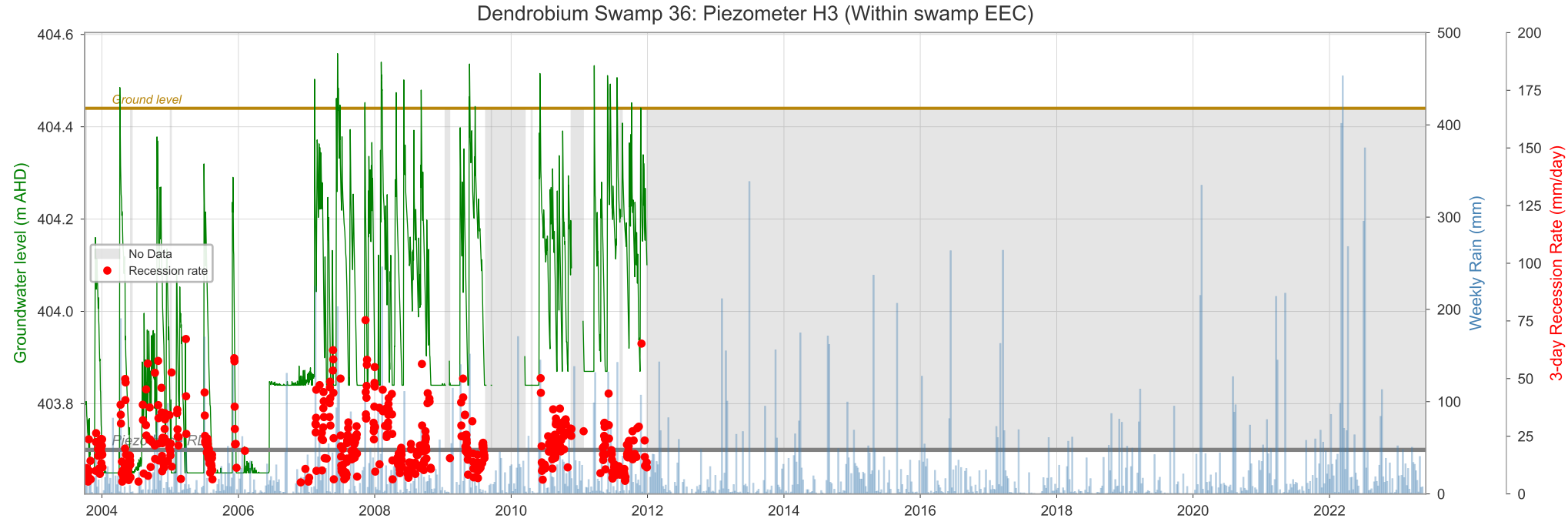

Dendrobium Swamp 34: Piezometer 01 (Within swamp EEC)
Ground level
LW18
LW19
LW21
No Data
Recession rate
LW passed <400m
Piezo base RL
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
397.5
397.4
397.3
397.2
397.1
397.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2021-09
2021-11
2022-01
2022-03
2022-05
2022-07
2022-09
2022-11
2023-01
2023-03
2023-05

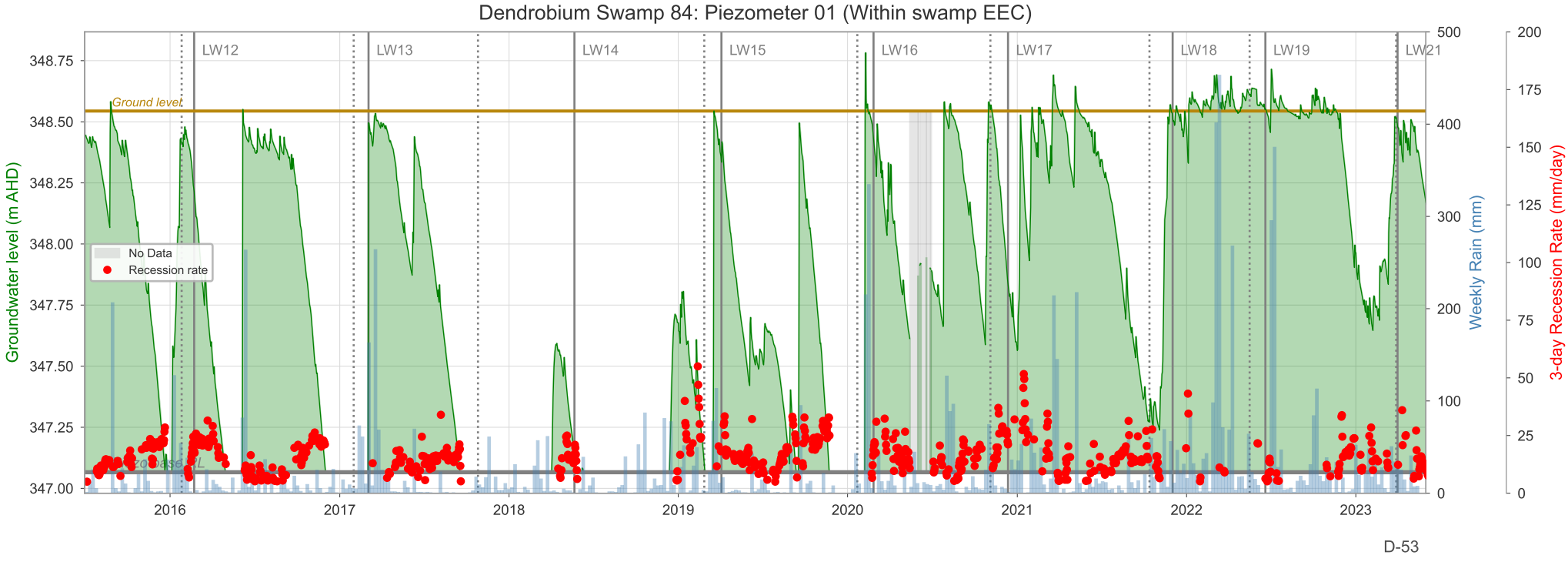

Dendrobium Swamp 35A: Piezometer 01 (Within swamp EEC)
Ground level
Piezo base RL
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
380.25
380.00
379.75
379.50
379.25
379.00
378.75
378.50
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

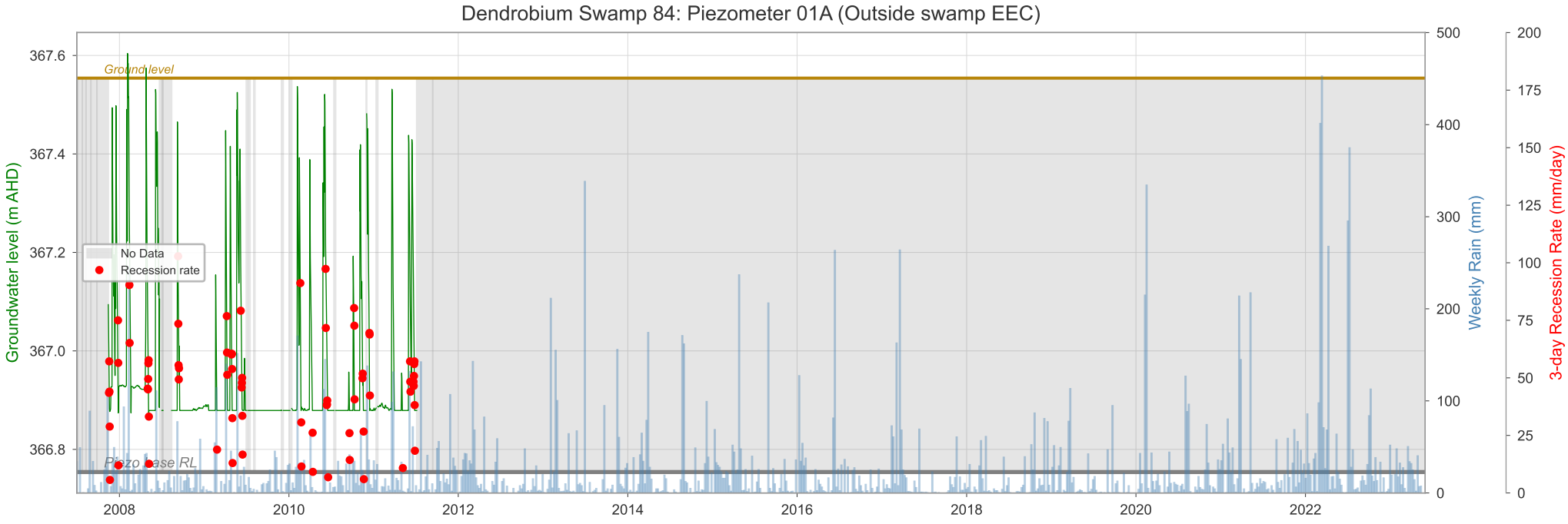

Dendrobium Swamp 35B: Piezometer 01 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
LW passed <400m
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
352.5
352.0
351.5
351.0
350.5
350.0
349.5
349.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

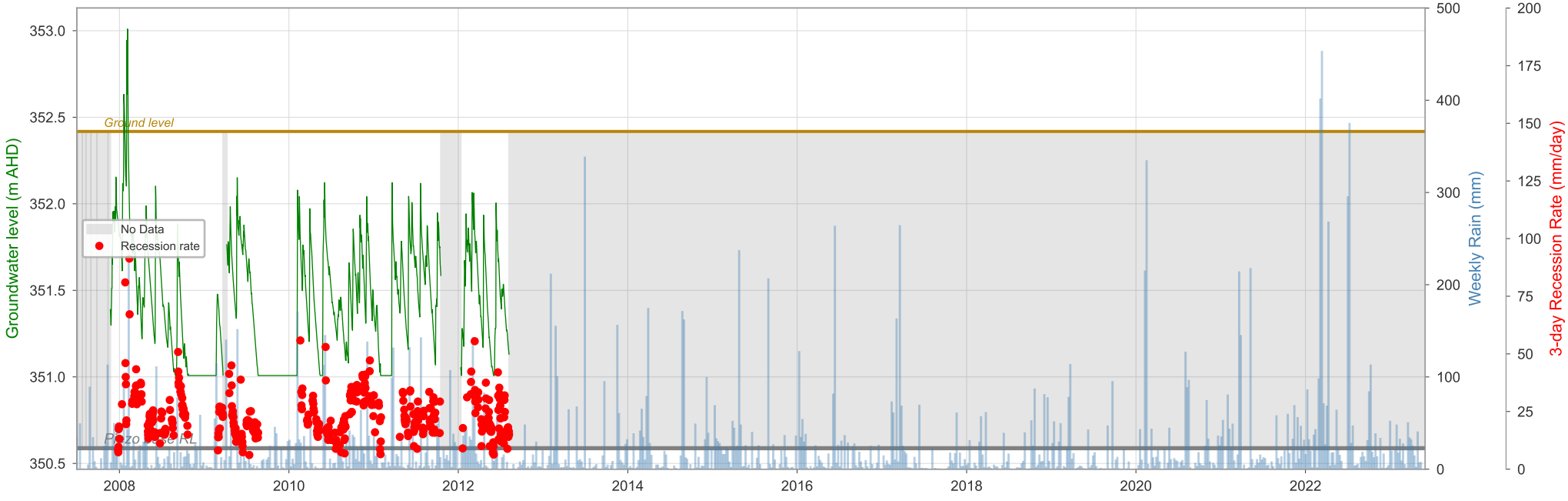

Dendrobium Swamp 36: Piezometer H1 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
No Data
Recession rate
432.6
432.4
432.2
432.0
431.8
431.6
431.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

