Proposed Burlington Quarry Expansion
JART COMMENT SUMMARY TABLE – Surface Water

Please accept the following as feedback from the Burlington Quarry Joint Agency Review Team (JART). Fully addressing each comment below will help expedite the potential for resolutions of the consolidated JART objections and individual agency objections. **Additional, new comments may be provided once a response has been prepared to the comments raised below and additional information provided**.

	JART Comments (February 2021)	Reference	Source of Comment	Applicant Response (July 2021)	JART Response
Report/Date: Surface Water Assessment, April 2020			**Author: Tatham Engineering**		
1.	Lacking details on groundwater monitor construction in or near surface water features. No monitor details or borehole logs in Appendices. Subsequent drive point information has been provided with no information on the soil units encountered.	General	Norbert M. Woerns	The groundwater monitoring wells and mini-piezometers near each surface water feature are identified in the Watercourse and Wetland Characterization Tables enclosed as Schedule B and Schedule C of this submission. Appendix A: Hydrogeological Field Investigations of the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report (Earthfx, April 2020) includes further details regarding the groundwater monitoring wells and mini-piezometers.	
2.	Only five wetlands of the 22 wetlands in the vicinity were instrumented with piezometers to assess vertical hydraulic gradients for water budget purposes. Water budget conclusions regarding the wetlands that have not been instrumented by Tatham therefore cannot be verified against measured data.	General	Norbert M. Woerns	The key larger wetlands were instrumented. Matching the dynamics of these features with the integrated surface and groundwater model gave us confidence in our ability to represent the remaining wetlands correctly. The models considered key components of the water budget including, precipitation, canopy interception, overland runoff into and out of the wetlands, ET, infiltration, interflow, groundwater recharge, streamflow in and out of the riparian wetlands, groundwater interaction with the streams, and groundwater interaction with the perennially ponded areas. Detailed water budgets were prepared using simulation period averages of all PRMS and MODFLOW inflows and outflows. The flows were averaged over all cells falling within the polygons defined by the wetland area. The purpose was to compare the flow terms under each scenario to see how they change and re-balance under the different conditions. Quantitative model comparisons were made against observed shallow groundwater levels and ponded water levels. Simulated values of soil moisture were compared against these observations to determine how well the model approximated hydroperiod. It needs to be kept in mind that the simulation compares proposed conditions to existing to evaluate any potential adverse impacts caused by the proposal.	
3.	Nelson Quarry obtained ECA from MECP in June 2017 that permits collection, transmission, treatment and off-site disposal of surface water and quarry water. Will	General	City of Burlington	The current PTTW and ECA will have to be amended for the proposed south and west	

	the current PTTW and the ECA revised if the quarry expansions extend southward and westward?			extensions, specifically for the new water taking and discharge from the south extension and discharge into the wetlands associated with the west extension.	
4.	What is the rate at which Quarry Sump 0100 pumps water to the Colling Road roadside ditch? Will this rate be altered under the future conditions? If so, the conveyance features along Colling Road should be assessed for capacity and erosion potential.	General	City of Burlington	The current PTTW allows a maximum discharge rate of 4,090 L/min (~68 L/s) from Sump 0100 into the roadside ditch along Colling Road. There are currently no plans to increase this discharge rate.	
5.	Similarly, will the pumping rate of Quarry Sump 0200 be maintained in compliance with the ECA? Is there an intention to apply for an amendment of the ECA which was issued in 2017?	General	City of Burlington	The current PTTW allows a maximum discharge rate of 945 L/min (~16 L/s) from Sump 0200 into the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. The PTTW and ECA will have to be amended as described under response to Comment 3. However, there are currently no plans to increase the discharge rate from Sump 0200.	
6.	Did Nelson Quarry encounter a spill incident during any of the effluent monitoring periods?	General	City of Burlington	Minor spills have occurred on-site and they have been addressed through the Quarry's Spills Management Plan. The MECP has been notified of all spills. The water quality sampling program completed under the ECA confirms contaminants from the minor spills have not entered the on-site settling ponds or been discharged off-site.	
7.	The surface water monitoring program has been implemented for the last 6 years. Were any of the public agencies (Conservation Halton, Region of Halton or the City of Burlington) involved in equipment installation and the review of the monitoring observations?	General	City of Burlington	The public agencies listed have not been involved in the monitoring program to date. Several of the surface water monitoring stations were installed in support of the PTTW and ECA. The remainder have been installed in support of the proposed expansion. The monitoring locations were selected to provide a comprehensive surface water monitoring network of the Quarry and its surrounding area based on experience on similar projects and considering the results from previous studies/applications.	
8.	What steps did the proponent take to ensure quality of the collected data from the monitoring stations? What QA/QC practices was in place to ensure proper functioning of the monitoring equipment. Were any outliers encountered?	General	City of Burlington	Monthly field visits are conducted to each monitoring station to collect in-situ calibration data (water depths, temperatures, flow rates) and confirm the monitoring devices are functioning properly. The continuous monitoring data collected by the data loggers at each monitoring station is adjusted to the monthly in-situ calibration data collected to ensure the data matches field observations. Over the course of the monitoring program, data loggers have malfunctioned, and the loggers were repaired or replaced as expediently as possible to ensure data loss is minimized.	
9.	The Burlington Springs Golf and Country Club has constructed a weir structure which maintains water levels in the wetland, maintains flow downstream to a tributary of Willoughby Creek and diverts flow to a series of constructed irrigation ponds on the golf course via a diversion channel. Will this weir continue to exist under the future conditions or will its function be replicated through another structure?	General	City of Burlington	It is the intent to utilize the existing weir structure and the stop logs employed by the Burlington Springs Golf and Country Club to maintain water levels in the upstream wetland and divert a	

				portion of the quarry discharge to the proposed infiltration pond.	
10.	Could not locate monitoring station SW11A, SW12A, SW13A and SW16A on the drawings. Please make sure the monitoring station names are consistent in the report and the drawings.	General	City of Burlington	The Existing and Proposed Surface Water Monitoring Locations Plans (Drawings SW-1 and SW-2) have been revised accordingly and are enclosed for reference. Its noted, the wetland hydroperiod and shallow groundwater monitoring stations are located at the same location. As such, we have not differentiated between the wetland hydroperiod and shallow groundwater monitoring stations on the plan. The wetland hydroperiod and shallow groundwater monitoring stations are identified as SW5, SW11, SW12, SW13, SW16, SW36, SW37 and SW38 on the revised drawings.	
11.	An assessment of the existing roadside ditches will be required to confirm enough capacity, or the existence of potential capacity to carry flow during design events.	General	City of Burlington	An assessment of the existing roadside ditches downstream of the discharge locations is enclosed for reference. The assessment confirms the roadside ditches have adequate capacity to convey the proposed flows.	
12.	Will the new conveyance system which will carry external flows, and which will be located within Nelson property, replace the existing drainage channel that runs roughly parallel to Colling Road within the quarry?	General	City of Burlington	The proposed Colling Road diversion will not replace the existing drainage channel within the Quarry. The existing drainage channel will remain.	
13.	There are several drainage features within the existing quarry. Will those features undergo any changes and realignments after the extraction operations cease?	General	City of Burlington	Yes, some of the current drainage features will be modified as part of the proposed rehabilitation plan for the existing quarry. The proposed site amendment for the existing quarry rehabilitation plan has been provided to the agencies under separate cover. Tatham assisted with the water management components of the rehabilitation design for the existing quarry and proposed extension.	
14.	Will the proposed new conveyance system along Colling Road only carry flow from S100 (84.0 hectares) or will the catchments S113 through S116 (a total of 58.0 hectares) also drain into the new conveyance feature.	General	City of Burlington	The proposed Colling Road diversion will convey surface runoff from Catchment S100 and Colling Road only. The surface runoff from Catchments S113 through S116 currently drain onto the existing quarry floor and will continue to do so if the Colling Road diversion is constructed.	
15.	Will the proposed conveyance system along Colling Road only carry minor flows? How are the major flows proposed to be managed?	General	City of Burlington	The proposed Colling Road diversion will be designed to convey both minor and major flows from Catchment S100 and Colling Road.	
16.	In which direction does catchment S102 drain from the Colling Road and Cedar Springs Road intersection. Does it flow north along Cedar Springs Road towards tributary of Willoughby Creek or does it flow east directly towards Willoughby Creek?	General	City of Burlington	We reviewed the existing drainage patterns at the intersection of Colling Road and Cedar Springs Road and believe surface runoff from Catchment S102 drains north along Cedar Springs Road to the Unnamed Tributary of Willoughby Creek.	
17.	Is the Wetland 13201 a natural feature or has it formed as a result of the obstructed culvert? Does this wetland feature provide any critical hydrologic function?	General	City of Burlington	It is unknown if Wetland 13201 is a natural feature or if it has been formed by the obstruction of the No. 2 Sideroad culvert. Wetland 13201 is not believed to provide a significant hydrologic function.	

18.	Thank you for confirming that the existing drainage patterns within Burlington will remain unchanged even if the quarry expands west and south.	General	City of Burlington	No response required.	
19.	Will there be operations and maintenance staff to monitor quarry sumps after the extraction operations cease at Burlington quarry?	General	City of Burlington	Operation and maintenance will be the responsibility of the new owners of the property and they will be required to comply with the instruments under the Ontario Water Resources Act.	
20.	Will the discharge from the two expansions follow the existing PTTW or is there a proposal to apply and obtain a separate PTTW and ECA.	General	City of Burlington	Refer to response to Comment 3.	
21.	City requests to be circulated on any proposed changes to the configurations of the existing settling ponds.	General	City of Burlington	Understood.	
22.	Please provide existing and proposed conditions Visual OTTHYMO 6 hydrologic model schematic.	General	City of Burlington	Existing and proposed VO6 model schematics are enclosed for reference.	
23.	Extraction in the west extension will reduce the size of sub-catchment draining to wetlands as well as those draining to the municipal drainage systems. This indicates that the drainage will be redistributed during the post development conditions. Please confirm that the extra, redirected flow will be retained in the reconfigured pond and will not result in an increase of flow in a different direction.	General	City of Burlington	The west extension will redistribute the surface runoff draining to the wetlands and municipal drainage systems. The redistributed surface runoff will drain internally to the Quarry's settling ponds where it will be stored and discharged off-site in accordance with the terms and conditions of the PTTW and ECA. As such, the flows draining off-site will not increase under proposed conditions (during operations and post rehabilitation).	
24.	It is recommended that the proponent take another look at the proposed rehabilitation plan towards the end of the extraction operation and to make any modifications to the rehabilitation plan to accommodate any hydrologic changes encountered during the extraction period.	General	City of Burlington	The design of the rehabilitated landform needs to be completed now since progressive rehabilitation is required during operations and the work includes significant grading. Mitigation, monitoring and annual reporting of hydrologic conditions will be completed throughout the operations and during rehabilitation to prevent adverse impacts to adjacent key hydrologic features. If the pumping regime requires any future adjustments this can be accommodated based on the proposed rehabilitated landform for the existing quarry and proposed extension.	
25.	All studies should be coordinated and integrated. In particular, the findings of the Hydrogeologic and Hydrologic Impact Assessment, Surface Water Assessment and Level 1 and 2 Natural Environment Technical Report should inform each other and should be reviewed for consistency.	General	Conservation Halton	The Watercourse and Wetland Characterization Tables enclosed have been prepared by the project team to assemble the results of the various studies in one location for ease of review.	
26.	Pre-quarry conditions should be described and evaluated, where feasible, to allow for comparison with existing and proposed conditions. The report should address cumulative impacts from quarrying operations and outline where a return to pre-quarry conditions would be preferable to existing conditions from a natural heritage and hazard perspective. Consultation with review agency staff is recommended.	General	Conservation Halton	Evaluating the pre-quarry condition is a difficult proposition recognizing the quarry is not the only change in the watershed over the past 60+ years and little to no data (topographic mapping, land use data, etc.) is available pre-quarry. As such, numerous assumptions would need to be made to model the pre-quarry condition and we question the validity of setting criteria based on assumptions. We also understand that this has not been required for other quarry applications within Conservation Halton's watershed. In the assessment base line conditions were current conditions and this includes impacts from the existing quarry. As part of the impact	

				assessment Tatham considered impacts from the existing quarry and recommended revisions to the existing quarry rehabilitation plan to maintain current hydrologic conditions to benefit the surrounding environment.	
27.	The report should include analysis of pre-golf course/quarry conditions and speak to how the drainage patterns of the area may have been impacted as a result of the existing extraction operation. Part 2.2.1 of the NEP requires the consideration of single, multiple, or successive development that has occurred or is likely to occur. • The report should also clarify language used in reference to the existing water features on the golf course lands. If they are features that contribute to the water balance and hydrological system of the area, a broader analysis of the impact of removing them on key natural and key hydrologic features should be incorporated. Any link to the proposed rehabilitation plan should be focused on protecting or enhancing the function of key hydrologic features including any identified wetlands (Part 2.6.3, 2.7.3, 2.7.6 (d), 2.9.3 (d & e), 2.9.11 (a & b). • If the ponds are considered man-made and their function and impact on the surface/groundwater artificial, a broader analysis of cumulative impacts should be incorporated as this will be the second identifiable time that key hydrologic functions of the golf course lands will have been altered. Coupled with better details on pre-golf course/quarry conditions, this analysis should drive proposed rehabilitation efforts.	General	Niagara Escarpment Commission	Refer to response to Comment 26. Similar to the Quarry, the Burlington Springs Golf and Country Club was constructed in 1962 and little information exists regarding the topography and land use prior to golf course construction. Its noted, the integrated surface and groundwater model provides a detailed analysis of the impact of removing these features on the surrounding key hydrologic features. The Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report (Earthfx, April 2020) provides a detailed description of the integrated surface and groundwater model and the impact assessment completed.	
28.	It is noted that extraction will reduce the drainage area to wetlands 13200 & 13201 but that the area will be supplemented with water pumped from the quarry in order to maintain hydroperiods. • Is this proposed in perpetuity? Will flows to this wetland be protected through the proposed rehabilitation strategy? • NEC Staff would not agree that pumping water into a wetland to maintain its hydroperiod fundamentally protects or enhances the feature. This proposed approach should be sufficiently evaluated by a qualified ecology professional to ascertain any additional mitigation strategies required to maintain the wetlands beyond balancing hydroperiods.	General	Niagara Escarpment Commission	The drainage area to Wetland 13200 will be reinstated as part of rehabilitation of the site and the discharge into this feature will cease post rehabilitation. The proposed discharge to Wetland 13201 will continue in perpetuity as part of the rehabilitation plan for the site.	
29.	Additional details for the ‘replica pond’ along Collings Road are being sought. • How does shifting the current irrigation ponds and implementing a longer diversion channel maintain or enhance the key hydrologic functions of the site? • Mitigation methods suggest that “a portion” of wetland 13200’s drainage area will be reinstated as part of the rehabilitation plan. As part of this it is identified that fill will be imported to raise grade in the area to original ground level. How much fill is required? Why is only ‘a portion’ being reinstated? Is some pumping still going to be required if the drainage area cannot be replicated? • New ‘replica’ ponds should be justified per Part 2.6.7 of the NEP (2017) that requires ponds be designed to avoid key natural and hydrologic features and shall be designed to be offline.	General	Niagara Escarpment Commission	The golf course ponds and diversion channel are not key hydrologic features. They are man-made features constructed to irrigate the golf course. The primary source of water for the diversion channel and golf course ponds is the quarry discharge which is diverted from the weir pond (Wetland 13202) onto the golf course property. The infiltration pond is proposed to mimic existing conditions, specifically the diversion channel and golf course irrigation ponds. The portion of Wetland 13200 drainage area that is removed during extraction will be reinstated as part of the rehabilitation of the site; reinstating the entire drainage area to Wetland 13200. The quantity of fill required to reinstate the drainage area is 305,000 m^3. Once the drainage area is reinstated, pumping from the quarry into the wetland will cease as it is no longer required.	

				The infiltration pond is proposed to mimic existing conditions and will be constructed offline with a passive inlet structure (diversion pipe).	
30.	The surface water assessment establishes surface water drainage conditions across the Burlington Quarry, South Extension, and West Extension lands to assess impacts from the proposed quarry extension and provides context to surface water hydrology and hydrogeology, which is directly linked to fish habitat impacts. This assessment was completed primarily through identification of existing drainage patterns, water balance, and event based hydrologic modelling. There is an overall lack of integration with the surface water report with regards to the 2020 NETR- this is primarily on the basis that the surface water discussion extends beyond the 120.0 metre limit of the extraction footprint.	General	Matrix Solutions Inc.	As noted by the reviewer, it was important to assess the likely changes to the local hydrology and to the groundwater system as a result of the proposed quarry extension because they are directly linked to fish habitat impacts. The purpose of building an integrated surface and groundwater model was to provide a quantitative framework for assessing these impacts in the vicinity of the quarry (which extended well beyond the 120 m limit). The data collection effort was a key part of the study as it provides targets for calibrating the model to ensure it represents current conditions regionally and in the quarry vicinity. Please refer to the Watercourse and Wetland Characterization Tables enclosed as Schedule B and Schedule C with this submission for additional information regarding the surface water impacts on fish and fish habitat.	
31.	The surface water assessment acknowledges Willoughby Creek and West Arm as fish habitat, and that baseflows and water temperature are critical to the form and function of the watercourses from a natural heritage and fish spawning perspective. The proposed condition integrated surface water/groundwater analysis predicts a minor reduction in monthly streamflow due to the lowering of groundwater and suggests maintaining the discharge from the Quarry Sump 0100 to ensure that some reaches of Willoughby Creek does not run dry. Furthermore, it mentions that the predictive water/groundwater model predicts a measurable reduction in flow of the unnamed tributary of Lake Medad during operations and quarrying. For this reason, the surface water assessment report recommends that streamflow and water temperature thresholds be established from historic surface water monitoring completed in support of the proposed quarry extension. The rationale for future management of quarry water as is lacking in critical details such as "how does the hydroperiods function in terms of downstream fisheries". There is also no table or rationale illustrating how the reductions streamflow and lowering of groundwater as predicted by the groundwater models will be offset by pumping operations.	General	Matrix Solutions Inc.	Additional information is provided in the JART NETR response to comments and the Watercourse Characterization Tables enclosed (Schedule C). Pumping is done under current (baseline) conditions to dewater the existing quarry. The water is discharged from the quarry sumps into the Unnamed Tributary of Willoughby Creek and to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Some of the discharge in these streams seep into the underlying aquifer. This practice is proposed to continue as part of the proposed quarry extensions. Streams close to the new excavations will likely experience a decrease in flows while the Unnamed Tributary to Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek will have higher flows and higher losses to groundwater. Determining the like changes in these volumes under the different scenarios was a key objective of the integrated model. The primary source of flow into the Unnamed Tributary of Willoughby Creek and to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek is quarry discharge. As mentioned, the reductions in	

				streamflow are predicted to be minor and quarry discharge is proposed to occur long-term to maintain streamflow in these features. Additional rationale and details regarding off-site discharge will be provided as the AMP is refined in consultation with the agencies moving forward.	
32.	Drainage to the South Extension is anticipated to be reduced in size as open extraction will intercept rainfall, groundwater, and surface runoff. To alleviate the reduced drainage, discharge to the West Arm from the Quarry Sump 0200 is proposed to continue throughout its operations in accordance with Nelson's Permit to Take Water (PTTW) and Environmental Compliance Approval (ECA) that will require an amendment to include the discharge from the south extension. For the West Extension, extraction activities will reduce the size of the sub catchments draining to several of its existing outlets. Extraction and quarry dewatering are predicted to lower groundwater levels surrounding the west extension within 350.0 metres of the extraction face. Similar to the West Arm discharges, discharge to the Colling Road roadside ditch and Willoughby Creek will be maintained from the Quarry Sump 0100 and is proposed to continue throughout the duration of quarry operations in accordance with Nelson's PTTW and ECA that will require an amendment to include the discharge from the west extension. The runoff regime to the discharge outlets requires further detail. For example, how is the reduced drainage from quarrying balanced by the pumping? As it is understood that the Assessment of impact to Willoughby Creek is based on computer simulations and not real field measurements to verify existing conditions, how is the flow to the downstream reaches validated? If the discharge regime is set to mimic existing conditions, how will this be operationalized in terms of pumping rate?	General	Matrix Solutions Inc.	Continuous streamflow monitoring data has been collected at three locations (SW14, SW7 and SW2) along Willoughby Creek and at SW1 at the upstream end of the Unnamed Tributary of Willoughby Creek since 2014. The integrated surface and groundwater model has been calibrated to the streamflow monitoring data from these monitoring stations. The streamflow data collection effort was a key part of the study as it provides targets for calibrating the model to ensure it represents current conditions regionally and in the quarry vicinity. The calibrated integrated surface and groundwater model has been used to predict the impacts the proposed quarry expansion will have on surface and groundwater features. As mentioned, the primary source of flow into the Unnamed Tributary of Willoughby Creek and Willoughby Creek is quarry discharge. As mentioned, the reductions in streamflow are predicted to be minor and quarry discharge is proposed to occur long-term to maintain streamflow in these features. Additional rationale and details regarding off-site discharge will be provided as the AMP is refined in consultation with the agencies moving forward.	
33.	The other aspect of the surface water assessment that should be discussed is the water quality of the discharge waters. If the extraction were to continue to occur in phases, is the water quality of the discharge assumed to be the same? There is a possibility that excavation procedures including blasting may result in the release of contaminants. There is also a possibility that the Enbridge Pipeline which runs along Colling Road could be ruptured through blasting and could impact downstream fish habitat. The cumulative effects of the extraction with respect to water quality and quantity should be explained further in this section.	General	Matrix Solutions Inc.	The discharge from the existing quarry operates under an ECA which specifies a sampling program to confirm the discharge water is of appropriate quality to discharge off-site. Moving forward, the quarry will continue to operate under the terms and conditions of the ECA. Also, the quarry operates a series of settling ponds on the quarry floor to settle sediment and contaminants out of the water before being discharged off-site. The settling ponds will remain throughout operations and post rehabilitation to ensure the water is adequately treated before being discharged off-site. It's noted, the quarry has operated in this manner for years and has remained in compliance with the terms and conditions of the ECA since issued.	

34.	The approved rehabilitation plan envisions that the existing Burlington Quarry will be rehabilitated into a lake upon completion of extraction activities, which will result in no further discharges to both Willoughby Creek and West Arm unless water levels in the lake rise in response to wet conditions. This scenario is anticipated to reduce or eliminate baseflows to these systems. As this scenario is considered a negative effect, a new proposed rehabilitation plan proposes rehabilitation of the west extension into a lake (mentioned originally as part of the adaptive management plan) but in the surface water management plan, this has been changed to a conversion of the lands to a landform suitable for recreational, natural heritage and water management purposes. This scenario also includes maintaining the long-term offsite discharge from Quarry Sump 0100 and Quarry Sump 0200 to the tributary of Willoughby Creek and West Arm as part of the new rehabilitation plan for the Burlington Quarry and West Extension. The discussion of continual pumping and controlled release of water coming from the lake should be explored further as there may be some benefit to having the lake discharge provide a more stable flow regime that is less susceptible to mechanical failure or disruptions. There is also a diversion from Colling Road that has been proposed and the resultant effects on downstream fisheries habitat along Willoughby Creek should also be discussed.	General	Matrix Solutions Inc.	If the existing quarry is rehabilitated as currently approved (into a lake), the predicted lake water level is expected to fluctuate from approximately 268.75 m to 269.30 m, with an average water level of 269.05 m. The existing weir discharging water to the Unnamed Tributary of Willoughby Creek at Collings Road has a sill elevation of 269.08 m and upstream wetland average water level is 269.27 m. As such, a rehabilitated quarry lake will not drain into the wetland via gravity flow. To achieve gravity flow into the Unnamed Tributary of Willoughby Creek, the existing weir will have to be lowered, adversely impacting the wetland upstream. The existing culvert crossing Collings Road downstream of the weir has an invert elevation of 268.85 m and a weir or outlet elevation below 268.85 m cannot be achieved. Its noted, even if the weir and wetland are removed and the rehabilitated lake outlet set to 268.85 m, there will be periods when discharge to the Unnamed Tributary of Willoughby Creek ceases. The proposed Colling Road diversion will direct surface runoff generated north of Colling Road to the Unnamed Tributary of Willoughby Creek, its current and historic outlet, by-passing the quarry settling ponds and quarry sump.	
35.	Evolution and background details on the purpose and development of the Terms of Reference would be helpful to understand the context of the scope of the surface water assessment.	General	Wood Environment & Infrastructure Solutions	The Terms of Reference were developed in accordance with the Halton Region Aggregate Resources Reference Manual.	
36.	Rating Curve development is unclear; given the importance to corroborating modelling results this should be discussed in further detail including an indication of potential error bands.	General	Wood Environment & Infrastructure Solutions	The rating curves at each surface water monitoring station have been developed from in-situ streamflow and depth measurements collected since the stations were established. A staff gauge has been installed at each monitoring location to provide a consistent water depth measurement for each streamflow measurement collected. The rating curves development for each streamflow monitoring station are enclosed for reference.	
37.	The Colling Rd. diversion seems central to future management of quarry water; additional background and status on this proposal is required including the potential for a back-up strategy in the event this is not ultimately feasible.	General	Wood Environment & Infrastructure Solutions	The Colling Road diversion is not central to the management of quarry water. If the diversion is not approved, the surface runoff from north of Colling Road will continue to drain through the quarry as it currently does. To accommodate the surface runoff from north of Colling road, the on-site settling ponds will be reconfigured to provide sufficient on-site volume to store the additional water until it can be discharged off-site in accordance with the terms and conditions of the PTTW.	

38.	Cross-references to the Hydrogeological Assessment reporting should be minimized and relevant text supporting the findings/recommendations in the Surface Water reporting should be extracted and repeated in the Surface Water reporting for completeness.	General	Wood Environment & Infrastructure Solutions	The Watercourse and Wetland Characterization Tables enclosed (Schedule B and Schedule C) have been prepared by the project team to assemble the results of the various studies in one location for ease of review.	
39.	Rationale as to why runoff parameters to wetlands were not adjusted for the wetland results calibration (validation) should be provided. Further, the methodology to establishing wetland "storage correction factors" should be expanded upon as this is a key aspect of validating the model's performance.	General	Wood Environment & Infrastructure Solutions	The wetland water balance calibration will be refined as additional surface water monitoring data is collected. The wetland water balance calibration methodology will be fully described as the AMP is further developed/refined.	
40.	Why was the hydrologic modelling conducted with a simplistic SCS event-based technique rather than a more detailed continuous modelling approach?	General	Wood Environment & Infrastructure Solutions	The integrated surface and groundwater model is a continuous hydrologic simulation which has been used for the impact assessment in support of the quarry expansion. The simplistic SCS event based hydrologic model was used to estimate the volume of storage required to manage surface runoff on-site during operations and post rehabilitation for the various design storms and Regional Storm. The volume of storage provided on-site is the greater of the storage estimated through the event based and continuous simulations.	
41.	The integration of the natural systems feature characteristics and their water needs is not well established. The form and function of these features should be elaborated on and better connected to the results interpretation.	General	Wood Environment & Infrastructure Solutions	Watercourse and Wetland Characterization Tables (enclosed – Schedule B and Schedule C) have been prepared to better integrate the potential impacts changes in surface and groundwater quantity will have on the natural heritage features.	
42.	The reporting states that there was an iterative process used to refine the Site Plan however no details are provided; documentation of this process should be included in the reporting.	General	Wood Environment & Infrastructure Solutions	The Site Plans have been revised as the project progressed from initiation through to first submission based on the results of the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, the Surface Water Assessment, and the Level 1 and 2 Natural Environment Technical Report. The Site Plans were revised to protect the existing Natural Heritage Features and key hydrologic features on and off-site. For example, the extraction limit was revised to maintain the drainage areas to the wetlands adjacent to the south extension, to provide adequate buffers around natural heritage features and eliminate disturbances to significant woodlands. We don't feel it is warranted to include a description of each Site Plan change in the reports. It is just important to know the Site Plans have been developed considering the recommendations and conclusions of the various technical studies.	
43.	Details of impacts during remediation when the lake is filling are not provided; these need to be documented and considered in the assessment of impacts to surrounding systems.	General	Wood Environment & Infrastructure Solutions	Upon completion of extraction in the south extension, the discharge from the south extension will cease and the quarry will be allowed to fill with water forming a lake. However, the discharge to the West Arm of the	

				West Branch of the Mount Nemo Tributary of Grindstone Creek will continue. The potential impacts during rehabilitation of the south extension are the same as those for extraction in the west extension (under Scenario PH3456).	
44.	The study is understood to have been guided by the TOR developed for the Level 1 and 2 Hydrogeologic and Hydrologic Assessment; these are dated Feb 2020 and the submitted report is April 2020. While it is acknowledged that considerable work occurred for several years prior to the submission of the subject reporting, the authors should consider adding a section which outlines how the TOR evolved, what was their purpose and how the reporting has met the requirements of the TOR, including any deviations.	Page 1 Section 1	Wood Environment & Infrastructure Solutions	Refer to response to Comment 35. The primary deviation from the TOR was the use of a 10-year rather than 25-year simulation period to determine long-term average components of the water budget. Long run times and model stability issues created practical limitations for the model run times. The stability issues were not related to the quarry but rather to conditions at Mt. Nemo, where the Escarpment is very steep. The model simulation started in 2009 (WY2010) and extends to 2019. There are dry periods and wet periods within that span. It also represents a period for which the best (continuous) observational data were available. There were limited data prior to 2006.	
45.	The text indicates that the "objective" of the study is to "establish the existing form and function of the surface water features on-site and in the surrounding area and determine if the proposed quarry extension will have an adverse impact …". As noted in several of the comments that follow, the study tends to focus on water balance and hydroperiod as the only markers for impacts to wetlands and outlet receivers. Form and function are not explicitly integrated into the assessment as this requires input and support from the natural ecology study. As such, there is a need to further and more directly integrate the understanding of impacts from an ecological perspective to further inform and guide the overall water management strategy.	Page 2 Section 1.1	Wood Environment & Infrastructure Solutions	Refer to response to Comment 41.	
46.	Were the monitoring locations advanced by Nelson reviewed and approved by the regulators/agencies either before or after installation? Also, what was the basis for establishing the locations of the gauges in the surrounding area?	Pages 5-7 Sections 2-2.1	Wood Environment & Infrastructure Solutions	Refer to Response to Comment 7.	
47.	The report states that there are two (2) additional wetlands (within the west extension area) which were to be monitored this spring (2020); have these data been collected and if so do they have any impact on recommendations for water management?	Page 7 Section 2	Wood Environment & Infrastructure Solutions	Continuous wetland and shallow groundwater monitoring stations were established in each wetland in the west extension lands in the spring of 2020. The wetland hydroperiod and shallow groundwater monitoring data collected to date is illustrated on graphs enclosed. Based on the results from 2020, both wetlands are perched and have short hydroperiods. The collected data does not change our conclusions or recommendations. Monitoring in both wetlands will continue throughout the ARA licensing process and they are both suggested as part of the long-term monitoring program for the quarry.	
48.	The report indicates that the monitoring period was established as six (6) years; as Tatham is aware not all gauges have 6 years of data with some only having 2 years and others no data (i.e. those proposed for this past spring). Can Tatham comment as to how the lack of a full (6-year) and consistent monitoring period for all gauges affects the findings? Further, has each monitoring year been reviewed in terms of its	Page 7 Section 2.1	Wood Environment & Infrastructure Solutions	The monitoring program implemented for this license application has evolved over the past six plus years with the findings and conclusions of the various technical studies. Monitoring data will continue to be collected throughout the	

	relationship to climatic norms? This is important when reviewing the results at gauges with different monitoring periods.			licensing process and our conclusions and recommendations will be re-evaluated as additional data is collected. Our findings are based on a combination of monitoring data and simulation results. The lack of a full 6-year monitoring period does not impact our findings. The use of on-going monitoring data to establish targets where required will be considered in development of the AMP in consultation with the appropriate agencies. Each monitoring year has been reviewed in terms of its relationship to climate normals, particularly in terms of wet and dry years. It is important to understand how climate impacts surface water features and this is considered in our analysis as our wetland water balance has been simulated over a 25 year period and the integrated surface and groundwater model simulation covers a 10 year period. A climate summary is enclosed for reference.	
49.	Rating curves at each gauge site were noted to be developed by Tatham however no details have been provided. How many data points have been collected at each site and how many reflect storm conditions vs. non-storm conditions? Further has there been any effort to corroborate the water levels to flows using theoretical hydraulics of the local reaches?	Page 7 Section 2.1	Wood Environment & Infrastructure Solutions	Refer to response to Comment 36. The number of in-situ streamflow measurements used to develop the rating curves are illustrated on the enclosed graphs. In-situ streamflow measurements have been collected during a variety of climate conditions including spring freshet and during rain events. The rating curves will continue to be refined moving forward as additional in-situ streamflow measurements are collected.	
50.	The reports states that monitoring at all sites was to continue beyond the September 15, 2019 period selected as the end of reporting. Can Tatham verify that all gauges have continued and that the data from these gauges will be used to support decision-making in the future?	Page 7 Section 2.1	Wood Environment & Infrastructure Solutions	All surface water monitoring stations remain in operation except SW7. SW7 was located on private property and the owner of the property asked for the device to be removed in 2020. All of the surface water monitoring locations currently in operation will remain operational throughout the ARA licensing process and it is expected a majority will be maintained throughout extraction in the expansion areas as a condition the Quarry's AMP.	
51.	'Streamflow monitoring location SW1 was established in July 2015 and is located in the weir pond (wetland 13202) downstream of the Quarry Sump 0100 discharge. SW1 measures the flow through the weir structure to the tributary of Willoughby Creek downstream. The quarry discharge occurs year-round, maintaining sufficient water depth and flow at SW1 to prevent freezing of the pressure transducer during the winter months. As such, the continuously recording pressure transducer typically remains installed year-round to capture the flows at the upstream end of the tributary of Willoughby Creek.'	Page 9 Monitoring Location SW1 1st Paragraph	Norbert M. Woerns	Surface water monitoring station SW1 records the flow rate leaving the weir structure. This does not include the 2 L/s discharge downstream through the head box diversion. SW1 does not measure the flow of water diverted to the golf course irrigation ponds through the diversion channel. A summary of the runoff volumes discharge from Sump 0100, through the head box diversion,	

	Is the flow to the irrigation ponds separate from or is that included in SW1 flow to the Tributary to Willoughby Creek? Does the flow in SW1 also include the 2.0 litres/second diversion through the head box diversion from the weir?			through the weir structure and to the golf course irrigation ponds is enclosed for reference.	
52.	Description of Monitoring Location SW31 in Section 2.1.1 does not match location shown on Drawing Dwg. SW-1. Update accordingly.	Page 12 Section 2.1.1. Streamflow Monitoring, Bronte Creek Watershed, & Dwg. SW-1	Conservation Halton	The Existing and Proposed Surface Water Monitoring Locations Plans (Drawings SW-1 and SW-2) have been revised accordingly.	
53.	Add label for Monitoring Location SW-9 to drawing.	Section 2.1.2. Streamflow Monitoring, Grindstone Creek Watershed, Dwg. SW-1	Conservation Halton	Existing and Proposed Surface Water Monitoring Locations Plans (Drawings SW-1 and SW-2) have been revised accordingly.	
54.	What was the protocol for the manual in-situ measurements taken at the 38 locations surrounding the existing quarry? Was there an inter-event time? Were they always dry periods or also wet periods? Were results adjusted for actual antecedent conditions?	Page 19 Section 2.1.4	Wood Environment & Infrastructure Solutions	In-situ streamflow measurements were collected every other month from the 38 locations surrounding the existing quarry to confirm the presence of flow. The measurements were generally collected in the spring, summer and fall to understand the seasonality of flow in these watercourses.	
55.	Remove/correct references to Wetland 13036.	Page 24 Section 2.2.5. Wetland Hydroperiod Monitoring, Monitoring Location SW16A (Wetland 13037)	Conservation Halton	The references to Wetland 13036 will be corrected.	
56.	The report states that a single drivepoint piezometer was installed adjacent to each wetland to monitor shallow groundwater to assist in baseline monitoring. Can Tatham advise as to the rationale for only having a single gauge and what the potential for up and downgradient variation may be and how this may affect the baseline conditions? Based on more common industry practices, wetlands are typically instrumented with multiple gauges to improve the understanding of groundwater/surface water interactions in complex settings.	Page 25 Section 2.3	Wood Environment & Infrastructure Solutions	A single shallow groundwater monitoring mini-piezometer was installed in each monitored wetland based on the results of previous monitoring and our understanding that the wetlands in the area are generally perched. As illustrated through the results of the groundwater monitoring and integrated surface and groundwater model, the wetlands are generally perched, receiving no to minor groundwater contributions (less than 3% of total annual inflow) during spring freshet.	
57.	Water quality samples were collected from selected surface water monitoring sites for 2018 and 2019 and tested for a limited suite of parameters (TSS, pH and Conductivity); can Tatham advise how these sites were selected and the sampling period determined and why only 3 parameters were tested? Further there seems to be limited interpretation of these data in terms of physical characterization - how is this information being used?	Page 26 Section 2.4	Wood Environment & Infrastructure Solutions	The sampling sites were selected to characterize the water quality as follows: 1) SW15 – external water quality entering the quarry; 2) SW1 – water quality entering Unnamed Tributary of Willoughby Creek; 3) SW2 – water quality of Willoughby Creek at downstream limit of study;	

				4) SW14 – water quality of Willoughby Creek upstream of quarry discharge; 5) SW29 – water quality in Unnamed Tributary of Lake Medad; 6) SW6 – water quality of West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek leaving the south extension lands; 7) SW10 – water quality of the West Branch downstream of confluence of West and East Arms; 8) SW28 – water quality of the East Branch; and 9) SW30/SW31/SW32/SW35/SW24 – water quality of watercourses in the surrounding area. Its noted, water quality samples are collected from the quarry discharge in accordance with the ECA. The water quality sampling was not restricted to three parameters. A full spectrum of parameters was tested including general chemistry, metals and nutrients as illustrated in the water quality sample results summaries included in Appendix H of the Surface Water Assessment.	
58.	The study should demonstrate the proposed works will have no negative impacts on sediment transport (erosion and aggradation). The analysis should establish erosion threshold flow rates, and use continuous modeling to assess changes to the duration and frequency of exceedances as well as cumulative effective work and cumulative effective discharge.	Pages 27-44 Section 3. Existing Conditions	Conservation Halton	The integrated surface and groundwater model (continuous simulation) generally predicts minor reductions in total streamflow through the Unnamed Tributary of Willoughby Creek, Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek as a result of the quarry expansion. Also, the quarry discharge From Sumps 0100 and 0200 are not proposed to be altered. The only changes proposed are: 1) The diversion of flow from external Catchment S101 directly to the Unnamed Tributary of Willoughby Creek; and 2) The temporary discharge of water from the south extension into the West Arm. The proposed Colling Road diversion will direct surface runoff generated north of Colling Road to the Unnamed Tributary of Willoughby Creek, its current and historic outlet, by-passing the quarry settling ponds and quarry sump. The Colling Road diversion is not expected to have a significant impact on the simulation results. As mentioned, the integrated surface and groundwater model generally predicts minor reductions in streamflow in both the Unnamed	

				Tributary of Willoughby Creek and Willoughby Creek. As such, we do not feel an erosion and sediment transport assessment is warranted for these watercourses. The proposal includes discharging water from the south extension to the West Arm at rates of up to 50 L/s. This discharge rate will be refined through the further development of the AMP. However, this discharge rate represents a streamflow that commonly occurs in the West Arm (see streamflow monitoring data) and is conveyed via the low flow channel through the subject property and downstream (as confirmed through the HEC-RAS hydraulic analysis of the West Arm). As such, we do not feel an erosion and sediment transport assessment is warranted for the West Arm.	
59.	Additional metrics should be used to provide a fulsome assessment of potential impacts to surface water features. At a minimum, the study should include at each key monitoring location (West Arm, East Arm, Willoughby Creek Tributary, Willoughby Creek (SW7 & SW14), Wetland 13201): • annual runoff volumes presented for each year (from Water Balance calculations as well as Integrated Surface Water Groundwater Model and/or continuous modeling) • monthly runoff volumes presented for each month (average, minimum and maximums; from Integrated Surface Water Groundwater Model and/or continuous modeling) • monthly average stream flows presented for each month (average, minimum and maximums; from Integrated Surface Water Groundwater Model and/or continuous modeling) • peak flow rates for event-based storm events (from event based hydrologic modeling) • duration and frequency of exceedances of the watercourse's erosion threshold (from continuous modeling) • cumulative effective work on the stream's beds and banks (from continuous modeling) • the watercourse's cumulative effective discharge (from continuous modeling) Additional metrics may be required, depending on the initial results and final water management strategy. Alternative metrics will be considered through consultation with the JART.	Pages 27-44 Section 3. Existing Conditions	Conservation Halton	Daily flow data from the integrated surface and groundwater model were provided for the simulation periods. This data was processed to provide monthly, annual, average monthly, and simulation period averages. Hydrographs of daily values were presented and discussed in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report. Simulation period averages were represented in maps and tables as they are the simplest format for comparative analyses.	
60.	The climate data for the impact assessments should be extended to a minimum of 20 years in keeping with the previously proposed duration and standard industry practices (2000 to 2019+, in conjunction with ongoing monitoring).	Pages 27-73 Sections 3, 4 & 5. Existing Conditions, Proposed Conditions - Operations, and Proposed	Conservation Halton	The wetland water balance analysis covered a 22-year period from 1998 to 2019.	

		Conditions - Rehabilitation			
61.	Can the source and vintage of the topographic and aerial mapping be provided? Further there is reference to field survey - can this report provide documentation on the extent and purpose of the field survey?	Page 27 Section 3.1	Wood Environment & Infrastructure Solutions	The topographic mapping was generated from a drone survey completed November 22, 2018 having an accuracy of +/- 3 cm. A topographic survey was completed of various on-site features including: 1) Groundwater monitoring wells; 2) Surface water monitoring stations; 3) Wetland bathymetry; 4) Golf course diversion channel and irrigation ponds; 5) Weir pond outlet structure; 6) Various culvert crossings; and 7) West Arm through the south extension lands.	
62.	Has Tatham compared drainage area mapping with that available through other sources? i.e. CH, MNRF, etc. This would be beneficial to assist in a comparative verification of the mapping.	Page 27 Section 3.1	Wood Environment & Infrastructure Solutions	Our watershed/catchment delineation has been compared against catchment delineations from the MNRF OFAT tool and Conservation Halton's watershed boundaries. Only minor discrepancies exist between the various catchment delineations compared.	
63.	The accuracy of the survey data used should be included within the document. LiDAR data with a +/- 0.1 metre accuracy is available for purchase from Conservation Halton to improve the accuracy of the results, if necessary.	Page 27 Section 3.1. Existing Drainage Patterns	Conservation Halton	The topographic mapping was generated from a drone survey completed November 22, 2018 having an accuracy of +/- 3 cm.	
64.	Section 3.1.1 (Page 28 of 601) "As part of ongoing operations within the existing Burlington Quarry, Nelson is exploring options to divert this external drainage from northwest of Colling Road directly to the discharge location of Quarry Sump 0100; preventing the runoff from entering the existing quarry. This would include the construction of a conveyance system (a culvert, ditch or combination of the two) alongside Colling Road within Nelson's property between Blind Line and the quarries existing discharge location (Quarry sump 0100). With this in place, the external runoff would drain to its existing outlet, the tributary of Willoughby Creek, without entering the active quarry operation. This will reduce the surface water management requirements of the active operation." Please provide more information about the proposed conveyance system along Colling Road between Blind Line and the weir pond (wetland 13202) which will carry external flows bypassing the active quarry operations.	Page 28 Section 3.1.1	City of Burlington	Refer to response to Comments 12,14,15, 37 and 65. A preliminary design of the proposed Colling Road diversion is enclosed for reference.	
65.	Report states that Nelson is exploring options to divert drainage external to the quarry along Colling Rd. This alternative/option is cited in subsequent sections of the reporting as a core requirement of the mitigation strategy. Can Tatham provide additional details on what Nelson has done to "explore" this alternative? Has the City of Burlington been contacted in terms of potential influence on roadway drainage? Has CH been contacted in terms of transferred impacts? Have neighbours been contacted? Have there been any earlier analyses and or design proposals?	Page 28 Section 3.1.1	Wood Environment & Infrastructure Solutions	The feasibility of diverting the flow has been explored and it has been confirmed that the flow can be diverted through a combination culvert and ditch system. The City of Burlington and Conservation Halton have been made of aware of the proposal through the circulation of the Surface Water Assessment. Local residents have not been contacted regarding the proposal.	