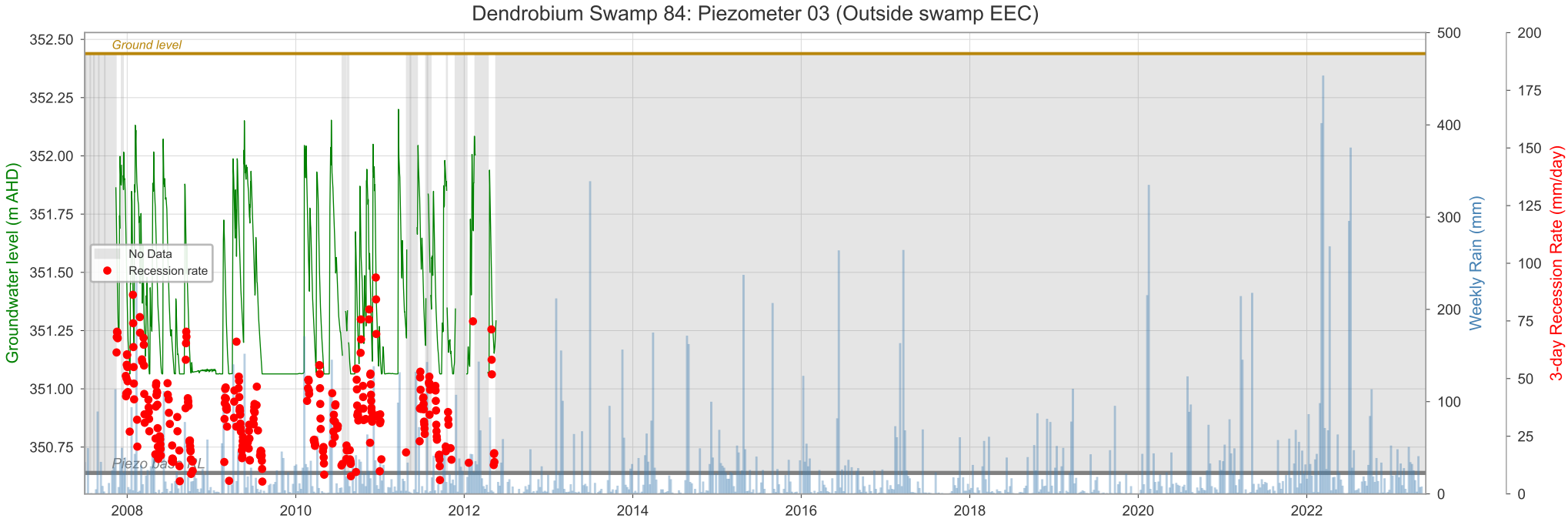

Dendrobium Swamp 36: Piezometer H2 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
No Data
Recession rate
423.3
423.2
423.1
423.0
422.9
422.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

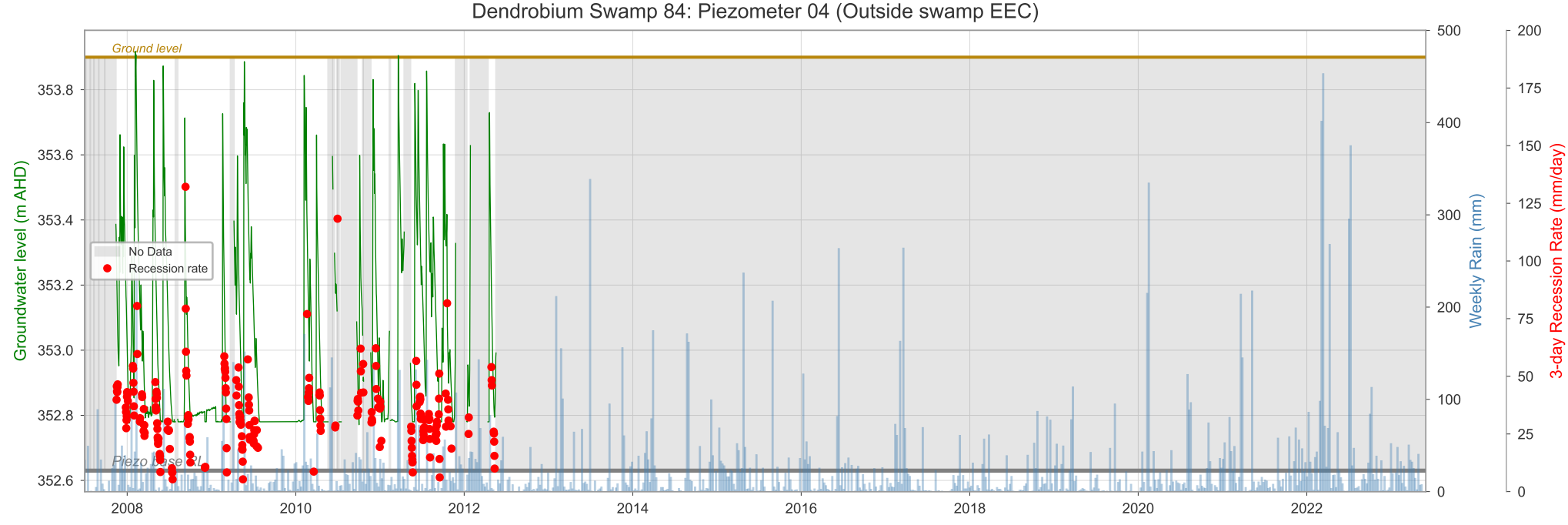

Dendrobium Swamp 36: Piezometer H3 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
No Data
Recession rate
404.6
404.4
404.2
404.0
403.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2004
2006
2008
2010
2012
2014
2016
2018
2020
2022

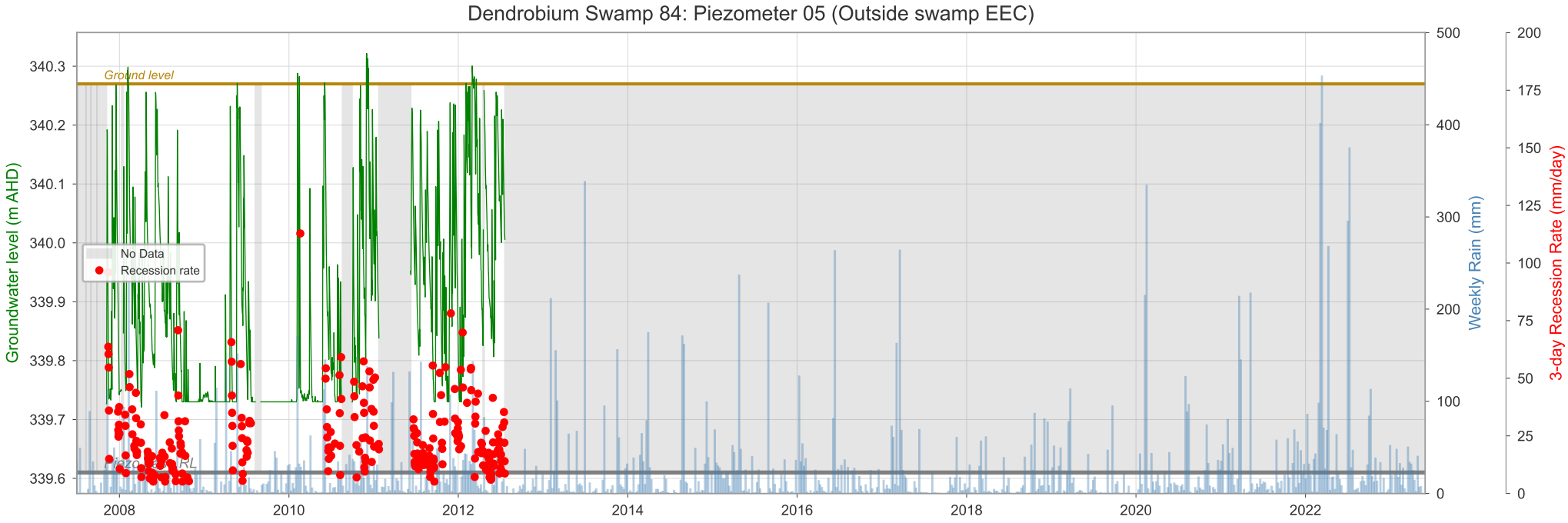

Dendrobium Swamp 84: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
No Data
Recession rate
348.75
348.50
348.25
348.00
347.75
347.50
347.25
347.00
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

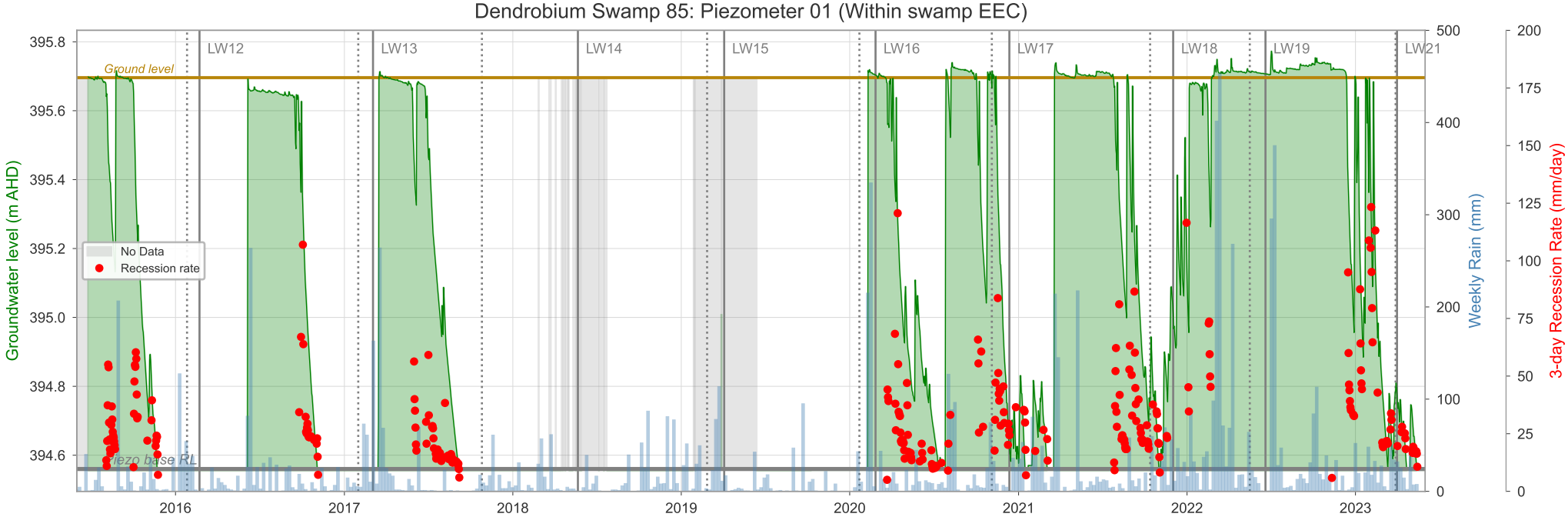

Dendrobium Swamp 84: Piezometer 01A (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
367.6
367.4
367.2
367.0
366.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

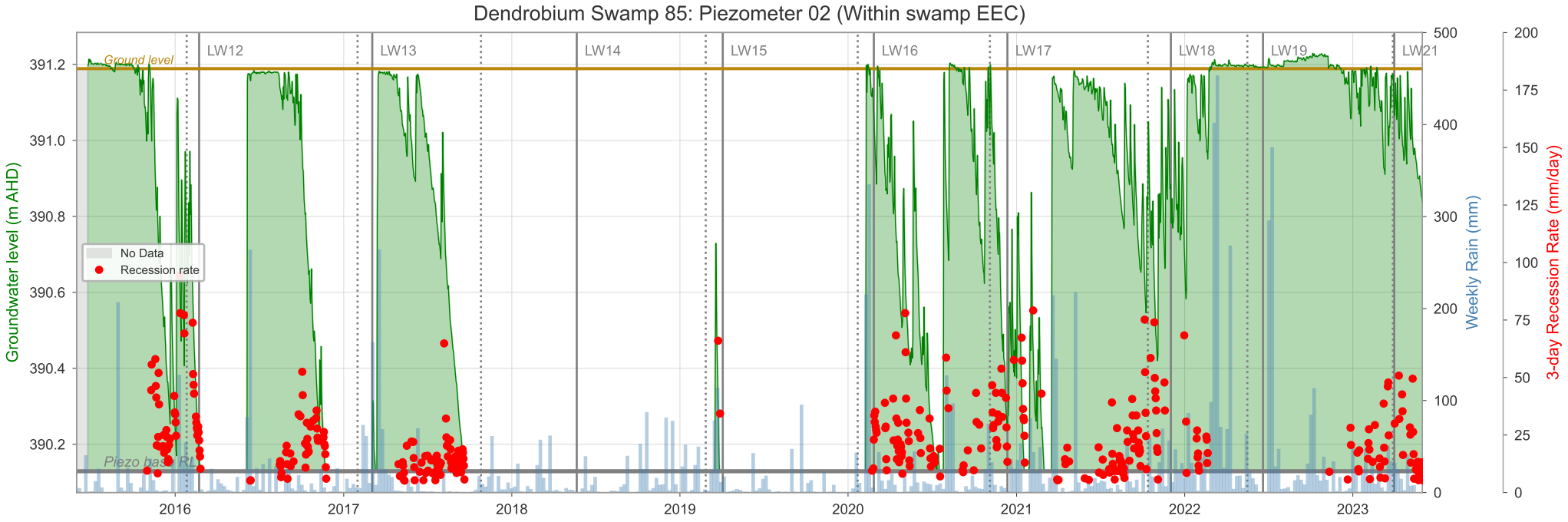

Dendrobium Swamp 84: Piezometer 02 (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
353.0
352.5
352.0
351.5
351.0
350.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

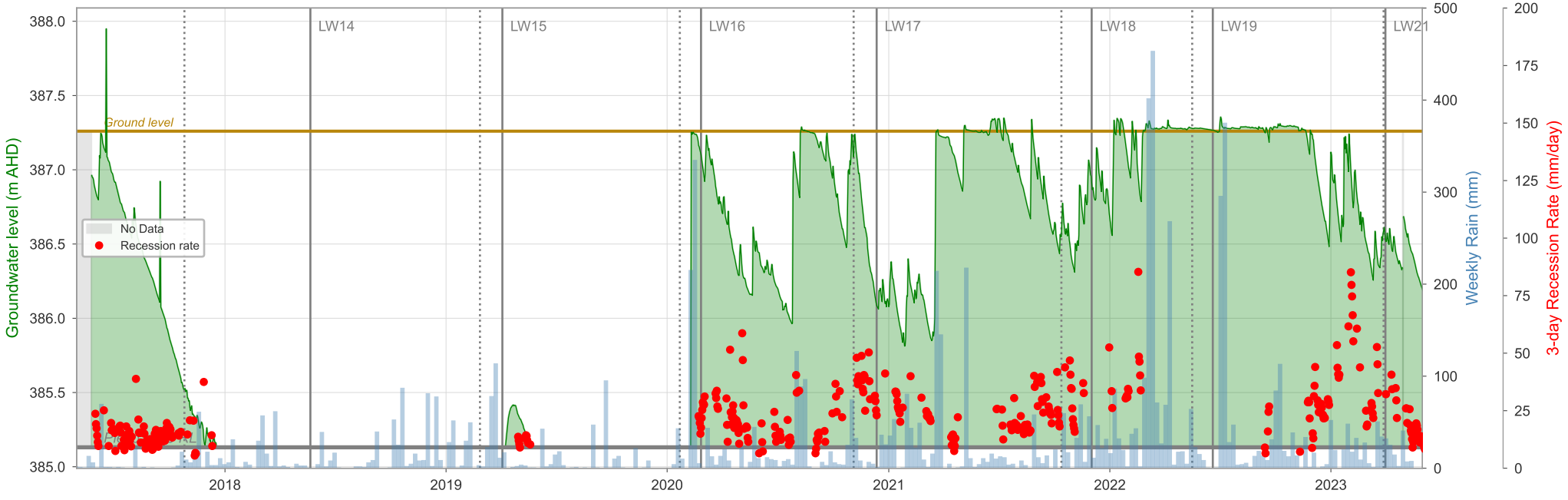

Dendrobium Swamp 84: Piezometer 03 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
352.50
352.25
352.00
351.75
351.50
351.25
351.00
350.75
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

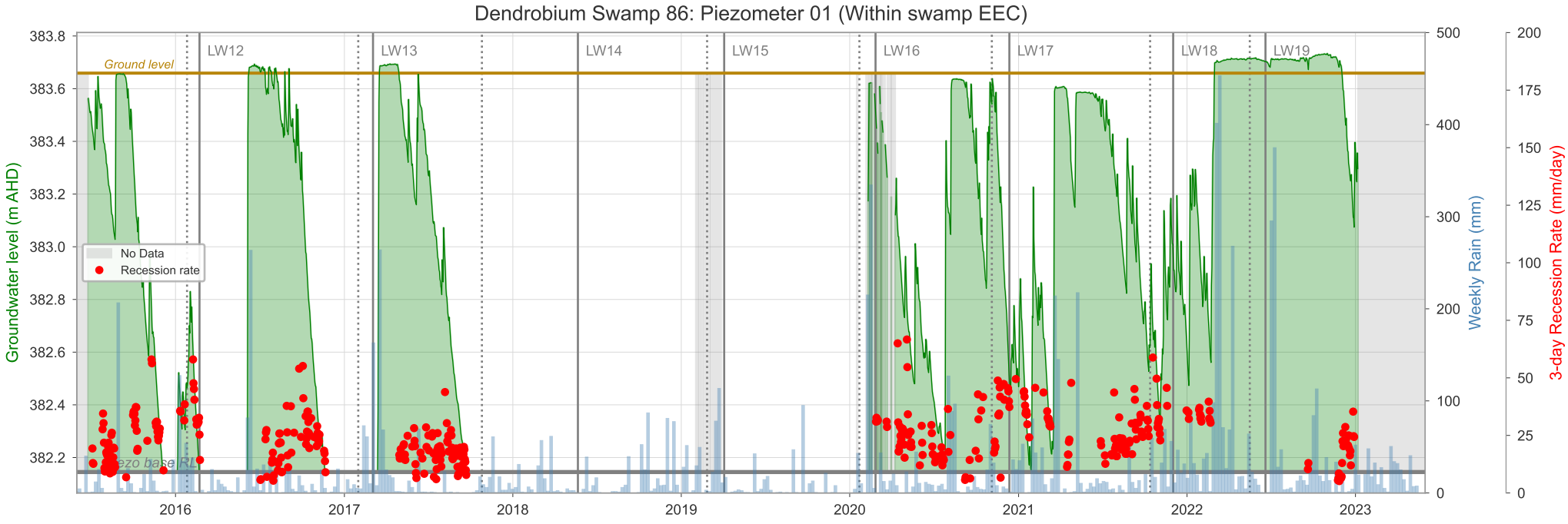

Dendrobium Swamp 84: Piezometer 04 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
353.8
353.6
353.4
353.2
353.0
352.8
352.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

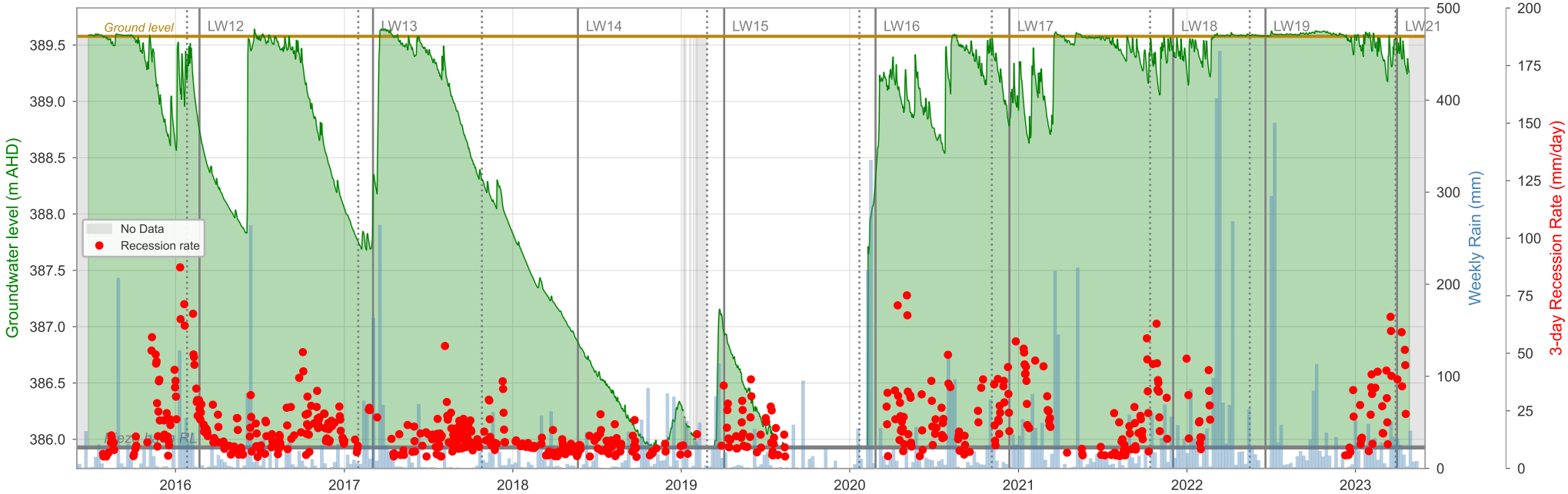

Dendrobium Swamp 84: Piezometer 05 (Outside swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
340.3
340.2
340.1
340.0
339.9
339.8
339.7
339.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