				Refer to response to Comment 37 and 64 for additional details.	
66.	The south extension is discussed in terms of drainage area which discharges to the West Arm (36.0 hectares). There is also reference to a further drainage area draining overland into wetlands which are part of the East Arm however no drainage area is provided? Can Tatham advise?	Page 28 Section 3.1.2	Wood Environment & Infrastructure Solutions	The drainage area to the East Arm is not being altered through the south extension. As such, changes were not discussed. The drainage areas to the East Arm are illustrated on the various Drainage Plans (Drawings DP-1, DP-2 and DP-3) enclosed.	
67.	Grading details and invert elevations should be provided for the existing golf course weir pond, diversion channel and irrigation pond system to fully illustrate how the existing water management system functions.	Page 29-30 Section 3.1.3. West Extension	Conservation Halton	The existing weir pond, diversion channel and golf course irrigation ponds have been surveyed. Drawings illustrating the function of these features are enclosed for reference.	
68.	In addition to the information provided in the Existing Condition Water Balance, the depth of water and bathymetry of the wetlands should be provided, in order to assess potential impacts to the wetlands. Changes in water depth should be provided in the interim and ultimate conditions as well.	Page 30 Section 3.2. Existing Condition Water Balance	Conservation Halton	The existing wetlands have been surveyed and drawings of the bathymetric survey are included in the Wetland Characterization Tables enclosed. The changes in water depth are illustrated on the graphs provided in Appendix N and Appendix R of the Surface Water Assessment.	
69.	Please provide digital, daily water levels, presented graphically (to depict the wetland hydroperiod) and summarize daily water balance analyses as average monthly water volumes presented in tabular format integrated in the report. Compare driest year, average and wettest year monthly water volumes to assess potential impact.	Page 30 Section 3.2. Existing Condition Water Balance	Conservation Halton	The wetland hydroperiod monitoring data is illustrated graphically in Appendix F of the Surface Water Assessment. Updated graphs including the remainder of the monitoring data for 2019 and the data for 2020 are enclosed. The results of the water balance analysis are illustrated on the graphs included in Appendix I, N and R of the Surface Water Assessment.	
70.	Section 3.2.3 West Extension (Page 30) "It is noted, the drainage systems, specifically roadside ditches, downstream of the culvert crossings Cedar Springs Road are poorly defined or nonexistent. It is expected that any surface runoff draining through the culverts will either, evaporate, infiltrate or drain overland following the topographic low through the road allowance or across private property to the Medad Valley and Willoughby Creek." Further investigation is needed to determine the baseline conditions in order to understand the flow regime.	Page 30 Section 3.2.2	City of Burlington	A summary of the drainage conditions established through additional field inspections and streamflow monitoring is as follows: 1) Surface water monitoring location M33 – culvert crossing No. 2 Sideroad is completely obstructed, the downstream end of the culvert could not be located and there is no define channel downstream of No. 2 Sideroad. It is expected surface runoff collects in the wetland upstream and infiltrates or evaporates. Based on monitoring of the wetland completed in 2020 and to date in 2021, little water accumulates in the wetland and the wetland is perched above the groundwater table. The shallow groundwater level increases rapidly during rain events indicating infiltration of surface runoff into the underlying soil. 2) Surface water monitoring location M34 – appears to drain east under Cedar Springs Road onto the Quarry property and into Wetland 13201. During our rounds of surface water monitoring, we	

				have not witnessed flow through this culvert. 3) Surface water monitoring location M35 – surface runoff drains west through a culvert crossing under Cedar Springs Road and a crossing under Cedar Springs Court. No defined outlet was identified downstream of Cedar Springs Court and surface runoff is expected to flow west overland as sheet flow to Willoughby Creek. During our rounds of surface water monitoring, flow has not been witnessed in this the Cedar Springs Road culvert. 4) Surface water monitoring location M36 – surface runoff drains west through a culvert crossing under Cedar Springs Road and continues west to Willoughby Creek through a poorly defined channel across private property. During our rounds of surface water monitoring, flow has not been witnessed in this culvert. 5) Cedar Springs Road and Colling Road intersection – refer to response to Comment 16.	
71.	Parameter assumptions (e.g. soil water holding capacity, SCS curve numbers, etc.) and detailed calculations should be provided in a supporting appendix.	Pages 31-34 Sections 3.2.2. & 3.2.3. Existing Condition Water Balance, Daily and Monthly Water Balance Methodology	Conservation Halton	The wetland water balance and event based hydrologic model input parameters have been summarized in a table enclosed for reference.	
72.	The initial wetland volume, stage-discharge curve, storage correction factor and overflow correction factor for each wetland should be provided to illustrate the scale of adjustment used and support the validity of the water balance calibration.	Page 34 Section 3.2.4. Water Balance Calibration	Conservation Halton	Refer to response to Comment 39. The initial wetland volumes, stage-storage-discharge curves, storage correction factors and overflow correction factors for each wetland are summarized in a table enclosed.	
73.	The Water Balance Calibration section provides details on the approach and suggests that there was a topographic survey - can details of this survey be provided? Also the calculations have been reported daily and monthly; it is also suggested that these be considered/assessed at a seasonal time period. It should also be noted that there are numerous cross-references in this section and others to the Level 1 and 2 Hydrolgeological Assessment; for completeness and readability it is suggested that relevant details be repeated in this document to improve the flow of content.	Page 34 Section 3.2.4	Wood Environment & Infrastructure Solutions	Refer to response to Comment 68. The wetland water balance has been completed on a daily time step for a period of 22 years (1998 to 2019) to consider seasonality. The Wetland Characterization Tables enclosed include the relevant conclusions and recommendations of the various reports in one location.	
74.	Given that only 4 years of data have been used for model performance review it is respectfully suggested that the analysis be re-titled to "Water Balance Validation" as 4 years of data would be considered insufficient for the purpose of model "calibration".	Page 34 Section 3.2.4	Wood Environment & Infrastructure Solutions	Refer to response to Comment 39.	

75.	This section indicates that the basis for the calibration (validation) was founded on the wetland discharge parameters rather than any of the runoff generating parameters. Tatham states that this is due to a review of the results which suggests this approach was "reasonable and did not warrant adjustment". Further it is unclear as to how the "correction factors" were established, along with the storage discharge curves and the "broad crested weir equation". Wetland discharge relationships are inherently complex and it is unclear as to how these have been represented accurately. Can Tatham offer more details?	Page 34 Section 3.2.4	Wood Environment & Infrastructure Solutions	Refer to Response to Comment 39.	
76.	The differences between observed and modelled hydroperiods ranges between 7 and 10 days - has the Nelson Team's ecological specialists weighed in on the adequacy of this predictive range?	Page 35 Section 3.2.5	Wood Environment & Infrastructure Solutions	The spring hydroperiod has generally been predicted within seven days or less and the fall hydroperiod within 10 days or less. It is our opinion the daily water balance is a reasonable predictor of the wetland hydroperiod and can be used to predict potential impacts from the proposed quarry extensions and dewatering. It needs to be kept in mind that the simulation compares proposed conditions to existing to evaluate any potential adverse impacts caused by the proposal.	
77.	While the daily water balance is a reasonable predictor of the wetland hydroperiods in 2016 through 2018, the report should discuss the weaker agreement for 2015 and 2019.	Page 35 Section 3.2.5. Wetland Water Balance Results	Conservation Halton	Refer to response to Comment 39.	
78.	Staff have assumed the Key Points of Interest on this drawing coincide with the five outlet points outlined in Table 19. Please confirm within the report.	Page 38 Section 3.2.6. Existing Condition Water Balance, Outlet Water Balance Results & Dwg. DP-1	Conservation Halton	The Key Points of Interest illustrated on the Drainage Plans (Drawings DP-1, DP-2 and DP-3) coincide with the five locations presented in Table 19.	
79.	Table 19 results for some years indicate more runoff than precipitation (e.g. 2009). Can Tatham advise as to the rationale?	Page 38 Section 3.2.6	Wood Environment & Infrastructure Solutions	There are no locations presented in Table 19 where runoff volume exceeds precipitation.	
80.	The surface-groundwater model has assumed the quarry discharge as fixed at 67.0 litres/second. It is questioned whether this assumption is valid and what the range of discharge rates are based on actual monitoring?	Page 39 Section 3.3	Wood Environment & Infrastructure Solutions	Quarry discharge was fixed in an earlier version of the baseline model. Because the model had to be capable of predicting quarry discharge under future conditions, the model was modified so that it could predict quarry discharge on a daily basis. The value calculated depended on simulated groundwater and surface water inflows (precipitation and runoff) inflows. The model was calibrated so that it reasonably matched the recorded discharges from the quarry which averaged 67 L/s.	
81.	Are the flows reported in Table 20 based on the calibrated (validated) modelling?	Page 39 Section 3.3	Wood Environment & Infrastructure Solutions	The flows depicted in Table 20 are results from the calibrated existing condition integrated surface and groundwater model.	
82.	'The portion of the quarry discharge assigned to Spring J is determined through numerical analysis within the integrated surface water groundwater model. The	Page 39 2nd Paragraph	Norbert M. Woerns	The discharge to the Unnamed Tributary of Willoughby Creek through the weir structure is	

	balance of the quarry discharge resurfaces at Spring K which drains to Willoughby Creek downstream of SW7.' There are no flow measurements of Spring J and K except for one occasion April 10, 2006 by Worthington, 2006. There are no field data to confirm flow conditions from these two springs and consequently flow from the tributary of Willoughby Creek which feeds these two springs. It is known that a minimum of 2.0 litres/second of pump discharge from quarry sump 100 is diverted to the tributary of Willoughby Creek but the total flow characteristics of quarry sump discharge into the tributary to Willoughby Creek are not known. It is also not known how much water is diverted from Sump 100 discharge to the existing irrigation ponds on the golf course property. An assessment of impact on this tributary therefore relies upon computer simulations in the absence of critical streamflow information and without the benefit of verification of existing conditions with field measurements.	Section 3.3 Existing Condition Integrated Surface Water Groundwater Analysis		monitored at surface water monitoring station SW1. The total flow is the sum of the weir discharge plus the 2 L/s discharge from the head box diversion. Refer to response to Comment 51.	
83.	Can a modelling schematic be provided for the OTTHYMO modelling?	Page 40 Section 3.4	Wood Environment & Infrastructure Solutions	VO model schematics are enclosed for reference.	
84.	For the surface water assessment for the hazard and erosion impact assessment why has a simplistic event based model been used rather than a more complex and comprehensive modelling approach (continuous simulation)? It is suggested that continuous modelling will provide a better and more representative result for the surface water flow regime, including sub-annual events. Further, the SCS CN methodology has been used for this assessment which again tends to be limiting and more black box in its methodology. Other time varying approaches for soil properties applied in long term continuous modelling are considered more accurate and superior to SCS and also eliminate bias when using design storm based methodologies.	Page 40 Section 3.4	Wood Environment & Infrastructure Solutions	The flood and erosion hazard limits have been established in accordance with the Provincial Policy Statement and the MNRF Natural Hazard Technical Guides (Flooding and Erosion Hazard Limits).	
85.	The report should include the following: a. A schematic supporting the hydrologic model. b. A summary of the sources/rationale for the selected hydrologic parameter values. c. A table of all input parameters for each subcatchment. d. Hard copy of input and output files.	Pages 40-41 Section 3.4. Existing Condition Event Based Hydrologic Analysis	Conservation Halton	Refer to response to Comments 71 and 83. A summary of the sources/rationale for the selected hydrologic parameters is enclosed for reference. The digital VO6 model files have been provided in lieu of hard copy input and output files. Please advise if you still require hard copy input and output files.	
86.	MTO IDF data was not provided in Appendix L. Conservation Halton staff recommend City of Burlington IDF curves be compared to the MTO data, and the more appropriate values used and provided in the report.	Page 40 Section 3.4.1. Existing Condition Event Based Hydrologic Analysis, Climate Data	Conservation Halton	A comparison of the MTO and City of Burlington IDF data is enclosed for reference along with a comparison of the hydrologic model results for each.	
87.	Revisit drainage areas to ensure model and Existing Conditions Drainage Plan, DP-1 match.	Page 40 Section 3.4.2. Existing Condition Event Based Hydrologic Analysis, Methodology	Conservation Halton	The hydrologic model and Existing Conditions Drainage Plan (Drawing DP-1) have been reviewed and revised to ensure consistency.	

88.	CN values used in the hydrologic model are low for the soil types in the subject area. Values used should be justified or revised accordingly. AMC III conditions should be used for the Regional Storm.	Page 40 Section 3.4.2. Existing Condition Event Based Hydrologic Analysis, Methodology	Conservation Halton	Refer to response to Comment 85. Regional Storm model runs have been completed using AMCIII antecedent moisture conditions. The Regional Storm model runs are included with the digital VO files enclosed.	
89.	As only the last 12 hours of the Regional Storm were modeled, the Initial Abstraction (Ia) rate used does not adequately account for saturated soil conditions and should be reduced.	Page 40 Section 3.4.2. Existing Condition Event Based Hydrologic Analysis, Methodology	Conservation Halton	The initial abstraction values included in the Regional Storm model runs have been revised accordingly.	
90.	It is noted that the MTO IDF has been selected - have these values been compared to local data available from the City of Burlington and CH?	Page 40 Section 3.4.3	Wood Environment & Infrastructure Solutions	Refer to response to Comment 86.	
91.	Revisit flow rates within Table 21, Existing Condition Hydrologic Model Results Summary, as they don't match the results within the digital VO6 model provided.	Pages 41 Section 3.4.3. Existing Condition Event Based Hydrologic Analysis, Hydrologic Model Results	Conservation Halton	Table 21 has been updated accordingly (see enclosed).	
92.	It is noted that Table 21 reports on the SCS 24 hour distribution but unclear as to why that distribution has been reported rather than the Chicago 4 hour which is also noted to have been executed - please advise; also the timestep is not documented in this section - please advise and outline supporting rationale for its selection	Page 41 Section 3.4.3	Wood Environment & Infrastructure Solutions	The SCS 24-hour design storm distribution produces greater peak flows than the Chicago 4-hour design storm distribution and therefore the SCS flows have been reported. Refer to response to Comment 85.	
93.	Why was the quarry discharge not included in the event based results from Quarry Sumps 100 and 200?	Page 41 Section 3.4.3	Wood Environment & Infrastructure Solutions	The simplistic SCS event based hydrologic model was used to estimate the volume of storage required on-site during operations and post rehabilitation for the various design storms and Regional Storm. The volume of storage provided on-site is the greater of the storage estimated through the event based and continuous simulations. The results represent the surface runoff, and only surface runoff, draining to each outlet.	
94.	The results of the event based hydrologic model during operation phase and in the post rehabilitation conditions remain the same. These both results are, however, quite different from the existing conditions hydrologic model results for all locations and for all design events. During the operations and under the rehabilitated conditions the West Arm, Weir Pond and Wetland 13201 flows are reduced, and the Burlington Quarry flows significantly increased as compared to the existing conditions. Please refer to Tables 21, 30, and 37. Were the review agencies previously made aware of the fluctuation in flows and is there any correspondence in this regard?	Tables 21, 30, and 37	City of Burlington	The review agencies were not previously made aware of these changes. The agencies have been made of aware of the changes through the circulation of the Surface Water Assessment.	

95.	Explanation for the difference in the Regional Storm flow for the West Arm of the West Branch identified in Table 22 (as used in the hydraulic model) and from that provided in Table 21 (Section 3.4.3) should be provided, or the analysis updated accordingly.	Page 42 Section 3.5.2. Natural Hazards Assessment – West Arm of the West Branch, Flood Hazard Limit Delineation & Appendix M	Conservation Halton	The Regional Storm peak flows have been updated accordingly.	
96.	The accuracy and extent of the drone survey data in the vicinity of the Quarry and expansion lands should be included within the document, confirming it is sufficient to support hazard delineations in keeping with Provincial Guidelines. To improve the accuracy of the results, LiDAR data with a +/- 0.1 metre accuracy is available from the Land Information Ontario Data Hub (https://geohub.lio.gov.on.ca/), if necessary.	Page 42 Section 3.5.2. Natural Hazards Assessment – West Arm of the West Branch, Flood Hazard Limit Delineation & Appendix M	Conservation Halton	The topographic mapping was generated from a drone survey completed November 22, 2018 having an accuracy of +/- 3 cm. A geodetic topographic survey of the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek was completed across the south extension lands in support of the Natural Hazards Assessment. The topographic survey was completed by Tatham Engineering Limited January 2020. The topographic survey data has been supplemented with the Drone survey data for the channel overbanks.	
97.	The Natural Hazards Plan, Dwg NH-1 should include: • Source of topographical information including vertical datum. • Stamps and signatures of the qualified professional(s) responsible for the hazard delineation.	Dwg NH-1 Section 3.5.2. Natural Hazards Assessment – West Arm of the West Branch, Flood Hazard Limit Delineation	Conservation Halton	The Natural Hazards Plan (Drawing NH-1) has been revised accordingly (see enclosed).	
98.	Saturated soils (i.e. AMCIII conditions) should be assumed when modeling the Regional Storm using the last 12 hours of the Hurricane Hazel rainfall distribution. Modeling and the report should be updated accordingly.	Page 42 Section 3.5.2. Natural Hazards Assessment – West Arm of the West Branch, Flood Hazard Limit Delineation & Appendix M	Conservation Halton	Refer to response to Comments 88 and 89.	
99.	Why was the flood hazard assessment restricted to the West Arm? Should not all outlets be examined for potential impacts due to the alteration of quarry surface water changes?	Page 42 Section 3.5.2	Wood Environment & Infrastructure Solutions	The Natural Hazards Assessment has been completed for the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek to confirm the proposed extraction limit does not encroach into the existing natural hazards on-site. There are no other natural hazards identified on-site requiring a Natural Hazards Assessment.	
100.	It is suggested that a Stream Morphologist be retained to review the erosion thresholds associated with the current predicted flow regime.	Page 43 Section 3.5.3	Wood Environment & Infrastructure Solutions	Refer to response to Comment 58.	

101.	The supporting documentation required for the Existing Conditions modeling is also required for Proposed Conditions modeling.	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton	The wetland water balance and event based hydrologic model input parameters have been summarized in a table enclosed for reference. VO model schematics are enclosed for reference. A summary of the sources/rationale for the selected hydrologic parameters is enclosed for reference. The digital VO6 model files have been provided in lieu of hard copy input and output files. Please advise if you still require hard copy input and output files. The hydrologic model and Proposed Conditions Drainage Plans (Drawings DP-2 and DP-3) have been reviewed and revised to ensure consistency.	
102.	Parameterization concerns identified for Existing Conditions should also be addressed within Proposed Conditions models.	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton	Understood. Refer to response to Comment 101.	
103.	Results are presented in different locations throughout the report. Recommend for each monitoring location a table for each metric, that summarizes results for pre-quarry (where applicable), existing, operational phases, and rehabilitation conditions.	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton	Refer to response to Comment 59.	
104.	Proposed Conditions should also document and consider impacts during north and south lake filling.	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton	Refer to response to Comment 43. In addition, the integrated surface and groundwater model evaluated the impacts of both rehabilitation scenarios for the existing quarry which are included in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report. As noted in the Surface Water Assessment, allowing the existing quarry to fill and form a lake in accordance with the approved rehabilitation plan will cease all discharge from the quarry to the Unnamed Tributary of Willoughby Creek and	

				an alternative rehabilitation scenario is recommended.	
105.	Quarry discharges and the Colling Road diversion are not applied consistently in the different analyses. Results should incorporate the proposed pumping regime with and without the proposed diversion at Colling Road.	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton	The event based hydrologic model has been updated to include proposed conditions with and without the Colling Road diversion. The digital VO files are enclosed for reference.	
106.	Results should be evaluated by the appropriate qualified professional (e.g. water resources engineer, ecologist, or fluvial geomorphologist).	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions - Rehabilitation	Conservation Halton	It is unclear as to what results have not been evaluated by a qualified professional. The Surface Water Assessment has been prepared by a water resource engineer, the Level 1 and 2 Natural Environment Technical Report was prepared by ecologists, and the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report was prepared by professional engineers.	
107.	The depth of water and bathymetry of the wetlands should be provided for any interim phases and in the ultimate condition, in order to assess potential impacts to the wetlands.	Pages 45-73 Section 4. Proposed Conditions – Operations and Section 5. Proposed Conditions – Rehabilitation	Conservation Halton	Refer to response to Comment 68.	
108.	Tatham references an "iterative" process to Site Plan development - for completeness and a more fulsome understanding of the process followed by the Nelson Team, can the iterative changes/adjustments be documented for the record?	Page 45 Section 4.1	Wood Environment & Infrastructure Solutions	Refer to response to Comment 42.	
109.	Per earlier comment on section 3.1.1. pg 28 - can Nelson provide details on the process to-date on establishing a diversion along Colling Rd?	Page 46 Section 4.1.1	Wood Environment & Infrastructure Solutions	Refer to response to Comments 64 and 65.	
110.	It is understood from Section 4.1.2 “South Extension” that a temporary settling pond will be constructed during the initial three years of extraction which will be ultimately replaced with a larger quarry sump that is proposed to maintain a discharge limit of 50.0 litres/second. Design details of both ponds, the temporary settling pond and quarry sump will be required at the design phase.	Section 4.1.2	City of Burlington	Understood.	
111.	For the South extension it states that the quarry water is being treated at rates "set to mimic existing conditions"; can Tatham elaborate on how this is going to be operationalized?	Page 46 Section 4.1.2	Wood Environment & Infrastructure Solutions	The proposed temporary settling pond will be designed to treat the discharge from the south extension in accordance with the effluent criteria established in the ECA. The discharge rates will be established to mimic existing flow rates and volumes in the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Additional rationale and details regarding off-site discharge will be provided as the AMP is refined in consultation with the agencies moving forward.	

112.	Can Tatham provide additional details as to how the 50.0 litres/second was established as a limit for pumping? This approach assumes a rate but has there also been a check on volumes? To this end can calculations and assumptions be provided for the 1800.0 cubic metres settling pond sizing?	Page 46 Section 4.1.2	Wood Environment & Infrastructure Solutions	Refer to response to Comment 111. The settling pond has been sized to settle the anticipated particle size distribution in the quarry effluent in accordance with the effluent criteria of the ECA for a flow rate of 50 L/s. The settling calculations are enclosed for reference.	
113.	The report states that 5.0 hectares is a threshold condition for extraction which triggers implementation of a new sump; can Tatham provide details on this determination? Why 5.0 hectares?	Page 46 Section 4.1.2	Wood Environment & Infrastructure Solutions	The 5.0 hectare threshold was established based on the required floor area to construct a sump with 1800 m^3 of available storage while providing sufficient space for operations. This threshold will be re-evaluated as the discharge rate from the south extension is finalized.	
114.	What is the source of the 350.0 metre dimension from the face as a point of comparison?	Page 47 Section 4.1.3	Wood Environment & Infrastructure Solutions	The reference to 350 m is incorrect. The drawdown in water levels, as per the integrated surface and groundwater model, is less than 2.0 m at a distance of 500 m from the active quarry face.	
115.	As a means of mitigating impacts to off-site systems Tatham is proposing a "replica" pond. This appears to be a long linear feature extending approx. 3/4 of the distance between No. 2 SR to Colling Rd. From the available documentation it appears that there is no preliminary design for this feature, rather it is shown as a concept in plan form on the Site Plan, with basic sections only. Given the importance which Tatham places on this "replica" facility to service off-site systems and maintain overall water balance can Tatham provide additional design details to ensure that the facility as conceptualized is feasible, particularly in light of its length and the number of inlets and outlets.	Page 47 Section 4.1.3	Wood Environment & Infrastructure Solutions	The preliminary design of the infiltration pond is illustrated on the Site Plans. The preliminary pond includes the proposed pond grading, the diversion pipe invert elevations and alignment, and the outlet pipe location. We believe the information provided on the Site Plans is sufficient to confirm the feasibility of the infiltration pond and additional details will be provided at detailed design.	
116.	It is postulated by Tatham that reducing flows to the roadside ditch and ultimately the Medad Valley and Willoughby Creek is positive for the function of the ditches however no comment is provided as to the potential environmental impact to the Medad Valley and Willoughby Creek - has this been assessed by Nelson's ecologist?	Pages 48-49 Section 4.1.3	Wood Environment & Infrastructure Solutions	Refer to response to Comment 70. The potential adverse impacts were identified in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, the Surface Water Assessment, and the Level 1 and 2 Natural Environment Technical Report. Additional information regarding the potential impacts and mitigation measures are included in the Watercourse Characterization Tables enclosed.	
117.	Section 4.1.3 – "Extraction and quarry dewatering will also lower groundwater levels surrounding the west extension within 350 m of the extraction face. As such, a series of mitigation measures are proposed to address any potential adverse impact that could result from extraction and quarry dewatering." Did the study team identify any of the potential adverse impacts? Mitigation measures must ensure that any identified impacts are satisfactorily addressed when the replica pond is constructed.	Section 4.1.3	City of Burlington	The potential adverse impacts were identified in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report, the Surface Water Assessment, and the Level 1 and 2 Natural Environment Technical Report. Additional information regarding the potential impacts and mitigation measures are included in the Watercourse Characterization Tables enclosed.	
118.	As suggested in Section 4.1.3, will the proposed replica pond exactly mimic the existing groundwater mounding? Location of the replica pond will essentially be different from the existing irrigation ponds which will result in the mounding being shifted. Will this impact the zone of influence of any wells in the surrounding area?	Section 4.1.3	City of Burlington	The purpose of the infiltration pond is to replace the golf course ponds that may have contributed to groundwater recharge in the area. Some of the quarry discharge will be diverted to the	

	Section 11.3.3.3 of the Burlington Quarry Extension Level 1/2 Assessment Report has further confirmed the impact to the private wells in the vicinity of West Expansion. What would be the strategy for implementing the mitigation measure of deepening the impacted wells?			infiltration pond, the remaining water will be discharged to the Unnamed Tributary of Willoughby Creek. It was assumed that the pond will be in good hydraulic contact with the bedrock surface and should provide higher leakage than the natural ponds with their accumulated sediments and underlying Halton Till. Some form of long-term maintenance may be required in the final design to ensure that the infiltration pond does not become silted up. The infiltration ponds were represented in the model for the P3456 and RHB1 scenarios. Some of the infiltrated water will likely discharge to the quarry and be recirculated, but the main effect is to recharge the groundwater west of the quarry and maintain higher heads and prevent the private wells from going dry.	
119.	All of the mitigation relies on the diversion of external flow along Colling Rd.; has Tatham considered a back-up or alternate strategy should this not be feasible or approved?	Page 49 Section 4.2	Wood Environment & Infrastructure Solutions	Refer to response to Comment 37.	
120.	Can Tatham confirm the statement that all surface drainage catchments draining to the wetlands under assessment will not change in area or use over the course of the extraction and post extraction?	Page 50 Section 4.2.1	Wood Environment & Infrastructure Solutions	The south extension extraction area has been refined during the project to ensure the catchment areas of the wetlands east and south of the south extension will not be altered. As discussed in the Surface Water Assessment, the catchment areas to Wetlands 13200, 13201, 13202 and 13203 will be altered through extraction in the south and west extensions and mitigation measures have been prescribed accordingly.	
121.	Tatham indicates that for 7 of the 10 years analysed the hydroperiod would be delayed 5 days or less; can Tatham indicate why the other 3 years have not been reported?	Page 50 Section 4.2.1	Wood Environment & Infrastructure Solutions	All ten years analysed have been reported in Table 24.	
122.	Further to above comments, it is noted specifically for Table 28, Proposed Condition (Operations) Outlet Water Balance Results Summary & Table 36, Proposed Condition (Rehabilitation) Outlet Water Balance Results Summary: a. Existing conditions should be presented in the same tables as Proposed conditions to facilitate reviews. b. Runoff volumes with mitigation measures (Quarry Sump Q100 & Q200 discharges) should be presented. Currently significant reductions in West Arm Runoff Volumes are indicated in the tables but proposed mitigation measures have not been included in the analysis. c. Significant increases in Weir Pond Runoff Volumes are predicted because of the proposed diversion of external runoff along Colling Road. An assessment of pre-Quarry conditions should be included in the report to support the claim this increase is reflective of a more natural streamflow hydrograph.	Page 54-56 Section 4.2.2 and Pages 70-71 Section 5.4.2. Outlet Water Balance Results	Conservation Halton	Refer to response to Comment 59. Tables 28 and 36 have been revised accordingly.	
123.	This section is understood to document the impacts to the runoff regime to the various outlets from the Quarry Study area; the last sentence in para. 2 in this section indicates that "if necessary, mitigation measures have been developed that could	Page 55 Section 4.2.2	Wood Environment &	You are correct, the sentence should refer to the outlets or watercourses.	

	address potential impacts on the wetlands, ...". For clarity should this not refer to the "outlets" and further what would constitute the measure to indicate if mitigation is "necessary"? Can Tatham elaborate in this section?		Infrastructure Solutions	The AMP will be refined moving forward in collaboration with the review agencies establishing appropriate thresholds and mitigation measures for the watercourses/outlets.	
124.	Can Table 28 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Page 56 Section 4.2.2	Wood Environment & Infrastructure Solutions	Refer to response to Comment 59. Table 28 has been revised accordingly.	
125.	Can Tatham provide details on how the system would be performing while the Lake is filling and how long this is predicted to take?	Page 56 Section 4.3	Wood Environment & Infrastructure Solutions	During filling of the lake, the discharge to the Unnamed Tributary of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek will continue from sumps 0100 and 0200. Water not needed to maintain discharge to the surface water systems will be pumped into the south extension, which will supplement the groundwater influx and direct precipitation to fill the lake. Currently the existing quarry stores approximately 1 billion litres of water. It will take 3 billion litres to fill the south extension. It is reasonable to suggest that Nelson could pump 5,000 L/min from the existing quarry to the south quarry extension. At this rate, the south extension would fill in 417 days, assuming no inputs from groundwater or direct precipitation. However, the downstream water demands and available water in the Quarry need to be considered. Recognizing the quarry currently holds approximately 1 billion litres of water, 3 billion are required, and the discharge from sump 0100 and 0200 need to be maintained, it is estimated it will take 2 to 5 years to fill the lake.	
126.	Further to above comments, it is noted the ISWGA does not discuss the proposed diversion along Colling Road. Table 29, Proposed Condition Integrated Surface Water Groundwater Model Results may require revision.	Page 56 Section 4.3. Proposed Condition Integrated Surface Water Groundwater Analysis	Conservation Halton	Understood. The surface water management strategy/report will be revised as necessary through the development/refinement of the AMP in consultation with the agencies.	
127.	'The Willoughby Creek watershed will be reduced in area at SW7 through extraction in the west extension. The overall watershed will be reduced by approximately 19 ha or 6% at SW7. As illustrated in the previous table, the proposed condition integrated surface water groundwater model predicts a minor reduction in Willoughby Creek average monthly streamflow through the Medad Valley due to the reduction in in watershed area, and consequently reduction in surface runoff, and the lowering of the groundwater table in the area through extraction and quarry dewatering. A reduction of 1.1 – 2.9 L/s is predicted at surface water monitoring location SW7. The reduction in streamflow is predicted to be greater in the fall, winter and spring (when more water is available in Willoughby Creek) and less during the summer months. The monitoring data collected to date shows a continuous baseflow of approximately 4 L/s in Willoughby Creek at SW7. However, the quarry discharge contributes to the baseflow	Page 58 2nd Paragraph Section 4.3 Proposed Condition Integrated Surface Water Groundwater Analysis	Norbert M. Woerns	In the interim condition, between the cessation of off-site discharge and full quarry lake, there is a potential for Willoughby Creek to dry out at surface water monitoring location SW7. As per the results of the integrated surface and groundwater model, leakage from the quarry lake, once filled, will help maintain streamflow in the Medad Valley and Willoughby Creek.	

	at SW7 and it is expected that Willoughby Creek would run dry at SW7 if the quarry discharge were to cease. As proposed, the quarry discharge from Quarry Sump 0100 will be maintained during operations and long-term post rehabilitation. Maintaining the off-site discharge will maintain baseflows in Willoughby Creek downstream of its confluence with its tributary.' Why is it expected that Willoughby Creek at SW7 will dry up by stopping pumping into the creek? See Earthfx, page 252, 1st paragraph where the model shows a net reduction in seepage at SW7 of 2.1 litres/second from phases 3456 extraction. This represents over 50.0% of measured base flow of 4.0 litres/second at SW7. By turning off the pumps in rehabilitation scenario 2 (RHB2) the model shows increased surface water flows in adjacent creeks not currently receiving sump discharge from the quarry (see Earthfx Figure 8.106, page 284)). There does not appear to be a complete cost benefit analysis with respect to the two rehabilitation scenarios.				
128.	Further to above comments, it is noted specifically for Table 30, Proposed Condition (Operations) Hydrologic Model Results Summary & Table 37, Proposed Condition (Rehabilitation) Hydrologic Model Results Summary – a. Willoughby Creek Tributary on the downstream side of Colling Road should be included in as a point of interest in addition to or instead of the Weir Pond. Results both with and without the diversion of runoff along at Colling Road should be provided. b. For consistency, peak quarry sump discharge peak flow rates should be added to the peak flows provided in the tables.	Page 58-60 Section 4.4. Proposed Condition (Operations) Event Based Hydrologic Analysis and Pages 72-73 Section 5.6. Proposed Conditions (Rehabilitation) Event Based Hydrologic Analysis	Conservation Halton	Refer to response to Comments 51, 59 and 105. The peak quarry discharge flow rate has been added to Tables 30 and 37 as requested.	
129.	Can Table 30 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Page 59 Section 4.4	Wood Environment & Infrastructure Solutions	Refer to response to Comment 59. Table 30 has been revised accordingly.	
130.	'The predicted average lake water level (269.00 m) is below the existing sill elevation (269.08 m) of the weir structure constructed by the BSGCC in the weir pond (wetland 13202) which created the weir pond (wetland 13202), maintains water levels in the wetland and controls discharge to the tributary of Willoughby Creek and consequently Willoughby Creek. When the lake water level drops below an elevation of 269.08 m, gravity discharge to the tributary of Willoughby Creek will not occur. Also, the average water level in the weir pond (wetland 13202) is 269.27 m. The wetland water level will drop in response to the lake water levels and cessation of off-site discharge.' Have modifications to the weir been considered to maintain gravity flow to the Tributary to Willoughby Creek?	Page 61 Section 5.1, Approved Rehabilitation 3rd Paragraph	Norbert M. Woerns	Refer to response to Comment 34.	
131.	'This is an important consideration as Willoughby Creek and the West Arm have been identified as fish habitat. Baseflow and water temperature are critical to the form and function of these watercourses from a natural heritage, habitat and spawning perspective. Rehabilitating the Burlington Quarry as approved will negatively impact Willoughby Creek and the West Arm as flows will be reduced and/or eliminated. Similarly, the weir pond (wetland 13202) and the wetland 13203 (located along the West Arm adjacent to the south extension) are currently identified as natural heritage	Page 61-62 Section 5.1, Approved Rehabilitation 4th Paragraph	Norbert M. Woerns	As illustrated in the streamflow monitoring summaries provided for surface water monitoring location SW1, the depth of water in the wetland has reached 0 m when the quarry discharge ceases for an extended period of time. At the same time, the discharge downstream into the Unnamed Tributary of Willoughby Creek ceases	

	features. These features are dependent on the quarry discharge to maintain their hydroperiod and may dry out under the approved rehabilitation plan.' Has drying out of features been established with supporting field evidence and analysis. The lack of understanding of the critical flow characteristics of the tributary of Willoughby Creek brings into question the validity of the conclusions regarding the impact from the quarry and quarry discharge on Willoughby Creek.			when discharge from the quarry ceases for extended periods of time.	
132.	Section 5.2 makes reference to a new rehabilitation plan which proposes to convert the Burlington Quarry into a landform rather than a lake. Drawing 3 of the Site Plan set outlines the proposed rehabilitation for the west extension however no plan(s) are provided for the existing Burlington Quarry. In order to fully understand the drainage patterns and operations affecting surface water, a plan should be provided at this stage which illustrates the full rehabilitation plan, including the existing quarry.	Page 62 Section 5.2	Wood Environment & Infrastructure Solutions	Refer to response to Comment 13.	
133.	Tatham references an "iterative" process to Site Plan development - for completeness and a more fulsome understanding can the iterative changes/adjustments be documented for the record?	Page 62 Section 5.3	Wood Environment & Infrastructure Solutions	Refer to response to Comment 42.	
134.	This section describes long term water management objectives for the Quarry but does not provide any indication as to the overall water budget nor the needs for each of the proposed features requiring water. Can Tatham outline the water demands and associated tolerances for each element cited and also provide an indication of sustainability?	Page 63 Section 5.3.1	Wood Environment & Infrastructure Solutions	The long-term water management objective of the Quarry is to maintain the existing discharge (rate and volume) to the Unnamed Tributary of Willoughby Creek and the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek. Also, the discharge of quarry water into Wetland 13201 via the bottom draw outlet and the infiltration pond is required to maintain the wetland hydroperiod. The wetland hydroperiod will be established as additional baseline monitoring data is collected from the wetland. Also, the wetland water balance will be updated and recalibrated to identify the water demands to the wetland long-term.	
135.	Tatham indicates that a water level control is not proposed for the lake - can the reason and rationale be provided? It is suggested that without some form of control adaptive management opportunities may be compromised	Page 63 Section 5.3.2	Wood Environment & Infrastructure Solutions	Based on the results of the integrated surface and groundwater model, the lake will fill to an elevation of 271.0 m. Minimum existing grade around the proposed south extension lake is 272.0 m and the grade will be raised via earthworks to contain the pond water level. An overflow weir will be installed to discharge water from the lake to the West Arm of the West Branch of the Mount Nemo Tributary of Grindstone Creek, preventing failure of the lake banks in case of an emergency. Although, the overflow weir is not expected to be used. If streamflow mitigation is required in the West Arm, there are opportunities to construct an outlet to the watercourse. However, discharge from quarry sump 0200 to the West Arm is proposed long-term and may also be adjusted to mitigate adverse impacts in the West Arm.	

				The AMP will be refined moving forward in collaboration with the review agencies establishing appropriate mitigation measures for the watercourses.	
136.	It is unclear if under the rehabilitated condition whether the water balance will change in the vicinity of the replica pond - can Tatham advise?	Page 64 Section 5.3.3	Wood Environment & Infrastructure Solutions	As noted, the infiltration pond will remain active and receive a portion of the discharge used to maintain low groundwater levels within the excavated area. This water will infiltrate the shallow bedrock and raise groundwater levels in its vicinity. Some of the infiltrating water would flow back into the excavation while the remainder would discharge to the Medad Valley. Simulated changes in the water balance in nearby streams and wetlands are discussed in the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report.	
137.	Tatham notes that a bottom draw outlet control will be maintained post extraction and monitoring of the wetland will be completed to maintain the hydroperiod; can Tatham advise on the triggers for adaptive management and the adjustments which may be required if those triggers are not met?	Page 64 Section 5.3.3	Wood Environment & Infrastructure Solutions	The AMP will be refined moving forward in collaboration with the review agencies establishing appropriate thresholds and mitigation measures for Wetland 13201.	
138.	Can Table 36 be re-structured to include a comparison between existing and proposed runoff volume at the respective outlets? Further can a table be added which provides a monthly or seasonal comparison at the outlets?	Page 71 Section 5.4.2	Wood Environment & Infrastructure Solutions	Refer to response to comment 59. Table 36 has been revised as requested.	
139.	Can Table 37 be re-structured to include a comparison between existing and proposed peak flows at the respective outlets?	Page 73 Section 5.6	Wood Environment & Infrastructure Solutions	Table 37 has been revised as requested.	
140.	Revisit and revise the Surface Water Management Strategy in conjunction with addressing the feedback on the Surface Water Assessment and other supporting studies.	Pages 74-91 Section 6. Surface Water Management Strategy	Conservation Halton	The surface water management strategy will be revised as necessary through the development/refinement of the AMP in consultation with the agencies.	
141.	Can Tatham provide a basis for the range in active storage requirements - i.e. 700,000.0 to 800,000.0 cubic metres?	Page 74 Section 6.1.1	Wood Environment & Infrastructure Solutions	Refer to response to Comment 40.	
142.	Section 6.1.1 Burlington Quarry – "It is recommended that Nelson seek to permanently increase the maximum allowable discharge rate from Quarry Sump 0100. A permanent increase in the maximum allowable discharge rate is not mandatory, only recommended." Will Nelson Aggregate implement this recommendation long term, under the operations and the rehabilitations scenarios?	Section 6.1.1	City of Burlington	The recommendation is being considered by Nelson. However, at this time no increase in off-site discharge is proposed. The discharge rates will be further reviewed as part of the AMP update. It is noted, an amendment to the Quarry's existing PTTW will be required for any increase to off-site discharge.	
143.	For clarity can Tatham indicate which gauges were installed for this study and which will remain and which will be added post extraction? Suggest adding these details to Tables 38 and 39.	Page 79 Section 6.3	Wood Environment & Infrastructure Solutions	The existing and proposed surface water monitoring locations are illustrated on the Existing and Proposed Surface Water Monitoring Locations Plans (Drawings SW-1 and SW-2).	

144.	Can Tatham outline the elements of the adaptive management plan which will potentially be available to meet the environmental management goals?	Page 79 Section 6.3	Wood Environment & Infrastructure Solutions	The AMP will be refined moving forward in collaboration with the review agencies to satisfy the environmental management goals.	
145.	Can Tatham describe the methodology proposed for Nelson to establish a long-term discharge protocol?	Page 81 Section 6.3	Wood Environment & Infrastructure Solutions	All discharge to Wetland 13201 should be recorded and analysed overtime to identify any trends in discharge. If trends are identified, a discharge protocol should be established to further protect the wetland and reduce the reliance of the weekly recommended monitoring to identify impacts on hydroperiod.	
146.	Surface water thresholds for wetland hydroperiod are proposed in this report (Section 6.4). It is noted on Page 86 that "If the wetland water level drops to zero at a monitoring location (0.0 water level staff gauge reading) before the hydroperiod threshold stipulated in the previous table, the applicable mitigation measures described in Section 6.5 are to be implemented while the cause of the potential impact is evaluated to determine if it has been caused by extraction and/or quarry dewatering." These thresholds are therefore critical for maintaining wetland functions related to hydroperiod. The thresholds are not sufficiently conservative to protect the function of these ponds should the quarry affect their hydroperiod. Pond functions such as amphibian breeding rely on "good" years (years where water remains late into spring and summer) to make up for years where ponds dry up unusually early. The individual monitoring results for each wetland shown in Tables 32 to 35 show that these wetlands generally dry up in late spring or early summer, while the monitoring thresholds in Table 42 show thresholds in the early spring, generally the end of April or beginning of May. Wetlands that consistently dry up in early spring have low capacity to support amphibian breeding and other functions. Later thresholds should be established to ensure standing water is maintained for long enough to promote amphibian breeding and other functions. Wetland 13023 (the wetland immediately to the west of the south extension, which supports SWH for breeding amphibians as well as Painted Turtle), is not included in these analyses. The report should discuss monitoring and thresholds for this wetland, even though it is supported by quarry discharge.	Page 86 Section 6.4 and Tables 32-35 and 42	North-South Environmental Inc.	The wetland hydroperiod thresholds have been established to identify potential impacts related to the quarry expansion based on wetland hydroperiod monitoring data. Establishing sufficiently conservative thresholds will lead to false triggers caused by climatic conditions during dry years. The intention is to set thresholds so the existing function of the wetlands is maintained. It is not the intention to set conservative thresholds to increase the length of time the wetlands hold water to improve amphibian breeding. The AMP will be refined moving forward in collaboration with the review agencies establishing appropriate thresholds for the wetlands. Wetland 13023 is included in the integrated surface and groundwater model and wetland water balance analysis.	
147.	Preliminary baseflow and temperature thresholds are recommended. Water quality thresholds for total suspended solids, pH, and oil and grease for discharge waters are part of the existing quarry Environmental Compliance Approval (ECA). Tatham recommended that these be maintained for the proposed expansion. No threshold or target water quality levels for the remaining water quality parameters included in the monitoring program, currently exist. 'Its recommended that the water quality thresholds be established from the results of the historic water quality sampling completed in support of the proposed quarry extension. Specifically, maximum and minimum concentration limits should be established from the sample results collected while considering the Provincial Water Quality Objectives (PWQO) and role water quality plays in the Natural Heritage Features.' (Tatham, page 88, 3rd paragraph.) No such recommendation has been made for groundwater quality parameters.	Page 88 3rd Paragraph	Norbert M. Woerns	The AMP will be refined moving forward in collaboration with the review agencies and additional water quality thresholds will be established, if necessary.	
148.	'Extraction will reduce the drainage area to wetland 13201 northwest of No. 2 Sideroad forming the headwaters of the unnamed tributary of Lake Medad. Reducing the drainage area of the wetland has the potential to adversely impact the wetlands	Page 89 3rd Paragraph	Norbert M. Woerns	The wetland threshold values will be developed from the wetland hydroperiod monitoring data currently being collected and the results of the	

	hydroperiod. As such, a mitigation strategy has been developed to supplement the flow into the wetland during operations as required. A bottom draw outlet will be constructed in the southeast corner of the proposed replica pond and an outlet pipe complete with a control valve will be installed to discharge water into the roadside ditch along No. 2 Sideroad feeding the wetland. The wetland hydroperiod will be monitored and water will be discharged to the wetland as required to maintain the wetland hydroperiod.' What are the threshold levels for the hydroperiod for this wetland?	Section 6.5. Mitigation		integrate surface and groundwater model and wetland water balance moving forward as part of the refinement of the AMP.	
149.	Mitigation measures are described with respect to meeting thresholds and triggering mitigation for streamflow, stream temperature, wetland hydroperiod, effluent limits, and water quality. Changes to surface water regime can change rapidly in response to precipitation events. How will the trigger levels be responded to and mitigative measures be implemented? The current monitoring program consists of continuous data logger recordings plus monthly manual flow measurements, quarterly water quality sampling, and weekly field visits to monitor wetland hydroperiods during the seasonal wetland hydroperiod.	Page 90 Section 6.5. Mitigation	Norbert M. Woerns	The AMP will be refined moving forward in collaboration with the review agencies providing clear direction on how the triggers will be responded to and mitigative measures will be implemented.	
150.	The City of Burlington expects Nelson Aggregates to implement the entire list of recommendations noted in Section 7 of the Surface Water Report.	Section 7	City of Burlington	Nelson commits to implementing the recommendations of the Surface Water Assessment.	
151.	Update recommendations and the summary as necessary to reflect any changes resulting from the above feedback.	Pages 92-95 Section 7. Recommendations and Section 8. Summary	Conservation Halton	The surface water management strategy will be revised as necessary through the development/refinement of the AMP in consultation with the agencies.	
152.	Please add arrows on drawing DP-1 to show direction of flow in drainage channels.	Drawing DP-1	City of Burlington	The drawings have been revised accordingly.	
153.	Manual water level readings are shown on hydrographs in Appendix G. Appendix F summarizes manual shallow groundwater levels although it is not clear what the measuring point was and the significance of negative values.	Appendices F and G	Norbert M. Woerns	The datum (existing grade) is provided on the graphs. As the datum is set at existing grade, positive values mean water levels are above existing grade and negative values mean water levels are below existing grade.	
154.	Water quality results are presented in Appendix H, however there is no discussion of water quality in the report with respect to drinking water quality standards. Infiltration of surface water is proposed to maintain down-gradient private well water supplies. Emphasis is focused upon the threshold values of selected parameters included in the Environmental Compliance Approval (ECA) for the existing quarry.	Appendix H	Norbert M. Woerns	Refer to the Level 1 and 2 Hydrogeological and Hydrological Impact Assessment Report for discussion regarding water quality and the impact the infiltration pond will have on down-gradient wells.	