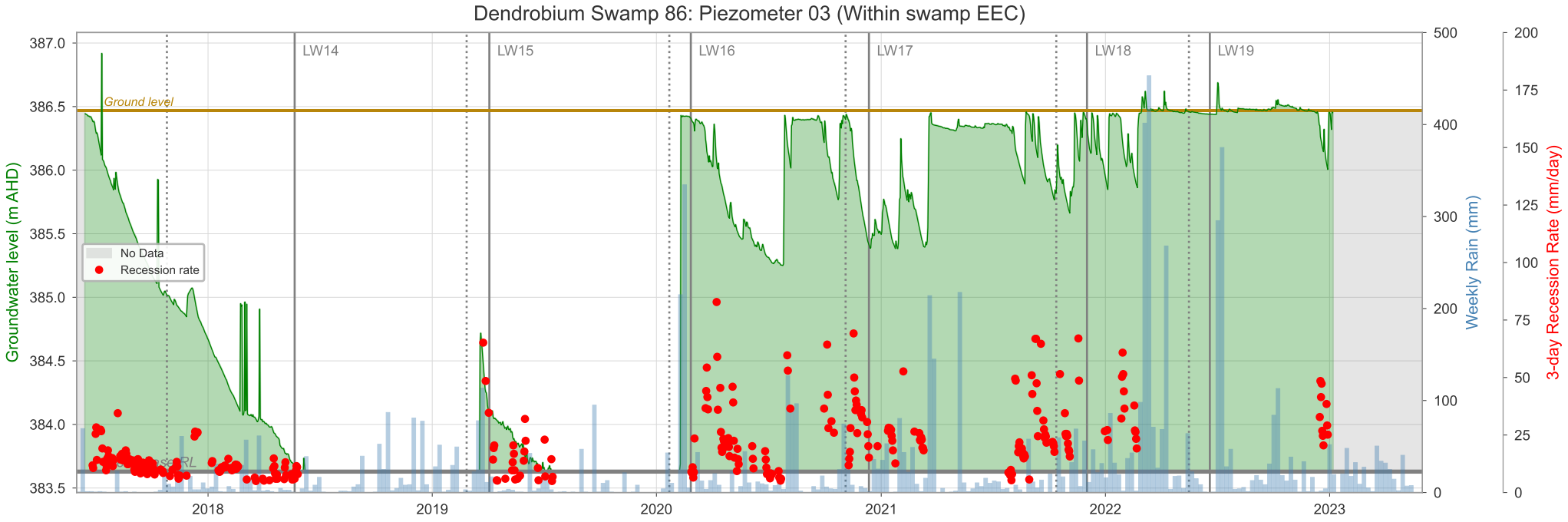

Dendrobium Swamp 85: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
Piezo base RL
No Data
Recession rate
395.8
395.6
395.4
395.2
395.0
394.8
394.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

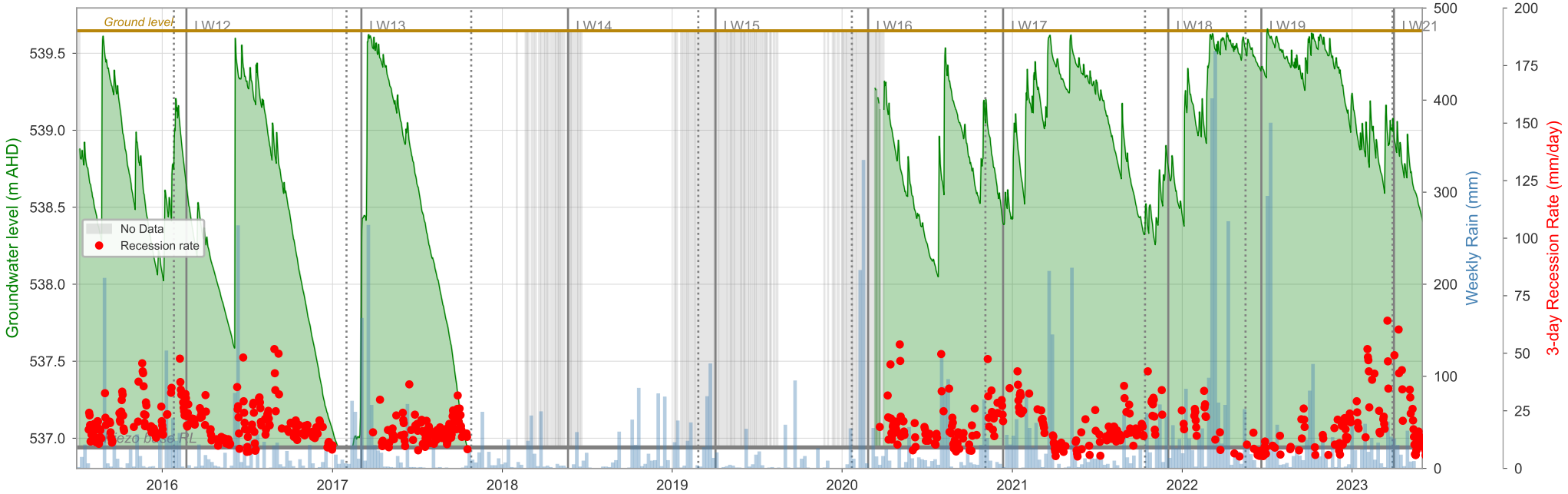

Dendrobium Swamp 85: Piezometer 02 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
391.2
391.0
390.8
390.6
390.4
390.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

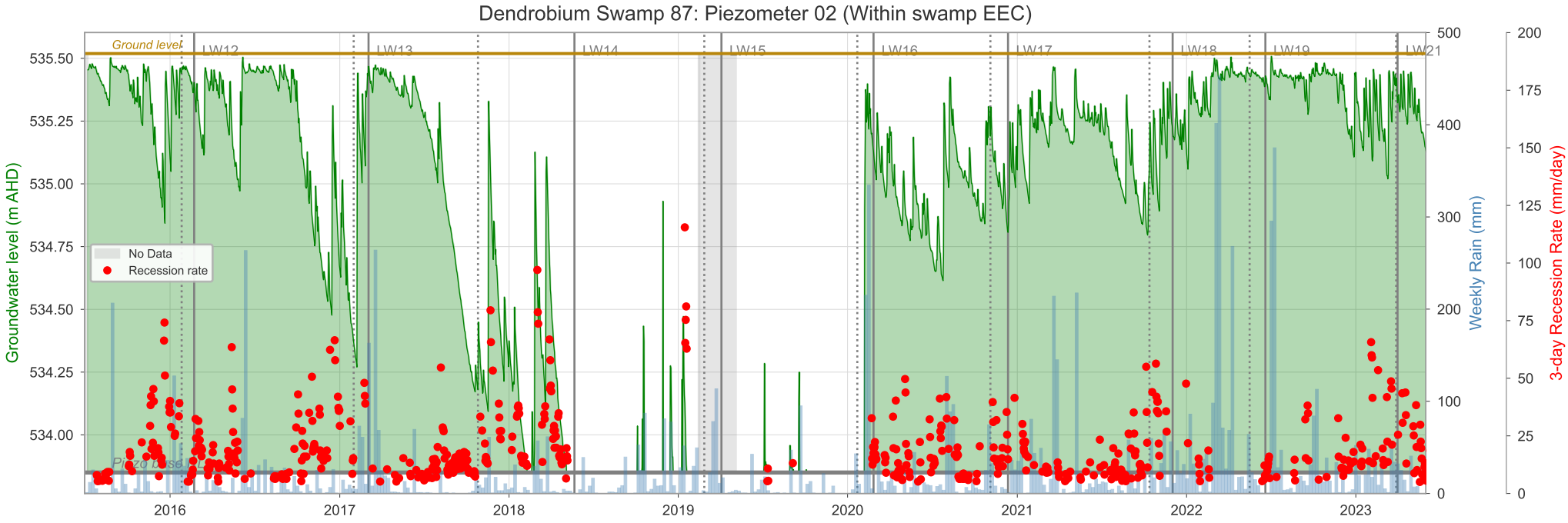

Dendrobium Swamp 85: Piezometer 03 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
No Data
Recession rate
LW14
LW15
LW16
LW17
LW18
LW19
LW21
388.0
387.5
387.0
386.5
386.0
385.5
385.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2018
2019
2020
2021
2022
2023

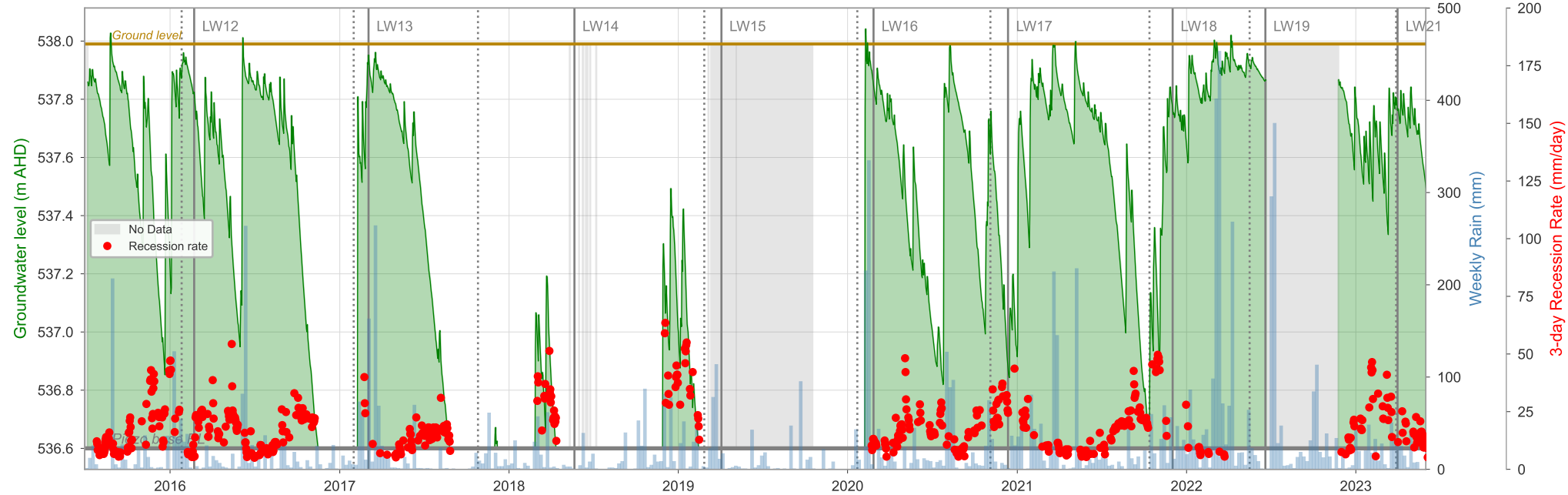

Dendrobium Swamp 86: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
383.8
383.6
383.4
383.2
383.0
382.8
382.6
382.4
382.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

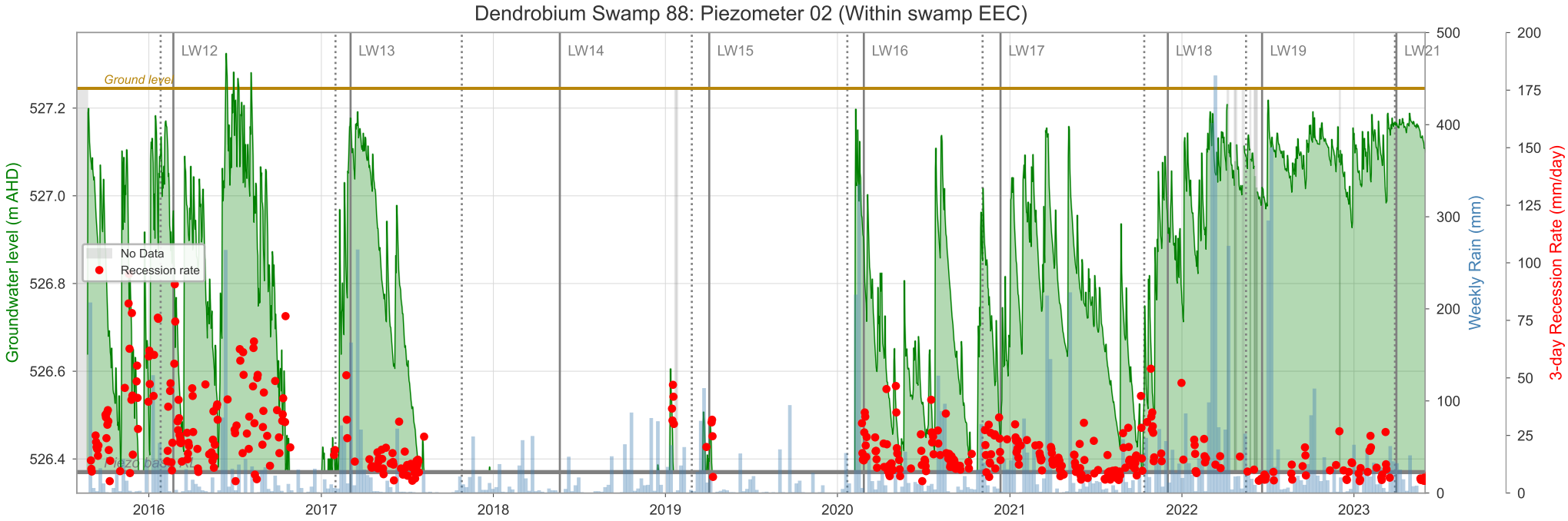

Dendrobium Swamp 86: Piezometer 02 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
389.5
389.0
388.5
388.0
387.5
387.0
386.5
386.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

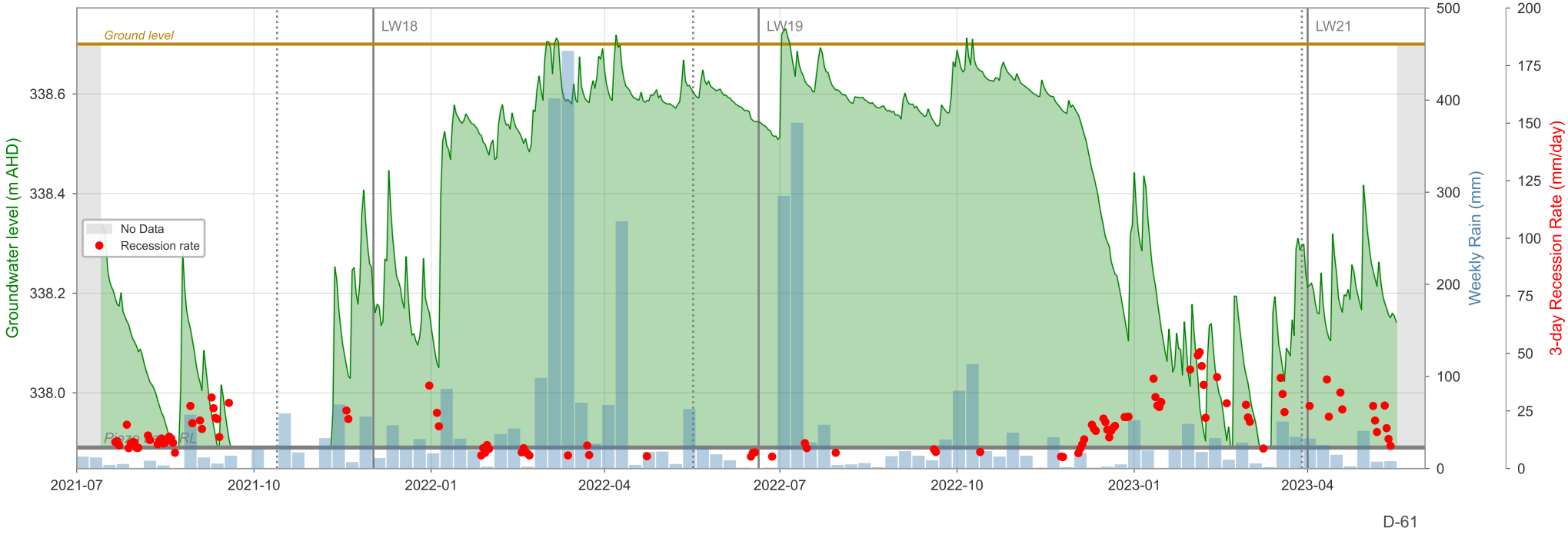

Dendrobium Swamp 86: Piezometer 03 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW14
LW15
LW16
LW17
LW18
LW19
387.0
386.5
386.0
385.5
385.0
384.5
384.0
383.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2018
2019
2020
2021
2022
2023

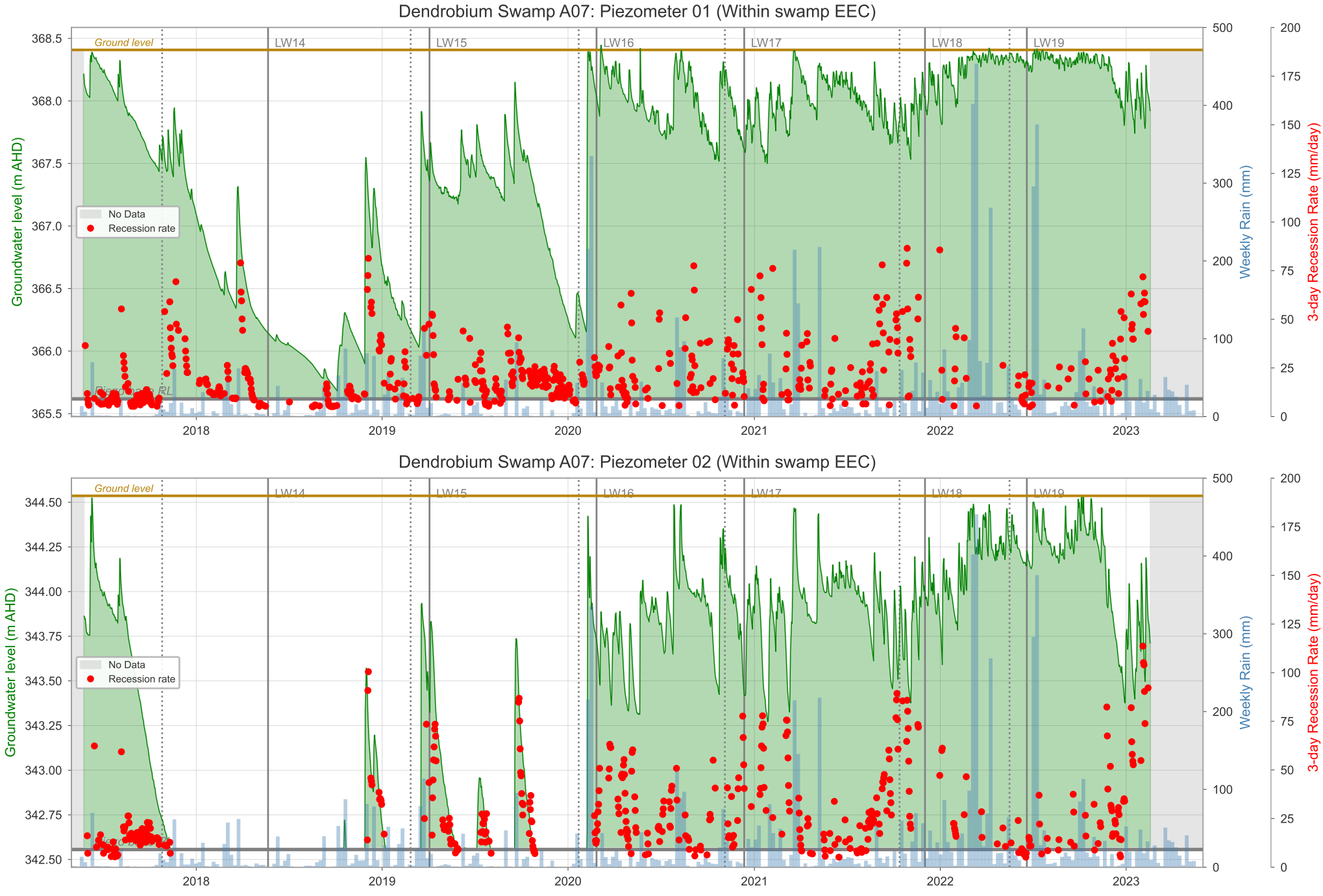

Dendrobium Swamp 87: Piezometer 01 (Within swamp EEC)
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
Ground level
Piezo base RL
No Data
Recession rate
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
539.5
539.0
538.5
538.0
537.5
537.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