LEGEND

- KEY POINT OF INTEREST
- CULVERT CROSSING
- EXISTING CHANNEL
- WATERCOURSE
- SUBCATCHMENT BOUNDARY
- CATCHMENT BOUNDARY
- WATERSHED BOUNDARY
- IRRIGATION PONDS
- WETLANDS
- FLOW DIRECTION

SUBCATCHMENT	AREA (ha)
S100	248.2
S101	84.2
S102	6.7
S103	16.5
S104	6.9
S105	1.7
S106	2.3
S107	8.7
S108	6.6
S109	7.4
S110	6.5
S111	14.9
S112	26.2
S113	10.6
S114	6.8
S115	17.5
S116	22.7
S117	1.6
S118	1.5
S119	3.1
S120	1.6
S121	0.5
S122	8.2
S123	17.2
S124	22.0
S125	0.9
S126	9.2
S127	4.1

POINT OF INTEREST	AREA (ha)
A	26.2
B	55.5
C	389.9
D	31.5
E	14.9

No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JUNE 2021

ENGINEERS STAMP

BURLINGTON QUARRY

EXISTING CONDITIONS DRAINAGE PLAN

TATHAM ENGINEERING

DESIGN: JG	FILE: 113187	DWG:
DRAWN: SD	DATE: MAY 2020	DP-1
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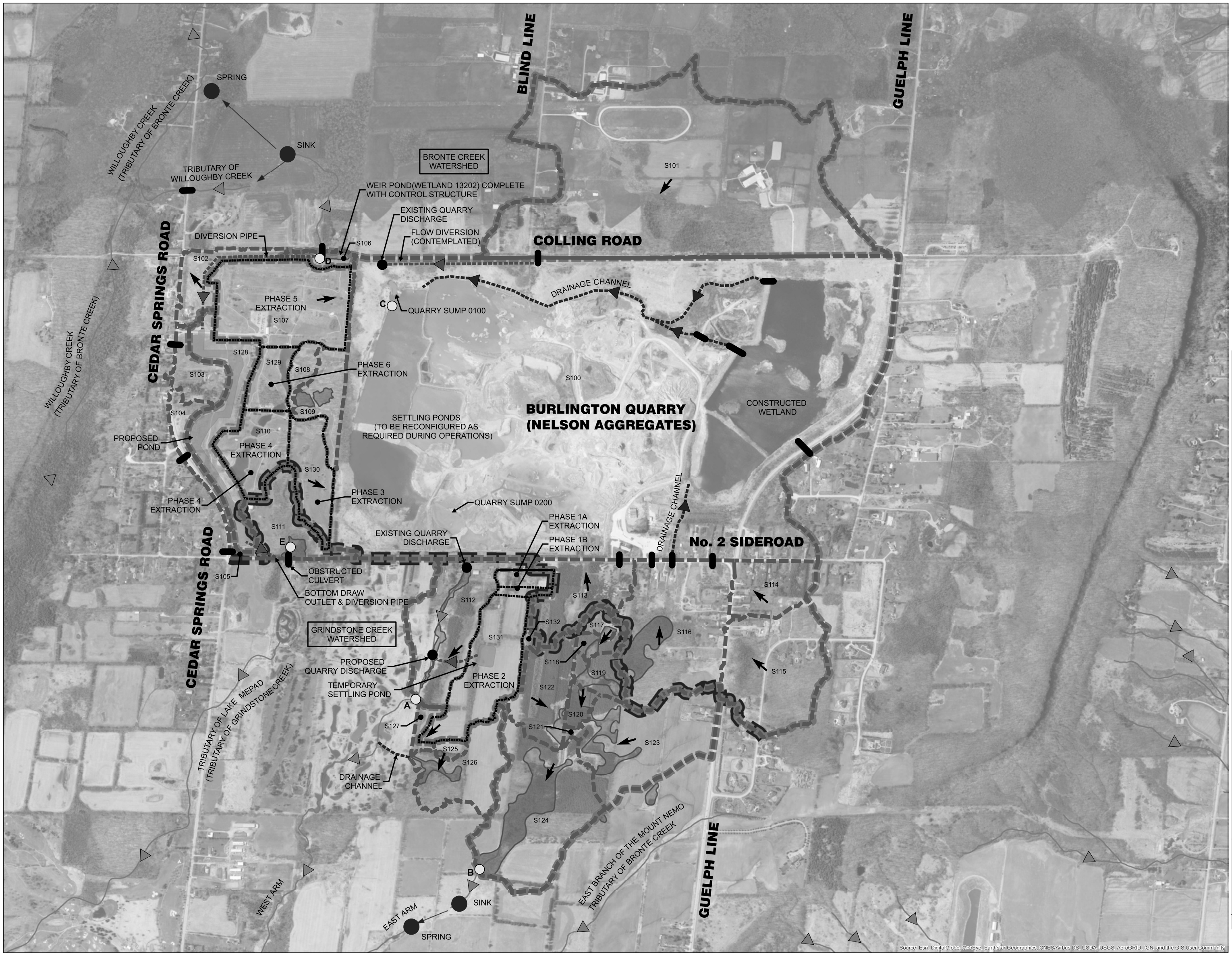

SUBCATCHMENT	AREA (ha)
S100	248.2
S101	84.2
S102	5.0
S103	4.4
S104	3.2
S105	0.6
S106	1.5
S107	18.3
S108	2.0
S109	5.4
S110	7.3
S111	7.6
S112	14.5
S113	9.7
S114	6.8
S115	17.5
S116	22.7
S117	1.6
S118	1.5
S119	3.1
S120	1.6
S121	0.5
S122	8.2
S123	17.2
S124	22.0
S125	0.9
S126	9.2
S127	1.2
S128	11.3
S129	4.0
S130	6.6
S131	14.5
S132	1.0

POINT OF INTREST	AREA (ha)
A	29.0
B	55.5
C	482.7
D	12.8
E	7.6

LEGEND

- KEY POINT OF INTEREST
- CULVERT CROSSING
- PROPOSED FLOW DIVERSION
- DRAINAGE CHANNEL
- EXTRACTION PHASE LIMITS
- SUBCATCHMENT BOUNDARY
- WATERCOURSE
- EXTRACTION PHASE LIMITS
- CATCHMENT BOUNDARY
- WATERSHED BOUNDARY
- PROPOSED POND
- WETLANDS
- FLOW DIRECTION

No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JUNE 2021

ENGINEERS STAMP

BURLINGTON QUARRY

PROPOSED CONDITIONS
(OPERATIONS) DRAINAGE PLAN

TATHAM
ENGINEERING

DESIGN: JG	FILE: 113187	DWG:
DRAWN: SD	DATE: MAY 2020	DP-2
CHECK: DRT	SCALE: 1:7500	

LEGEND

- KEY POINT OF INTEREST
- CULVERT CROSSING
- PROPOSED FLOW DIVERSION
- DRAINAGE CHANNEL
- WATERCOURSE
- PROPOSED LAKE
- SUBCATCHMENT BOUNDARY
- CATCHMENT BOUNDARY
- WATERSHED BOUNDARY
- PROPOSED POND
- WETLANDS
- FLOW DIRECTION

SUBCATCHMENT	AREA (ha)
S100	248.2
S101	84.2
S102	5.0
S103	4.4
S104	3.2
S105	0.6
S106	1.5
S107	18.3
S108	2.0
S109	6.5
S110	7.3
S111	7.6
S112	14.5
S113	9.7
S114	6.8
S115	17.5
S116	22.7
S117	1.6
S118	1.5
S119	3.1
S120	1.6
S121	0.5
S122	8.2
S123	17.2
S124	22.0
S125	0.9
S126	9.2
S127	1.2
S128	11.3
S129	4.0
S130	5.6
S131	14.5
S132	1.0

POINT OF INTREST	AREA (ha)
A	14.5
B	55.5
C	482.7
D	12.8
E	7.6

No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JULY 2021

ENGINEERS STAMP

BURLINGTON QUARRY

PROPOSED CONDITION (REHABILITATION) DRAINAGE PLAN

TATHAM ENGINEERING

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DRAWN: SD	DATE: MAY 2020	**DP-3**
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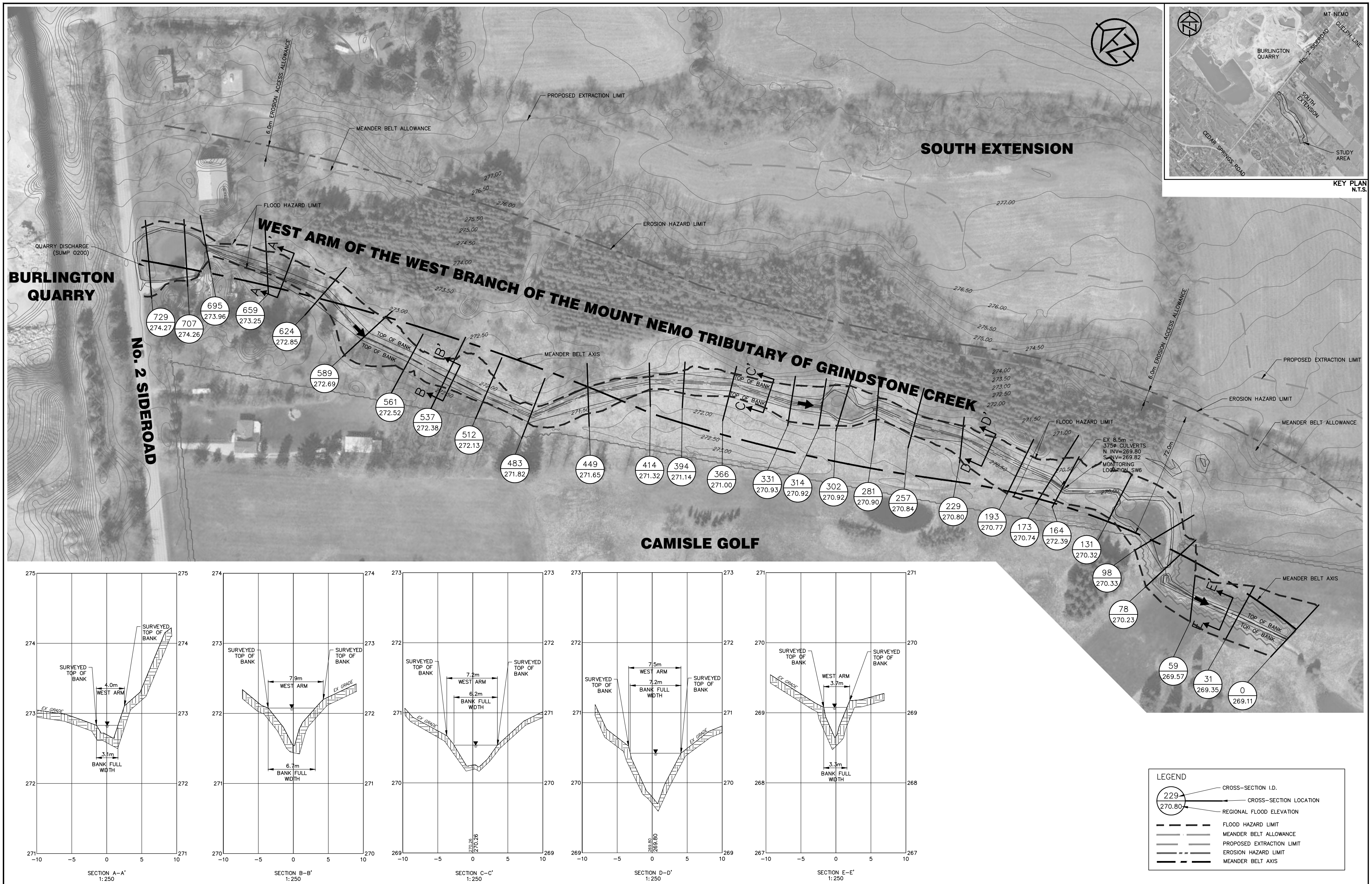

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Drawing Name: 113187_FLD-1-AT.dwg, Plotted: Jul 09, 2021

BENCHMARKS

NOTES

TOPOGRAPHIC SURVEY – TATHAM ENGINEERING LIMITED. DATE: JANUARY 2020

TOPOGRAPHIC MAPPING – EARTH FX LIMITED, DRONE SURVEY CALIBRATED TO GROUND CONTROL POINTS WITH +/– 3cm ACCURACY. DATE: NOVEMBER 2019

No.	REVISION DESCRIPTION	DATE
1.	FIRST SUBMISSION	APRIL 2020
2.	RESPONSE TO JART COMMENTS	JUNE 2021

ENGINEER STAMP

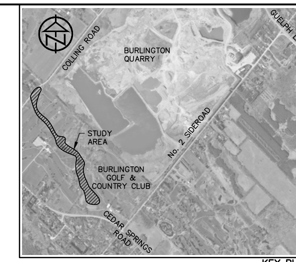
LICENSED PROFESSIONAL ENGINEER D.R.W. TWIGGER 100147566 July 7, 2021 PROVINCE OF ONTARIO

BURLINGTON QUARRY

NATURAL HAZARDS PLAN

TATHAM ENGINEERING

DESIGN: JG	FILE: 113187	DWG:	
DRAWN: CA	DATE: FEB./2020	NH-1	
CHECK: DRT	SCALE: 1:1,000		



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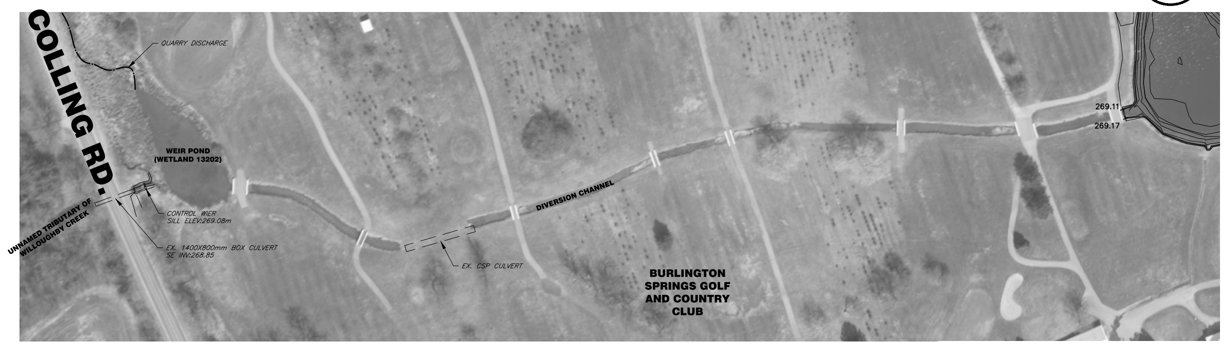

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No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JULY 2021

ENGINEER STAMP

BURLINGTON QUARRY

BURLINGTON SPRINGS GOLF & COUNTRY CLUB WEIR POND, DIVERSION CHANNEL & IRRIGATION POND PLAN

TATHAM ENGINEERING

DESIGN: DRT	FILE: 113187	DWG: PND-1
DRAWN: SD	DATE: JUNE 2021	
CHECK: DRT	SCALE: 1:1000	

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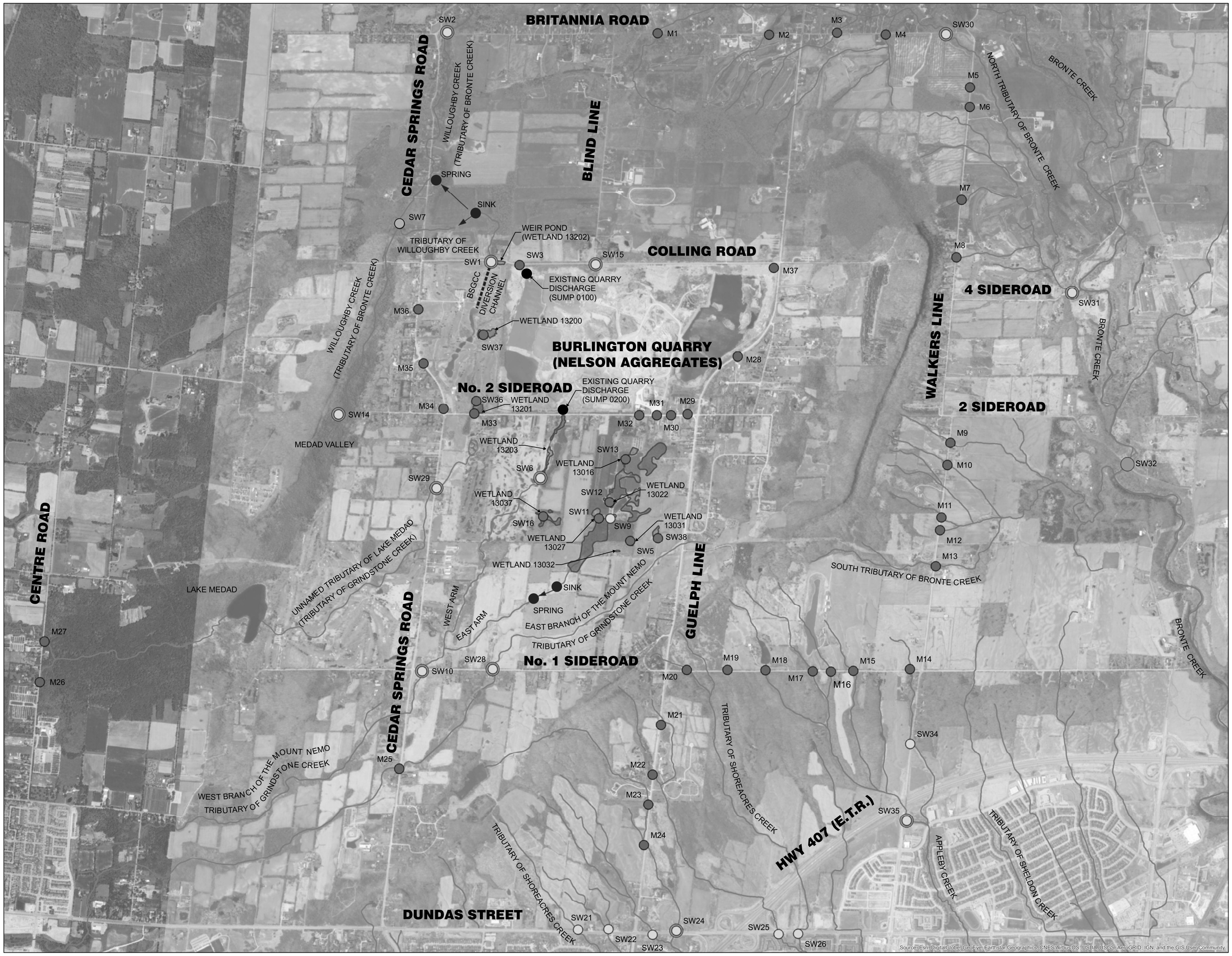

LEGEND

SURFACE WATER MONITORING LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- MONTHLY MANUAL IN-SITU STREAMFLOW MEASUREMENTS
- CONTINUOUSLY RECORDING STREAMFLOW
- FORMER MONITORING WELL LOCATION
- WATER QUALITY SAMPLING
- WATERCOURSE
- DIVERSION CHANNEL
- WETLANDS

No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JUNE 2021

ENGINEERS STAMP

BURLINGTON QUARRY

EXISTING SURFACE WATER MONITORING LOCATIONS PLAN

TATHAM ENGINEERING

DESIGN: JG	FILE: 113187	DWG:
DRAWN: SD	DATE: MAY 2020	SW-1
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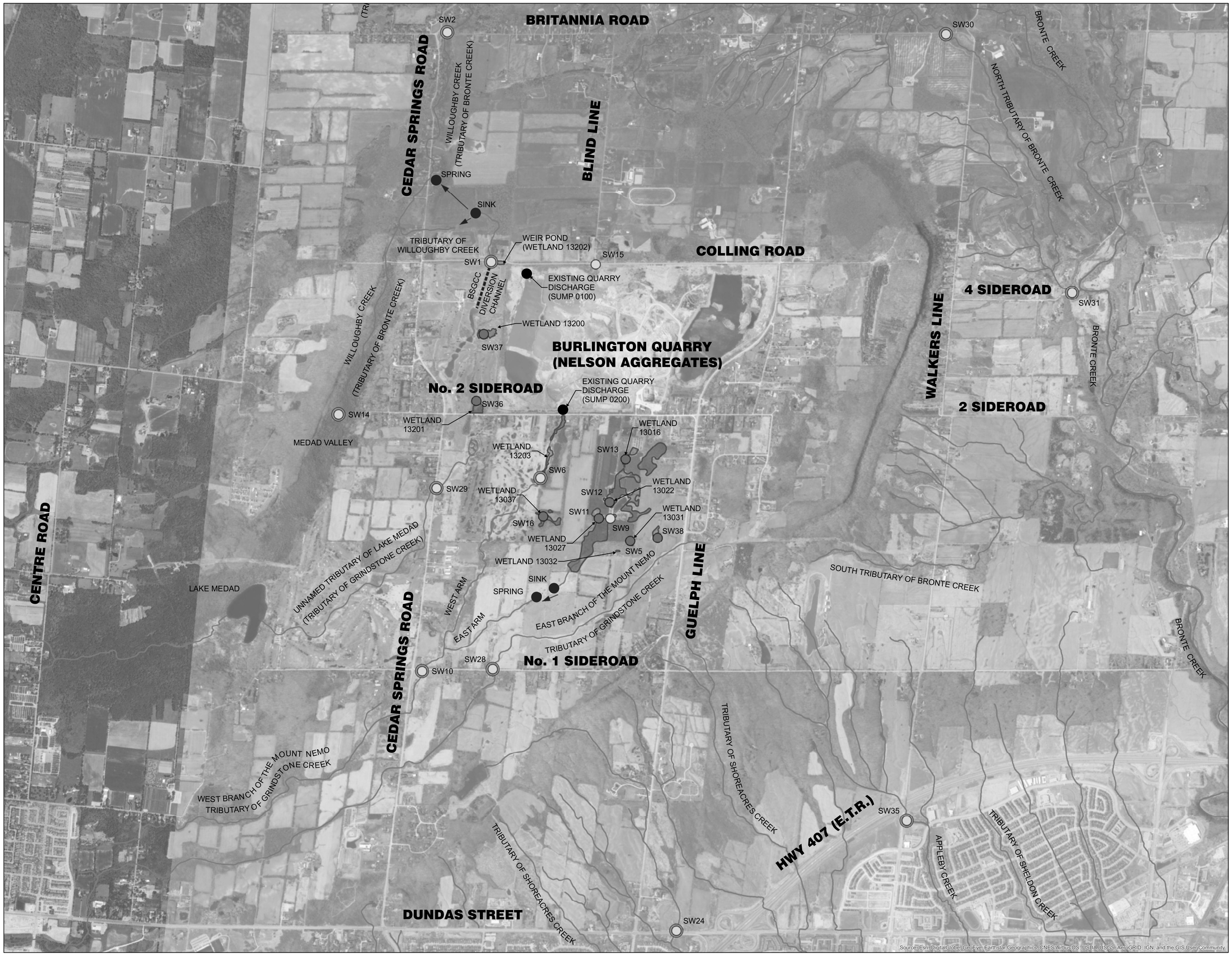


LEGEND

SURFACE WATER MONITORING LOCATIONS

- WETLAND HYDROPERIOD / SHALLOW GROUNDWATER
- CONTINUOUSLY RECORDING STREAMFLOW
- WATER QUALITY SAMPLING
- WATERCOURSE
- DIVERSION CHANNEL
- WETLANDS

No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JUNE 2021

ENGINEERS STAMP

BURLINGTON QUARRY

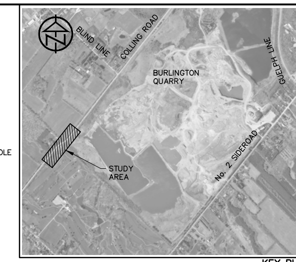
POST-APPROVALS SURFACE WATER MONITORING LOCATIONS PLAN

TATHAM ENGINEERING

DESIGN: JG	FILE: 113187	DWG:
DRAWN: SD	DATE: MAY 2020	**SW-2**
CHECK: DRT	SCALE: 1:15000	

LEGEND

— - — -	PROPERTY LINE
— — —	EXISTING CULVERT
— GAS —	EXISTING GAS MAIN
— X —	EXISTING FENCE LINE
— · —	EXISTING DITCH
⊏ ═ ⊐	EXISTING CULVERT
⊏ ═ ⊐	PROPOSED CULVERT
O PMHCB	PROPOSED CATCHBASIN MAINTENANCE HOLE



KEY PLAN
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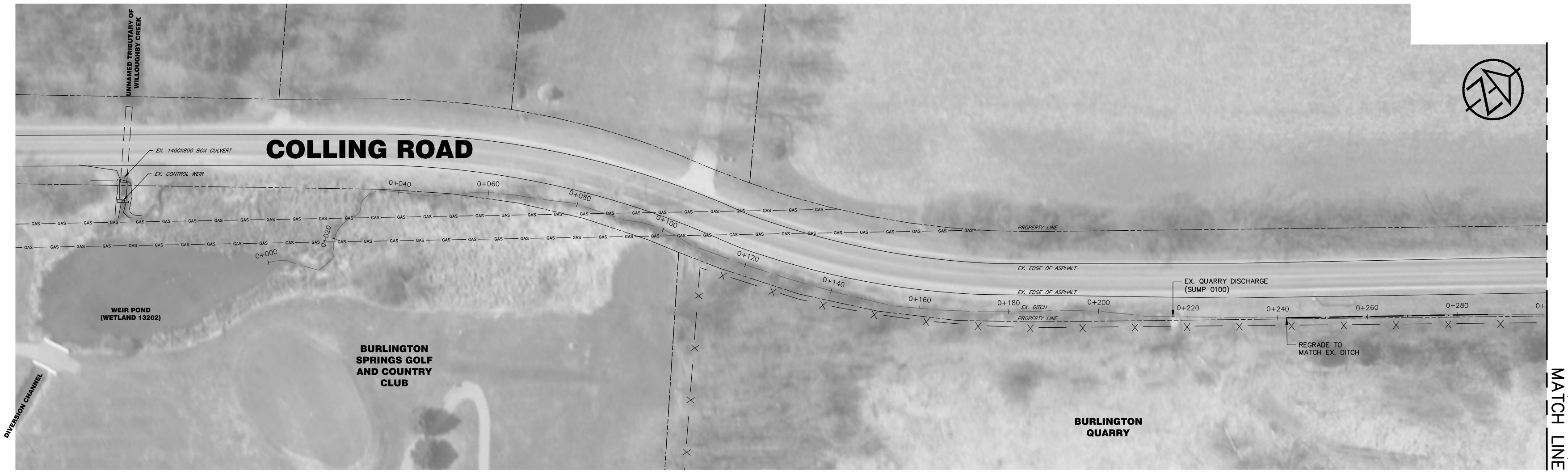
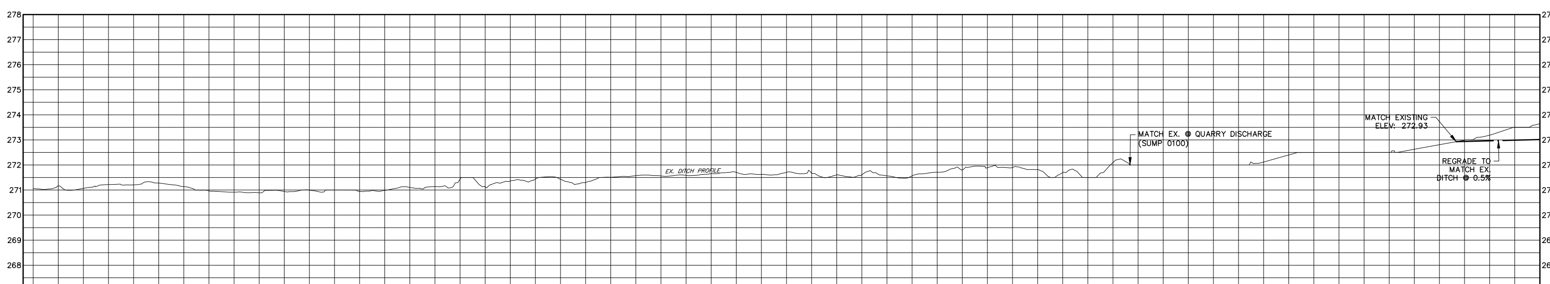




PROPOSED C/L ELEV															
EXISTING C/L ELEV	271.07	271.21	270.92	271.00	271.14	271.44	271.57	271.70	271.60	271.71	271.82	272.00	272.00	272.50	272.81
CHAINAGE	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280

BENCHMARKS

NOTES

TOPOGRAPHIC SURVEY – TATHAM ENGINEERING LIMITED. DATE: JANUARY 2020

TOPOGRAPHIC MAPPING – EARTH FX LIMITED, DRONE SURVEY CALIBRATED TO GROUND CONTROL POINTS WITH +/- 3cm ACCURACY. DATE: NOVEMBER 2019

No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JULY 2021

ENGINEER STAMP

PRELIMINARY

BURLINGTON QUARRY

PLAN & PROFILE
STA. 0+000 – STA 0+300

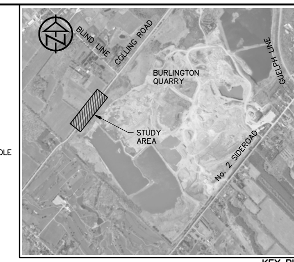
TATHAM ENGINEERING

DESIGN: DRT	FILE: 113187	DWG: PP-1
DRAWN: SD	DATE: JUNE 2021	
CHECK: DRT	SCALE: H 1:500 V 1:100	

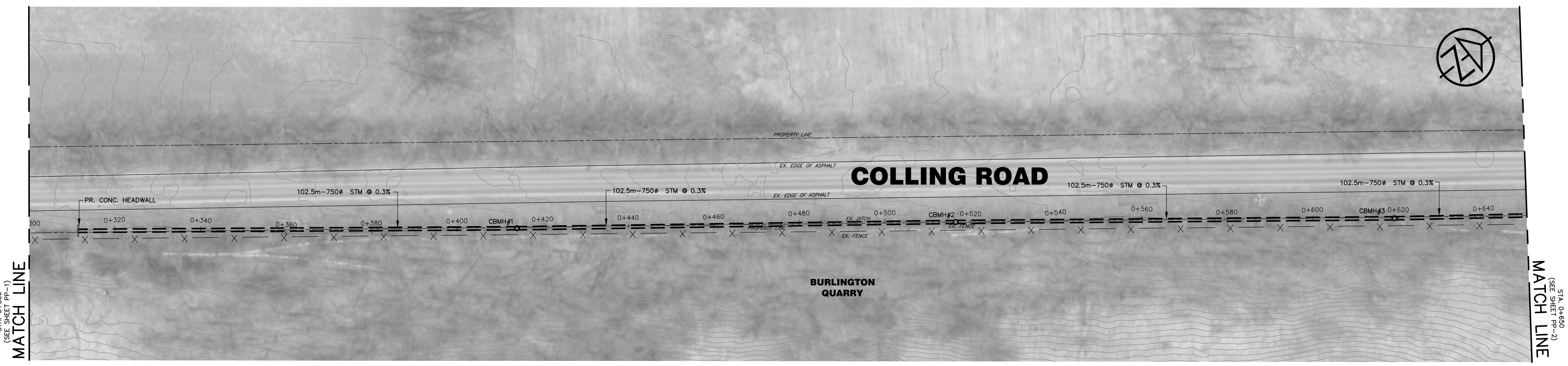
Drawing Name: 113187-PP01.dwg, Plotted: Jul 14, 2021

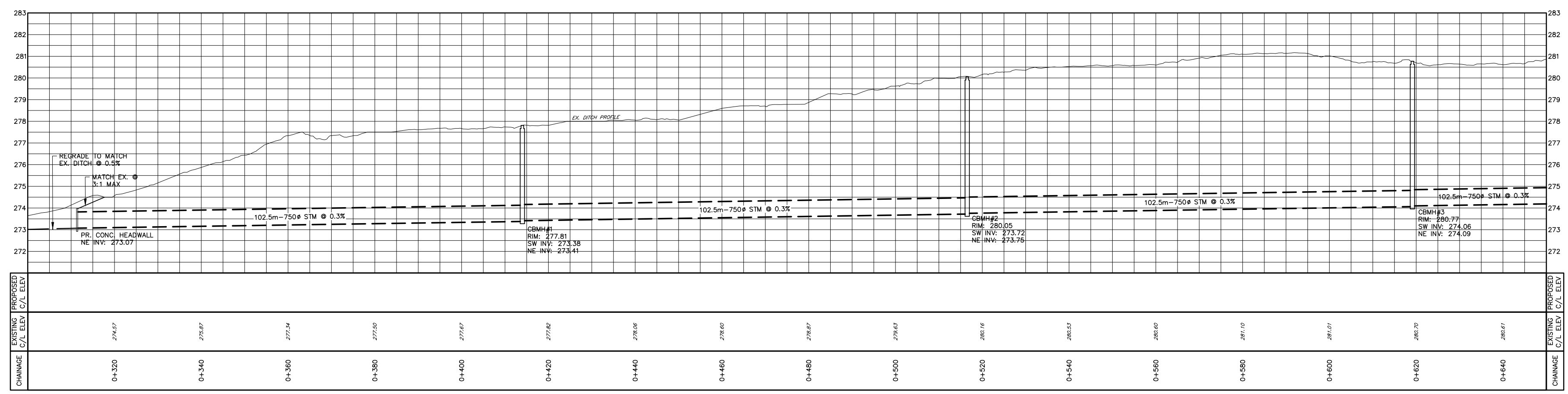
LEGEND

—— - ——	PROPERTY LINE
— — —	EXISTING CULVERT
—GAS—	EXISTING GAS MAIN
—X—	EXISTING FENCE LINE
——·——	EXISTING DITCH
⊏ ═ ⊐	EXISTING CULVERT
⊏ ═ ⊐ (bold)	PROPOSED CULVERT
o PMHCB	PROPOSED CATCHBASIN MAINTENANCE HOLE



KEY PLAN
N.T.S.





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No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JULY 2021

ENGINEER STAMP

PRELIMINARY

BURLINGTON QUARRY

PLAN & PROFILE
STA. 0+300 – STA 0+650

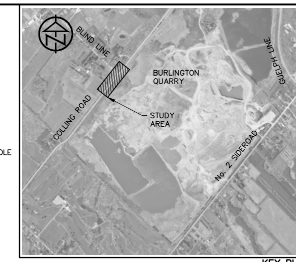
TATHAM ENGINEERING

DESIGN: DRT	FILE: 113187	DWG:
DRAWN: SD	DATE: JUNE 2021	**PP-2**
CHECK: DRT	SCALE: H 1:500 V 1:100	

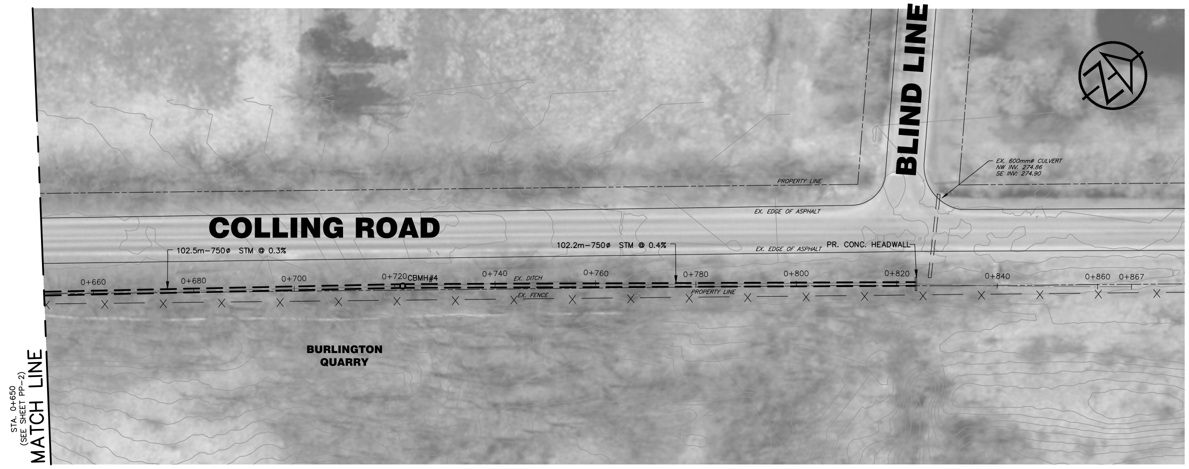
Drawing Name: 113187-PP01.dwg, Plotted: Jul 14, 2021

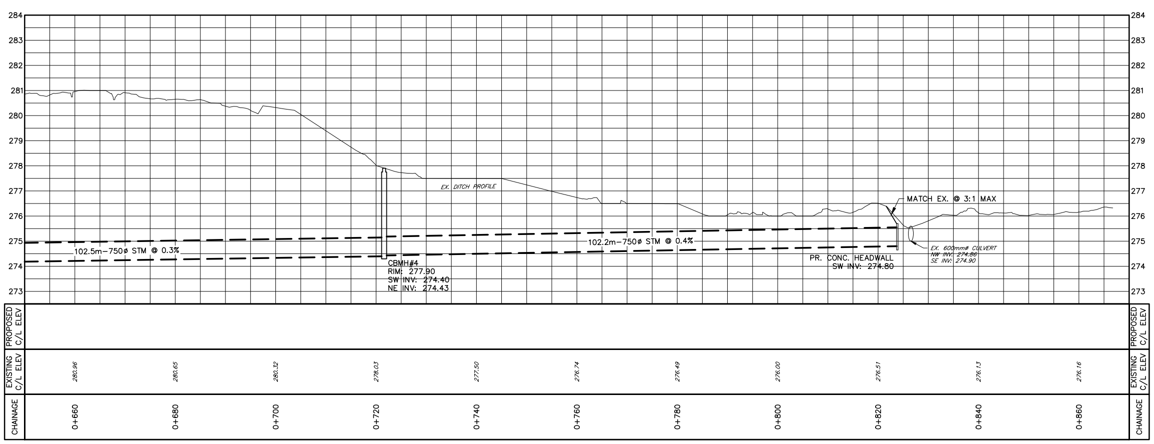
LEGEND

— - - —	PROPERTY LINE
— — —	EXISTING CULVERT
— GAS —	EXISTING GAS MAIN
— X —	EXISTING FENCE LINE
— · —	EXISTING DITCH
⊏ ═ ⊐	EXISTING CULVERT
⊏ ═ ⊐	PROPOSED CULVERT
O PMHCB	PROPOSED CATCHBASIN MAINTENANCE HOLE



KEY PLAN
N.T.S.





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BENCHMARKS

NOTES

TOPOGRAPHIC SURVEY – TATHAM ENGINEERING LIMITED. DATE: JANUARY 2020

TOPOGRAPHIC MAPPING – EARTH FX LIMITED, DRONE SURVEY CALIBRATED TO GROUND CONTROL POINTS WITH +/– 3cm ACCURACY. DATE: NOVEMBER 2019

No.	REVISION DESCRIPTION	DATE
1.	RESPONSE TO JART COMMENTS	JULY 2021

ENGINEER STAMP

PRELIMINARY

BURLINGTON QUARRY

PLAN & PROFILE
STA. 0+650 – STA 0+870

TATHAM ENGINEERING

DESIGN: DRT	FILE: 113187	DWG:
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CHECK: DRT	SCALE: H 1:500 V 1:100	

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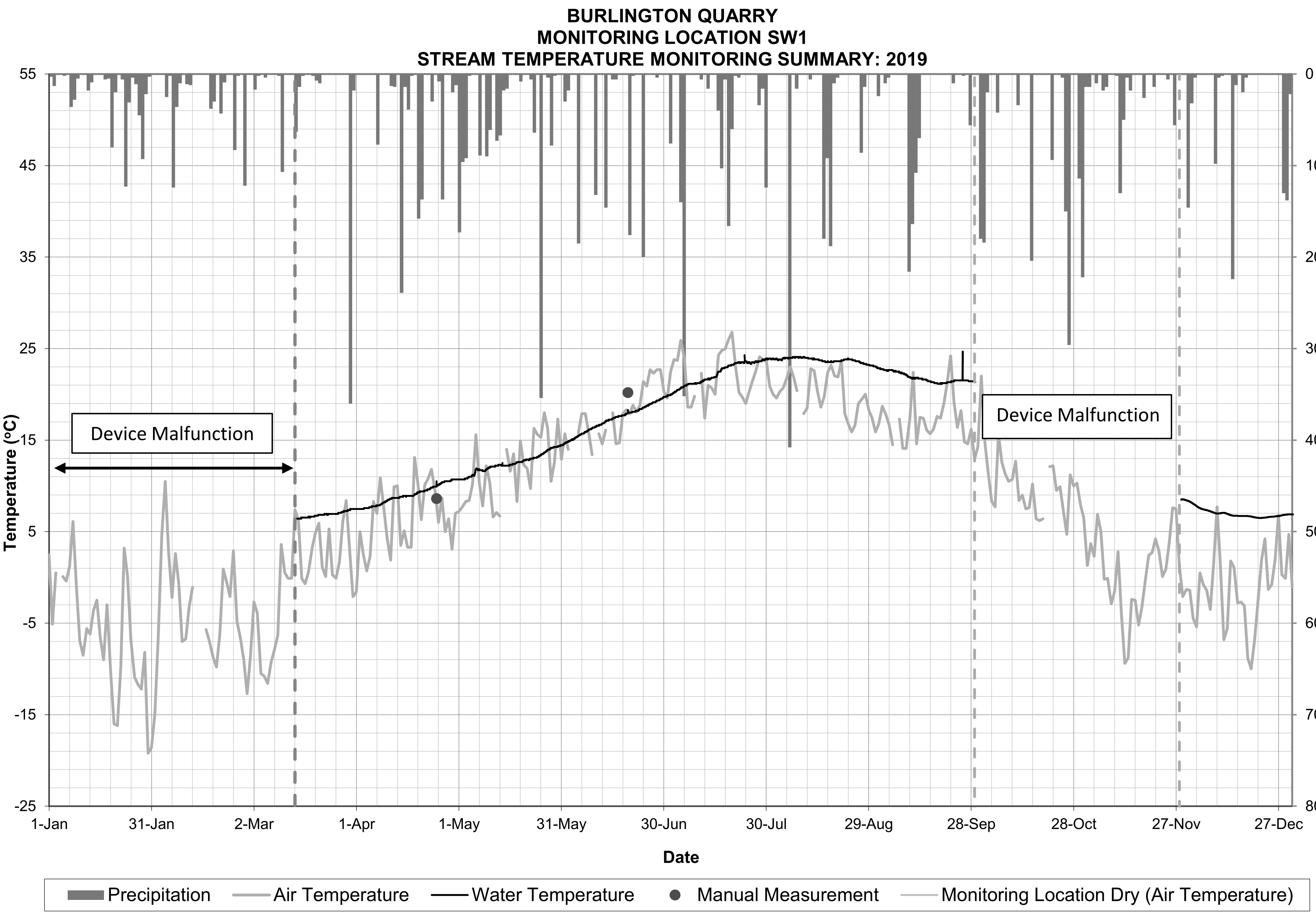
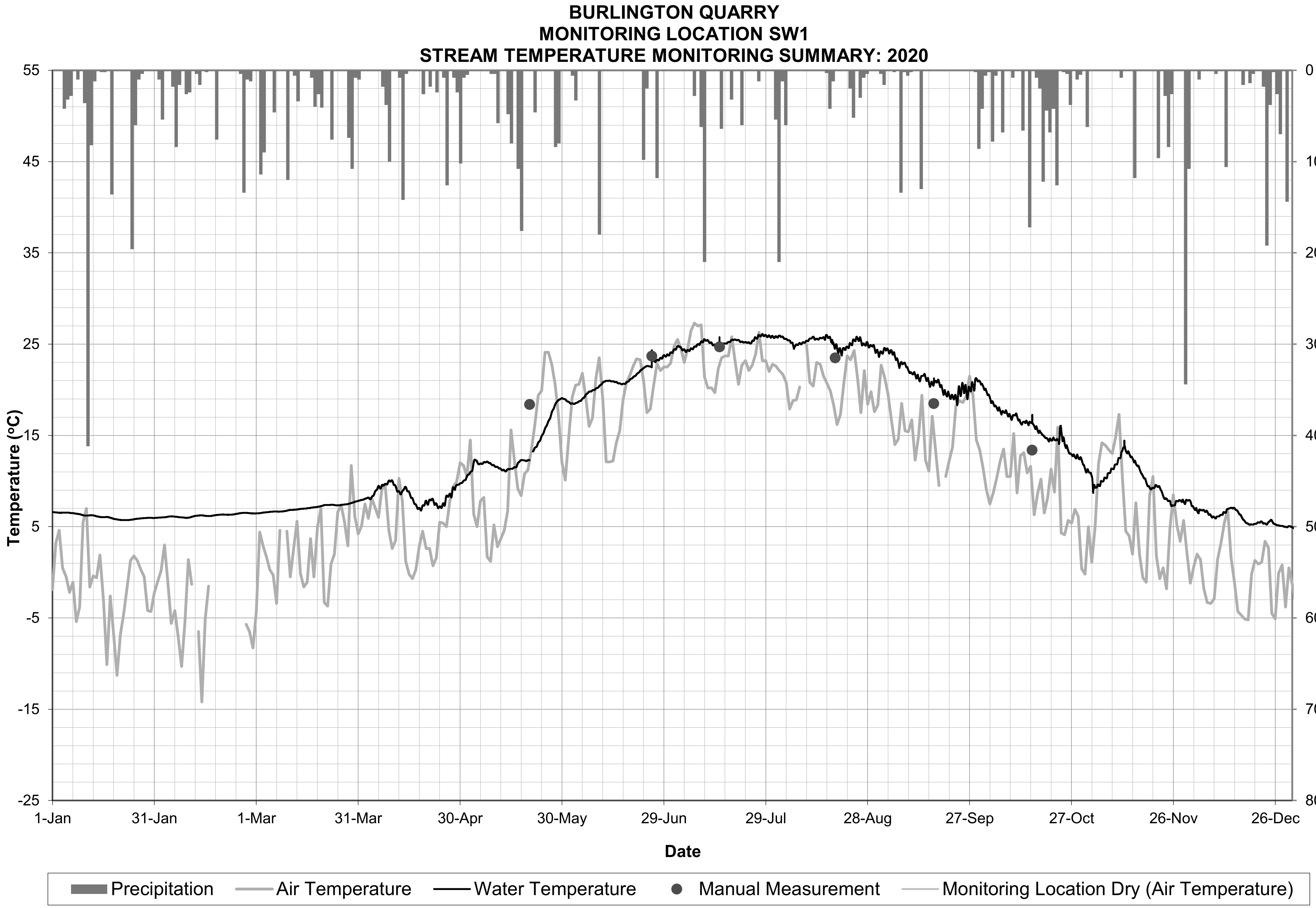
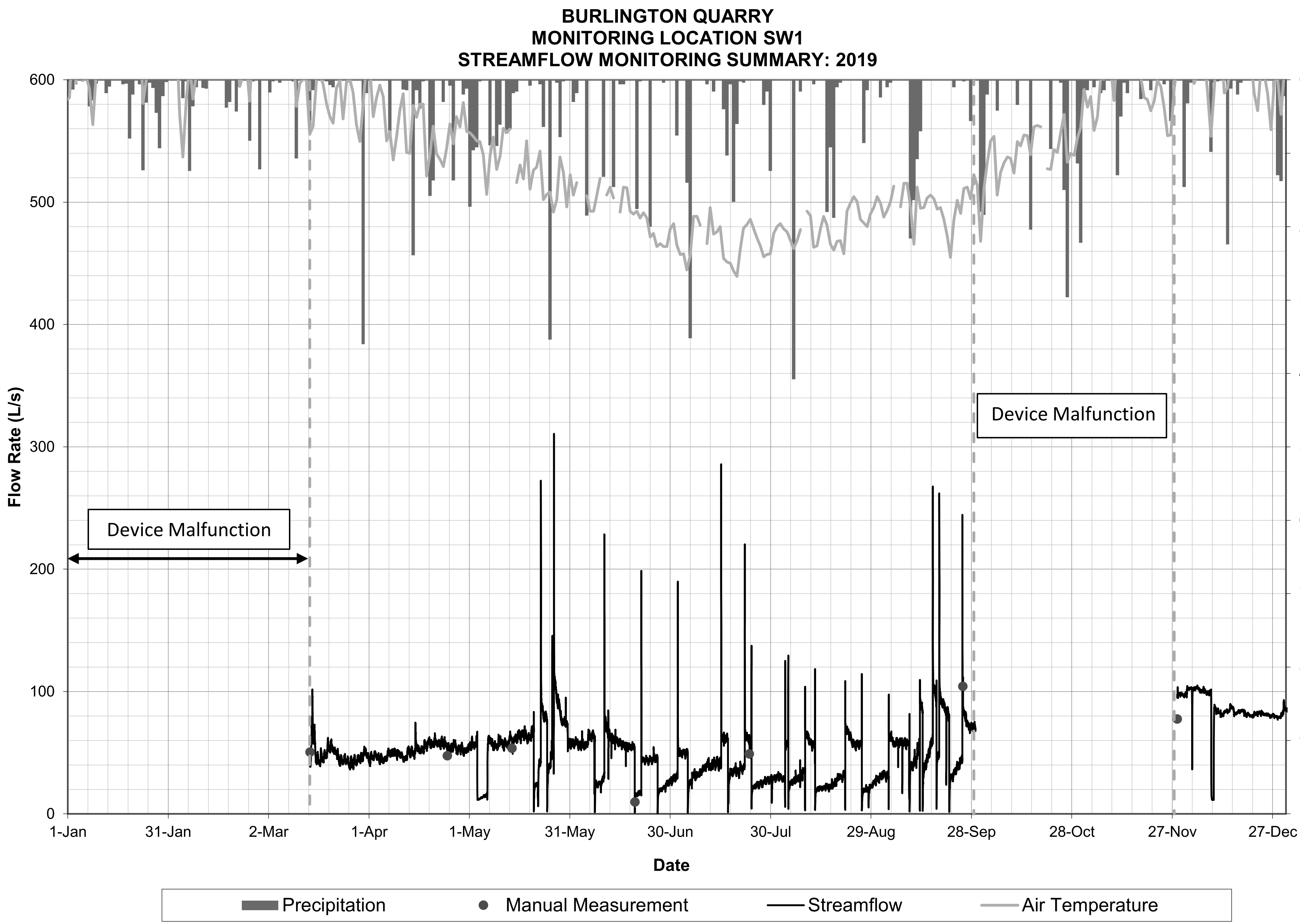
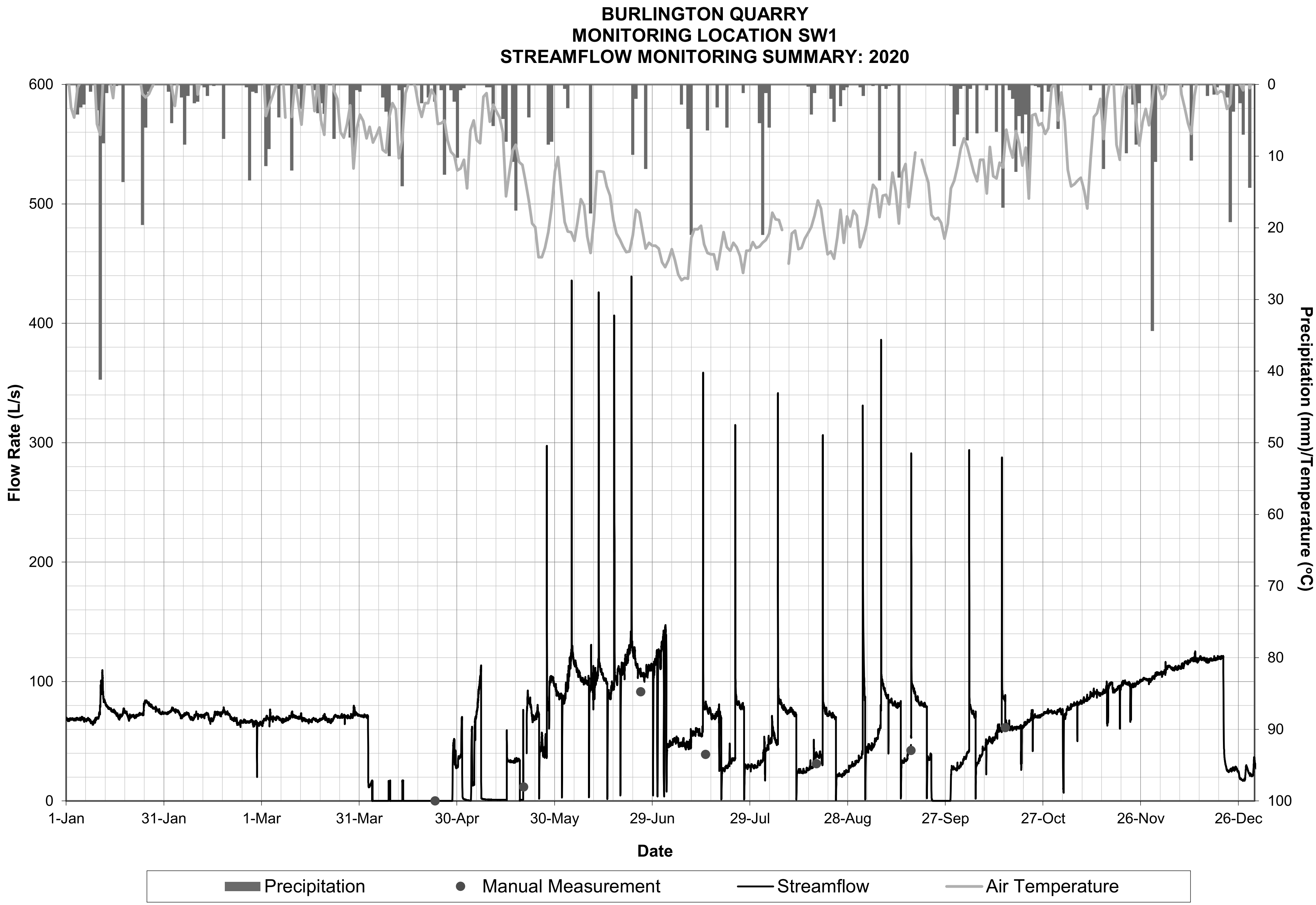
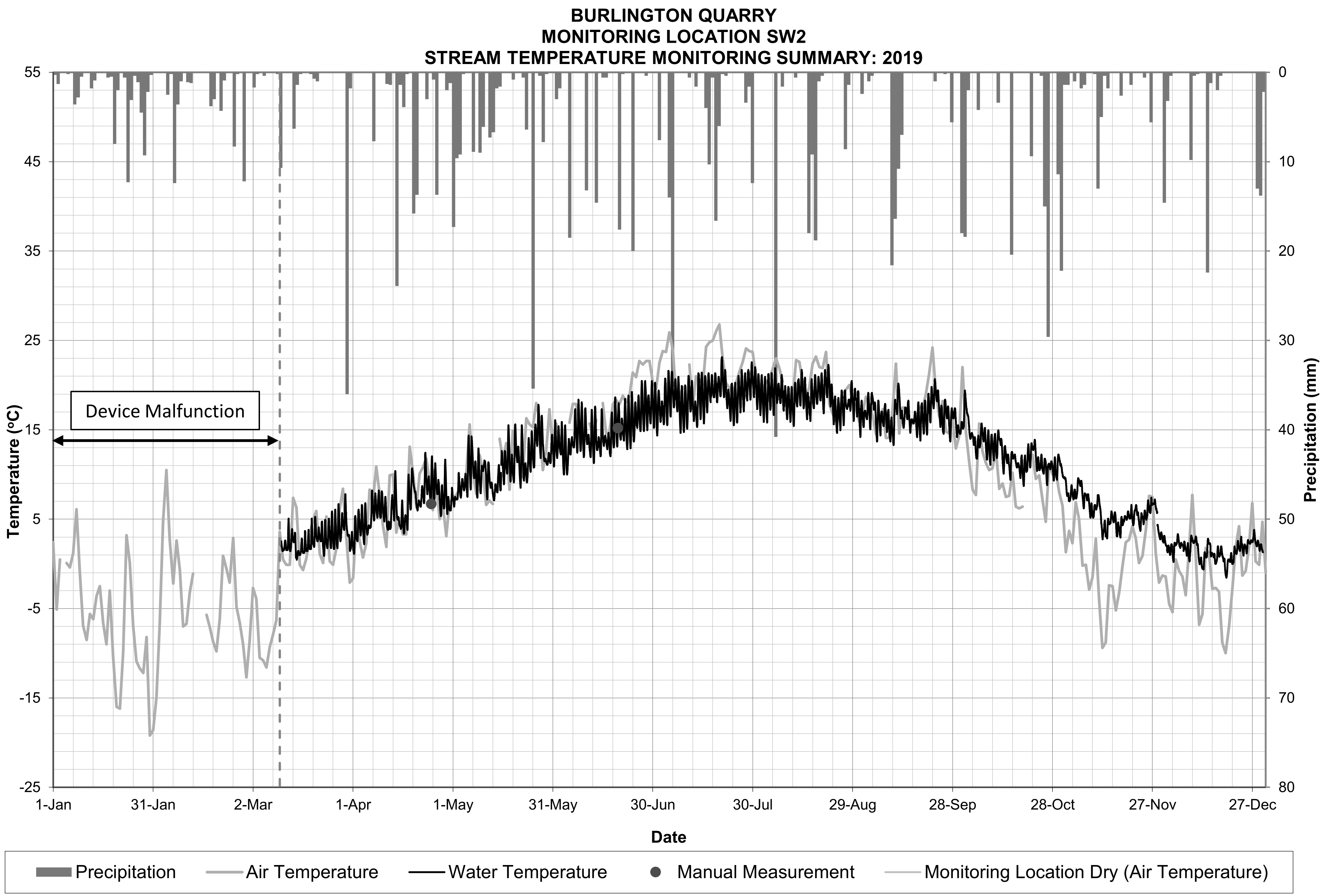