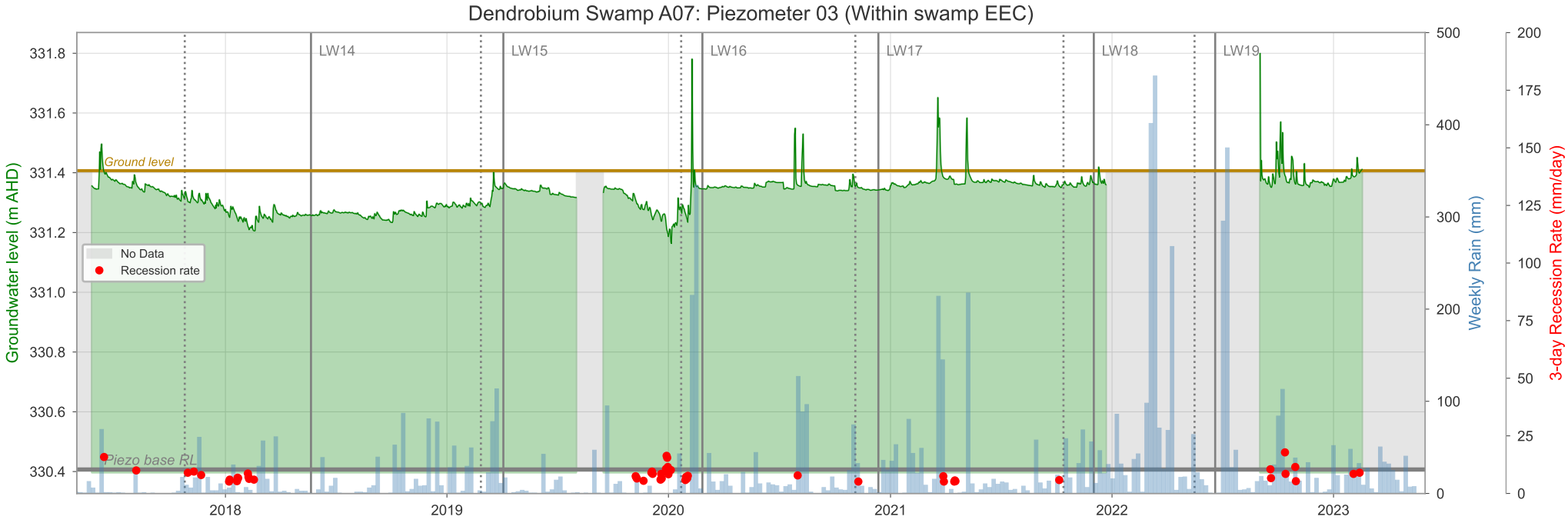

Dendrobium Swamp 87: Piezometer 02 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
535.50
535.25
535.00
534.75
534.50
534.25
534.00
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

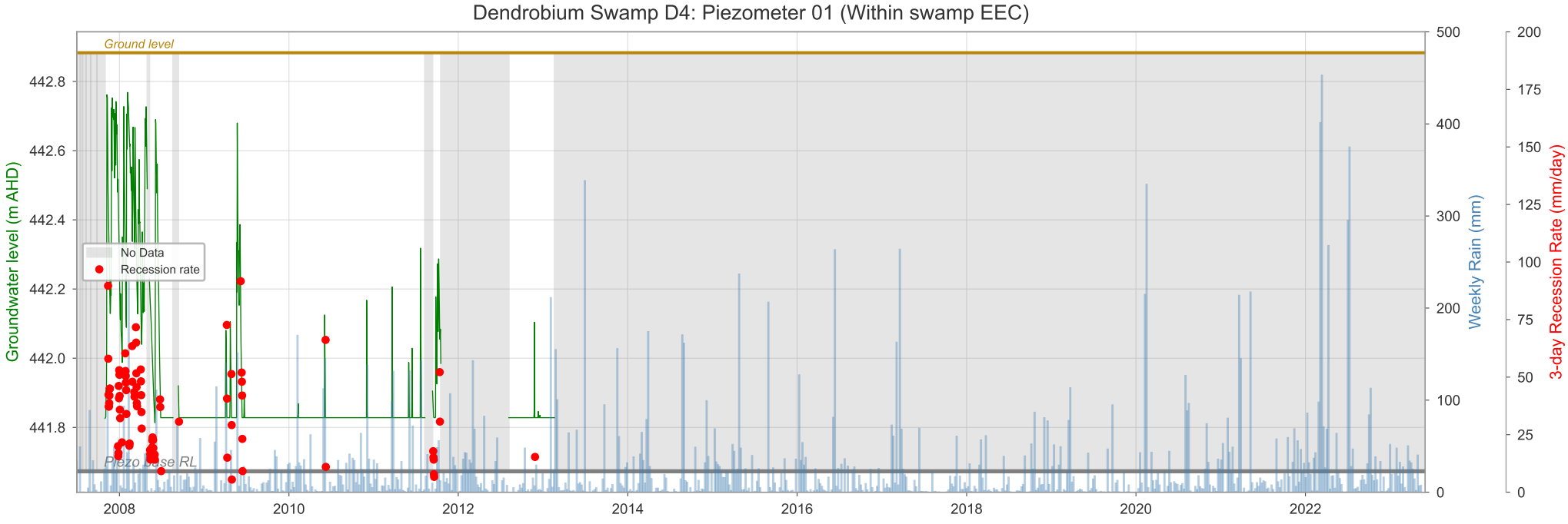

Dendrobium Swamp 88: Piezometer 01 (Within swamp EEC)
Ground level
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
538.0
537.8
537.6
537.4
537.2
537.0
536.8
536.6
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2016
2017
2018
2019
2020
2021
2022
2023

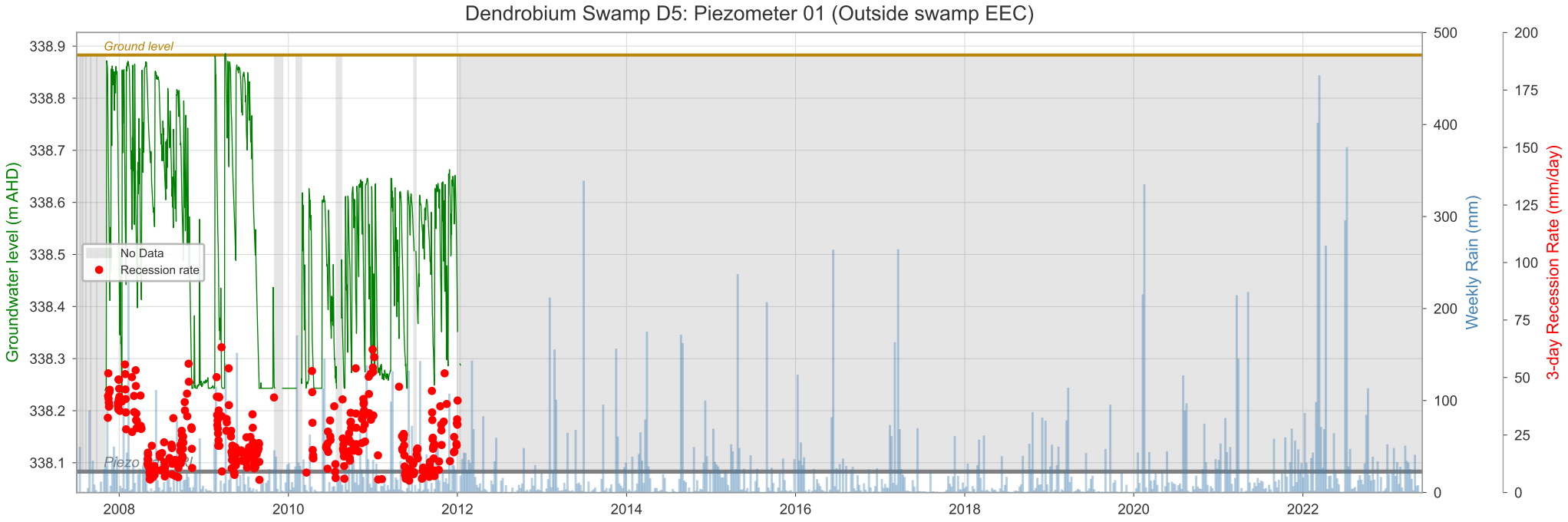

Dendrobium Swamp 88: Piezometer 02 (Within swamp EEC)
LW12
LW13
LW14
LW15
LW16
LW17
LW18
LW19
LW21
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
527.2
527.0
526.8
526.6
526.4
2016
2017
2018
2019
2020
2021
2022
2023
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0

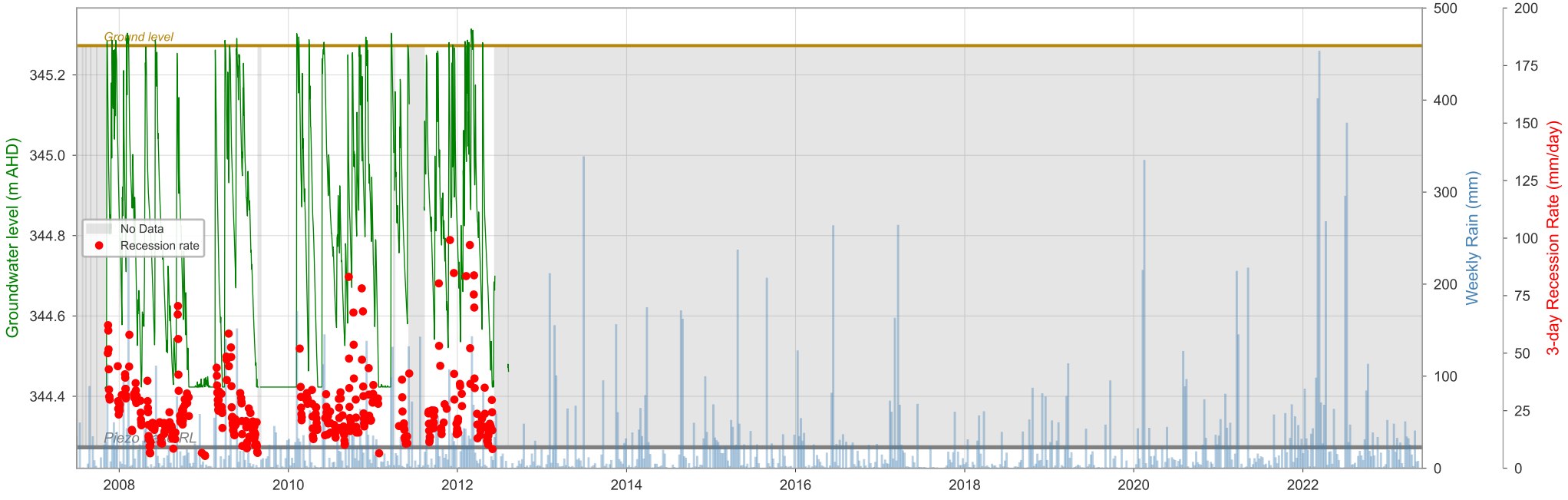

Dendrobium Swamp 95: Piezometer 01 (Within swamp EEC)
LW18
LW19
LW21
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
338.6
338.4
338.2
338.0
2021-07
2021-10
2022-01
2022-04
2022-07
2022-10
2023-01
2023-04
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0

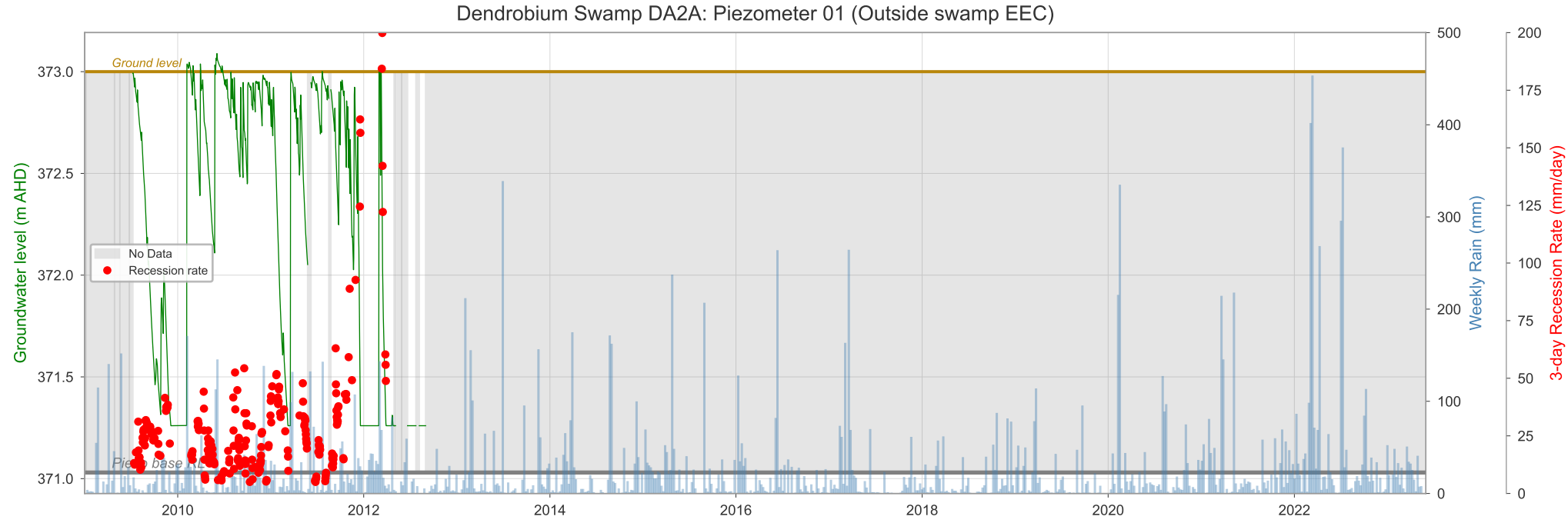

Dendrobium Swamp A07: Piezometer 01 (Within swamp EEC)
Ground level
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
368.5
368.0
367.5
367.0
366.5
366.0
365.5
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2018
2019
2020
2021
2022
2023
Dendrobium Swamp A07: Piezometer 02 (Within swamp EEC)
Ground level
LW14
LW15
LW16
LW17
LW18
LW19
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
344.50
344.25
344.00
343.75
343.50
343.25
343.00
342.75
342.50
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2018
2019
2020
2021
2022
2023

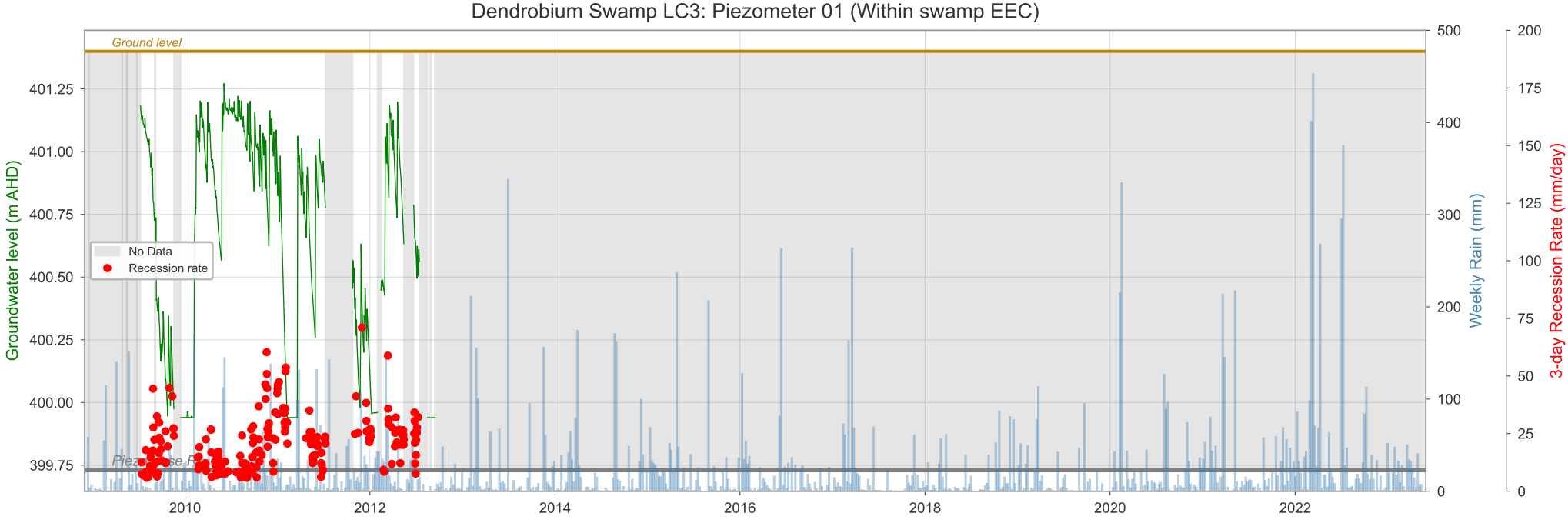

Dendrobium Swamp A07: Piezometer 03 (Within swamp EEC)
LW14
LW15
LW16
LW17
LW18
LW19
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
331.8
331.6
331.4
331.2
331.0
330.8
330.6
330.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2018
2019
2020
2021
2022
2023

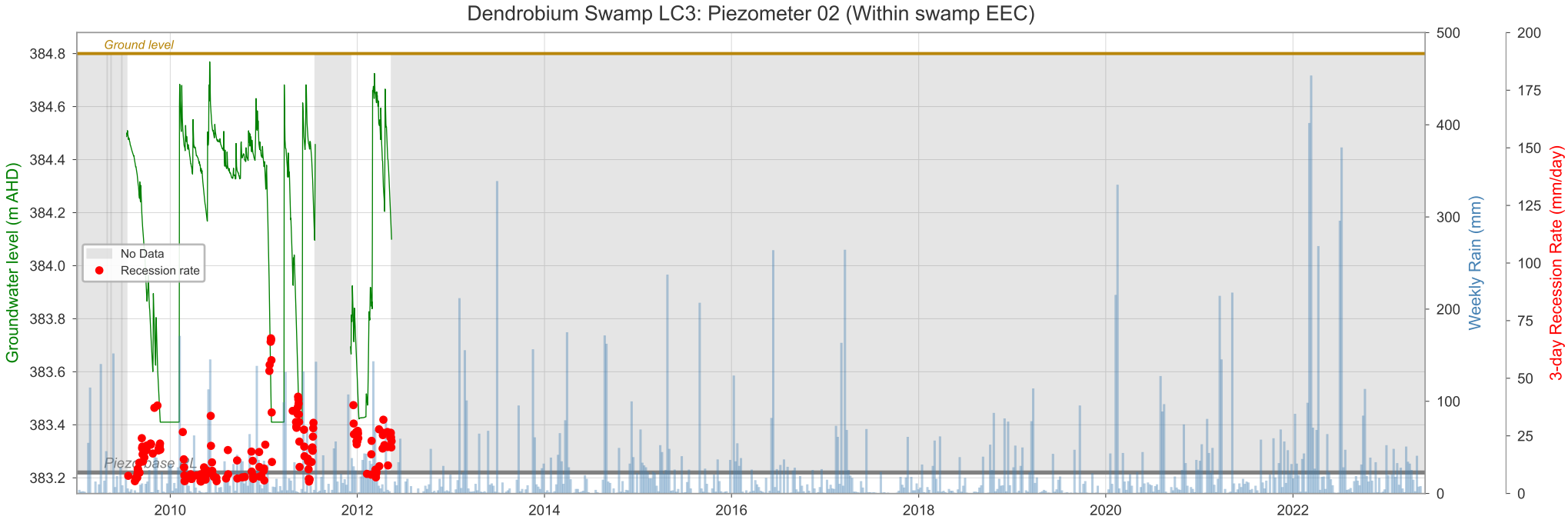

Dendrobium Swamp D4: Piezometer 01 (Within swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
442.8
442.6
442.4
442.2
442.0
441.8
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

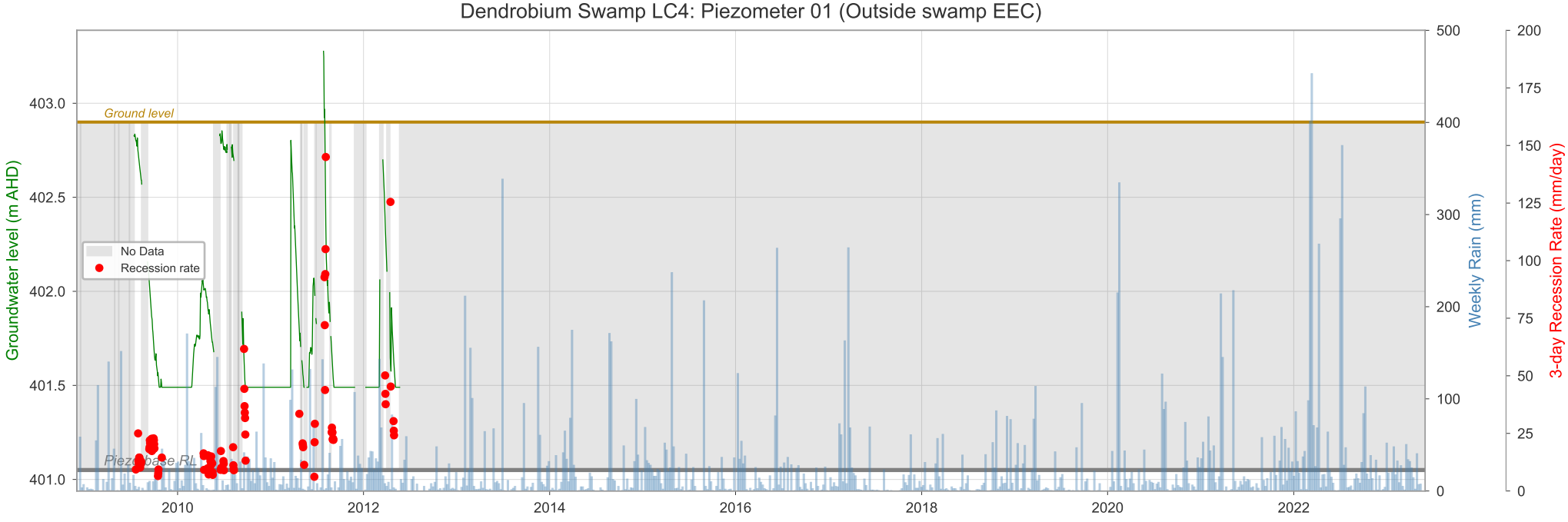

Dendrobium Swamp D5: Piezometer 01 (Outside swamp EEC)
Ground level
Piezo TOC RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
338.9
338.8
338.7
338.6
338.5
338.4
338.3
338.2
338.1
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