BURLINGTON QUARRY
MONITORING LOCATION SW1
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Precipitation (mm)
Date
Device Malfunction
Device Malfunction
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

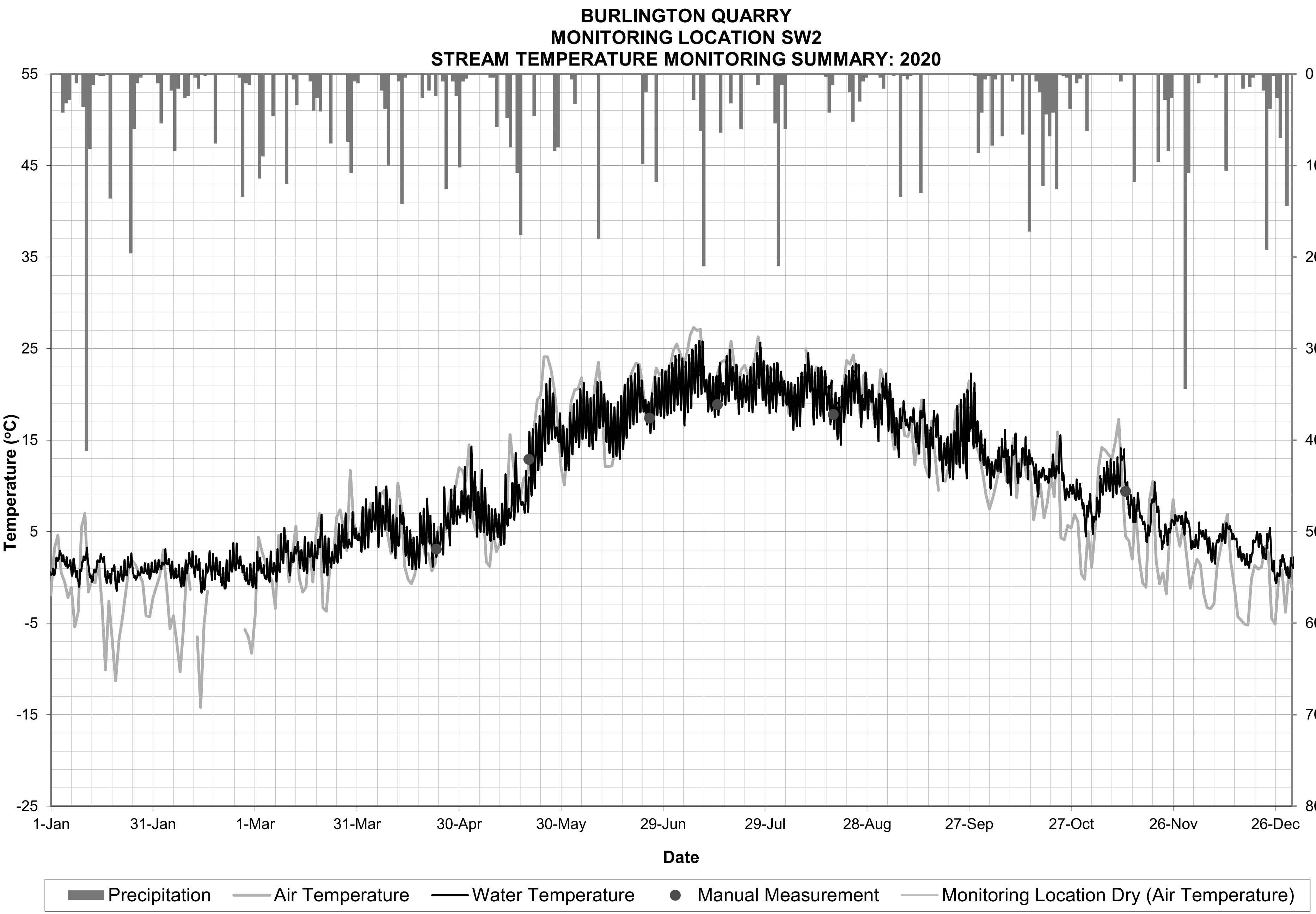

BURLINGTON QUARRY
MONITORING LOCATION SW1
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Precipitation (mm)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



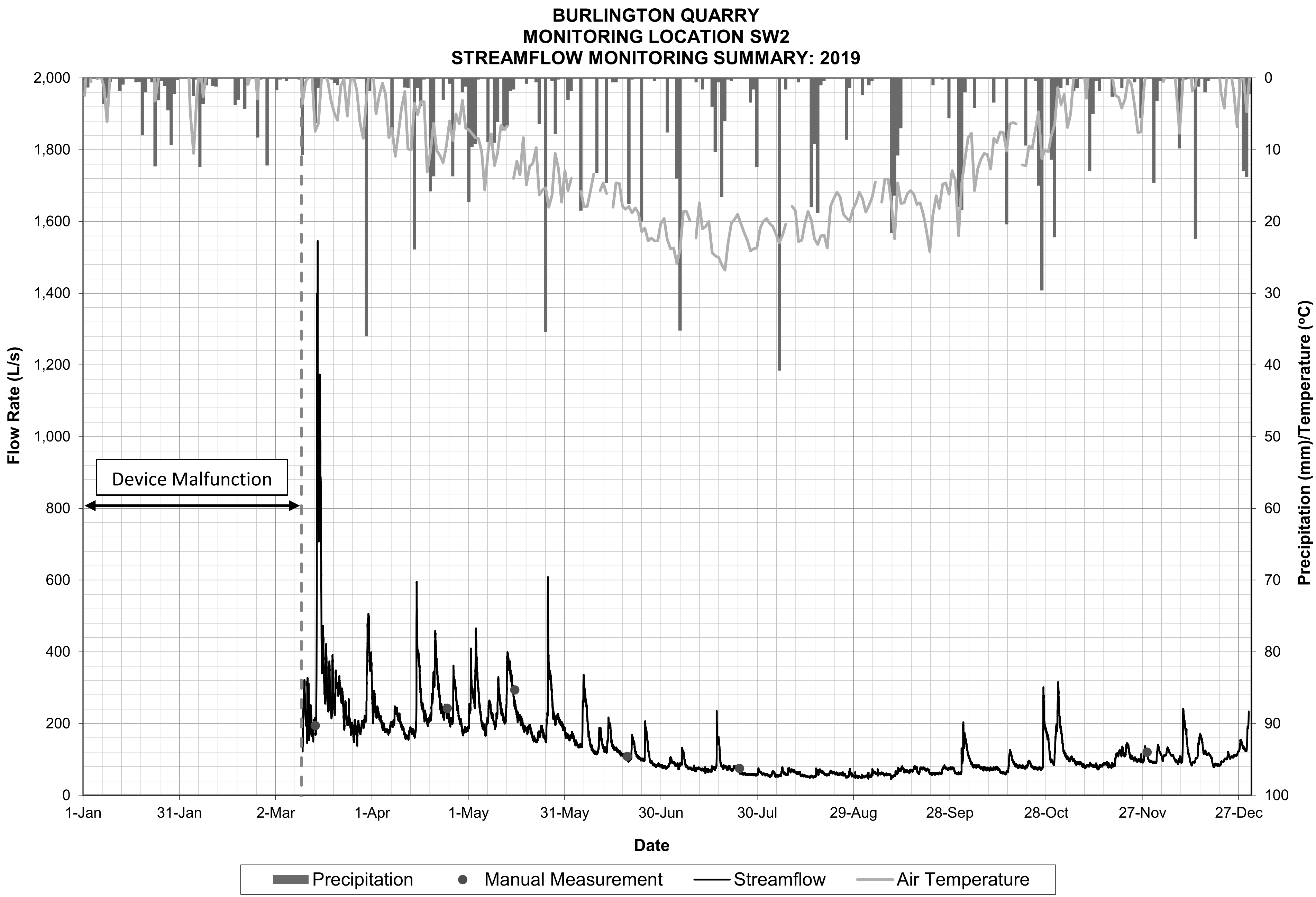
BURLINGTON QUARRY
MONITORING LOCATION SW1
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Malfunction
Device Malfunction
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW1
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
0
100
200
300
400
500
600
10
20
30
40
50
60
70
80
90
Precipitation
Manual Measurement
Streamflow
Air Temperature

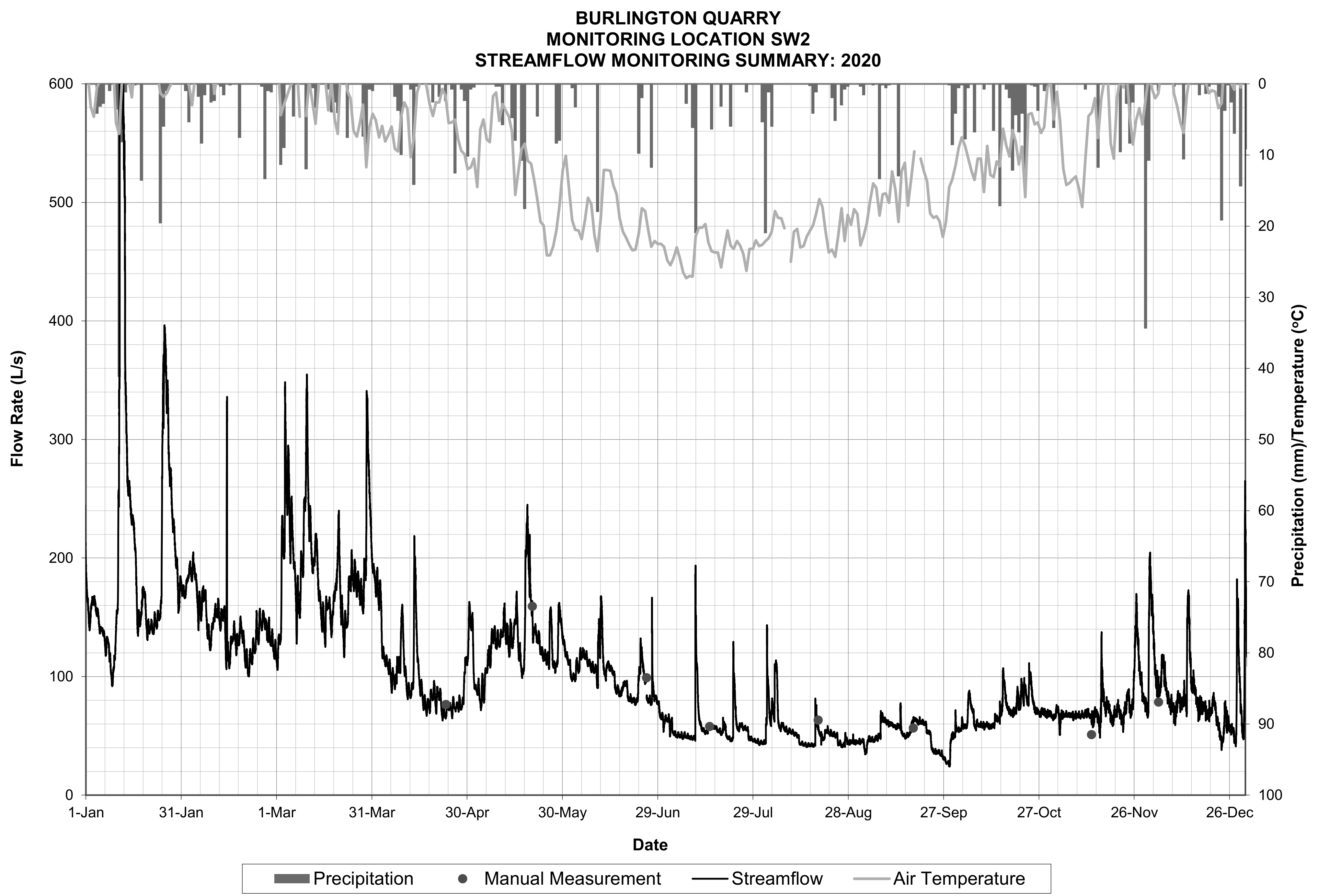

BURLINGTON QUARRY
MONITORING LOCATION SW2
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Device Malfunction
Temperature (ºC)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



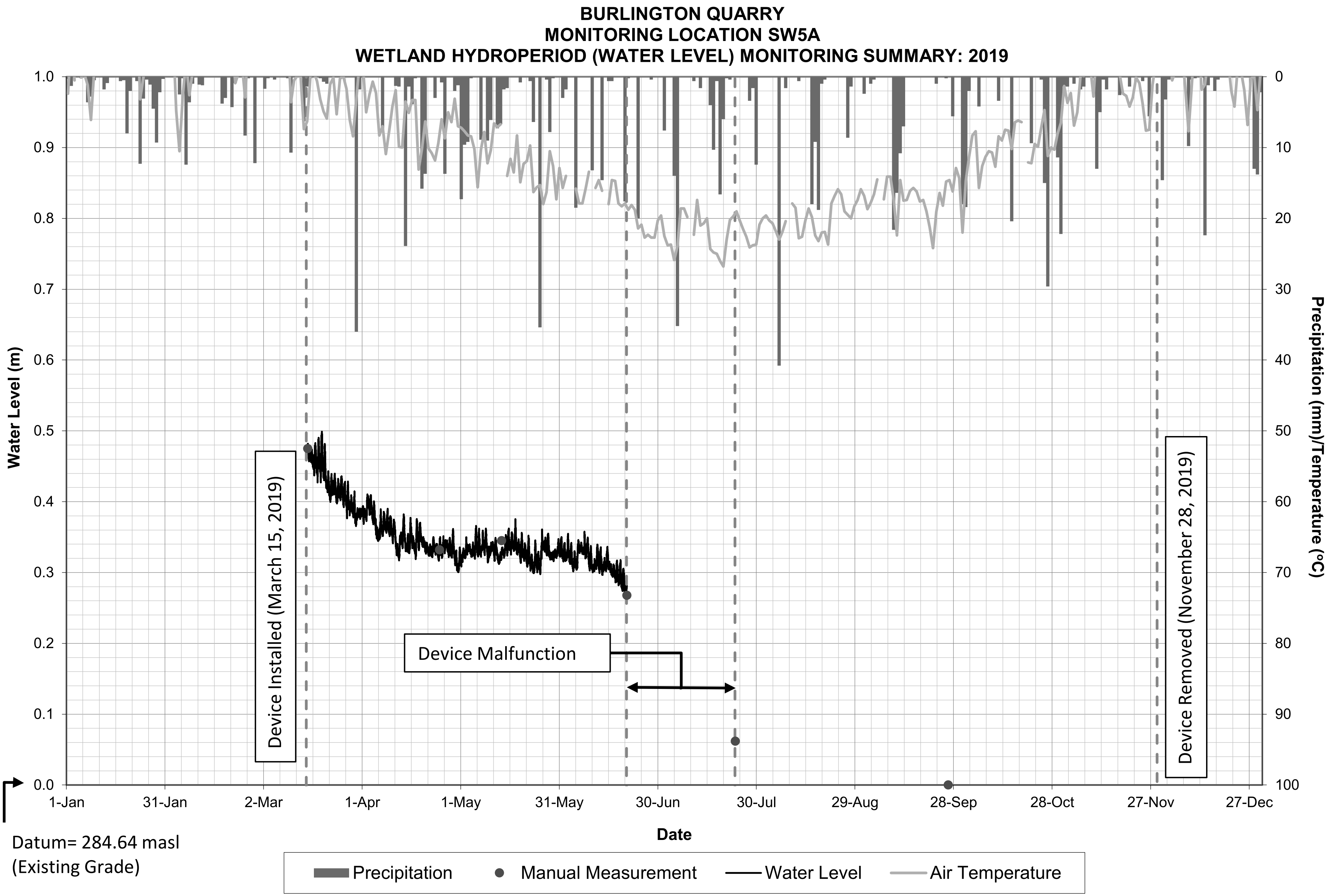
BURLINGTON QUARRY
MONITORING LOCATION SW2
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Precipitation (mm)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



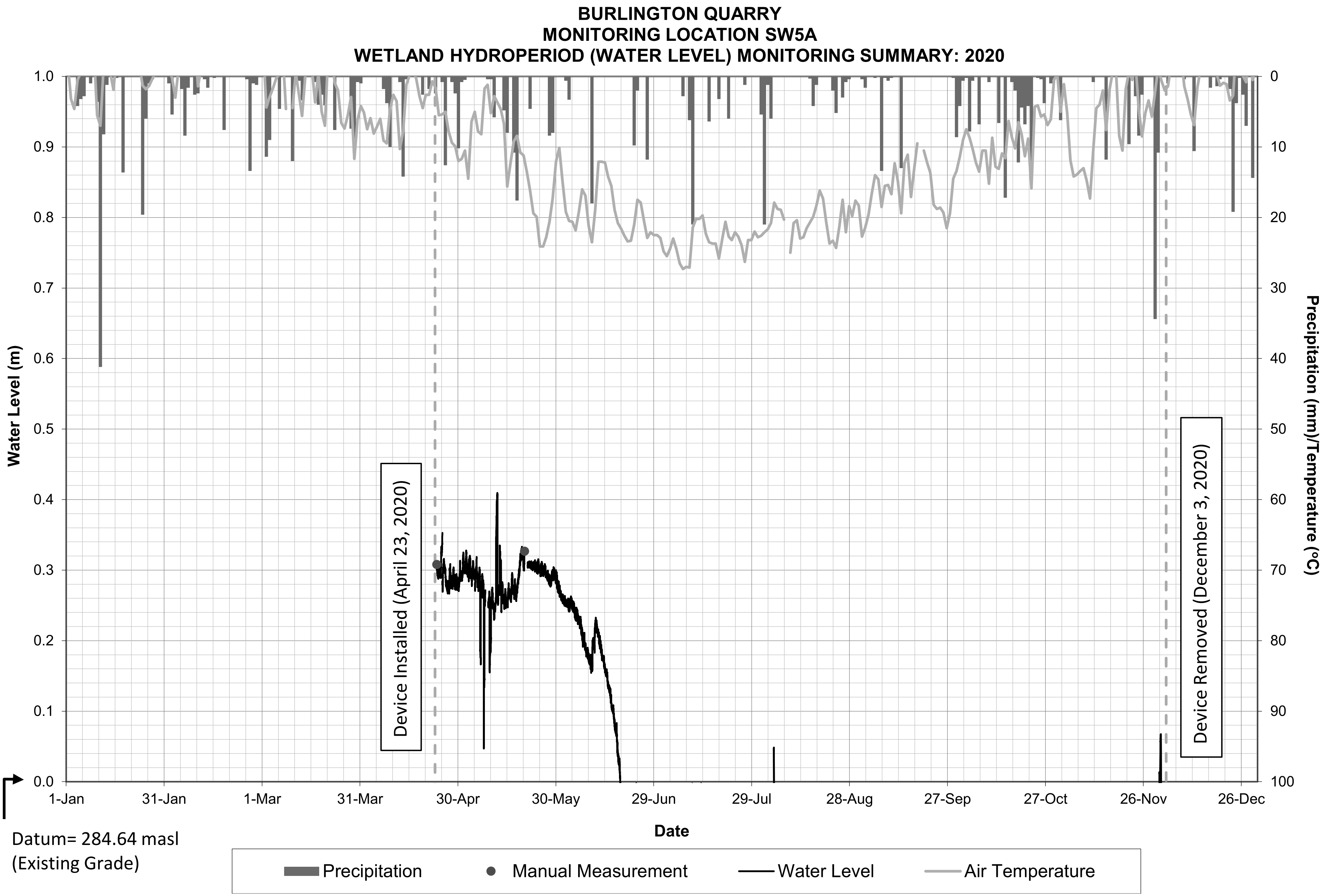
BURLINGTON QUARRY
MONITORING LOCATION SW2
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (ºC)
Device Malfunction
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Precipitation
Manual Measurement
Streamflow
Air Temperature



BURLINGTON QUARRY
MONITORING LOCATION SW2
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (ºC)
Date
0
100
200
300
400
500
600
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature

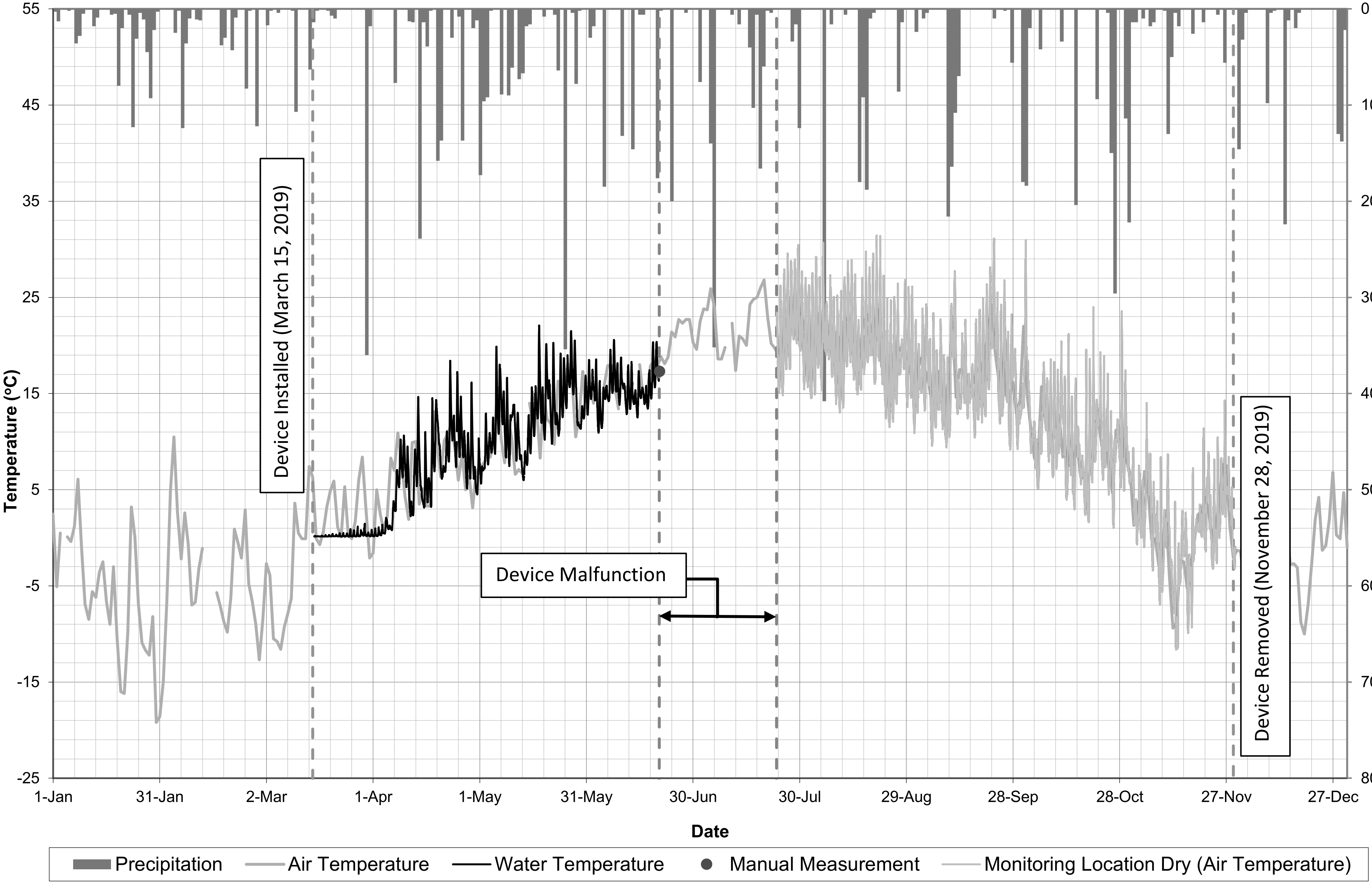


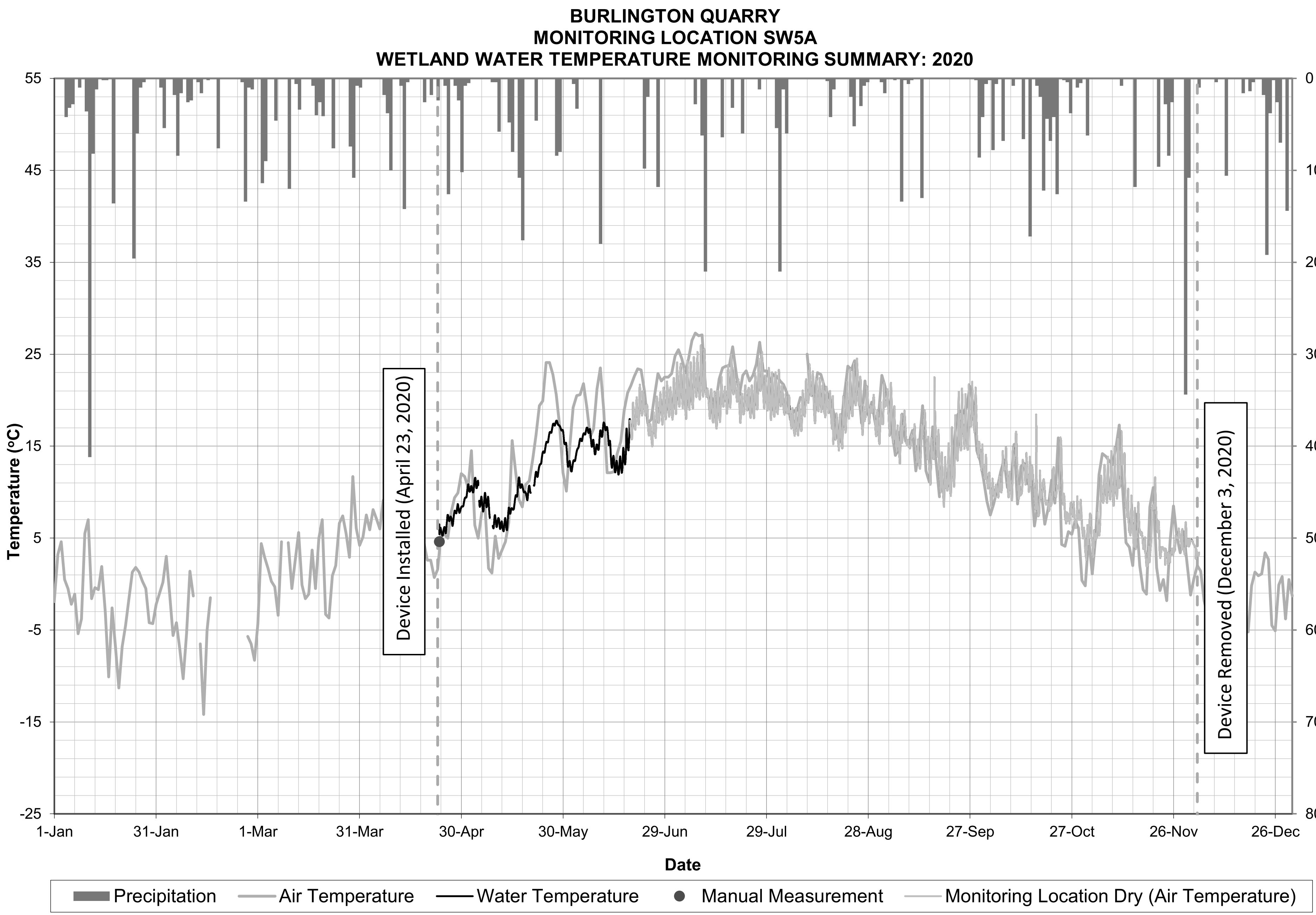
BURLINGTON QUARRY
MONITORING LOCATION SW5A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2019
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
10
20
30
40
50
60
70
80
90
100
Device Installed (March 15, 2019)
Device Malfunction
Device Removed (November 28, 2019)
Datum= 284.64 masl
(Existing Grade)
Precipitation
Manual Measurement
Water Level
Air Temperature

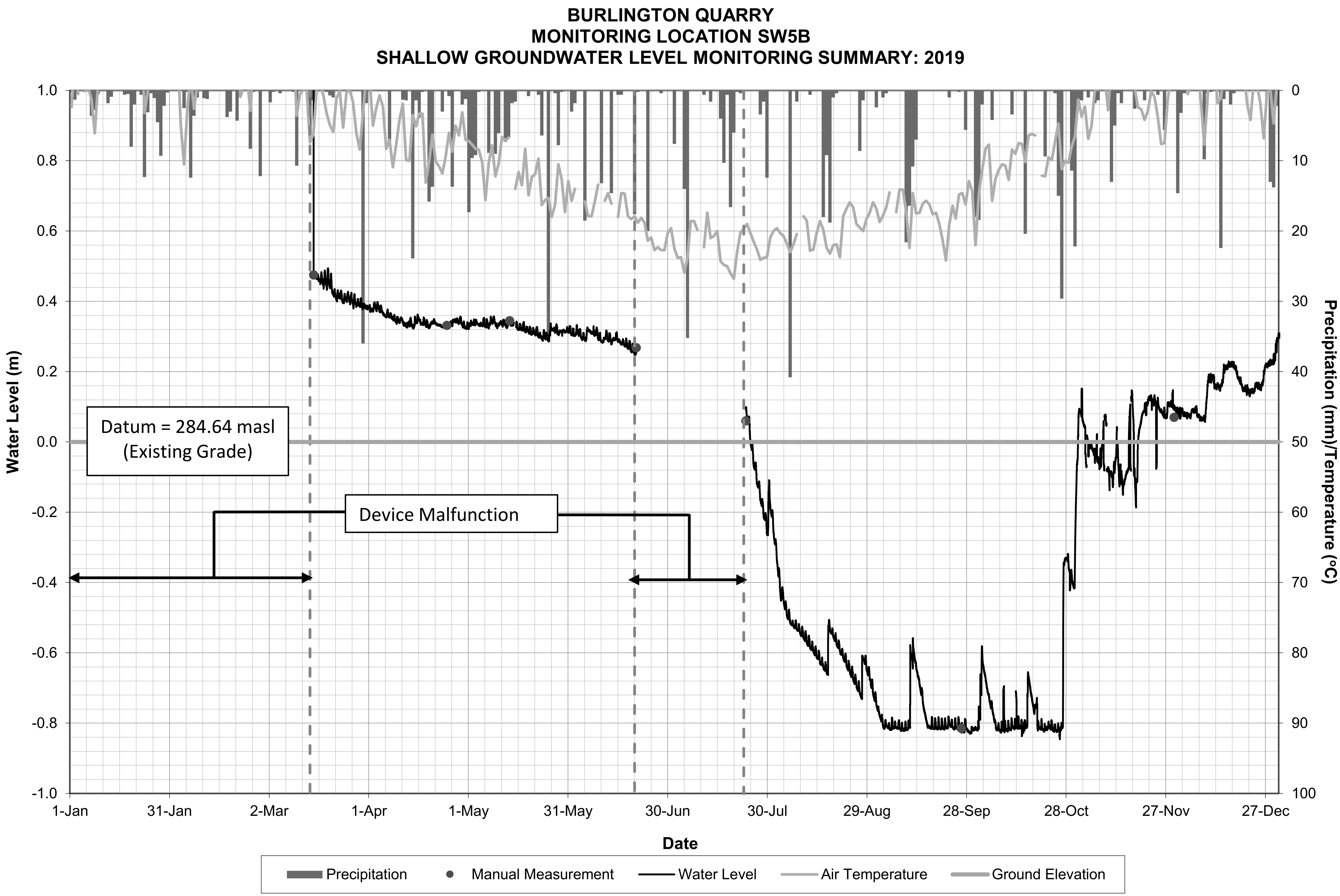


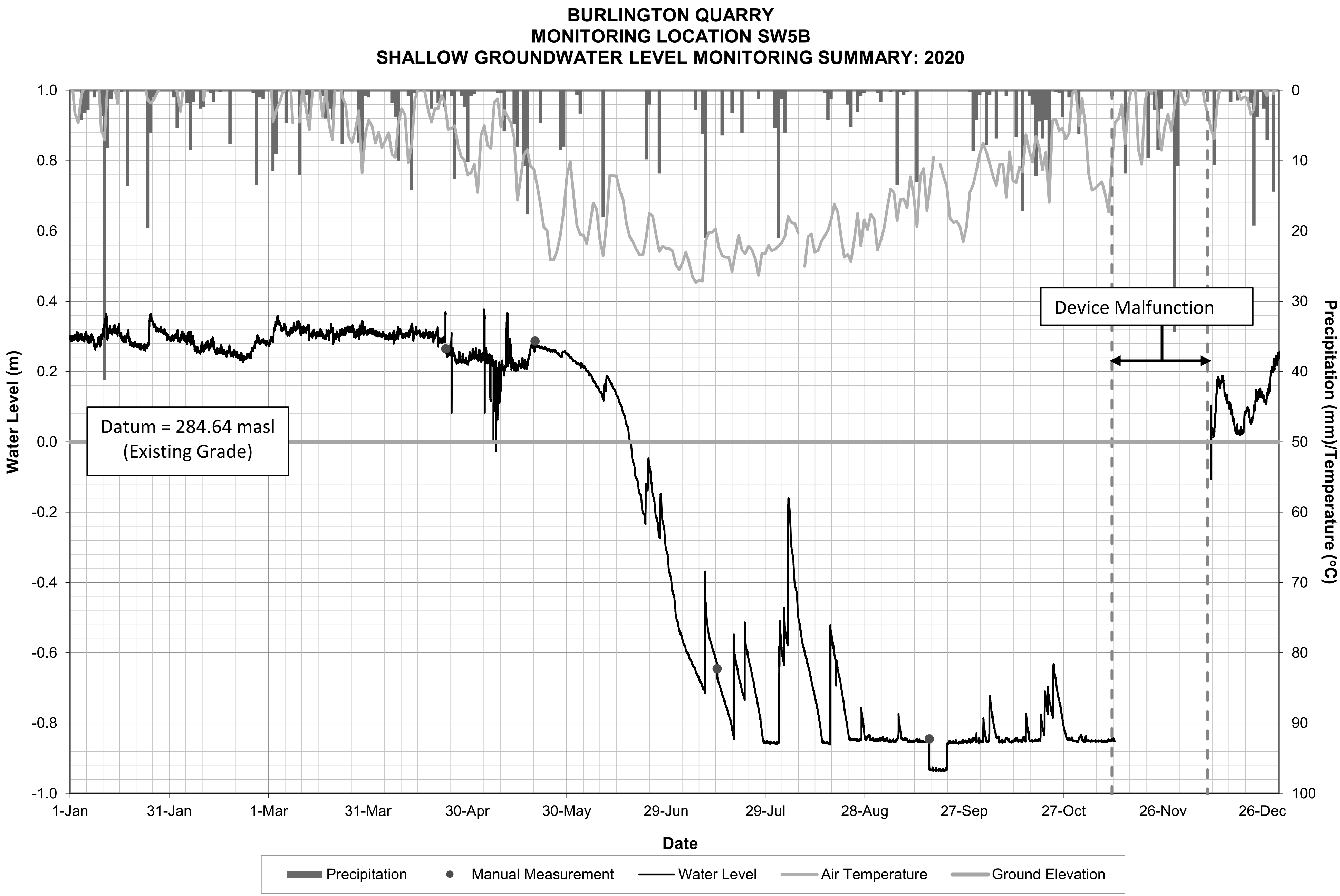
Datum= 284.64 masl
(Existing Grade)

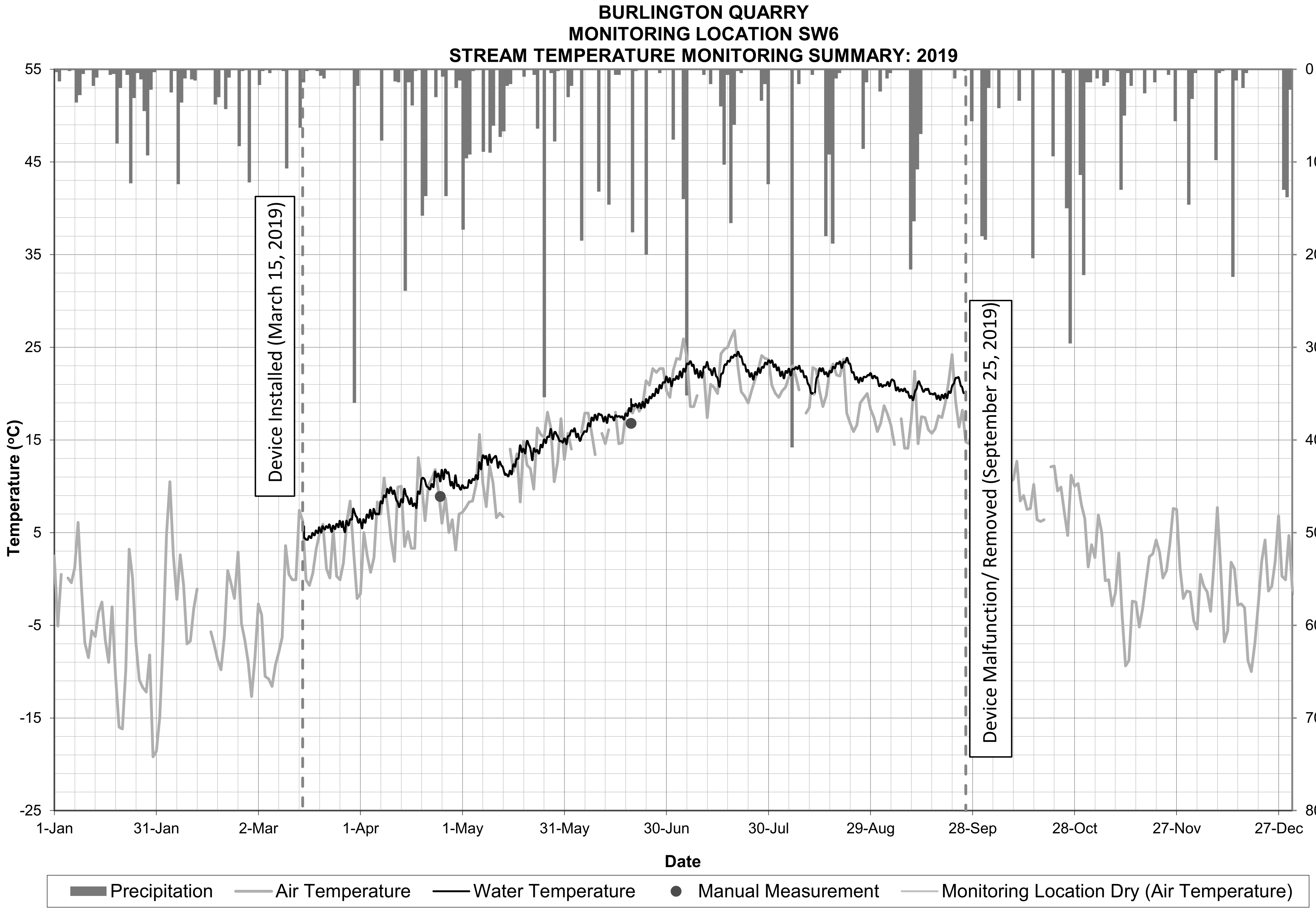
BURLINGTON QUARRY
MONITORING LOCATION SW5A
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2019



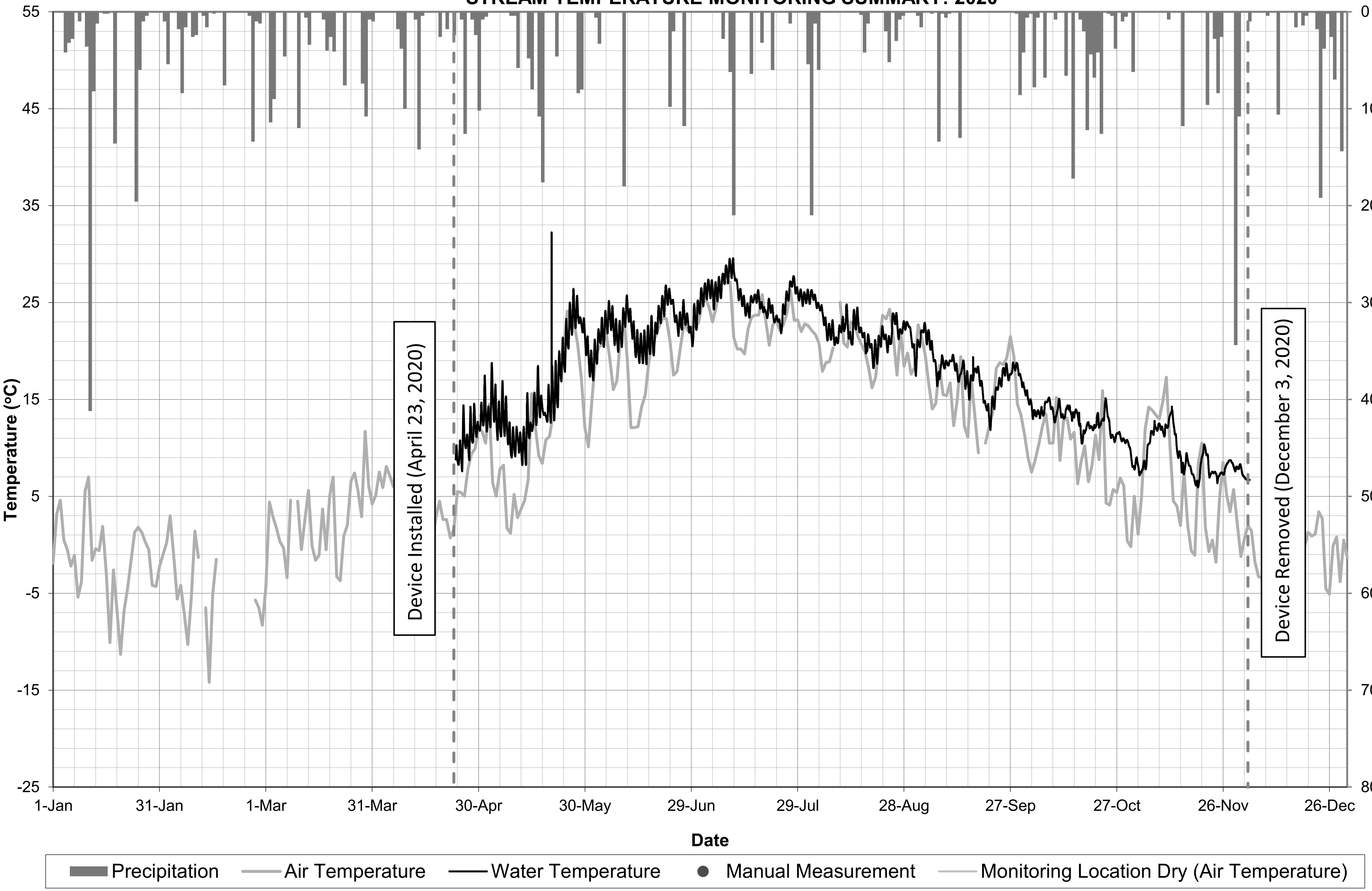

BURLINGTON QUARRY
MONITORING LOCATION SW5A
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Precipitation (mm)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

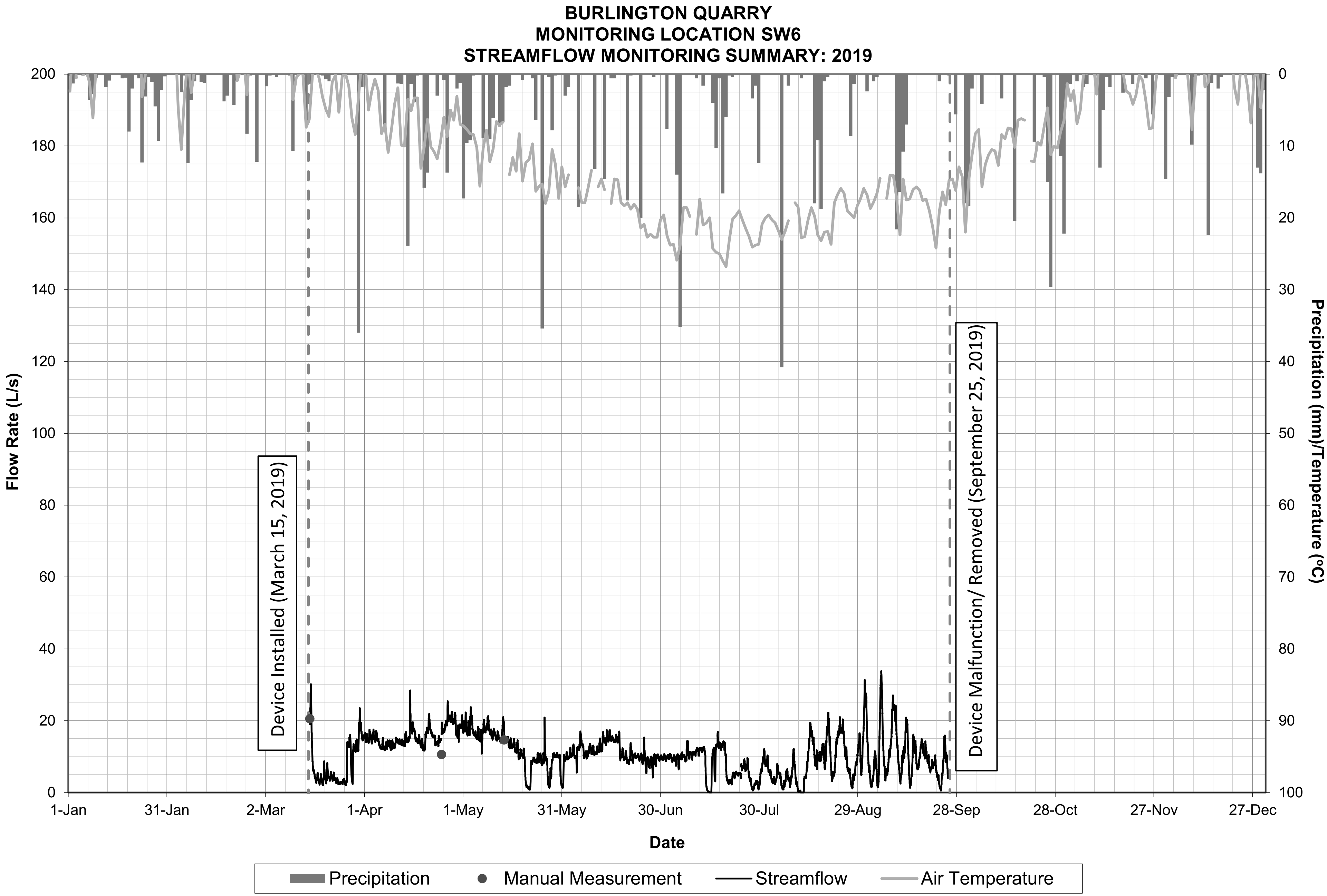

BURLINGTON QUARRY
MONITORING LOCATION SW5B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2019
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
Datum = 284.64 masl
(Existing Grade)
Device Malfunction
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Manual Measurement
Water Level
Air Temperature
Ground Elevation


BURLINGTON QUARRY
MONITORING LOCATION SW5B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Datum = 284.64 masl
(Existing Grade)
Device Malfunction
Precipitation
Manual Measurement
Water Level
Air Temperature
Ground Elevation


BURLINGTON QUARRY
MONITORING LOCATION SW6
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Device Installed (March 15, 2019)
Device Malfunction/ Removed (September 25, 2019)
Temperature (ºC)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

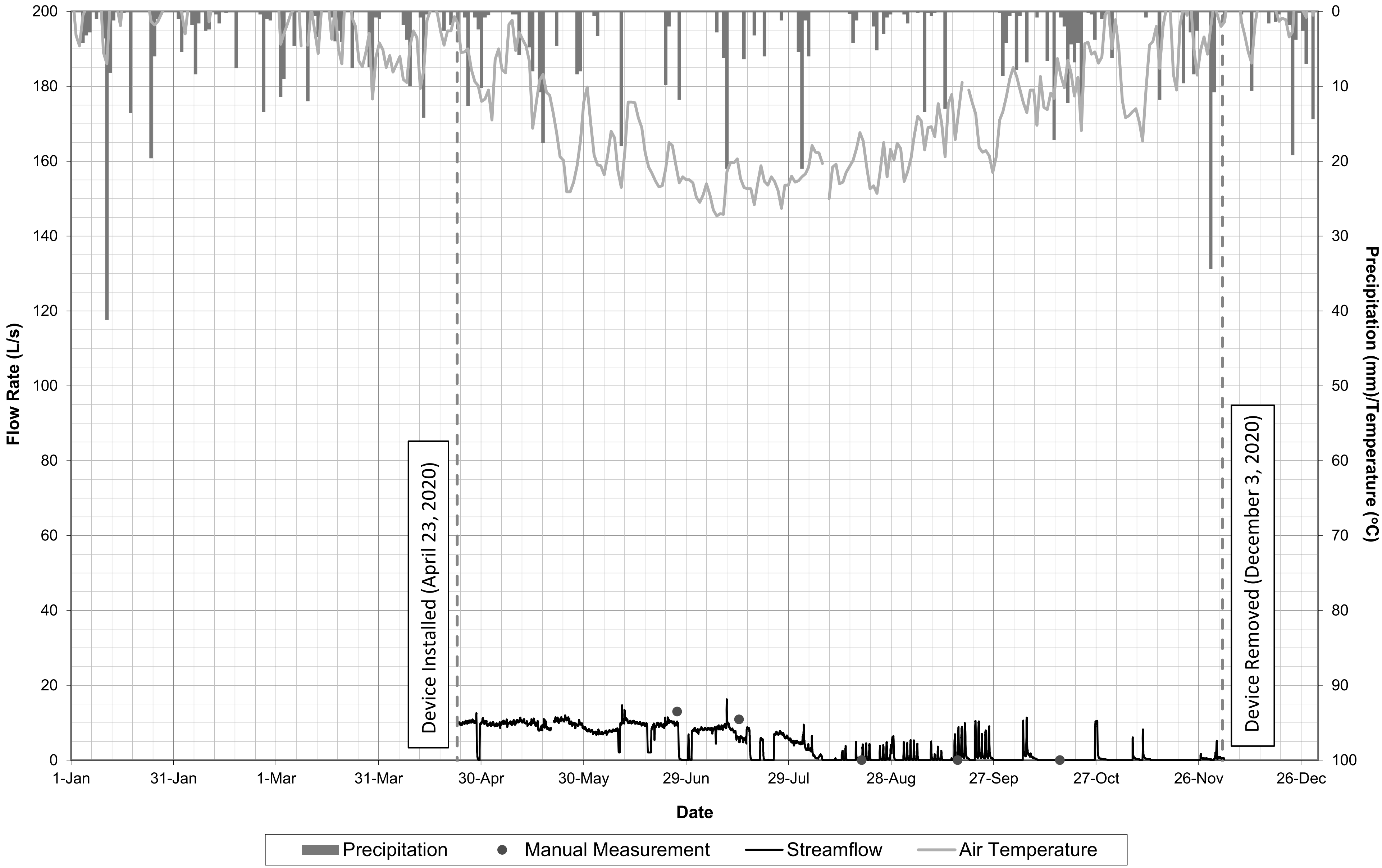
BURLINGTON QUARRY
MONITORING LOCATION SW6
STREAM TEMPERATURE MONITORING SUMMARY: 2020

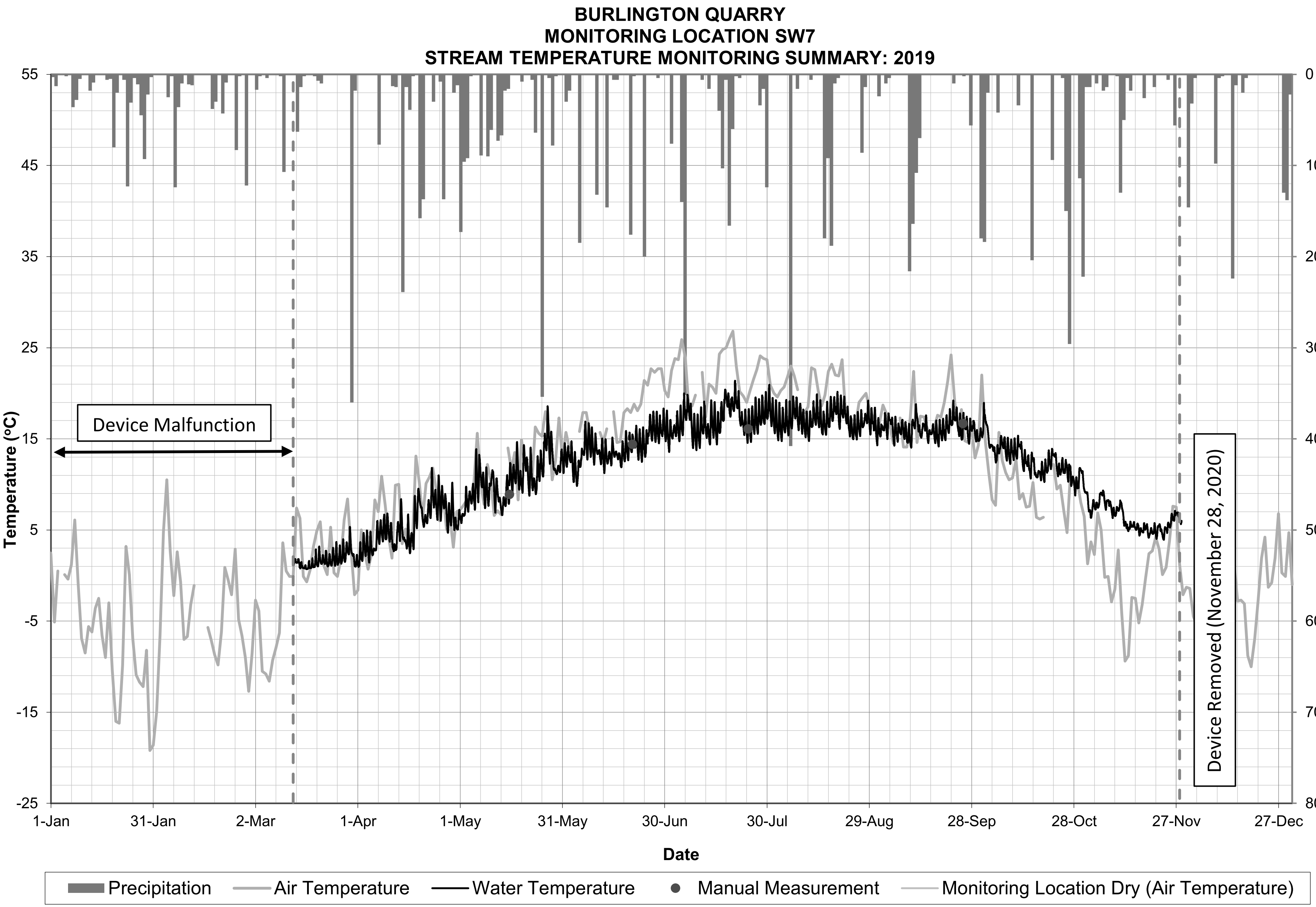




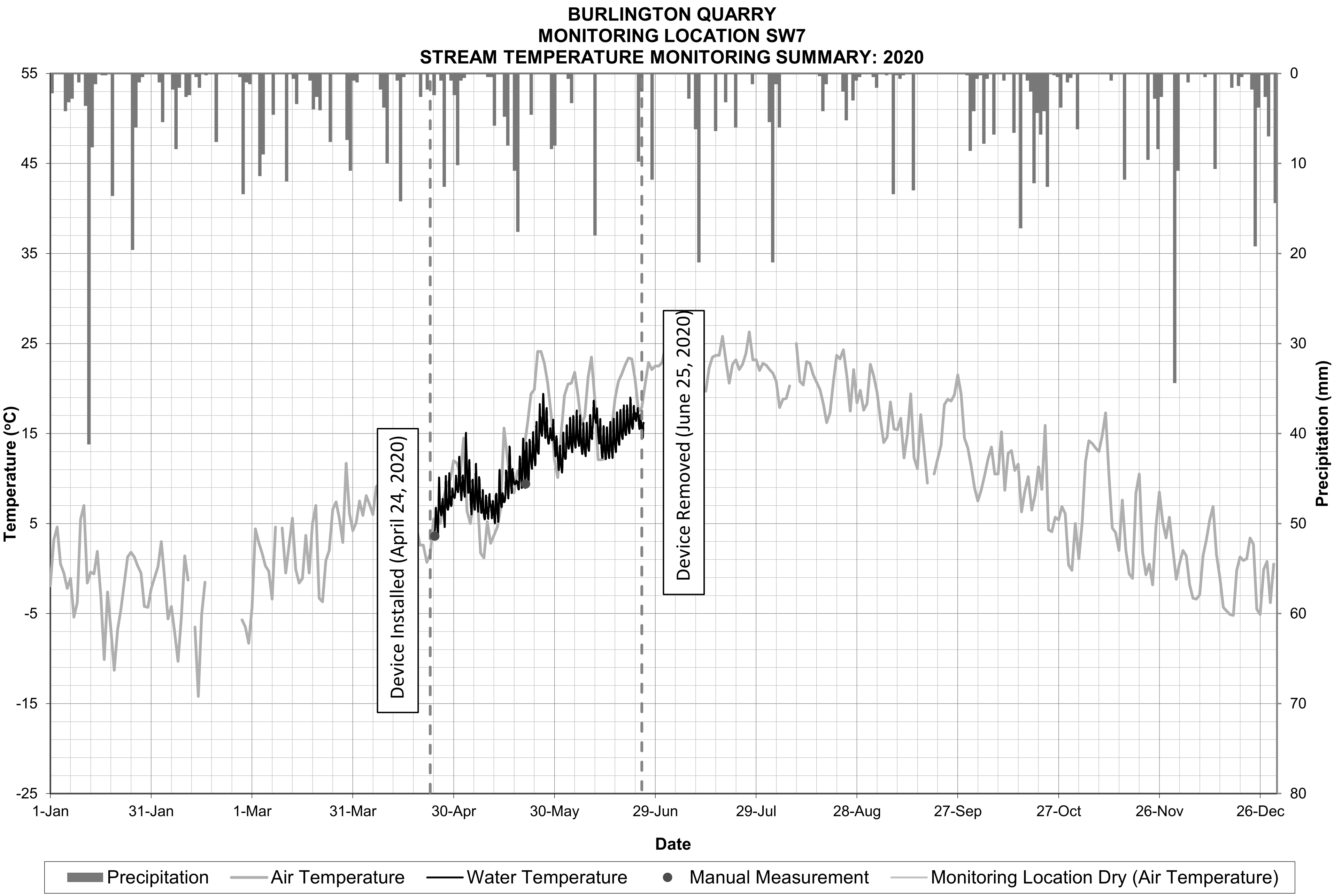
BURLINGTON QUARRY
MONITORING LOCATION SW6
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (March 15, 2019)
Device Malfunction/ Removed (September 25, 2019)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature

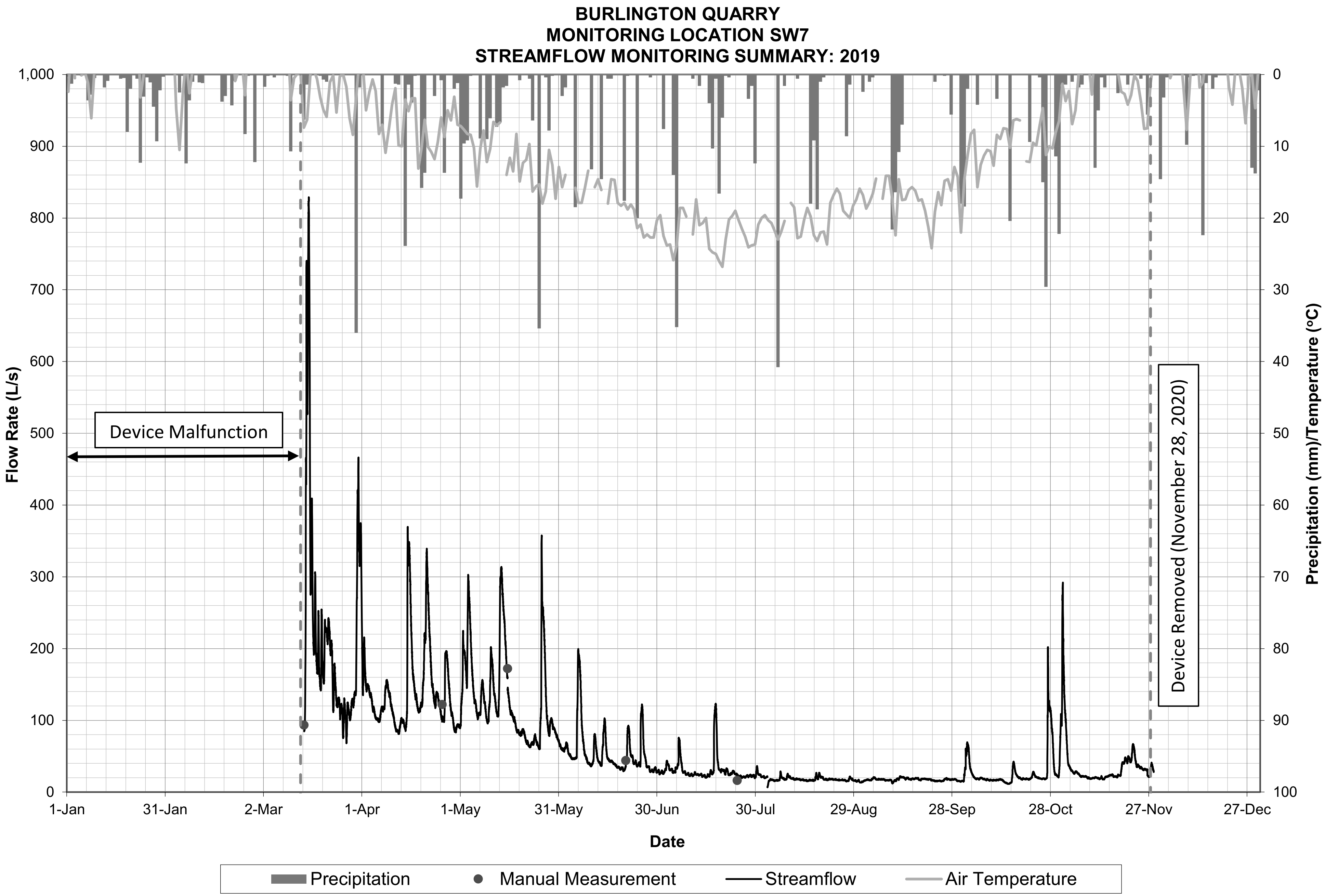
BURLINGTON QUARRY
MONITORING LOCATION SW6
STREAMFLOW MONITORING SUMMARY: 2020



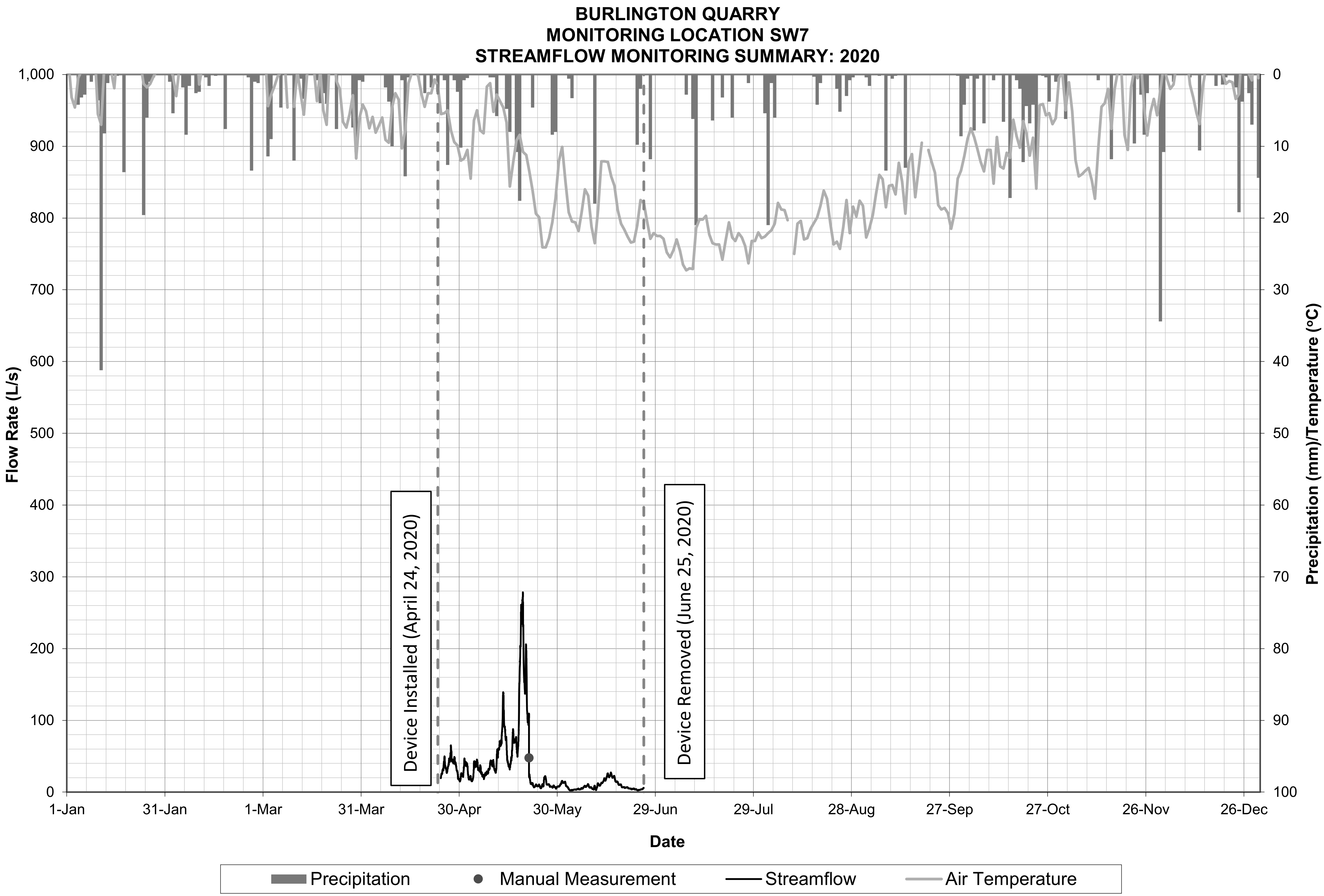


BURLINGTON QUARRY
MONITORING LOCATION SW7
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Precipitation (mm)
Date
Device Malfunction
Device Removed (November 28, 2020)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

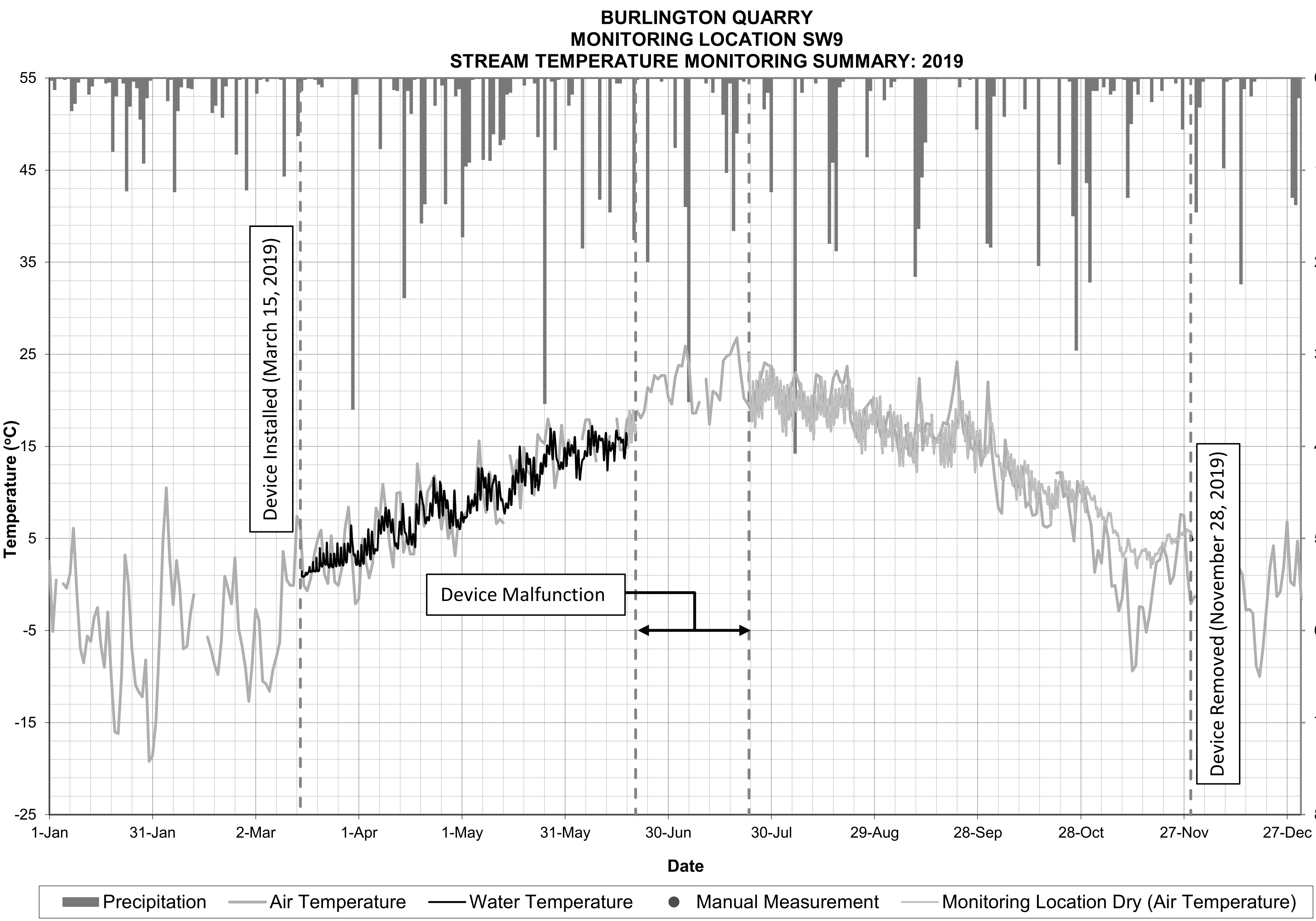

BURLINGTON QUARRY
MONITORING LOCATION SW7
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (°C)
Precipitation (mm)
Date
Device Installed (April 24, 2020)
Device Removed (June 25, 2020)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



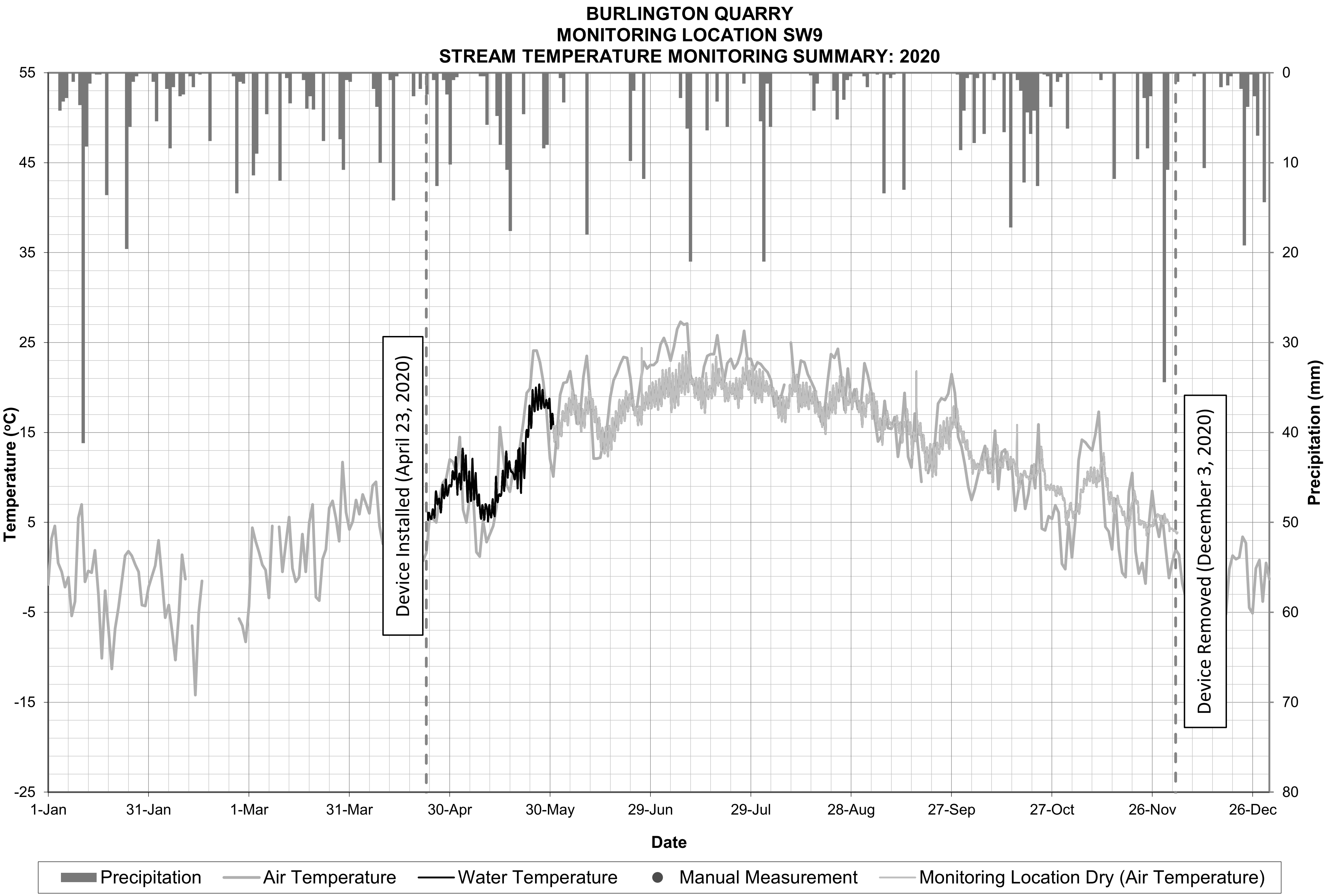
BURLINGTON QUARRY
MONITORING LOCATION SW7
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (ºC)
Date
1,000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Malfunction
Device Removed (November 28, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature



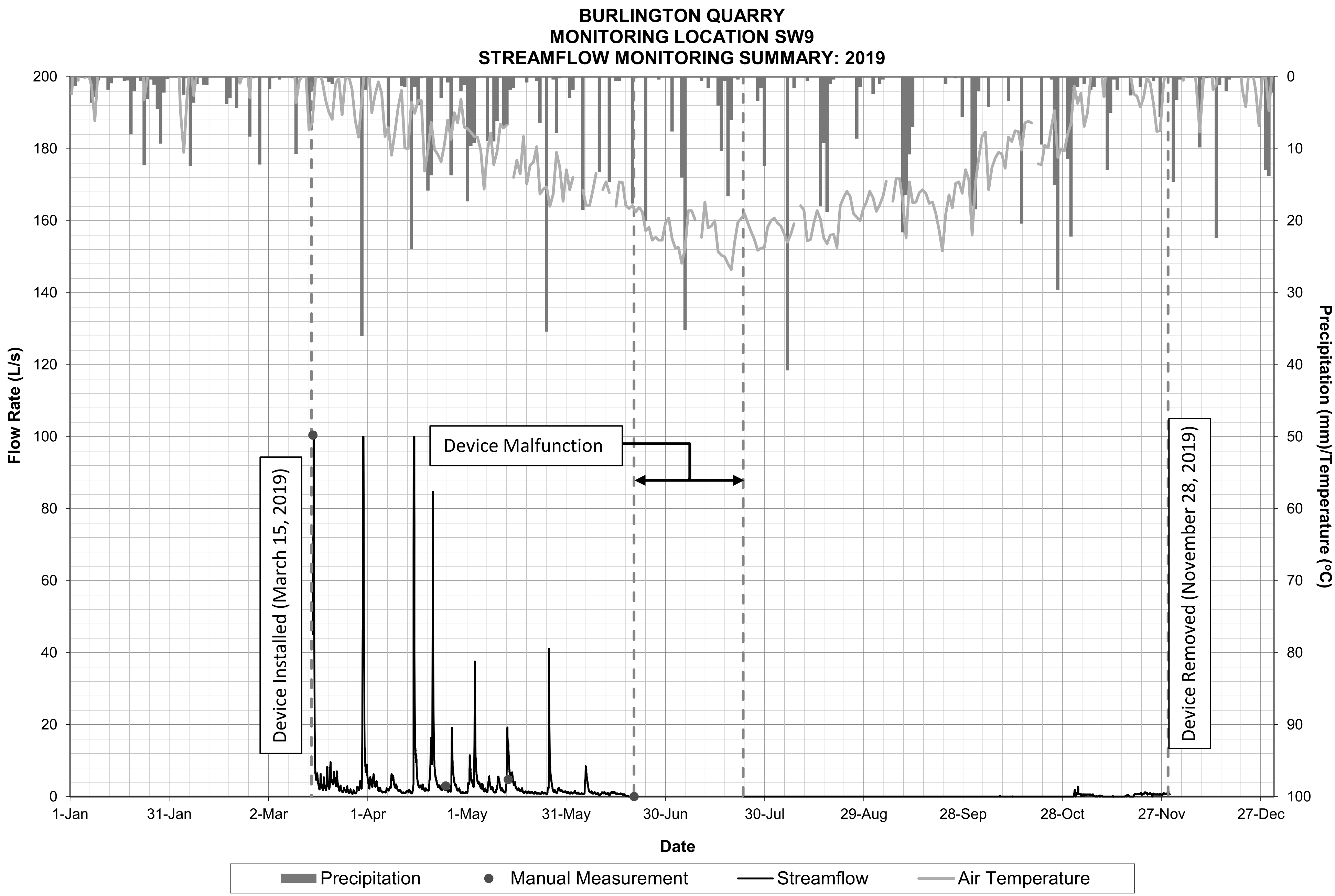
BURLINGTON QUARRY
MONITORING LOCATION SW7
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1,000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 24, 2020)
Device Removed (June 25, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature



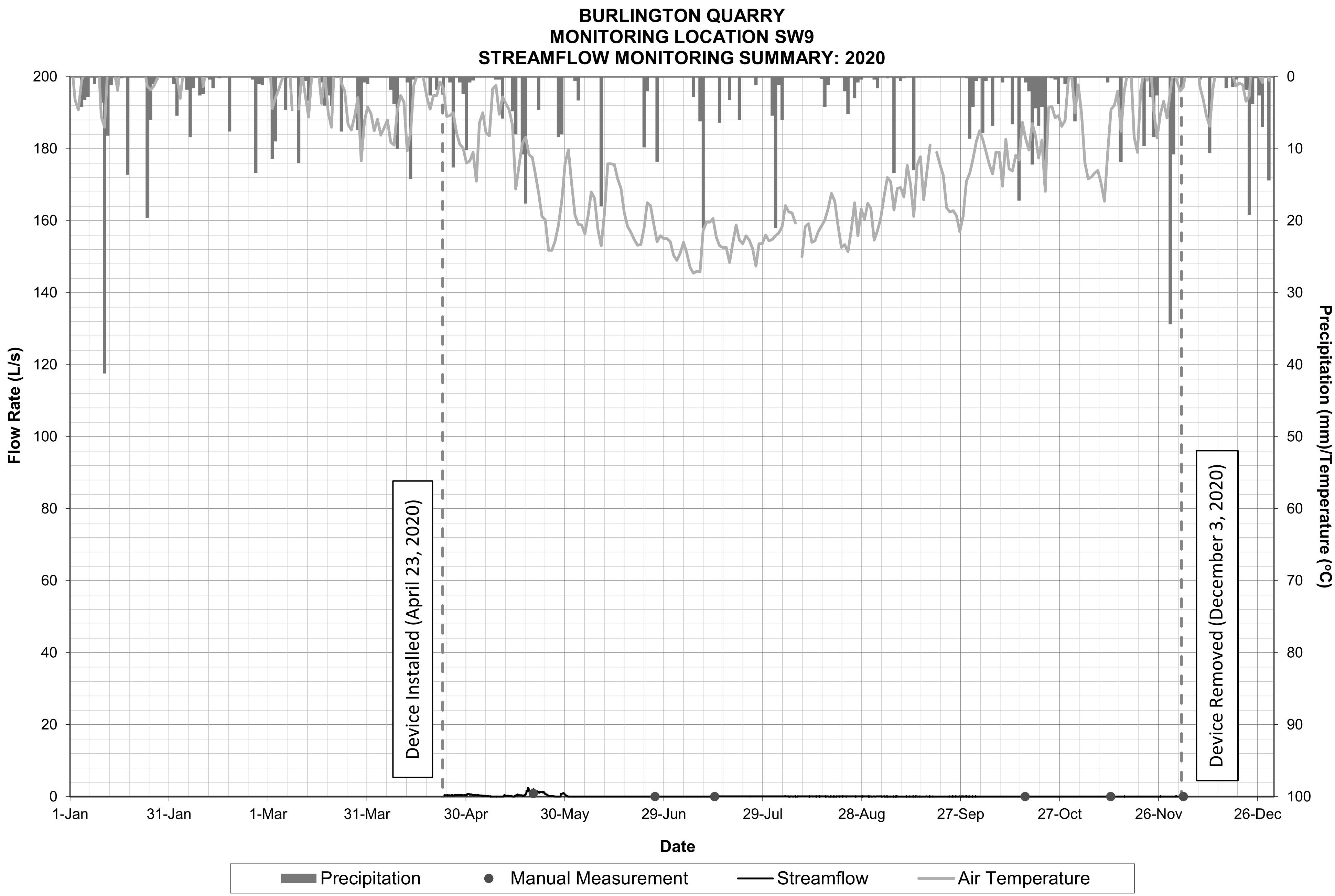
BURLINGTON QUARRY
MONITORING LOCATION SW9
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Precipitation (mm)
Date
Device Installed (March 15, 2019)
Device Malfunction
Device Removed (November 28, 2019)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



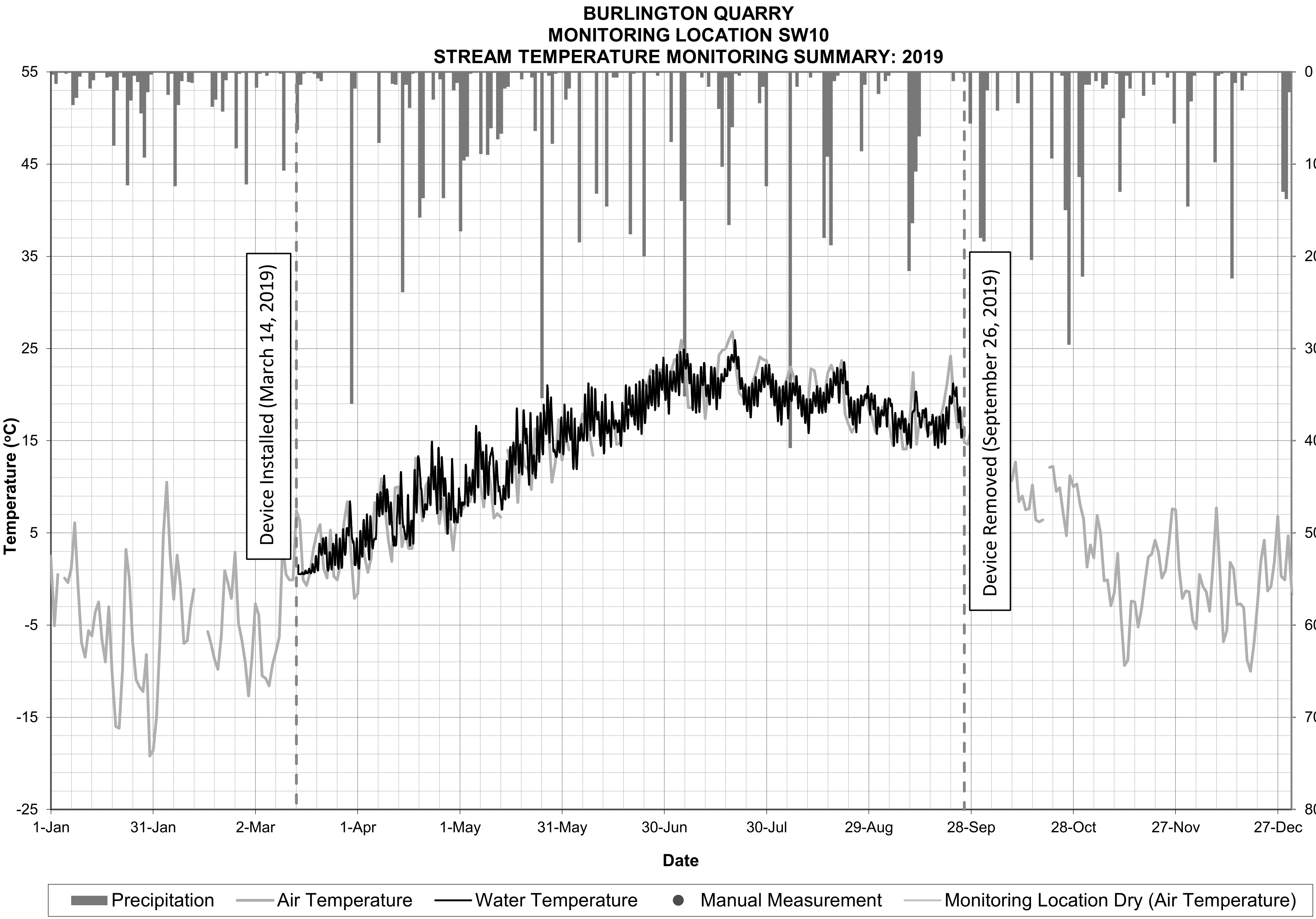
BURLINGTON QUARRY
MONITORING LOCATION SW9
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