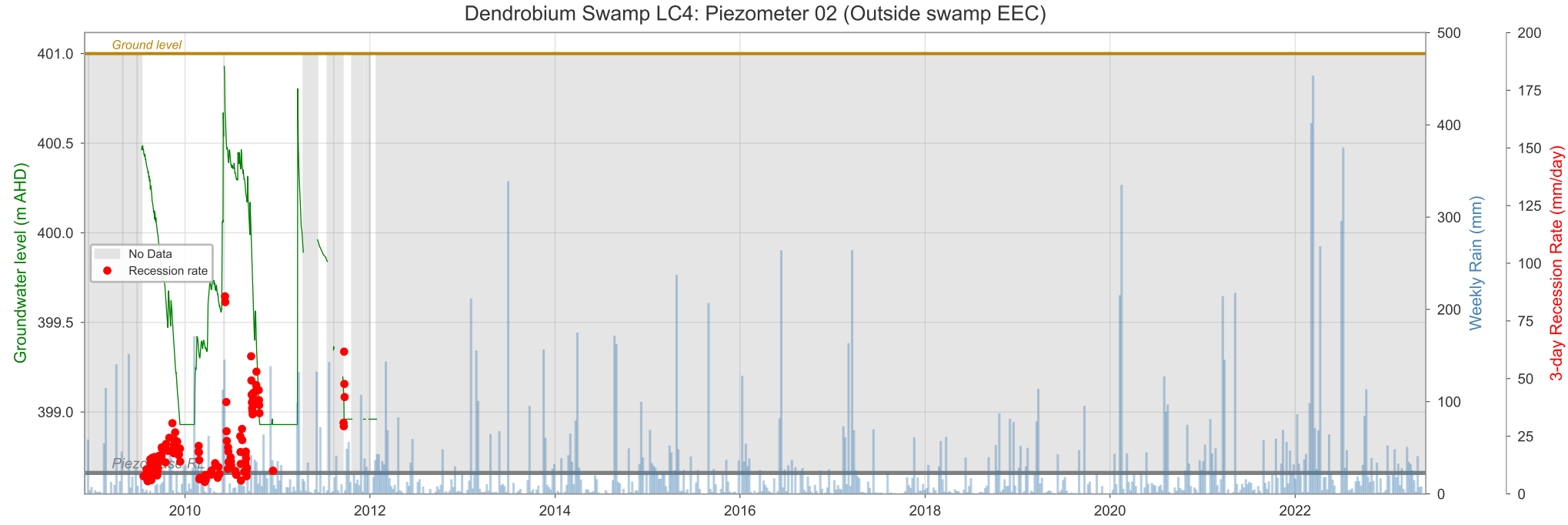

Dendrobium Swamp D5: Piezometer 02 (Outside swamp EEC)
Ground level
Piezo TOC RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
345.2
345.0
344.8
344.6
344.4
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2008
2010
2012
2014
2016
2018
2020
2022

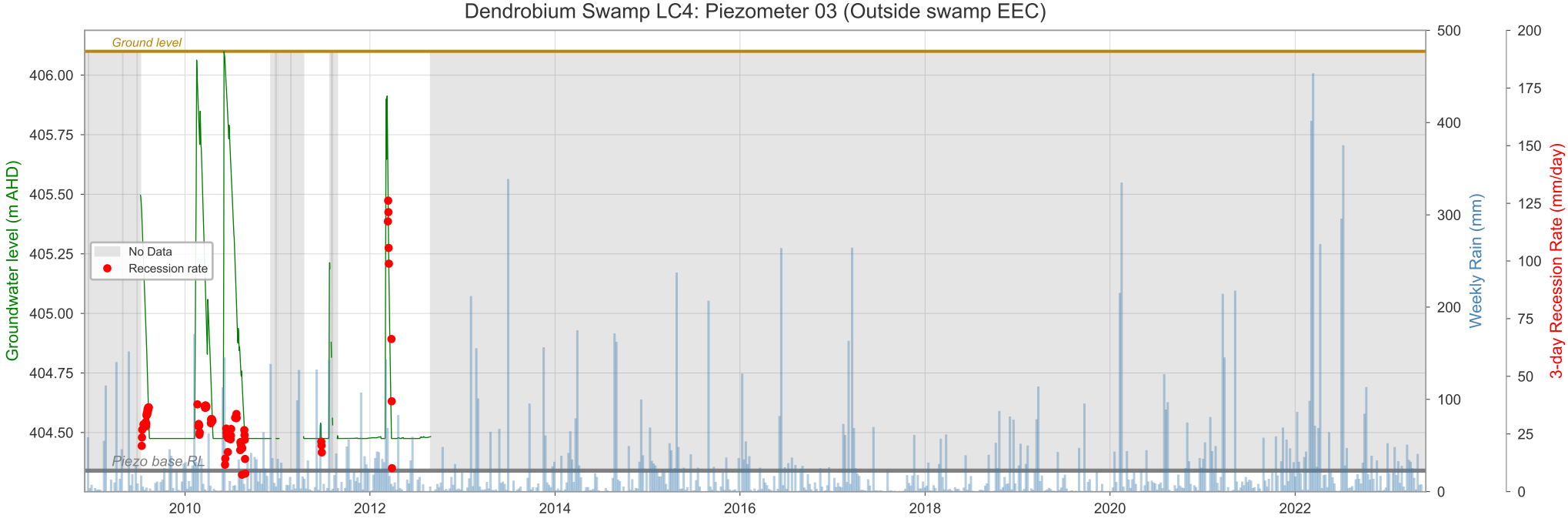

Dendrobium Swamp DA2A: Piezometer 01 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
373.0
372.5
372.0
371.5
371.0
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022

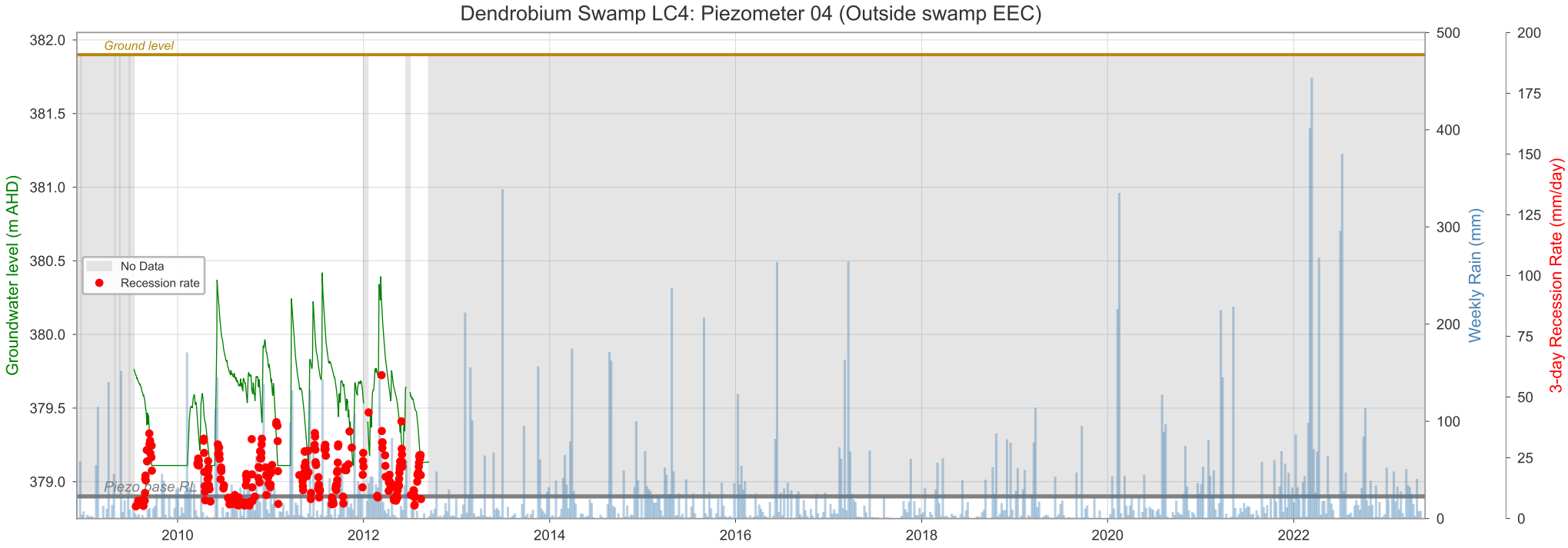

Dendrobium Swamp LC3: Piezometer 01 (Within swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
401.25
401.00
400.75
400.50
400.25
400.00
399.75
Weekly Rain (mm)
500
400
300
200
100
0
3-day Recession Rate (mm/day)
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022


Dendrobium Swamp LC3: Piezometer 02 (Within swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
384.8
384.6
384.4
384.2
384.0
383.8
383.6
383.4
383.2
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022


Dendrobium Swamp LC4: Piezometer 01 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
403.0
402.5
402.0
401.5
401.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022


Dendrobium Swamp LC4: Piezometer 02 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
401.0
400.5
400.0
399.5
399.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022


Dendrobium Swamp LC4: Piezometer 03 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
406.00
405.75
405.50
405.25
405.00
404.75
404.50
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022


Dendrobium Swamp LC4: Piezometer 04 (Outside swamp EEC)
Ground level
Piezo base RL
No Data
Recession rate
Groundwater level (m AHD)
Weekly Rain (mm)
3-day Recession Rate (mm/day)
382.0
381.5
381.0
380.5
380.0
379.5
379.0
500
400
300
200
100
0
200
175
150
125
100
75
50
25
0
2010
2012
2014
2016
2018
2020
2022