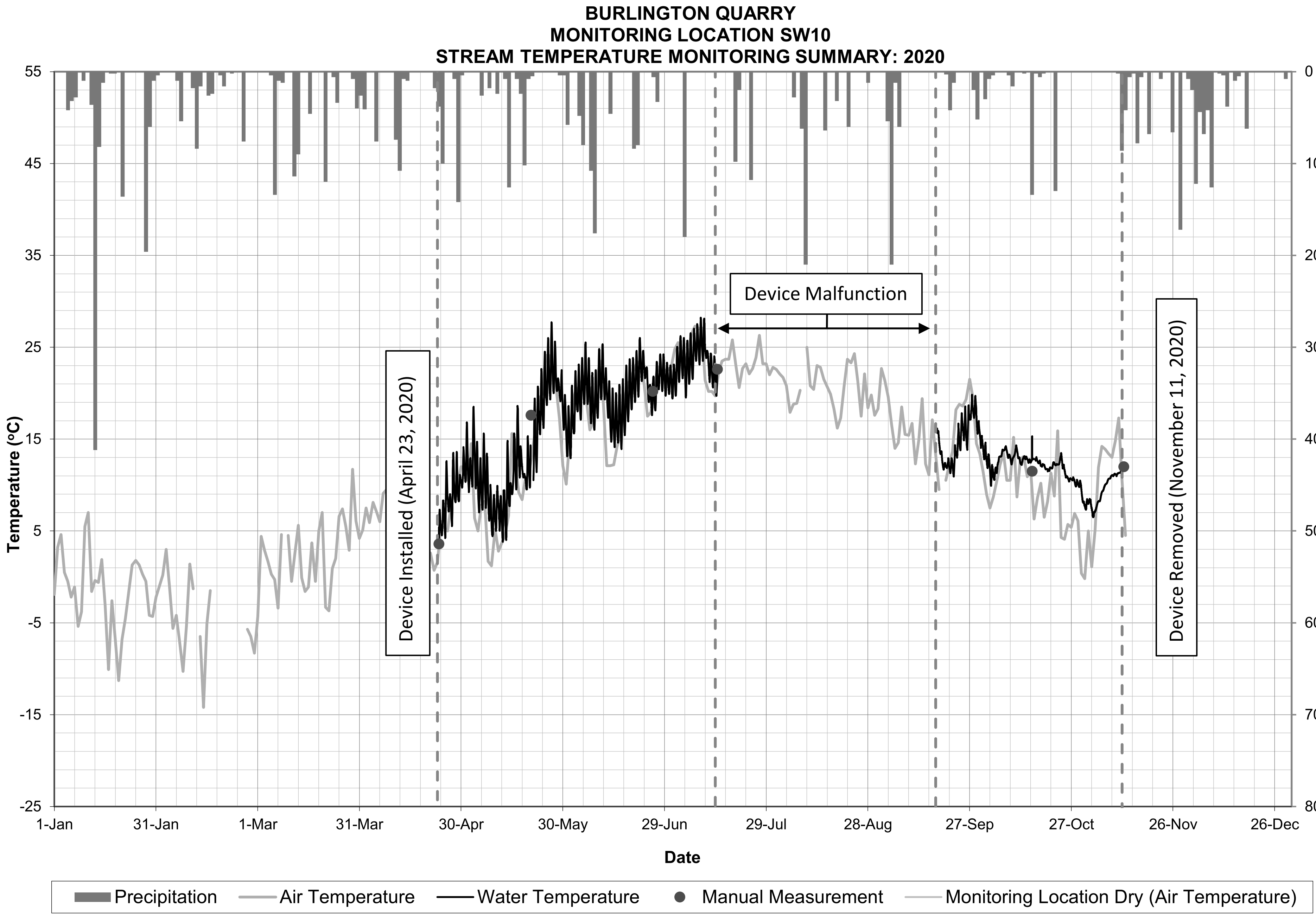
BURLINGTON QUARRY
MONITORING LOCATION SW9
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (March 15, 2019)
Device Malfunction
Device Removed (November 28, 2019)
0
20
40
60
80
100
120
140
160
180
200
100
90
80
70
60
50
40
30
20
10
0
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature

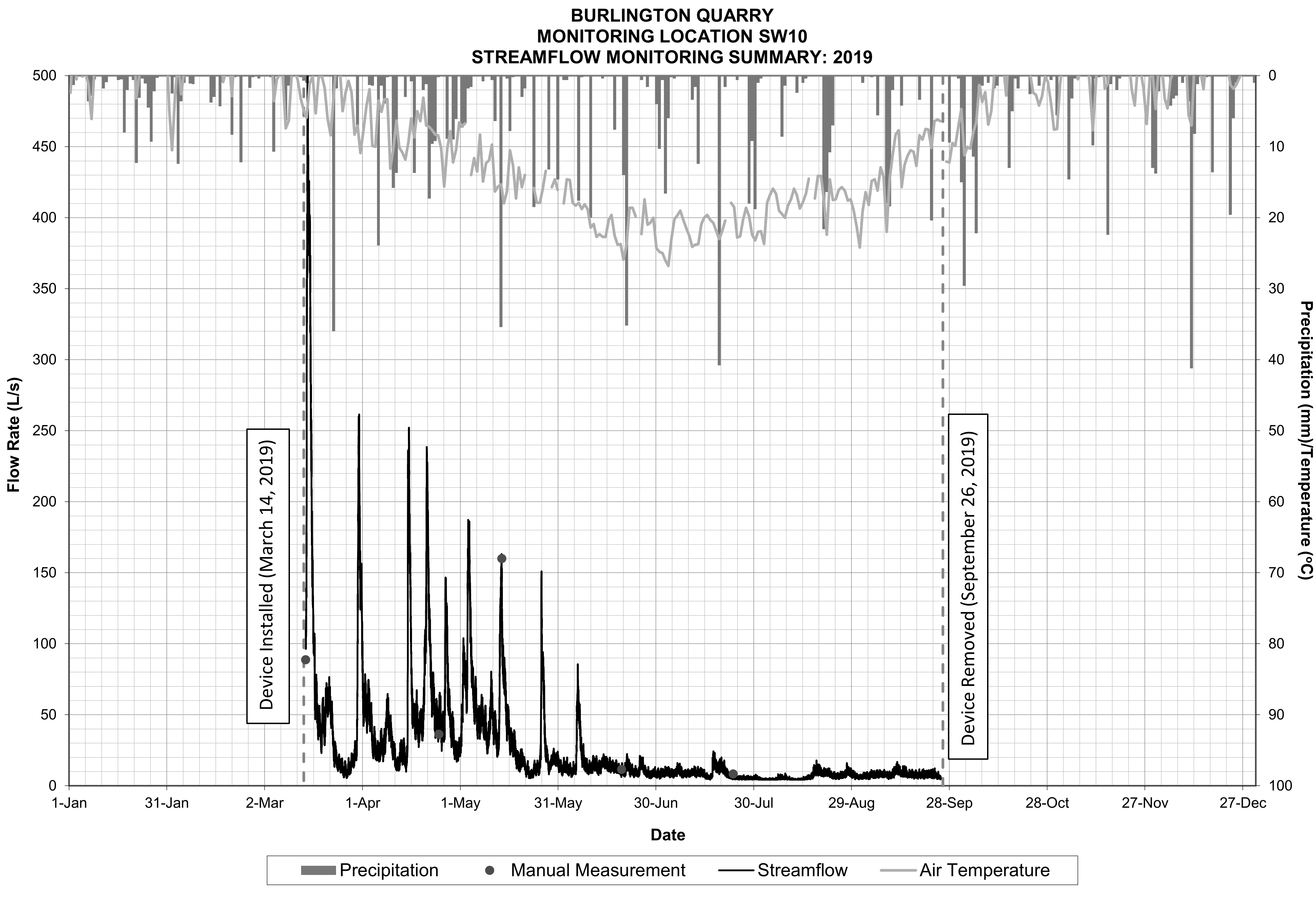


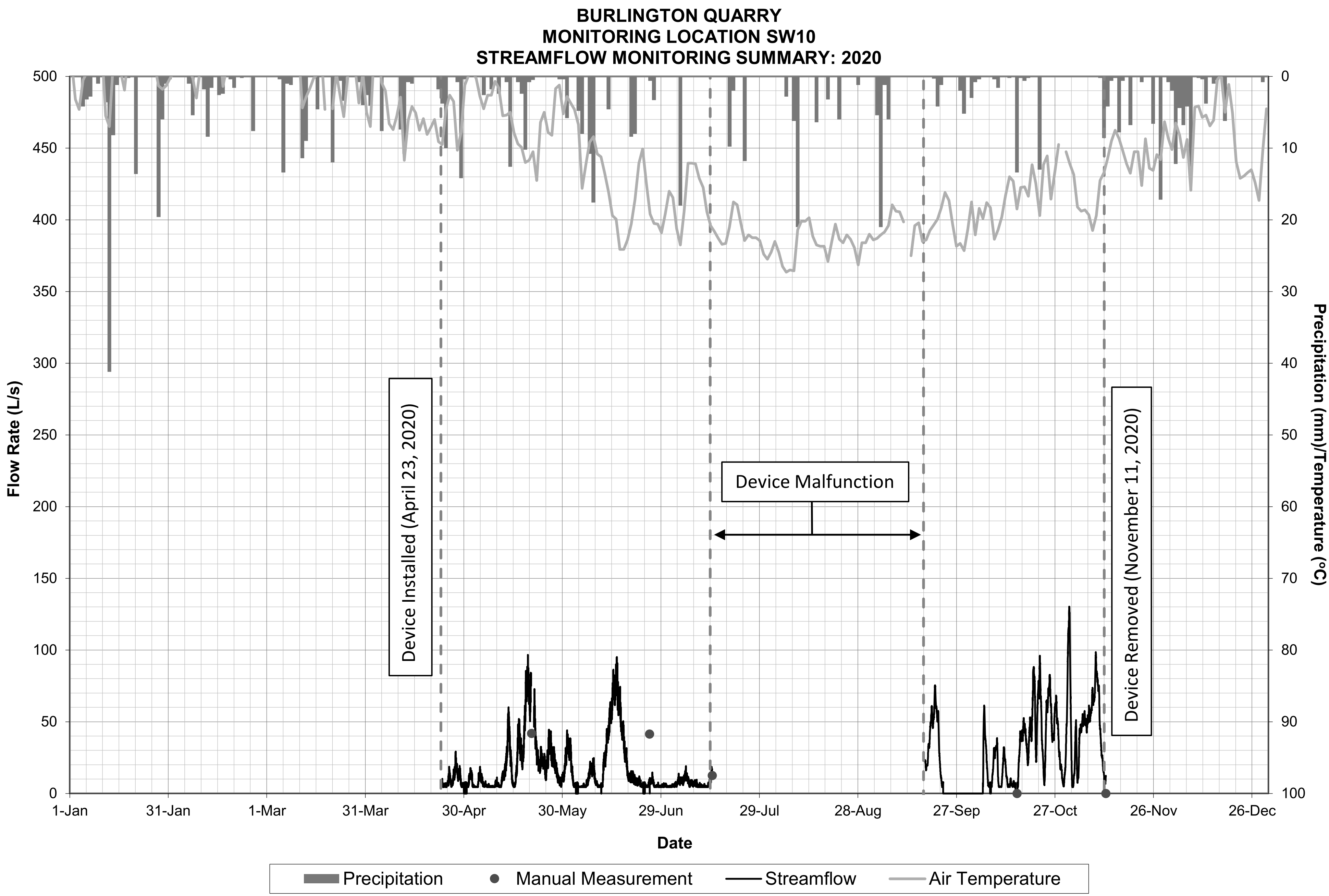
BURLINGTON QUARRY
MONITORING LOCATION SW9
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
200
180
160
140
120
100
80
60
40
20
0
10
30
50
70
90
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature



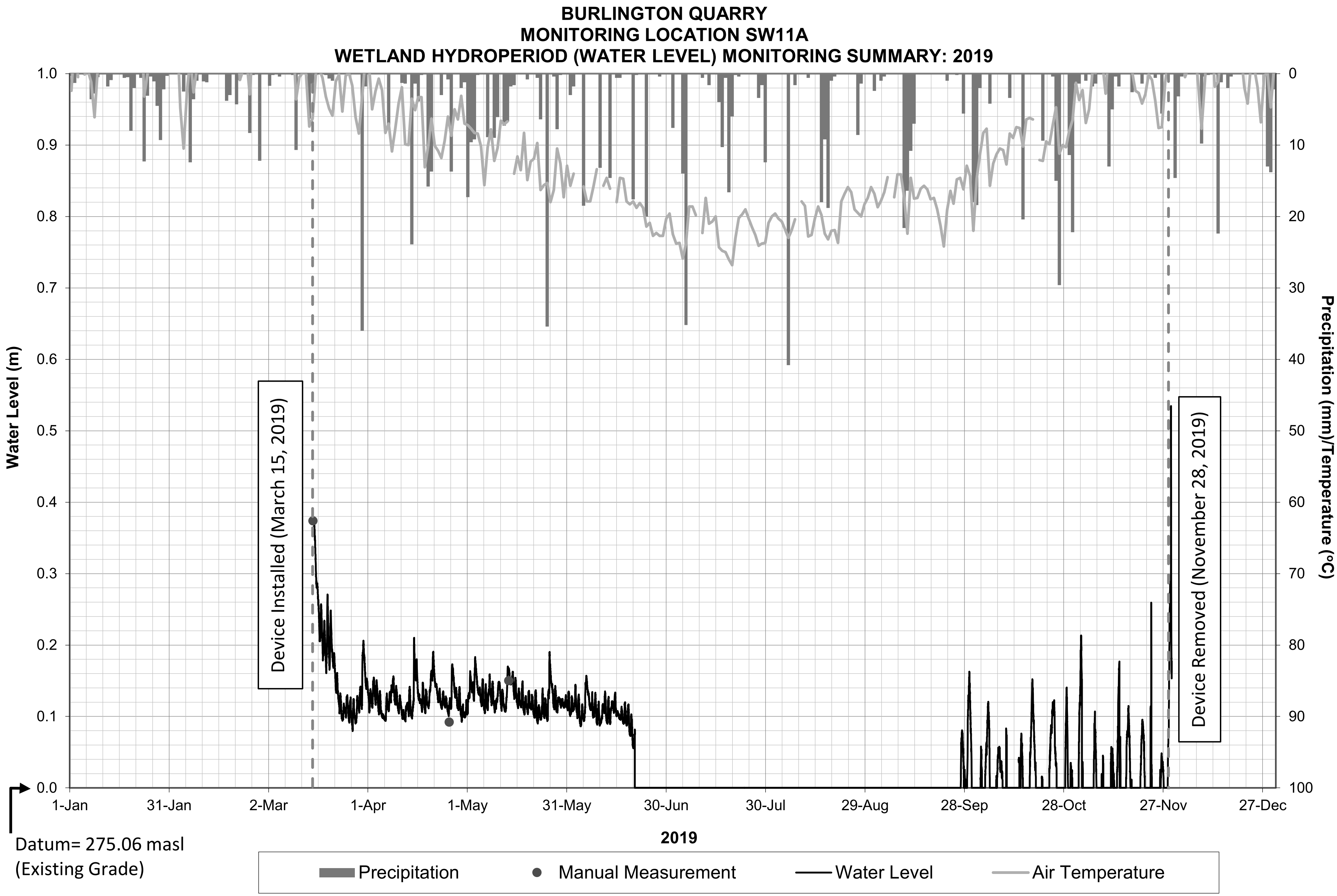
BURLINGTON QUARRY
MONITORING LOCATION SW10
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Device Installed (March 14, 2019)
Device Removed (September 26, 2019)
Temperature (ºC)
Precipitation (mm)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)


BURLINGTON QUARRY
MONITORING LOCATION SW10
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Precipitation (mm)
Date
Device Installed (April 23, 2020)
Device Malfunction
Device Removed (November 11, 2020)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

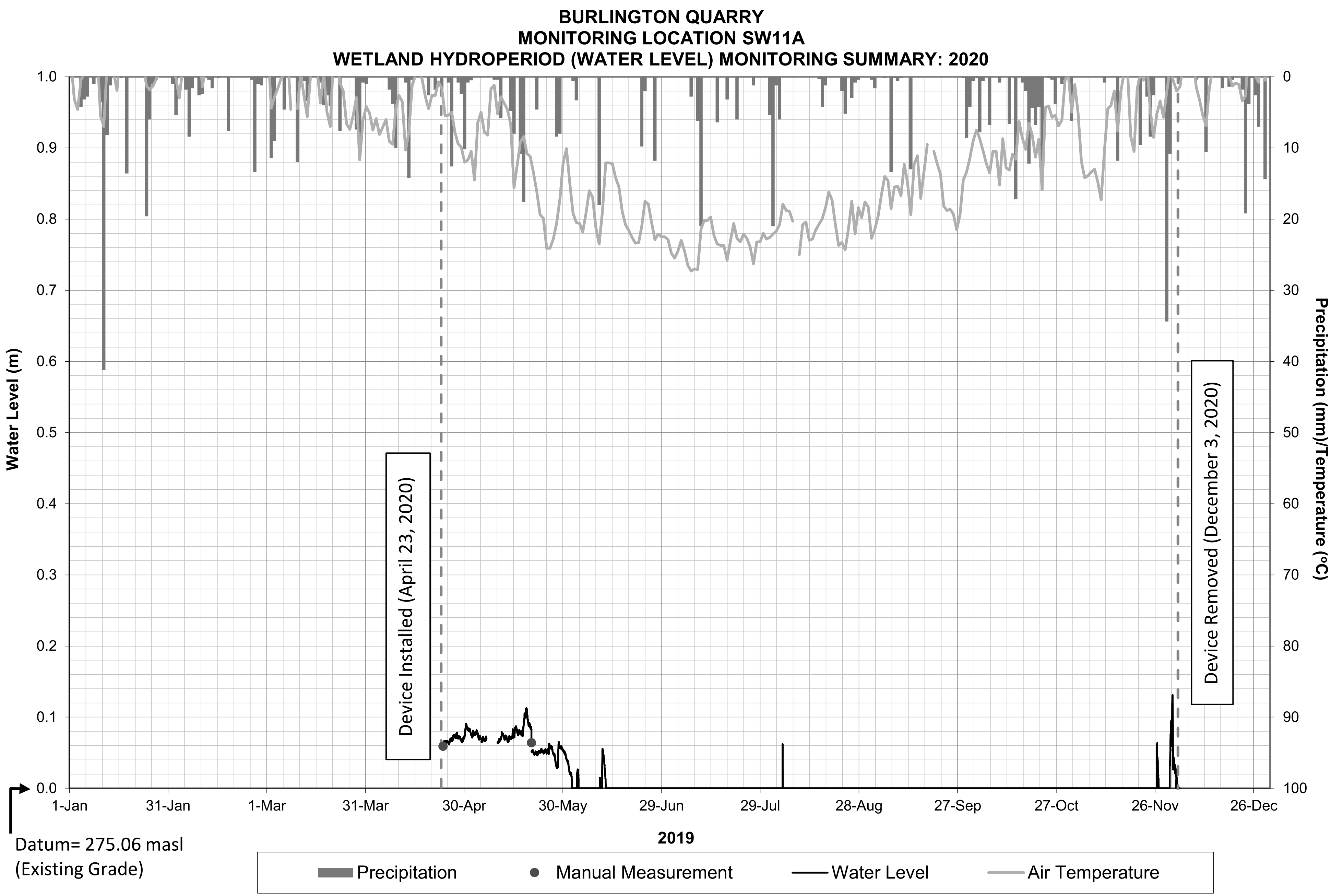

BURLINGTON QUARRY
MONITORING LOCATION SW10
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (March 14, 2019)
Device Removed (September 26, 2019)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature



BURLINGTON QUARRY
MONITORING LOCATION SW10
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
500
450
400
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 23, 2020)
Device Malfunction
Device Removed (November 11, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature

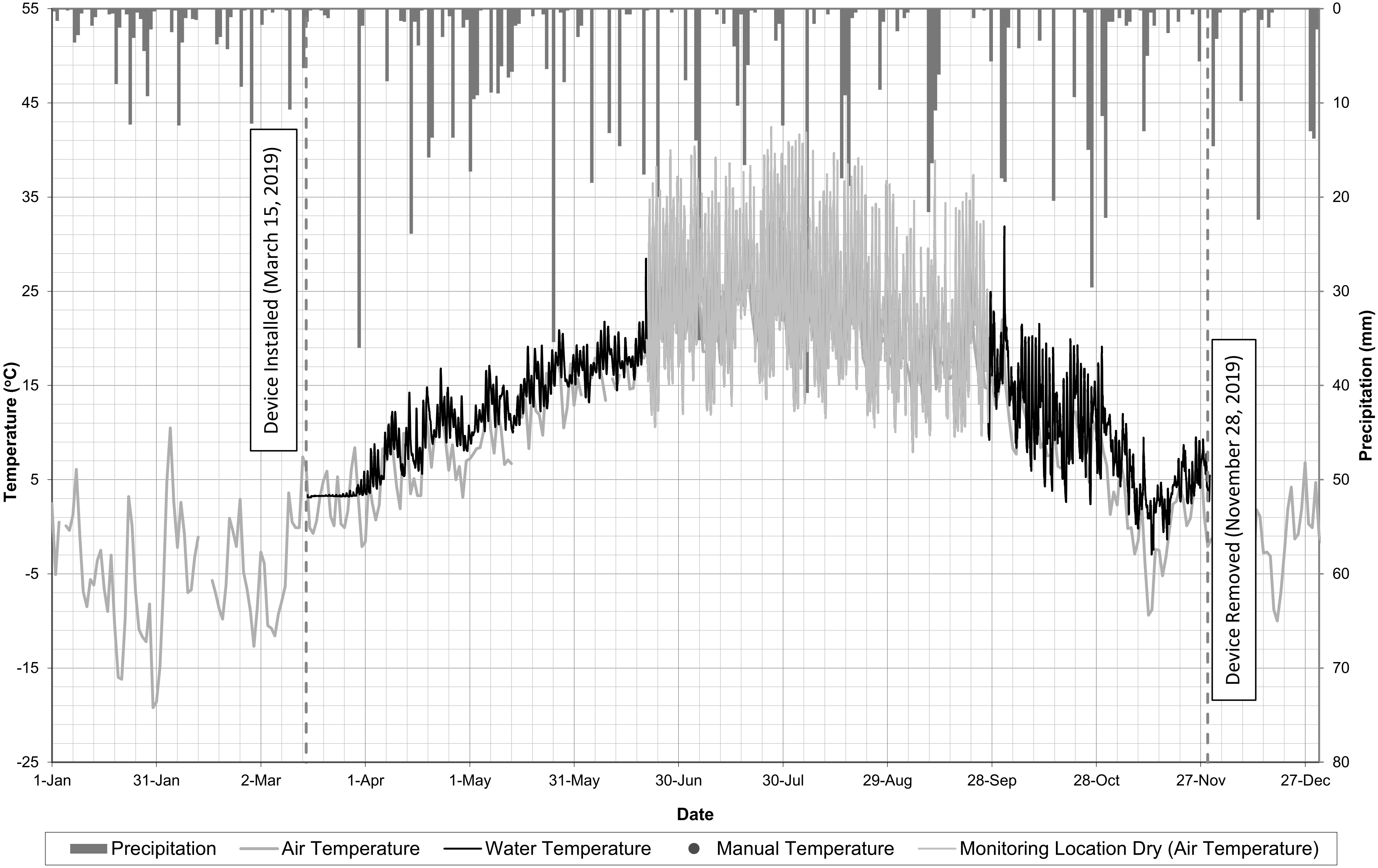


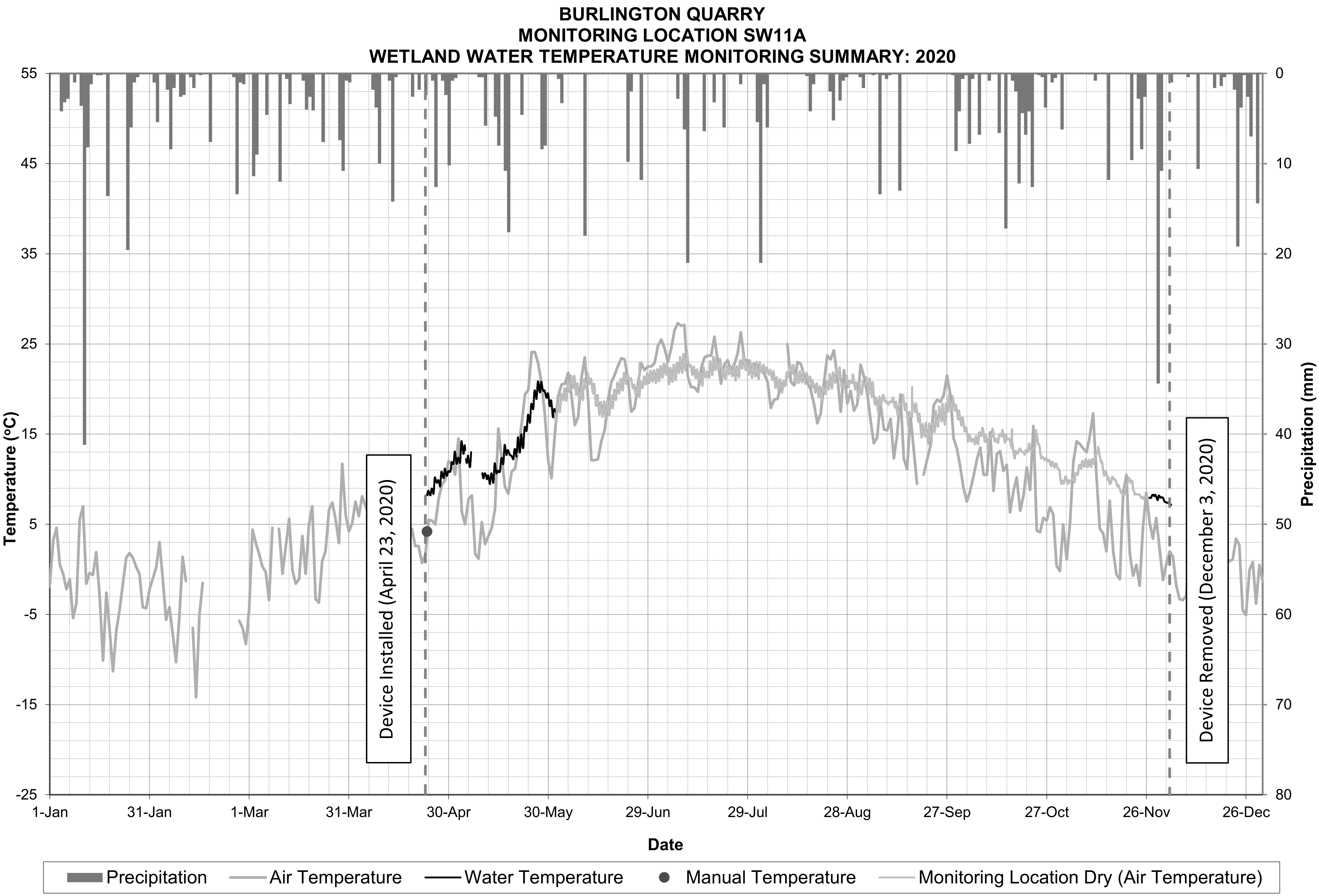
BURLINGTON QUARRY
MONITORING LOCATION SW11A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2019
Water Level (m)
Precipitation (mm)/Temperature (°C)
Device Installed (March 15, 2019)
Device Removed (November 28, 2019)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
2019
Datum= 275.06 masl
(Existing Grade)
Precipitation
Manual Measurement
Water Level
Air Temperature



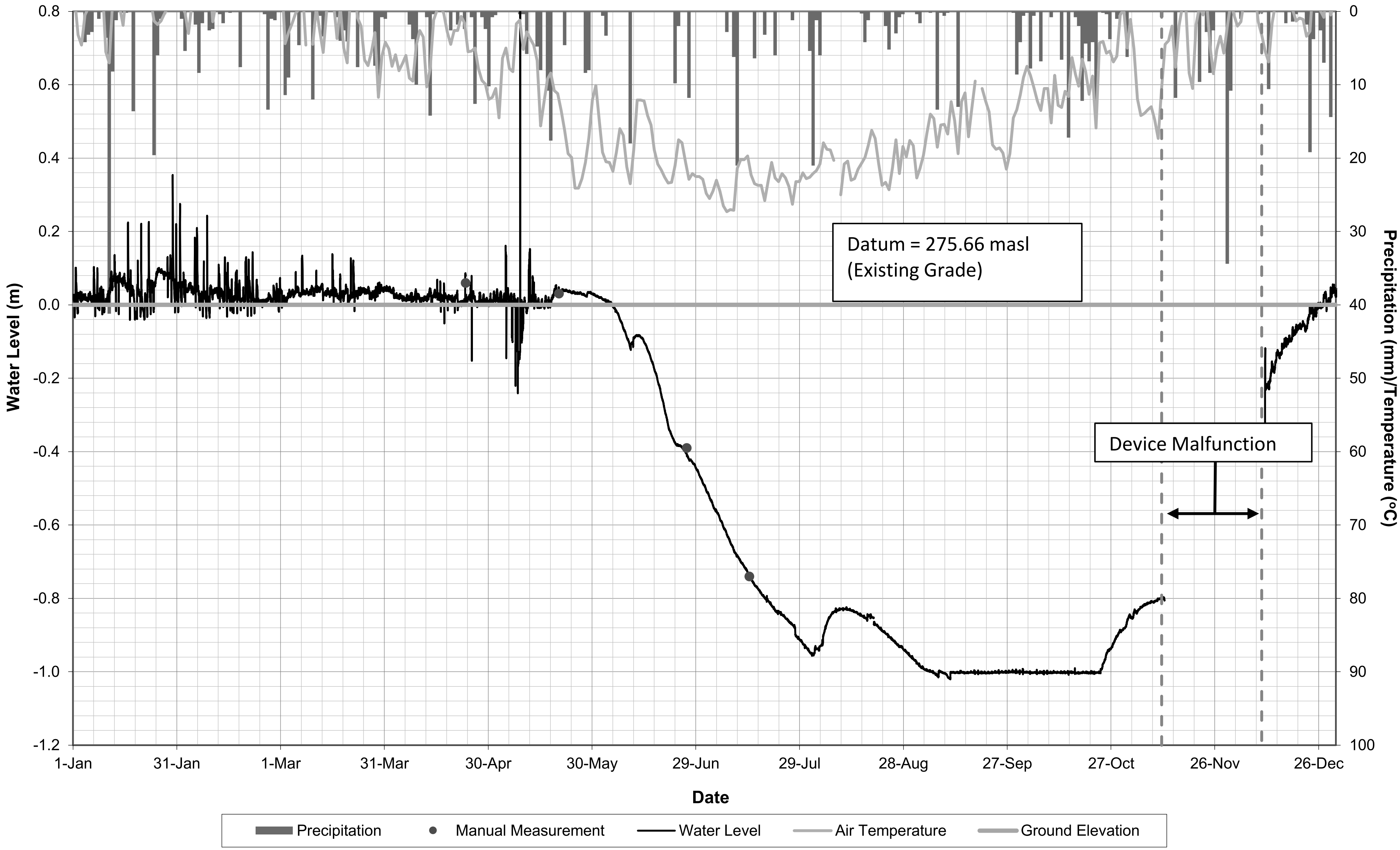
BURLINGTON QUARRY
MONITORING LOCATION SW11A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
2019
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Datum= 275.06 masl
(Existing Grade)
Precipitation
Manual Measurement
Water Level
Air Temperature

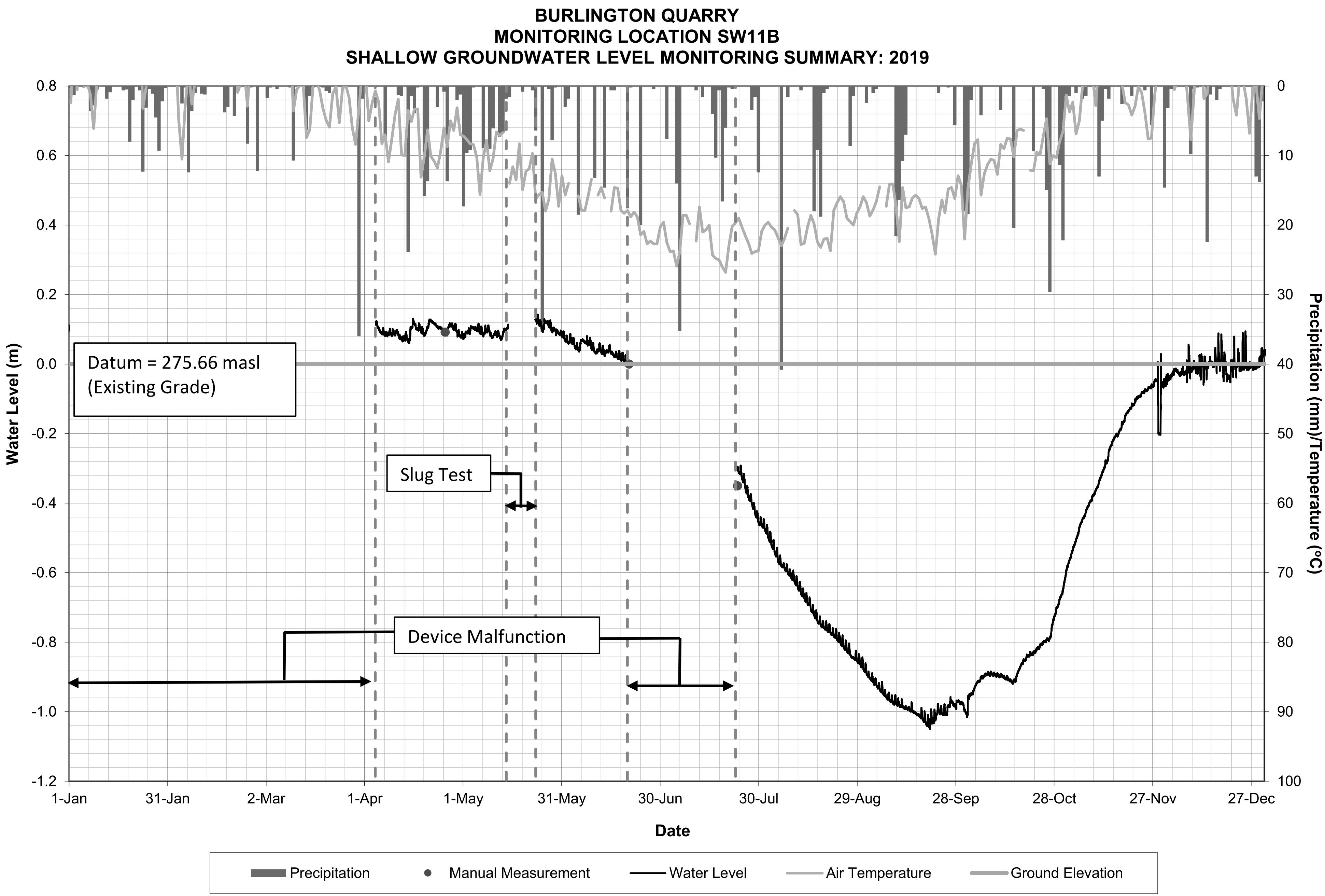
BURLINGTON QUARRY
MONITORING LOCATION SW11A
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2019



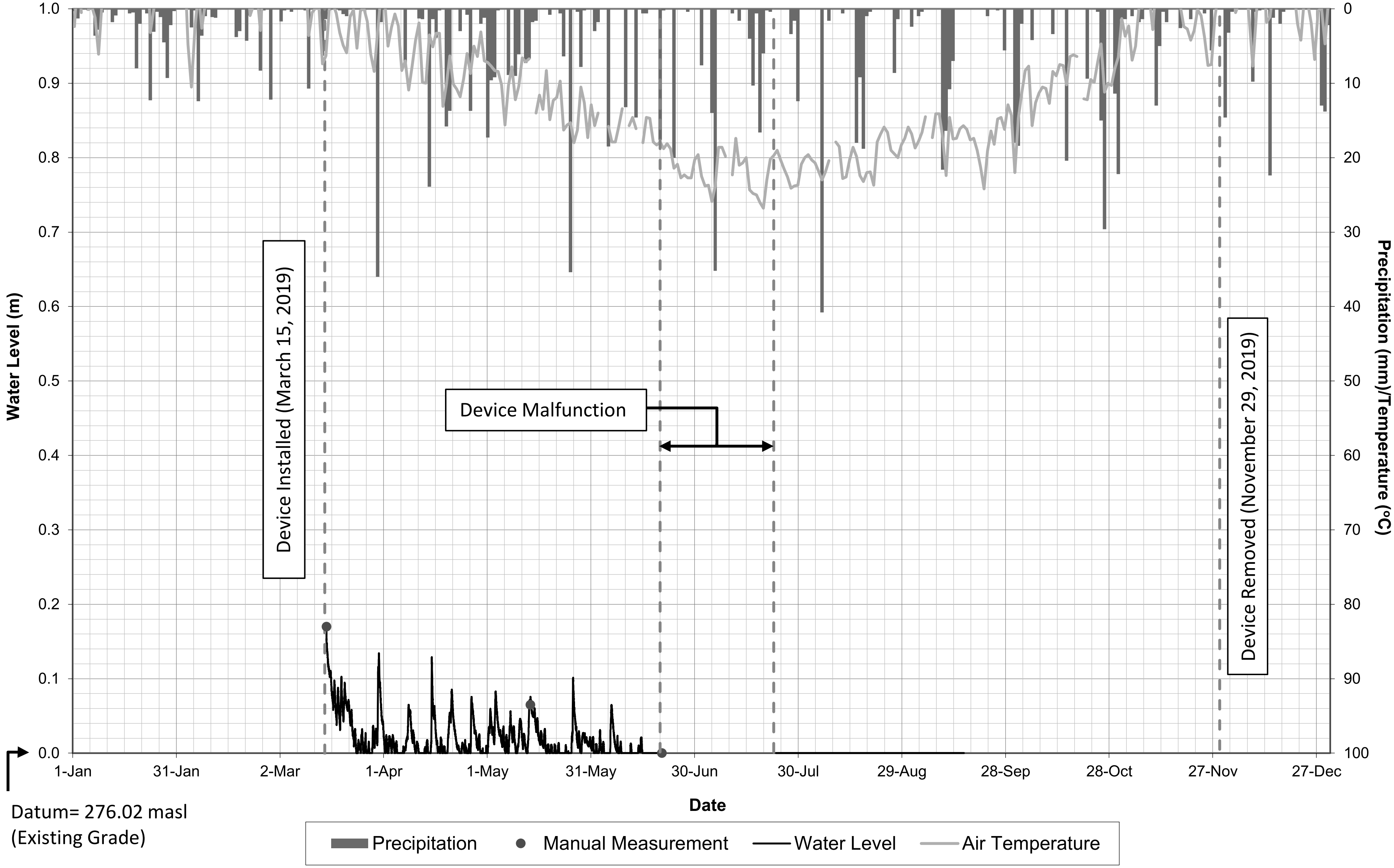

BURLINGTON QUARRY
MONITORING LOCATION SW11A
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Precipitation (mm)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Temperature
Monitoring Location Dry (Air Temperature)

BURLINGTON QUARRY
MONITORING LOCATION SW11B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2020

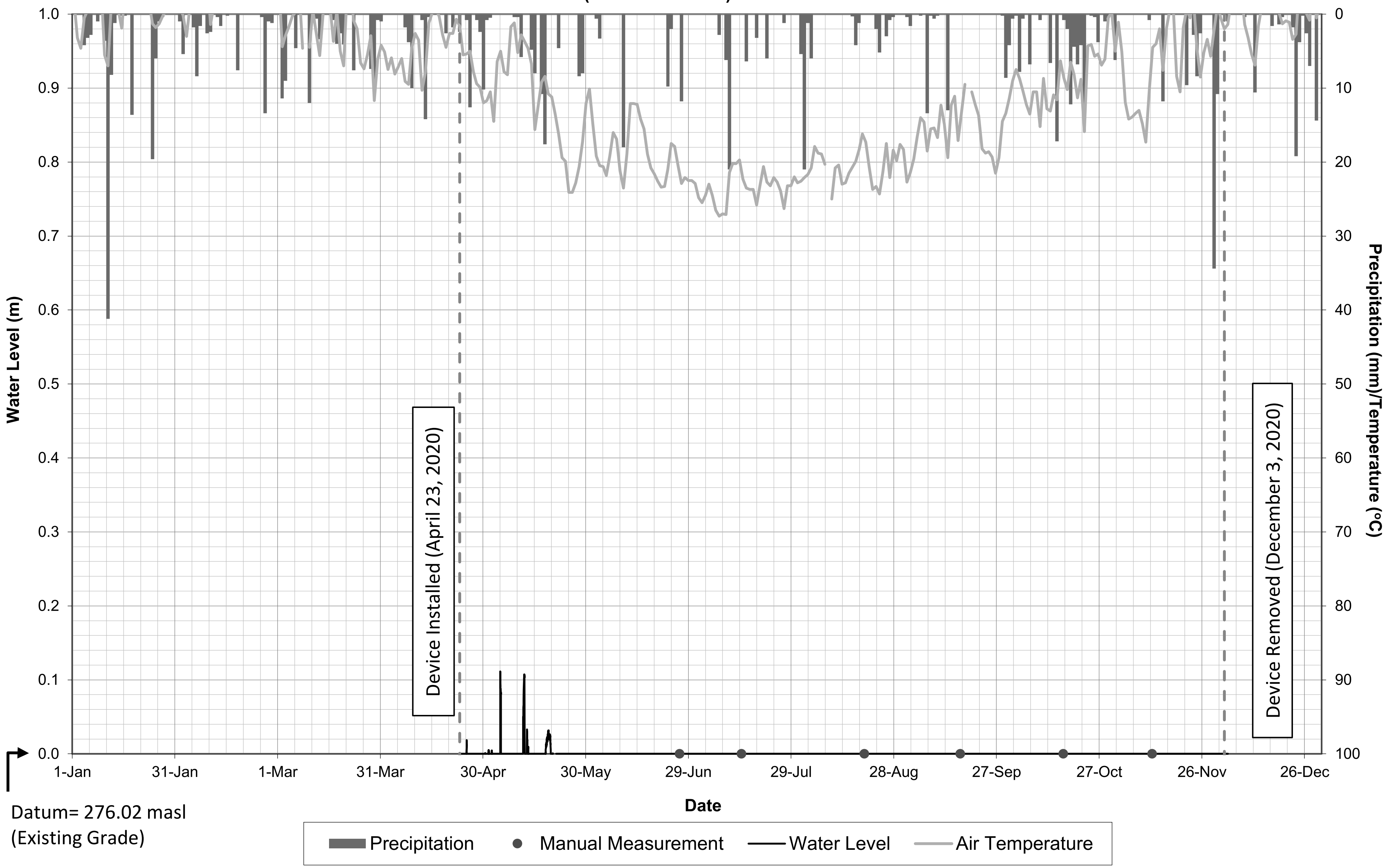


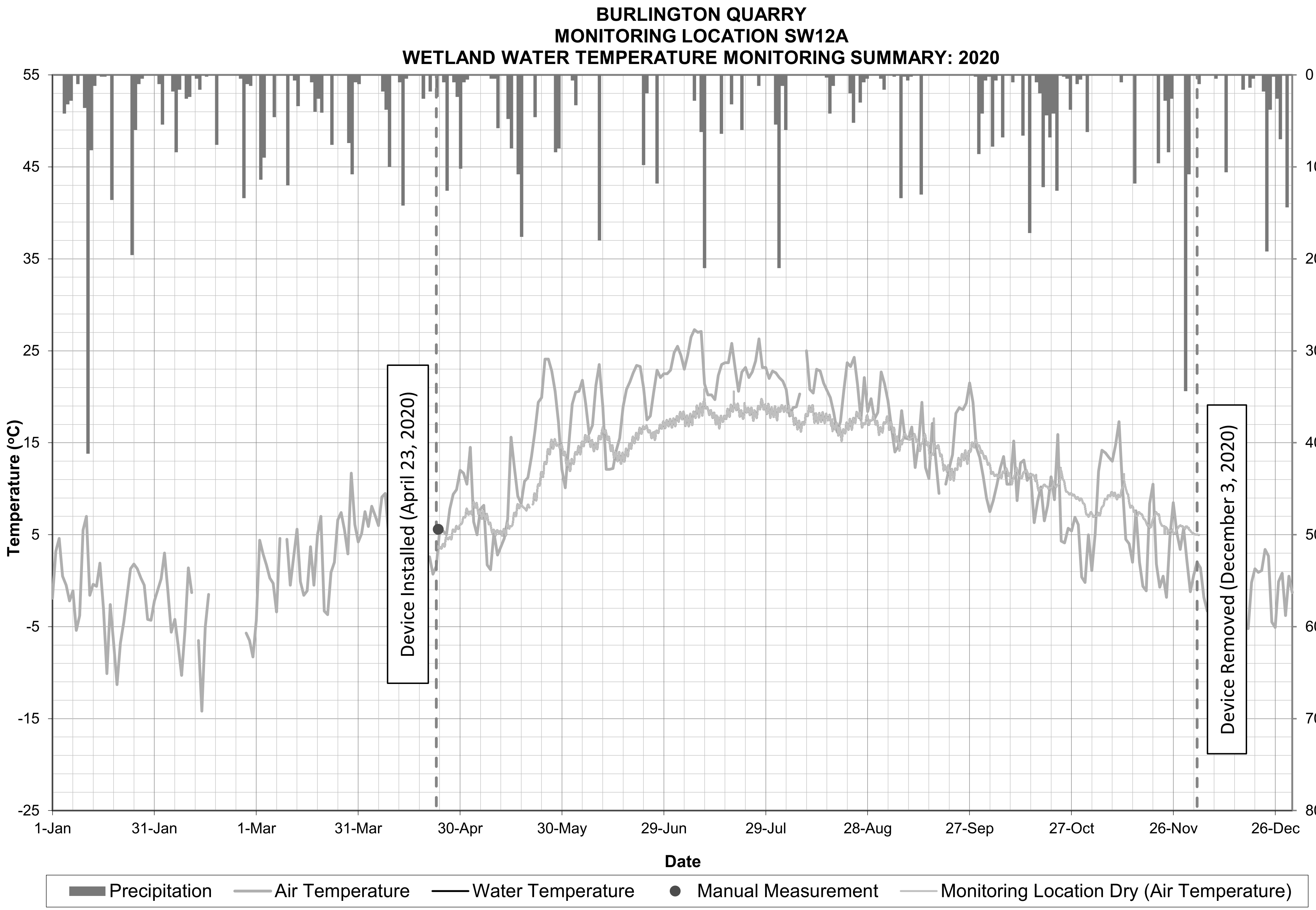

BURLINGTON QUARRY
MONITORING LOCATION SW11B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2019
Datum = 275.66 masl
(Existing Grade)
Slug Test
Device Malfunction
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0
10
20
30
40
50
60
70
80
90
100
Precipitation
Manual Measurement
Water Level
Air Temperature
Ground Elevation

BURLINGTON QUARRY
MONITORING LOCATION SW12A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2019

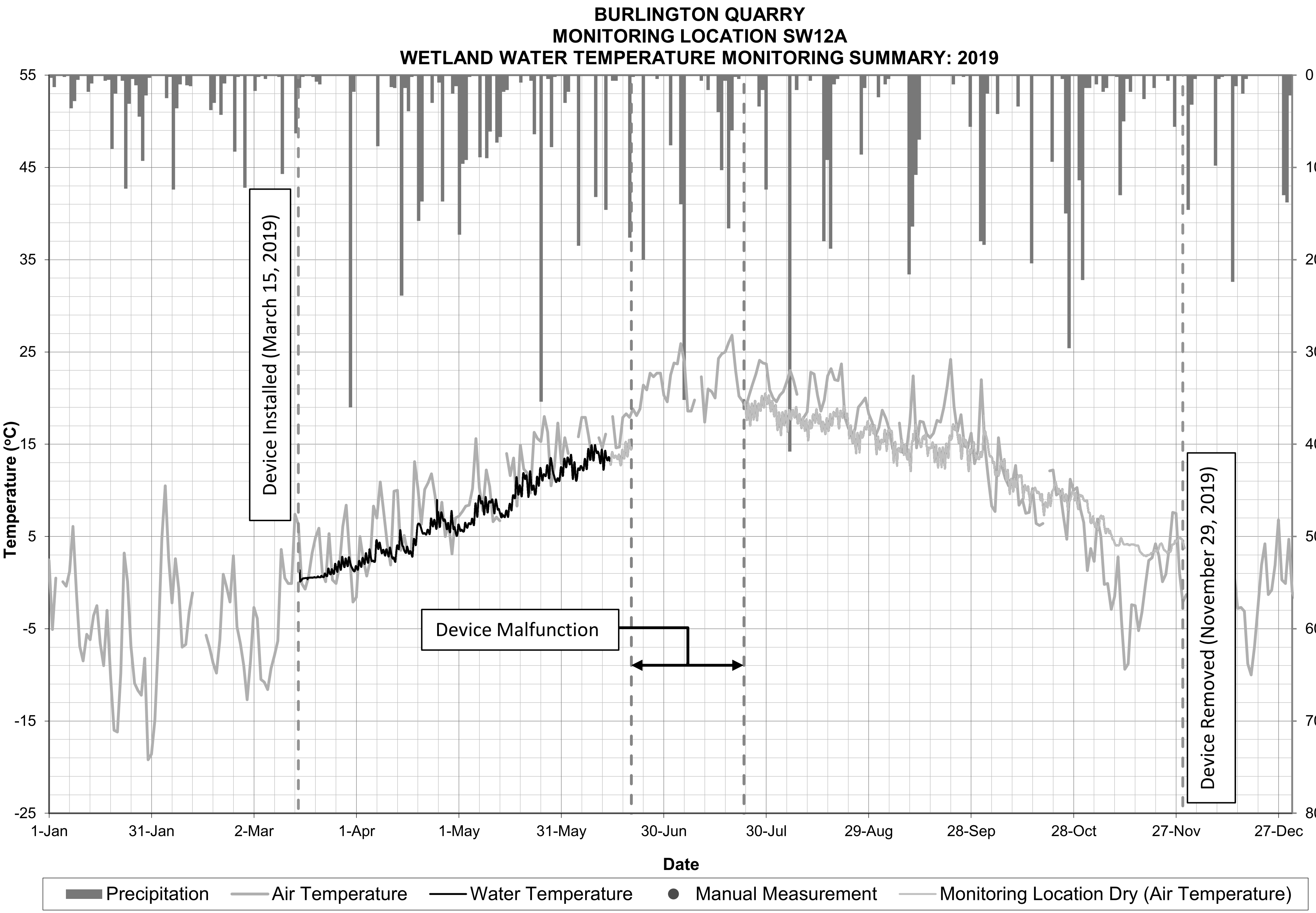


BURLINGTON QUARRY
MONITORING LOCATION SW12A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2020

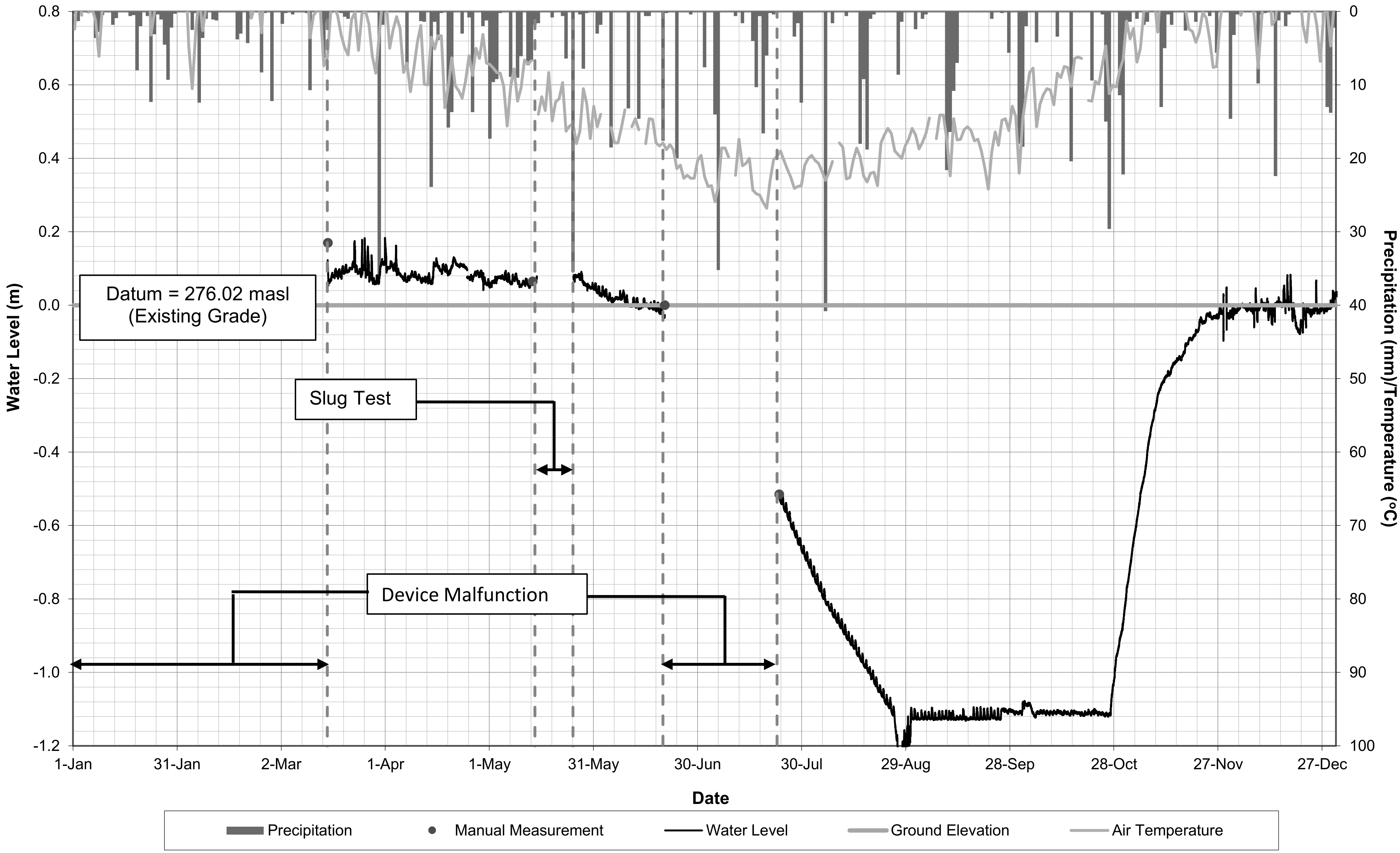


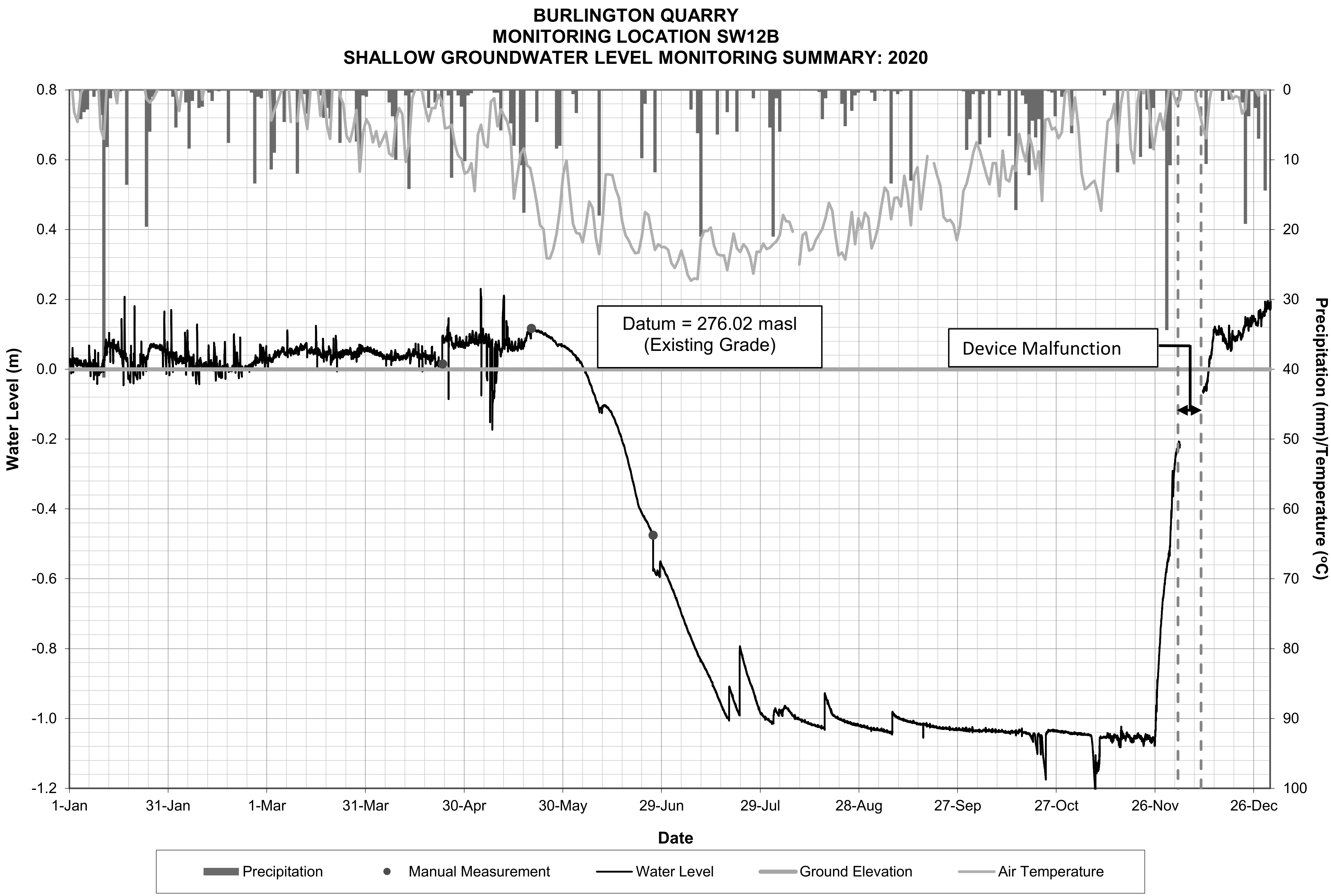


BURLINGTON QUARRY
MONITORING LOCATION SW12A
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Precipitation (mm)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

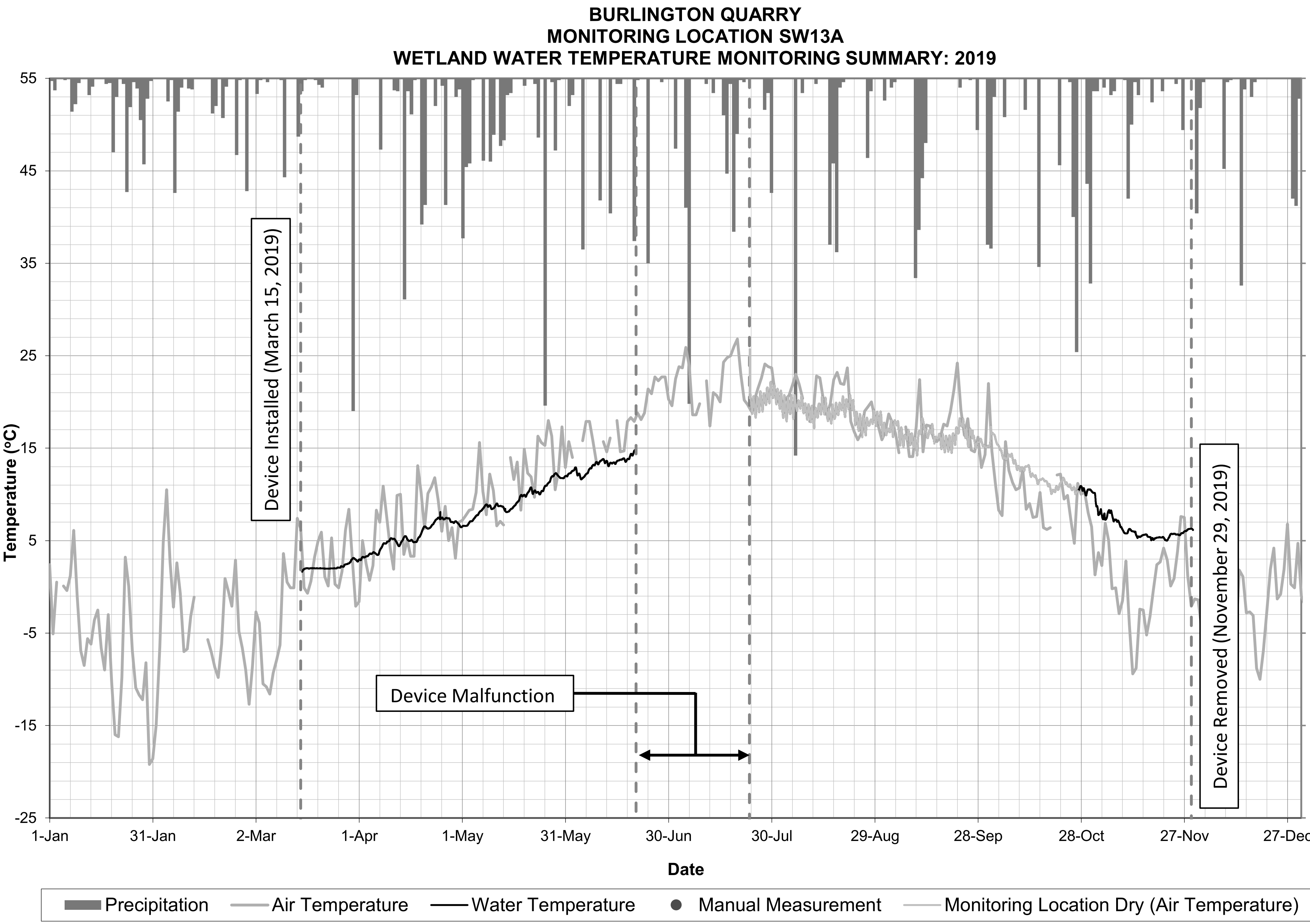

BURLINGTON QUARRY
MONITORING LOCATION SW12A
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 15, 2019)
Device Malfunction
Device Removed (November 29, 2019)
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

BURLINGTON QUARRY
MONITORING LOCATION SW12B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2019

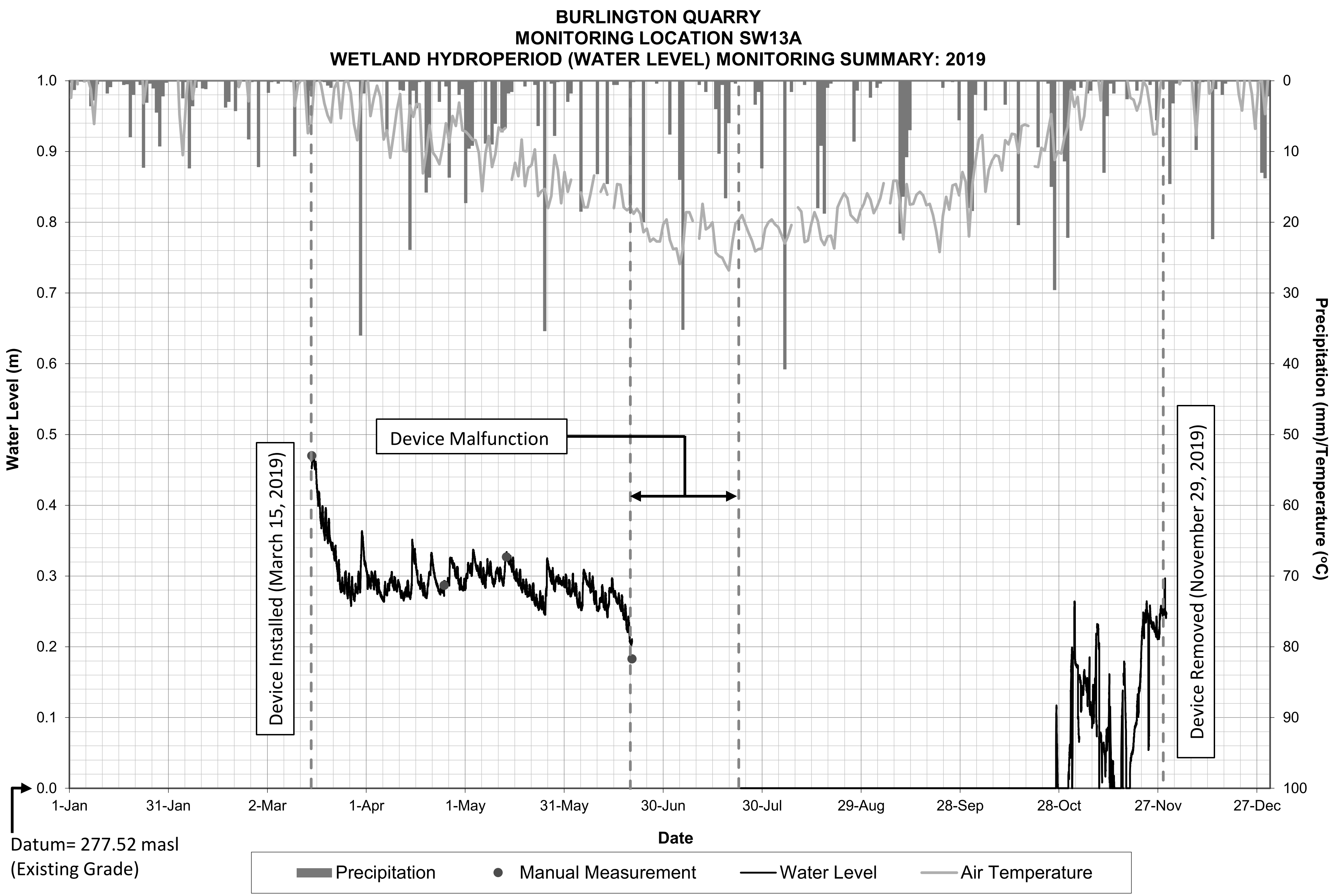




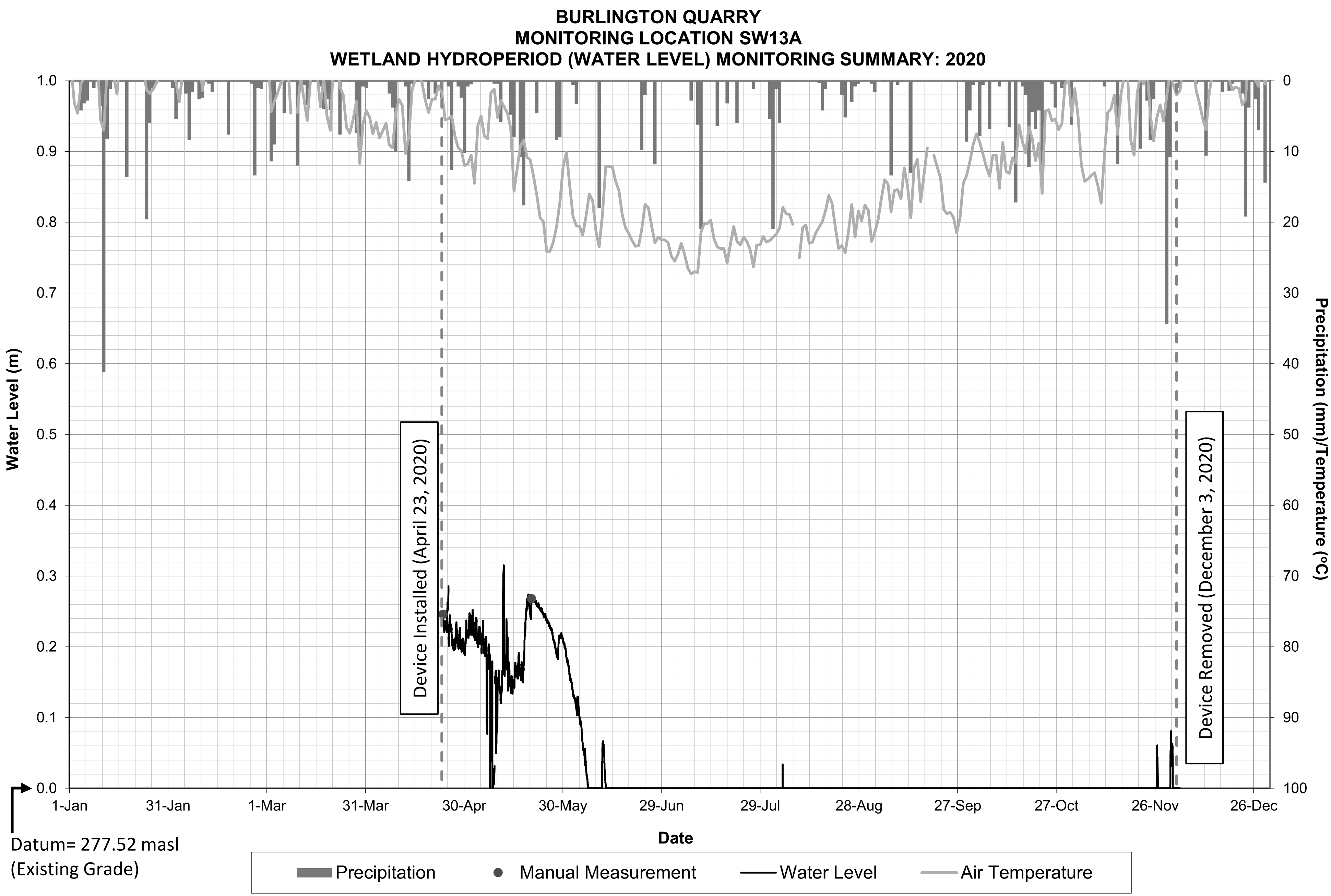
BURLINGTON QUARRY
MONITORING LOCATION SW12B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2020
Datum = 276.02 masl
(Existing Grade)
Device Malfunction
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Manual Measurement
Water Level
Ground Elevation
Air Temperature

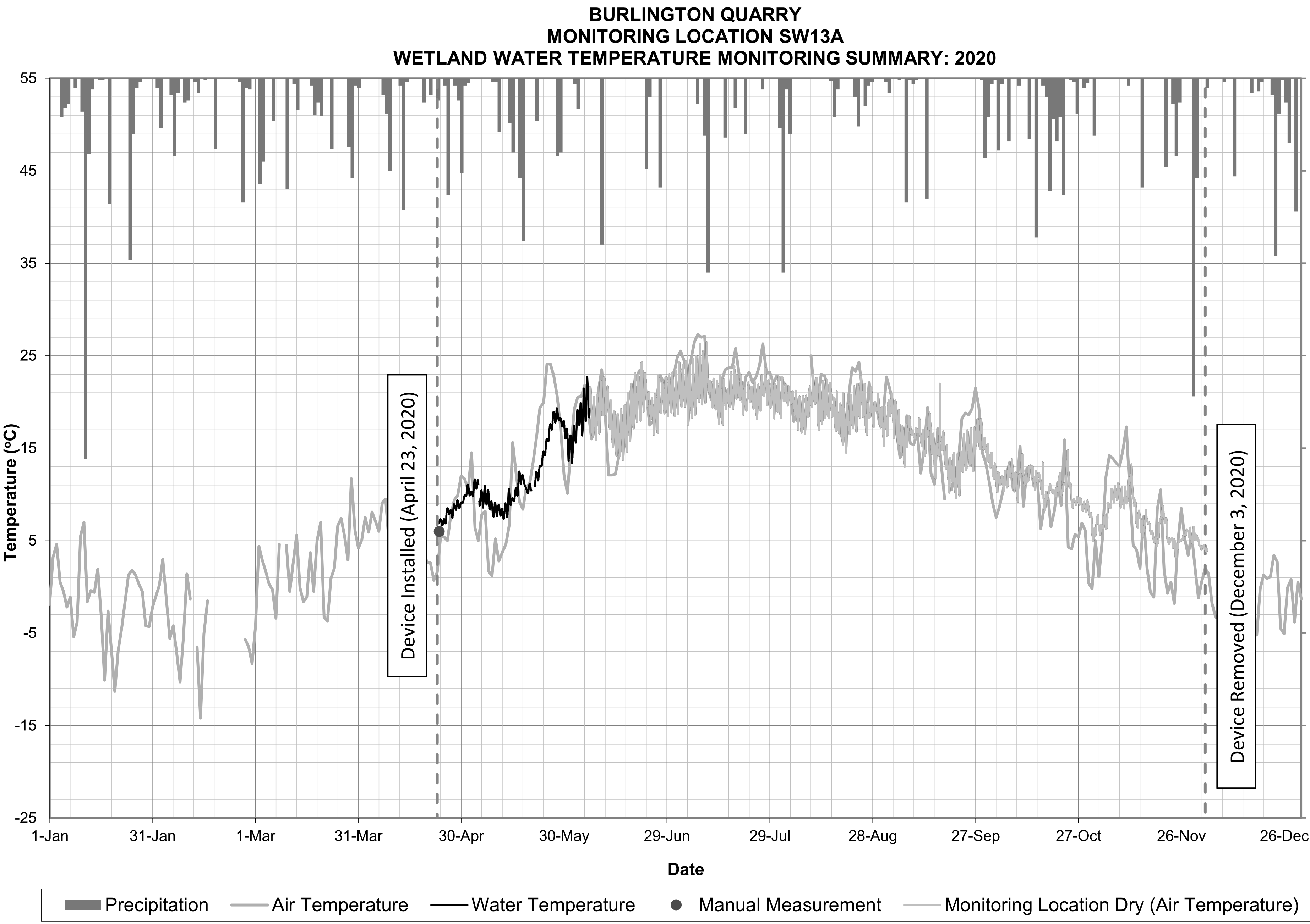


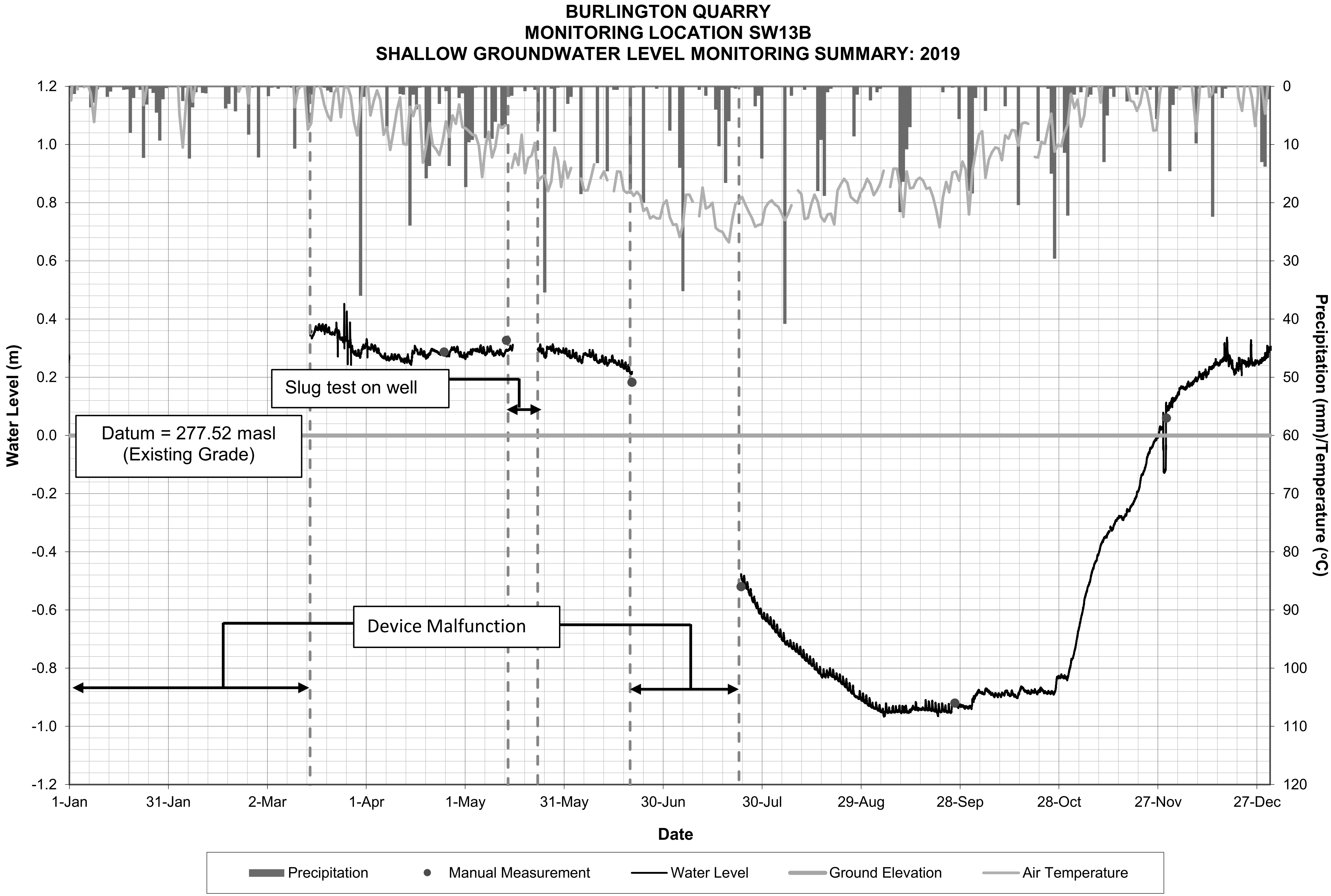
BURLINGTON QUARRY
MONITORING LOCATION SW13A
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 15, 2019)
Device Malfunction
Device Removed (November 29, 2019)
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



BURLINGTON QUARRY
MONITORING LOCATION SW13A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2019
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 15, 2019)
Device Malfunction
Device Removed (November 29, 2019)
Datum= 277.52 masl
(Existing Grade)
Precipitation
Manual Measurement
Water Level
Air Temperature

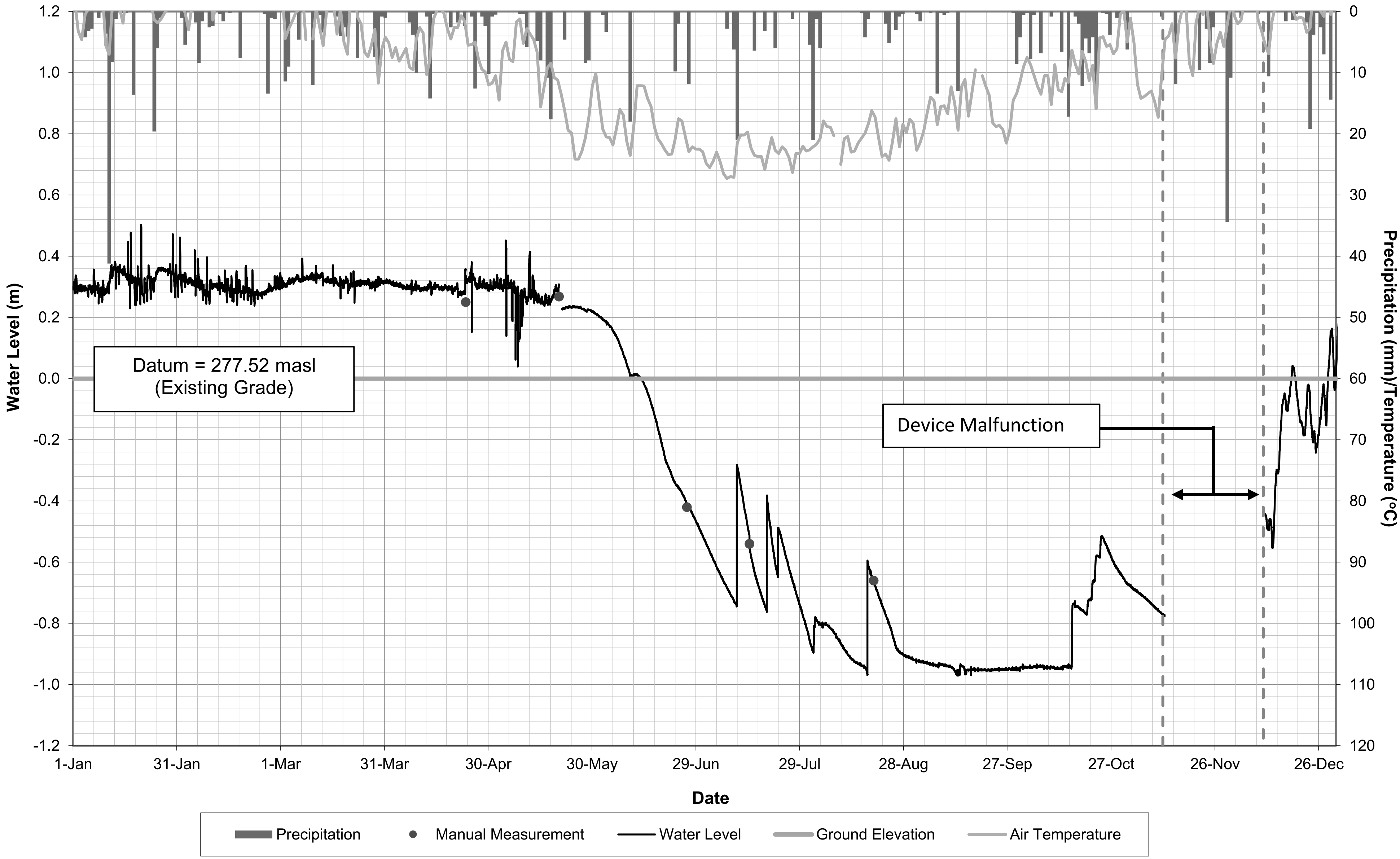

BURLINGTON QUARRY
MONITORING LOCATION SW13A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Datum= 277.52 masl
(Existing Grade)
Precipitation
Manual Measurement
Water Level
Air Temperature

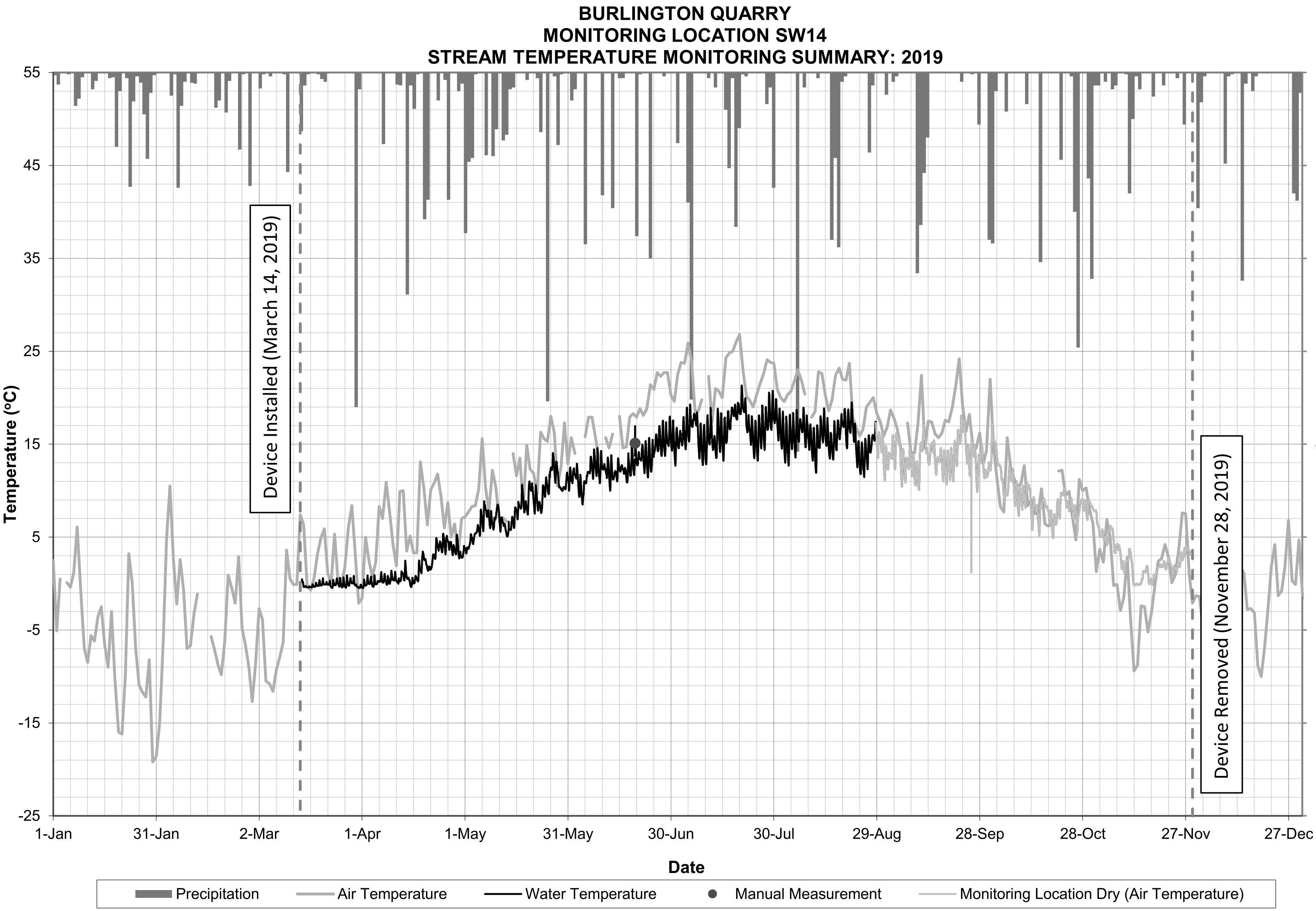

BURLINGTON QUARRY
MONITORING LOCATION SW13A
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2020
Temperature (°C)
Precipitation (mm)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

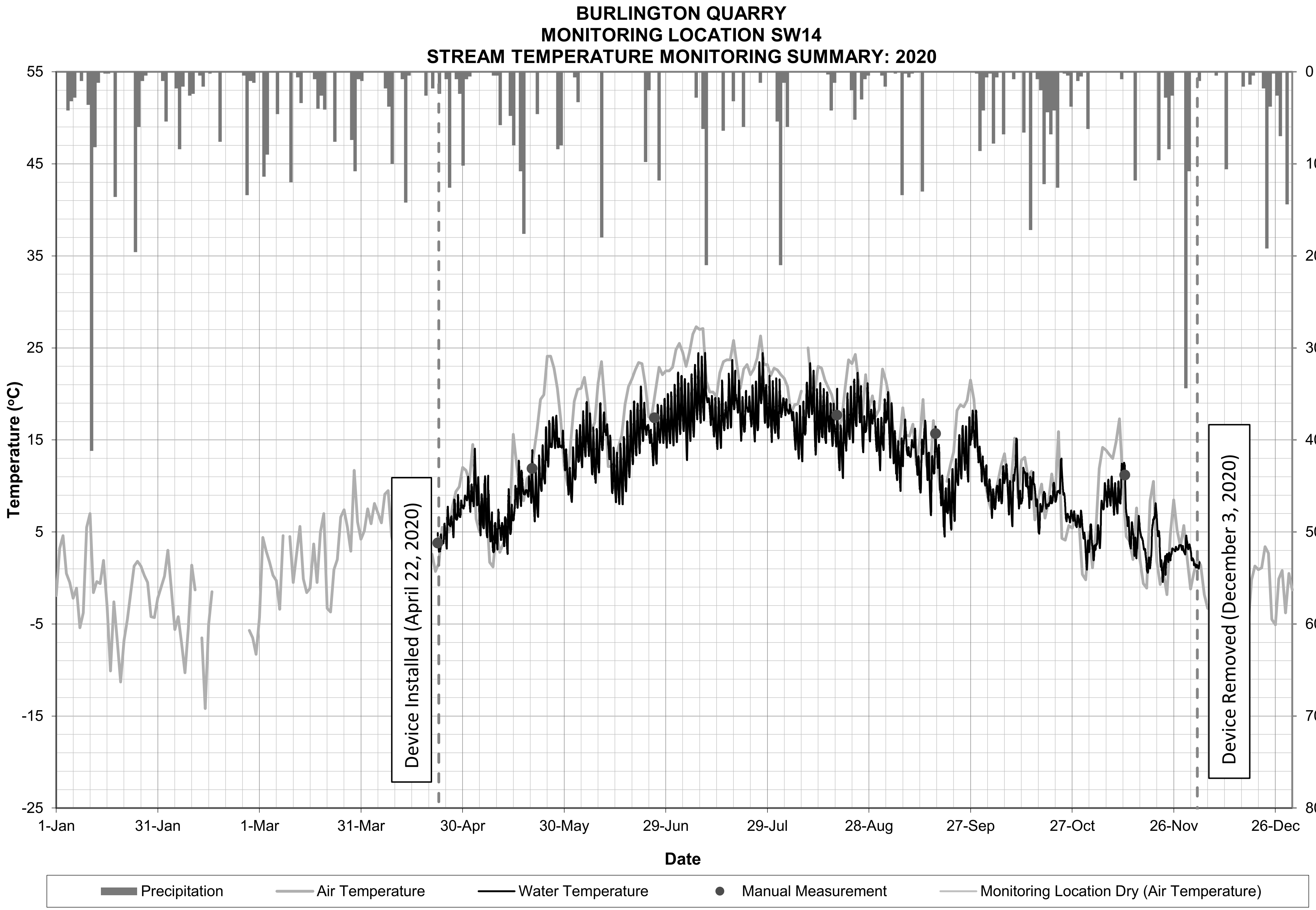


BURLINGTON QUARRY
MONITORING LOCATION SW13B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2019
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0
10
20
30
40
50
60
70
80
90
100
110
120
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Slug test on well
Datum = 277.52 masl
(Existing Grade)
Device Malfunction
Precipitation
Manual Measurement
Water Level
Ground Elevation
Air Temperature

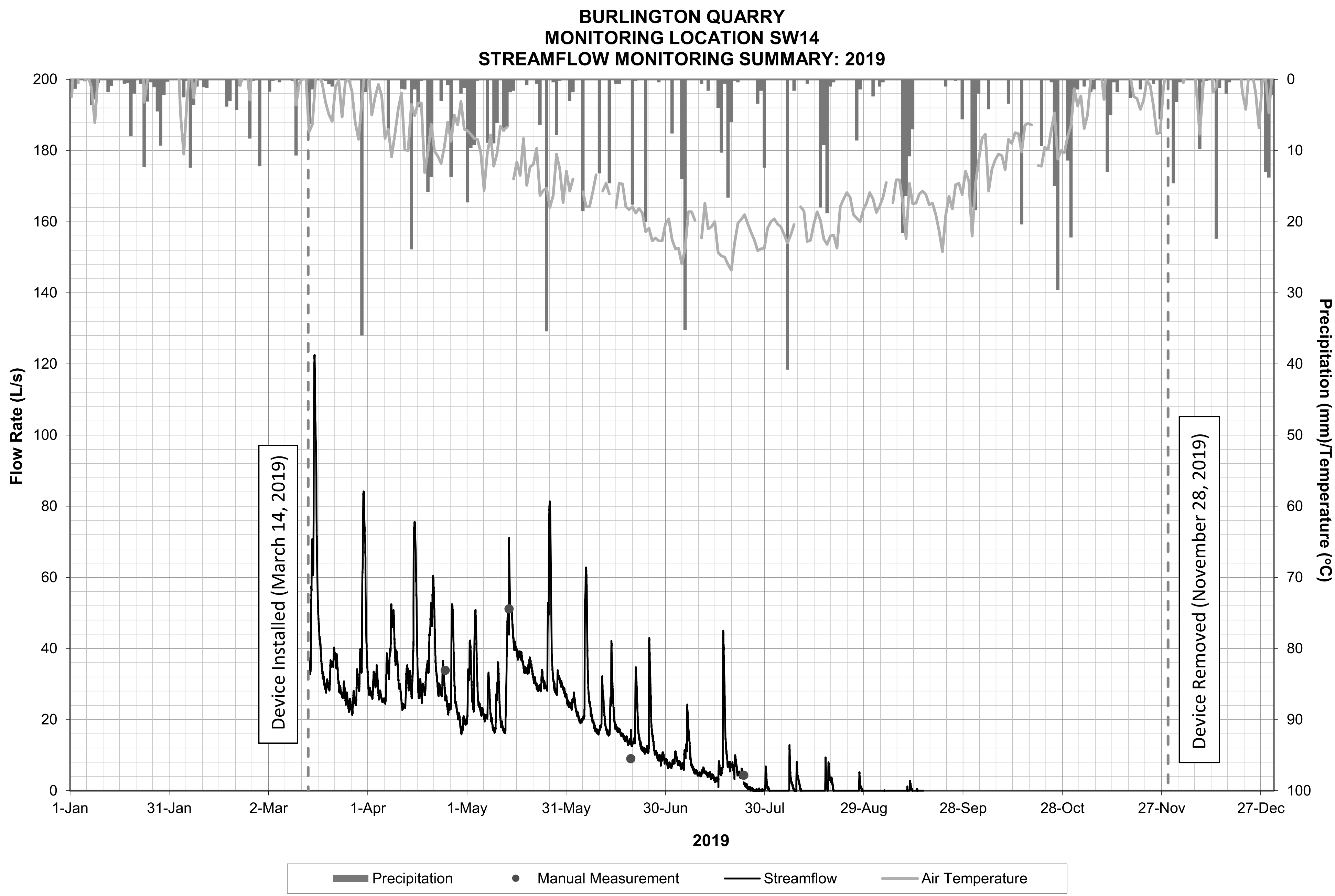
BURLINGTON QUARRY
MONITORING LOCATION SW13B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2020



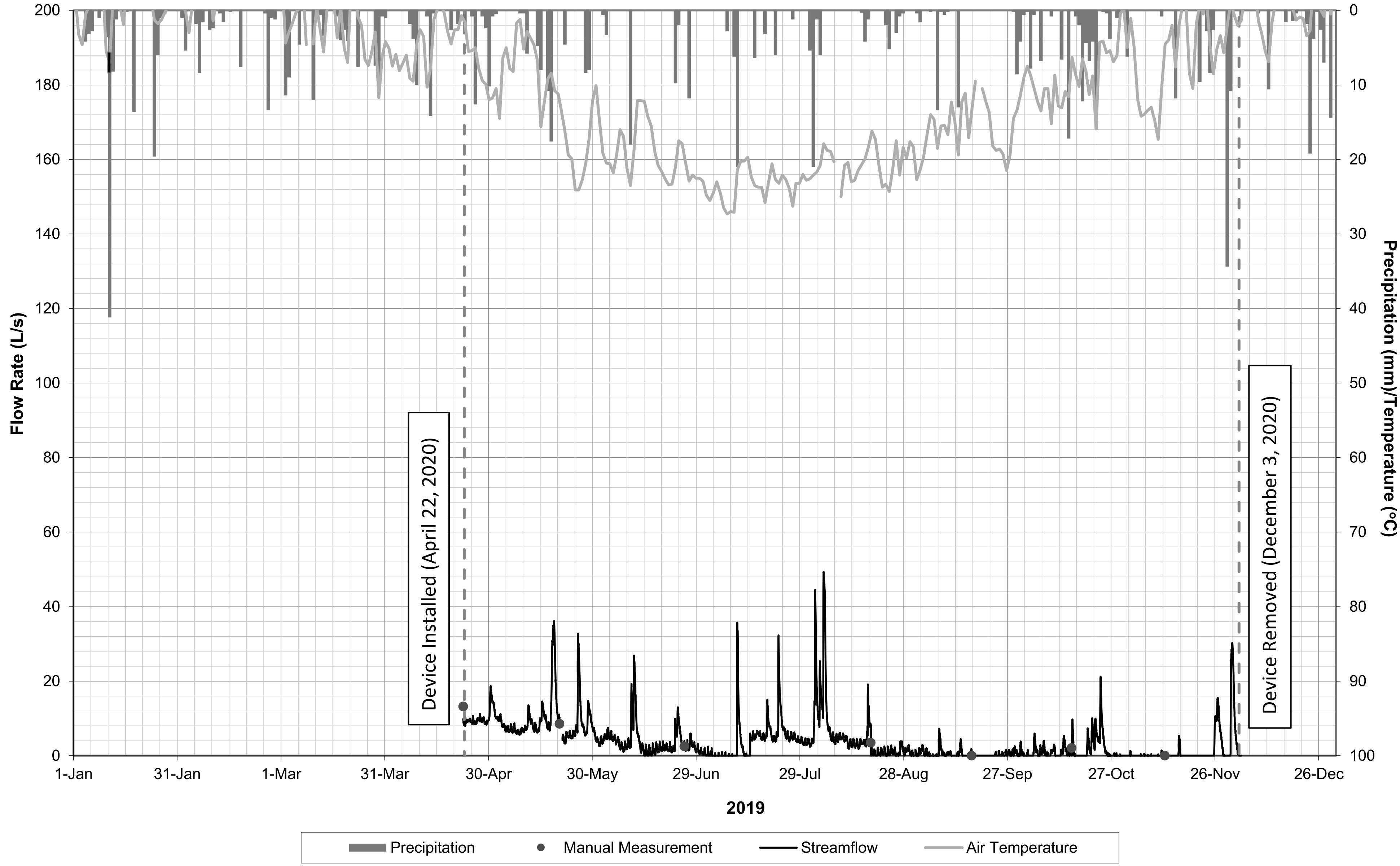

BURLINGTON QUARRY
MONITORING LOCATION SW14
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Precipitation (mm)
Device Installed (March 14, 2019)
Device Removed (November 28, 2019)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

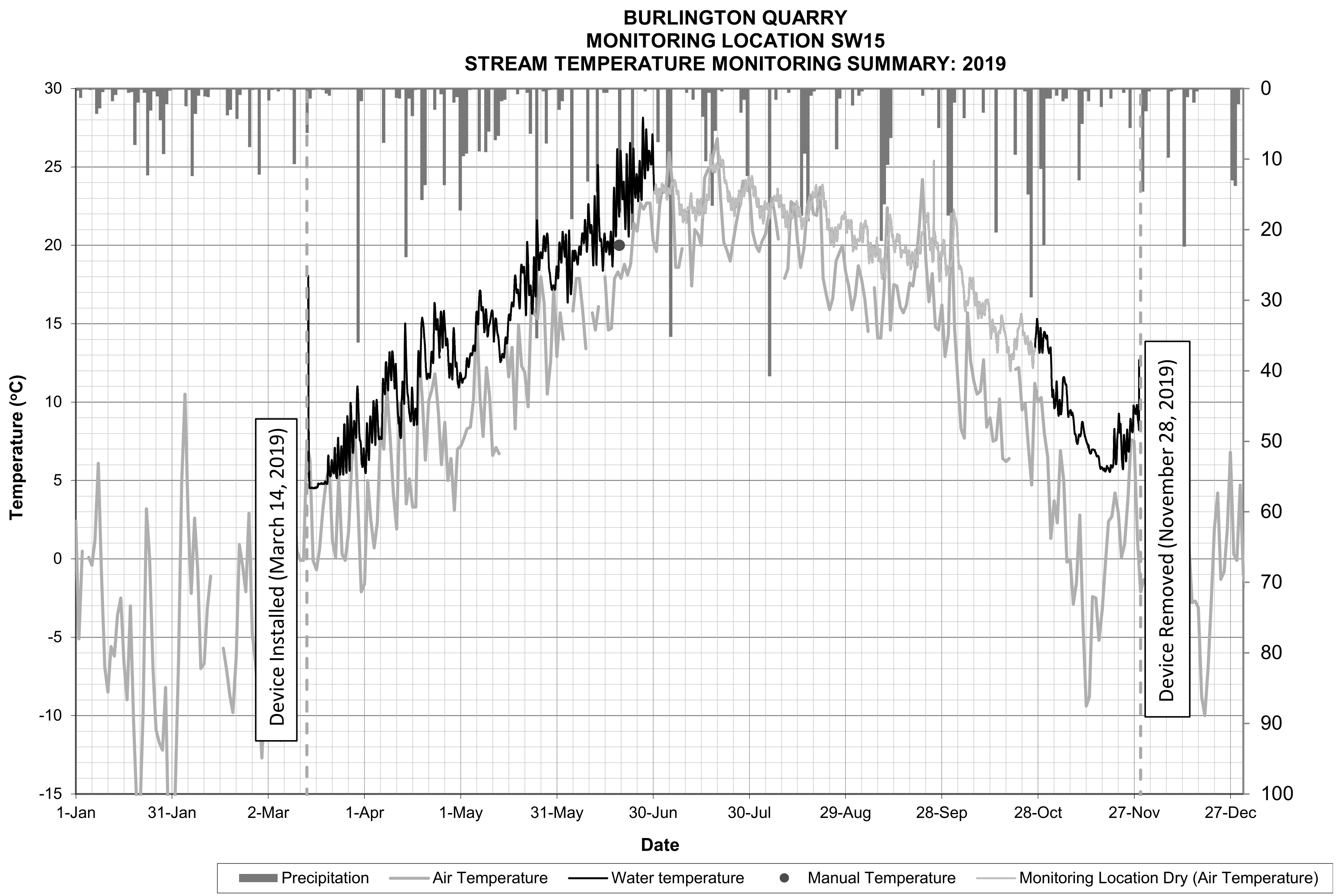


BURLINGTON QUARRY
MONITORING LOCATION SW14
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Precipitation (mm)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Device Installed (April 22, 2020)
Device Removed (December 3, 2020)
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

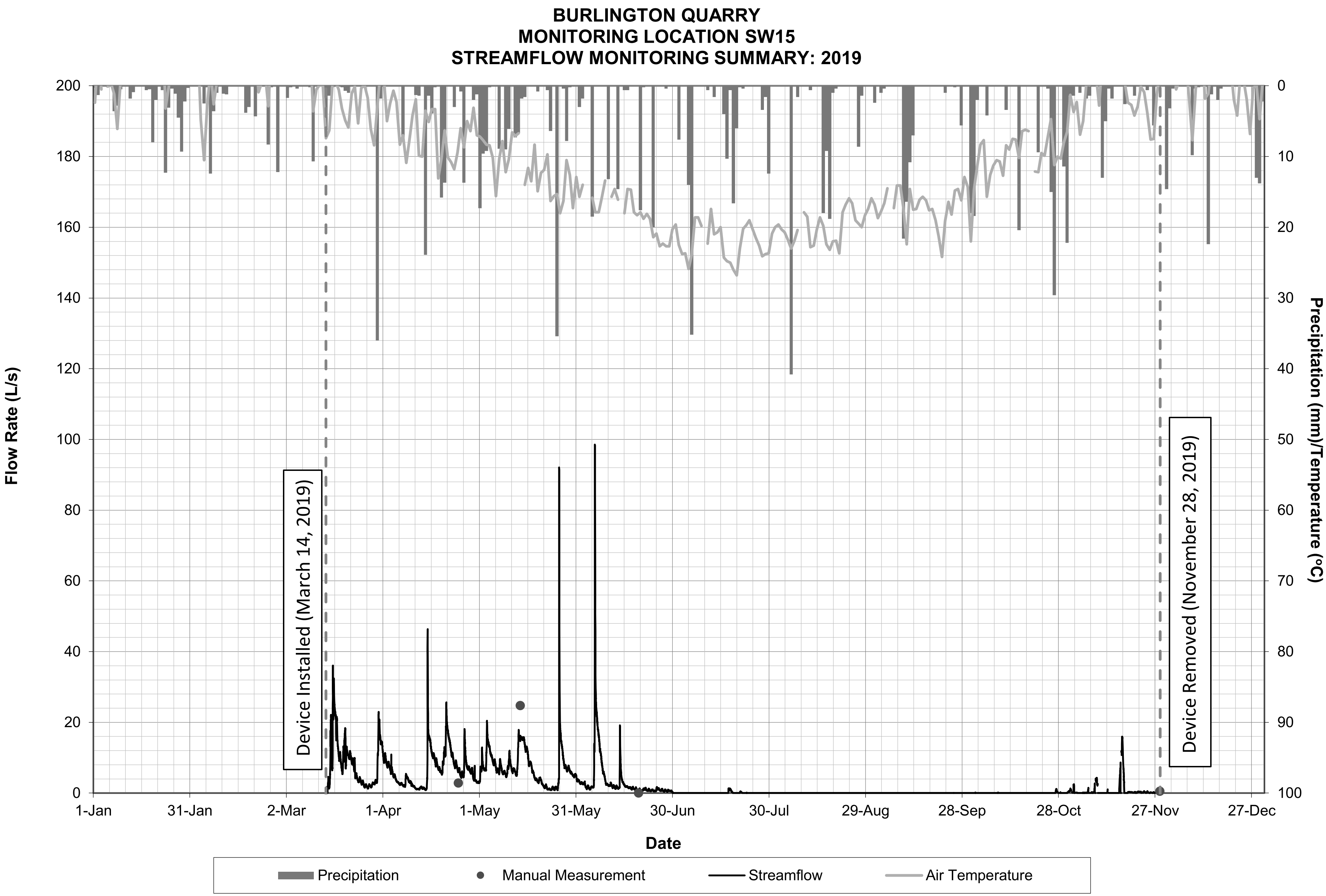

BURLINGTON QUARRY
MONITORING LOCATION SW14
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Device Installed (March 14, 2019)
Device Removed (November 28, 2019)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
2019
Precipitation
Manual Measurement
Streamflow
Air Temperature

BURLINGTON QUARRY
MONITORING LOCATION SW14
STREAMFLOW MONITORING SUMMARY: 2020

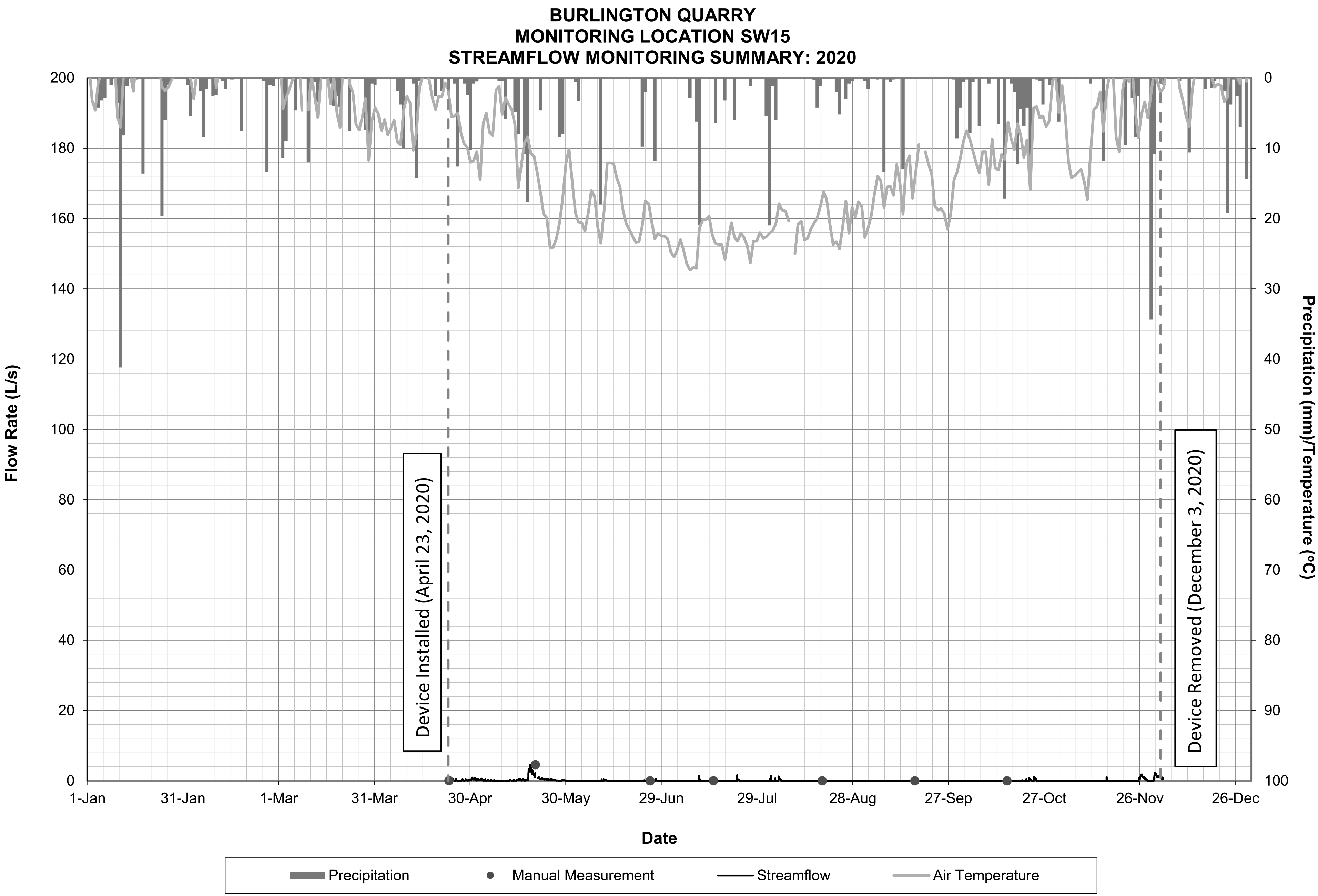




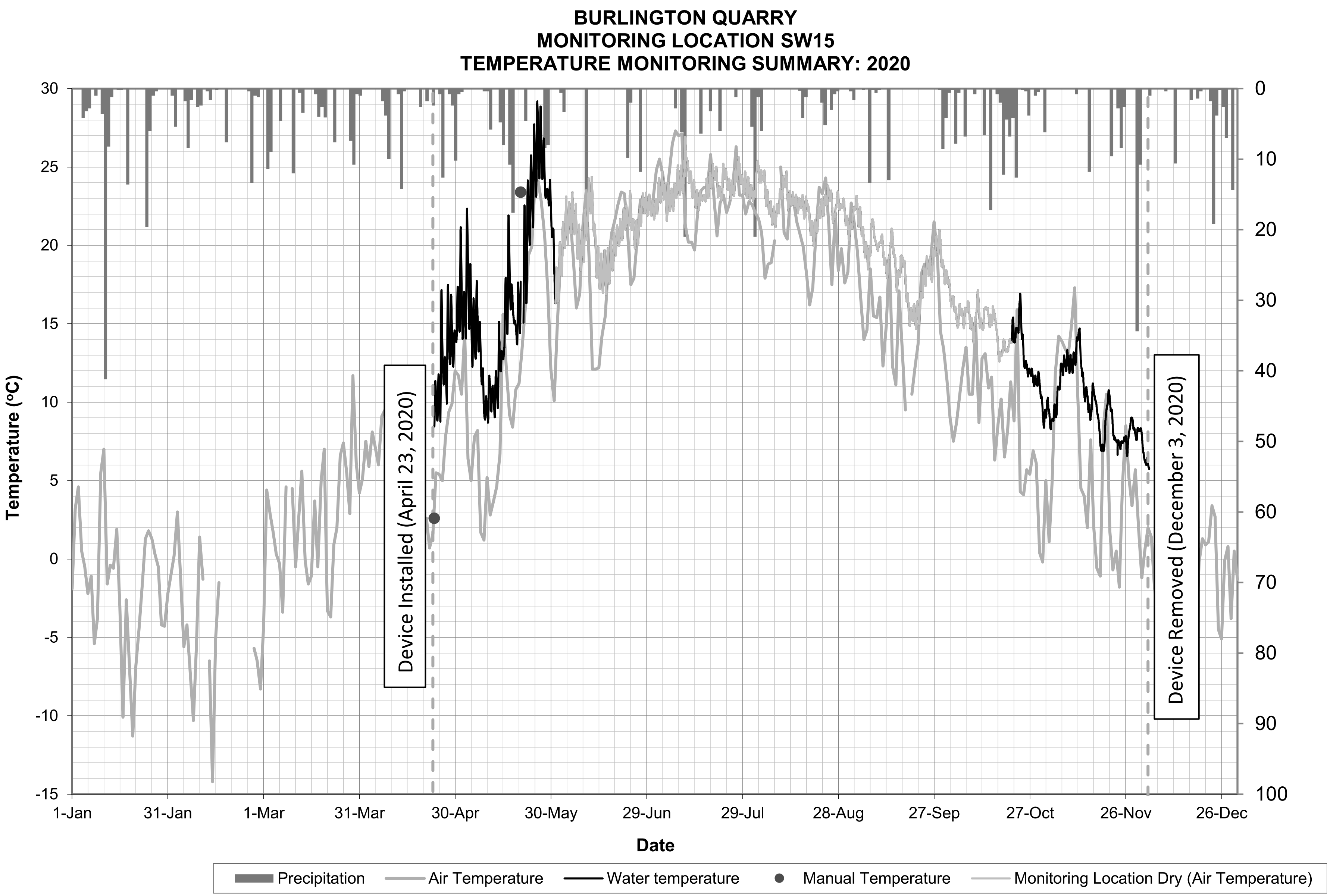
BURLINGTON QUARRY
MONITORING LOCATION SW15
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
100
Device Installed (March 14, 2019)
Device Removed (November 28, 2019)
Precipitation
Air Temperature
Water temperature
Manual Temperature
Monitoring Location Dry (Air Temperature)



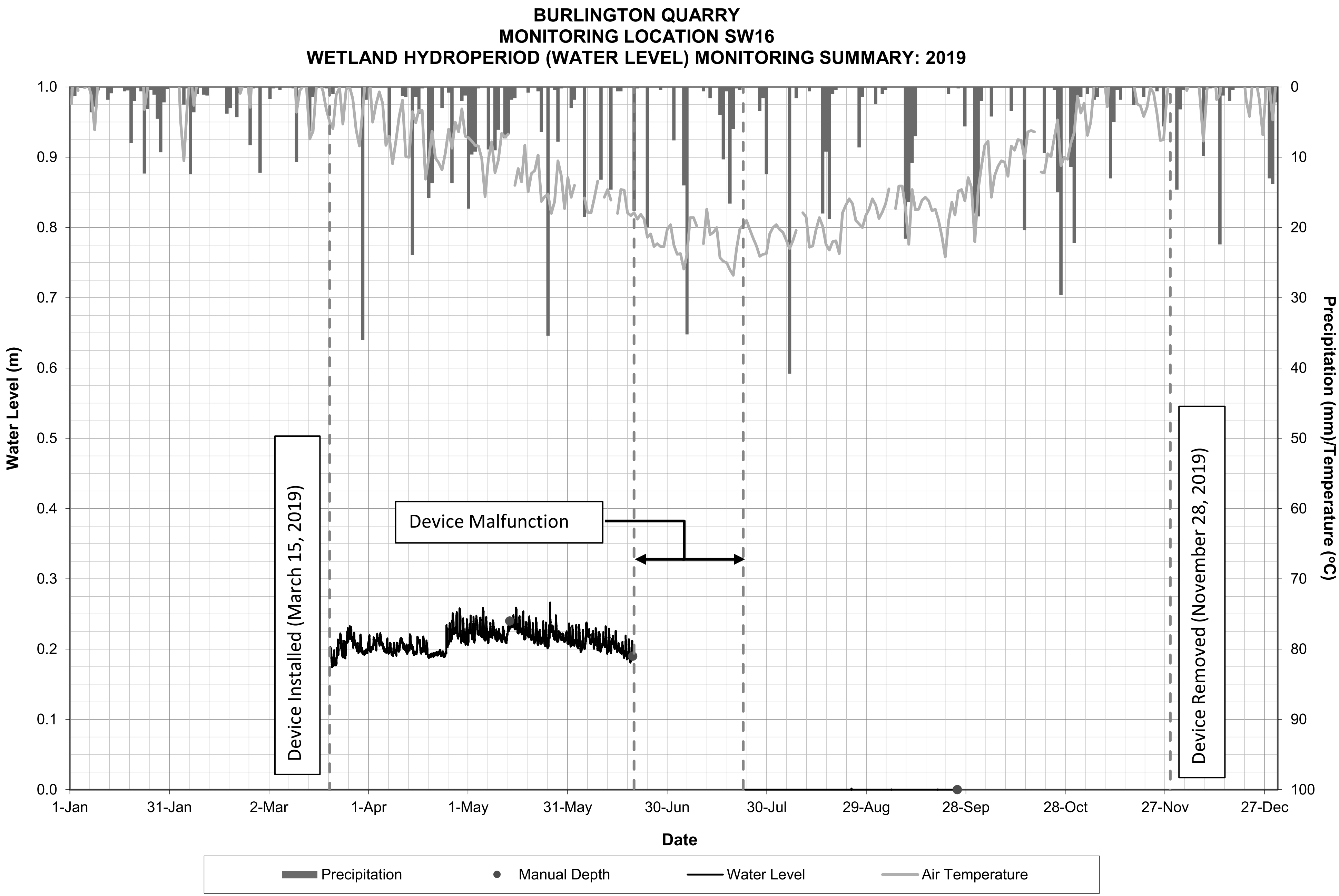
BURLINGTON QUARRY
MONITORING LOCATION SW15
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
0
20
40
60
80
100
120
140
160
180
200
10
30
50
70
90
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 14, 2019)
Device Removed (November 28, 2019)
Precipitation
Manual Measurement
Streamflow
Air Temperature

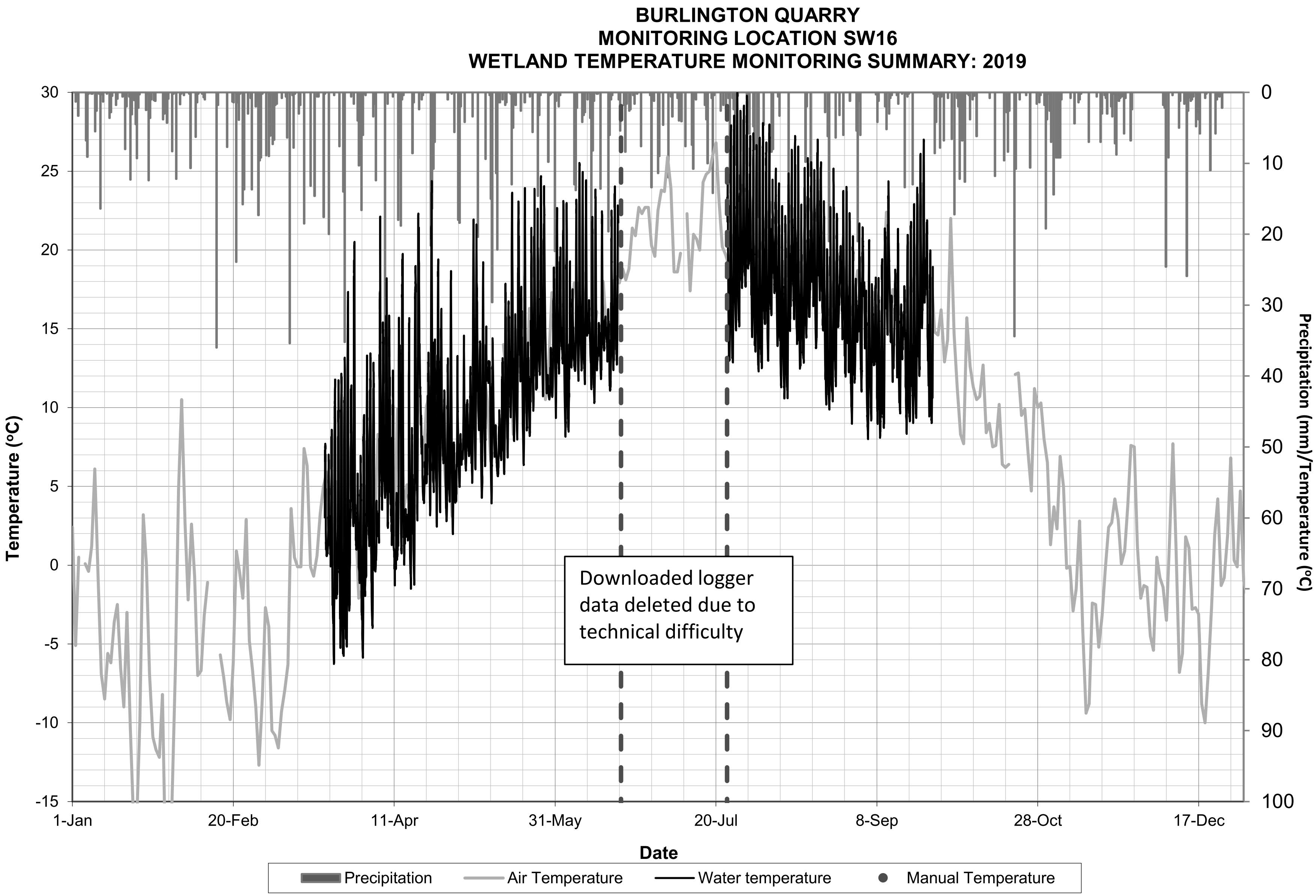


BURLINGTON QUARRY
MONITORING LOCATION SW15
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature

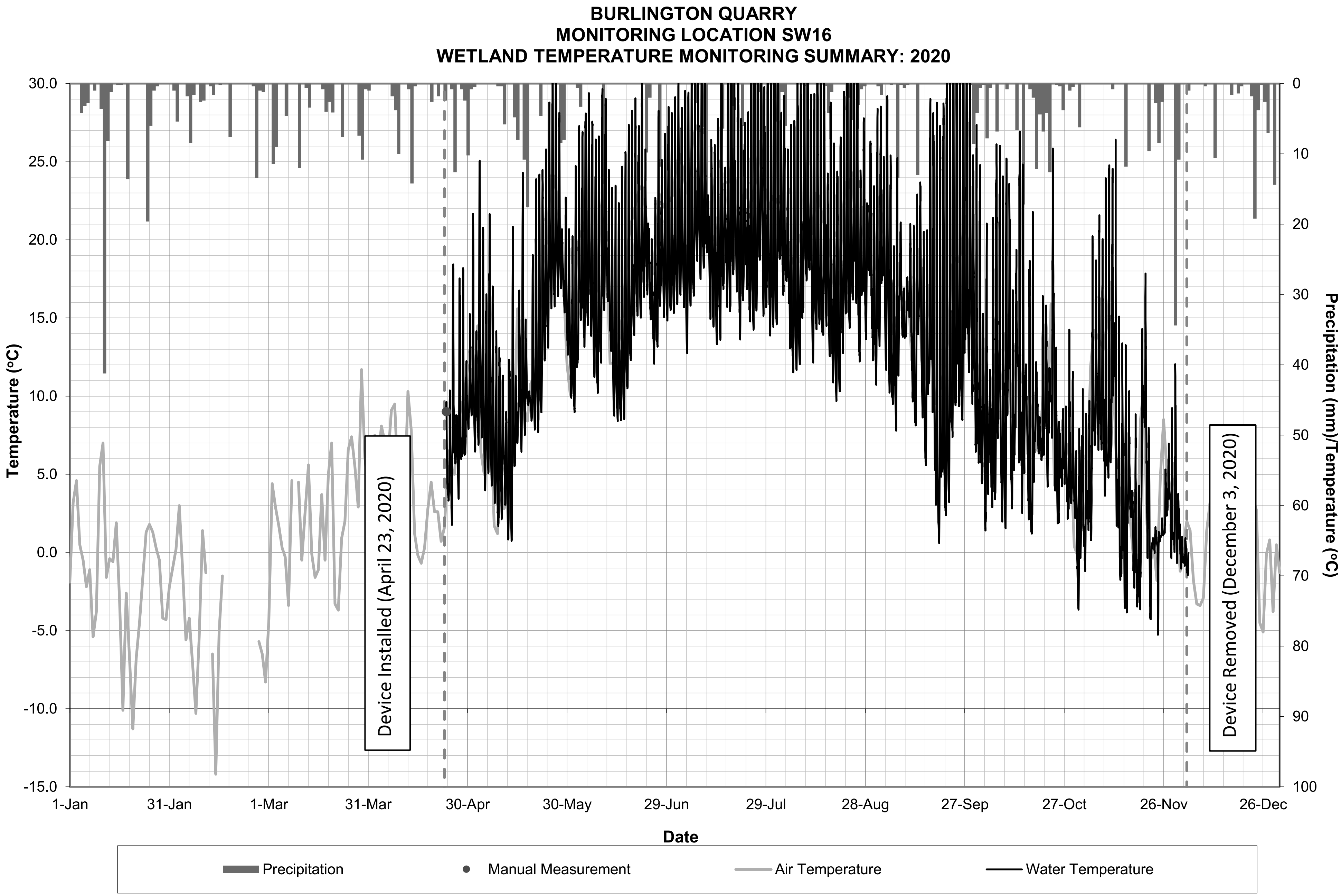


BURLINGTON QUARRY
MONITORING LOCATION SW15
TEMPERATURE MONITORING SUMMARY: 2020
Temperature (°C)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water temperature
Manual Temperature
Monitoring Location Dry (Air Temperature)


BURLINGTON QUARRY
MONITORING LOCATION SW16
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2019
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 15, 2019)
Device Malfunction
Device Removed (November 28, 2019)
Precipitation
Manual Depth
Water Level
Air Temperature

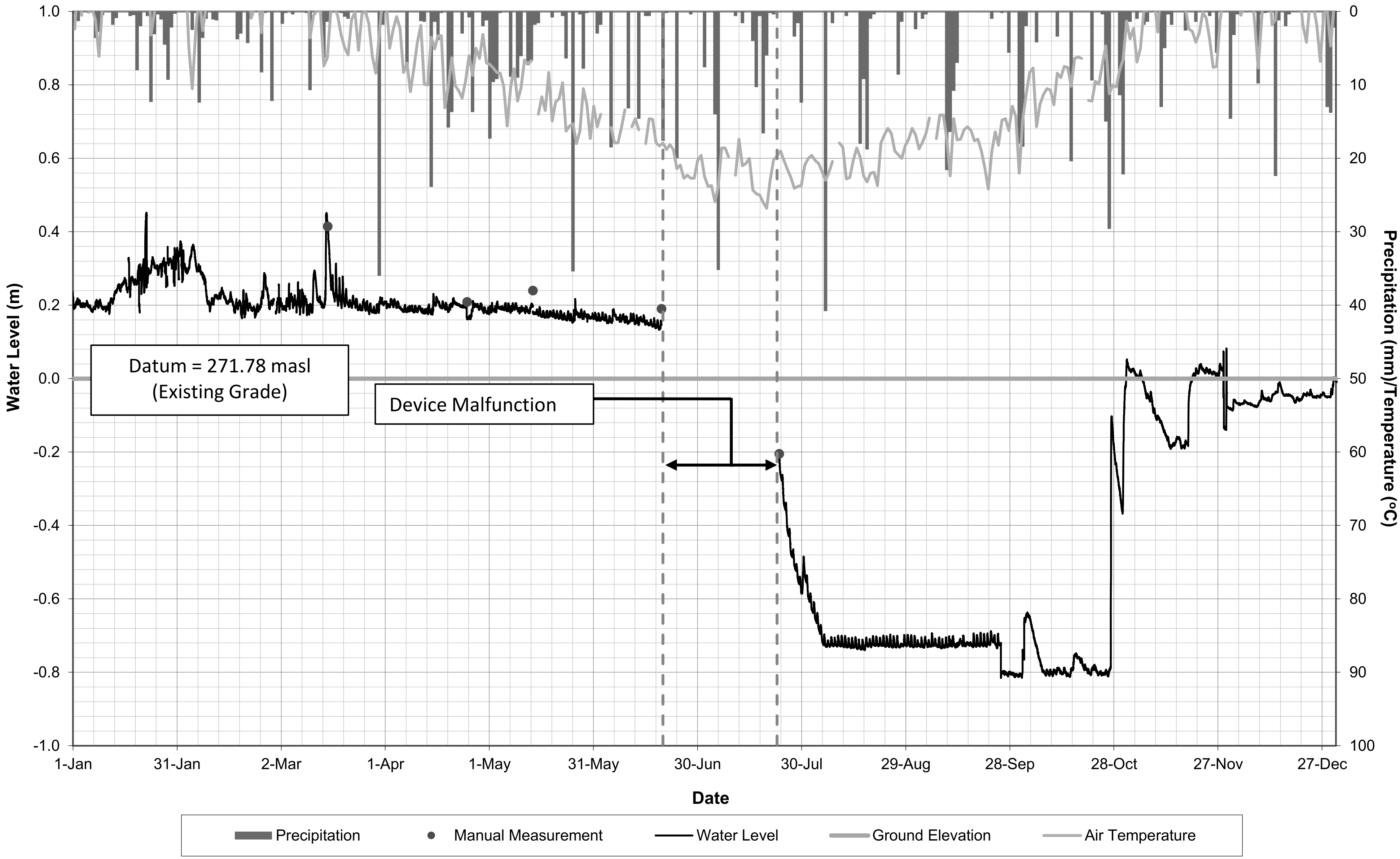


BURLINGTON QUARRY
MONITORING LOCATION SW16
WETLAND TEMPERATURE MONITORING SUMMARY: 2019
Temperature (°C)
Precipitation (mm)/Temperature (°C)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
100
1-Jan
20-Feb
11-Apr
31-May
20-Jul
8-Sep
28-Oct
17-Dec
Date
Downloaded logger data deleted due to technical difficulty
Precipitation
Air Temperature
Water temperature
Manual Temperature

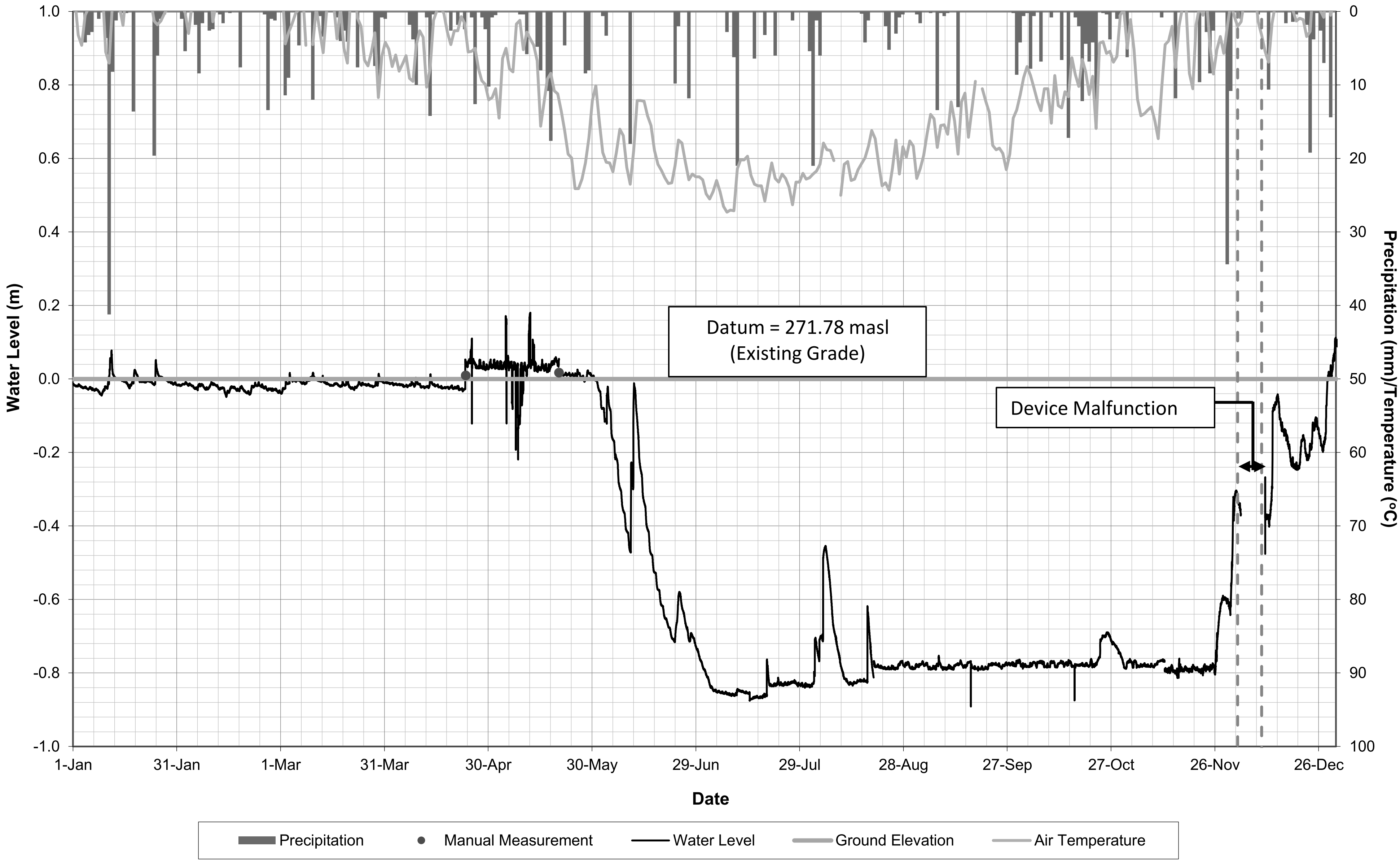


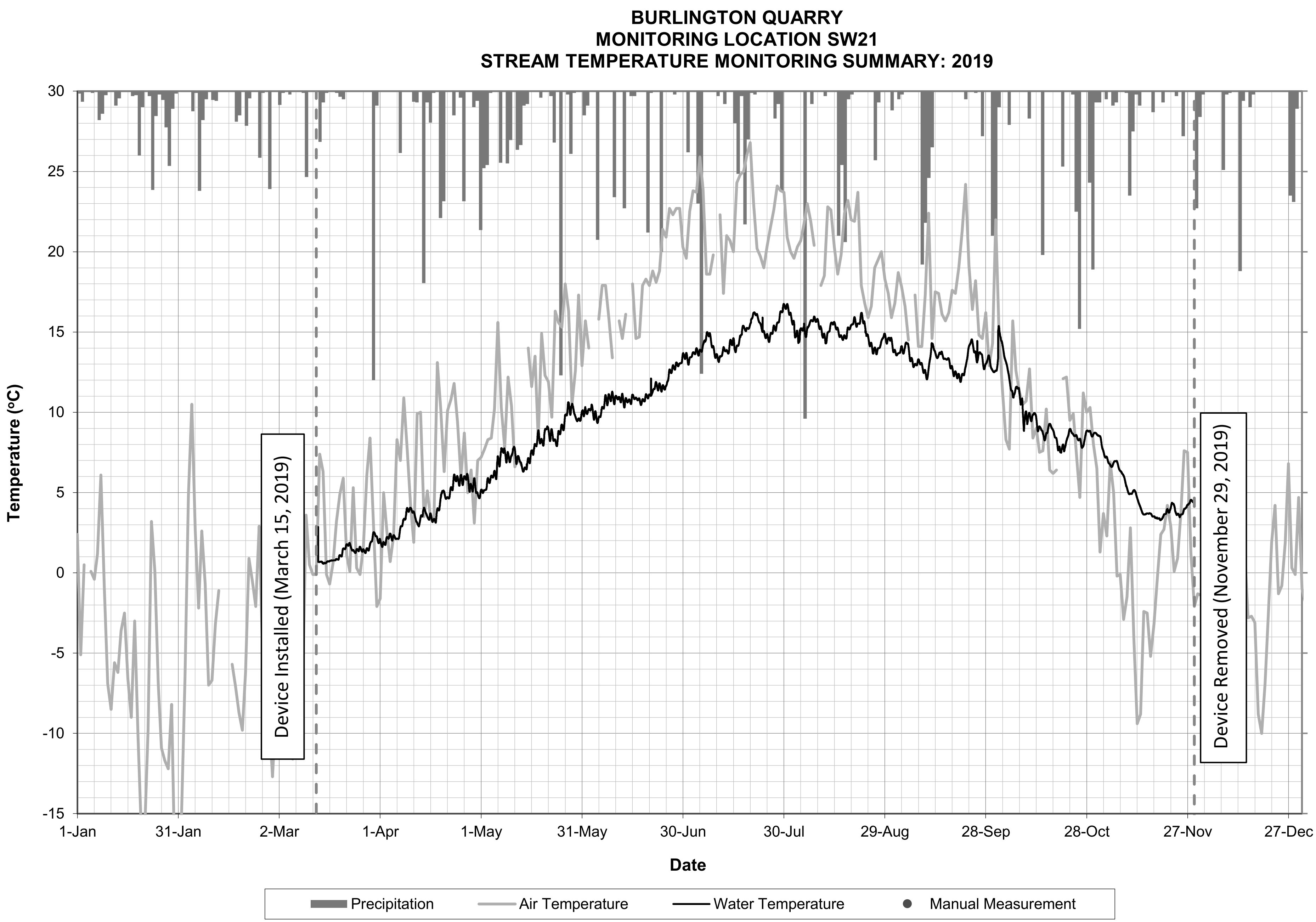
BURLINGTON QUARRY
MONITORING LOCATION SW16
WETLAND TEMPERATURE MONITORING SUMMARY: 2020
Temperature (°C)
Precipitation (mm)/Temperature (°C)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
0
10
20
30
40
50
60
70
80
90
100
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Precipitation
Manual Measurement
Air Temperature
Water Temperature

BURLINGTON QUARRY
MONITORING LOCATION SW16B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2019



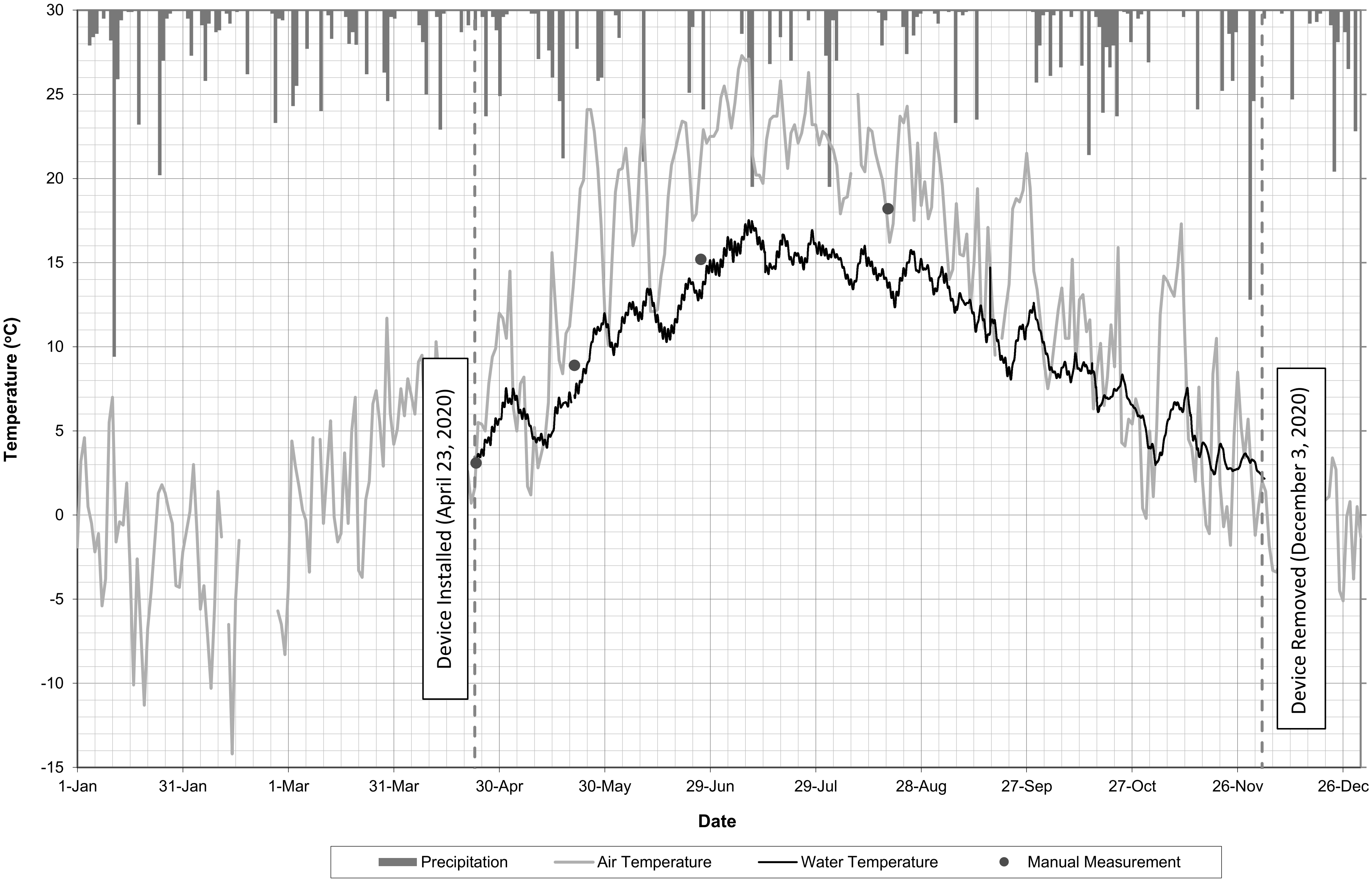
BURLINGTON QUARRY
MONITORING LOCATION SW16B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2020

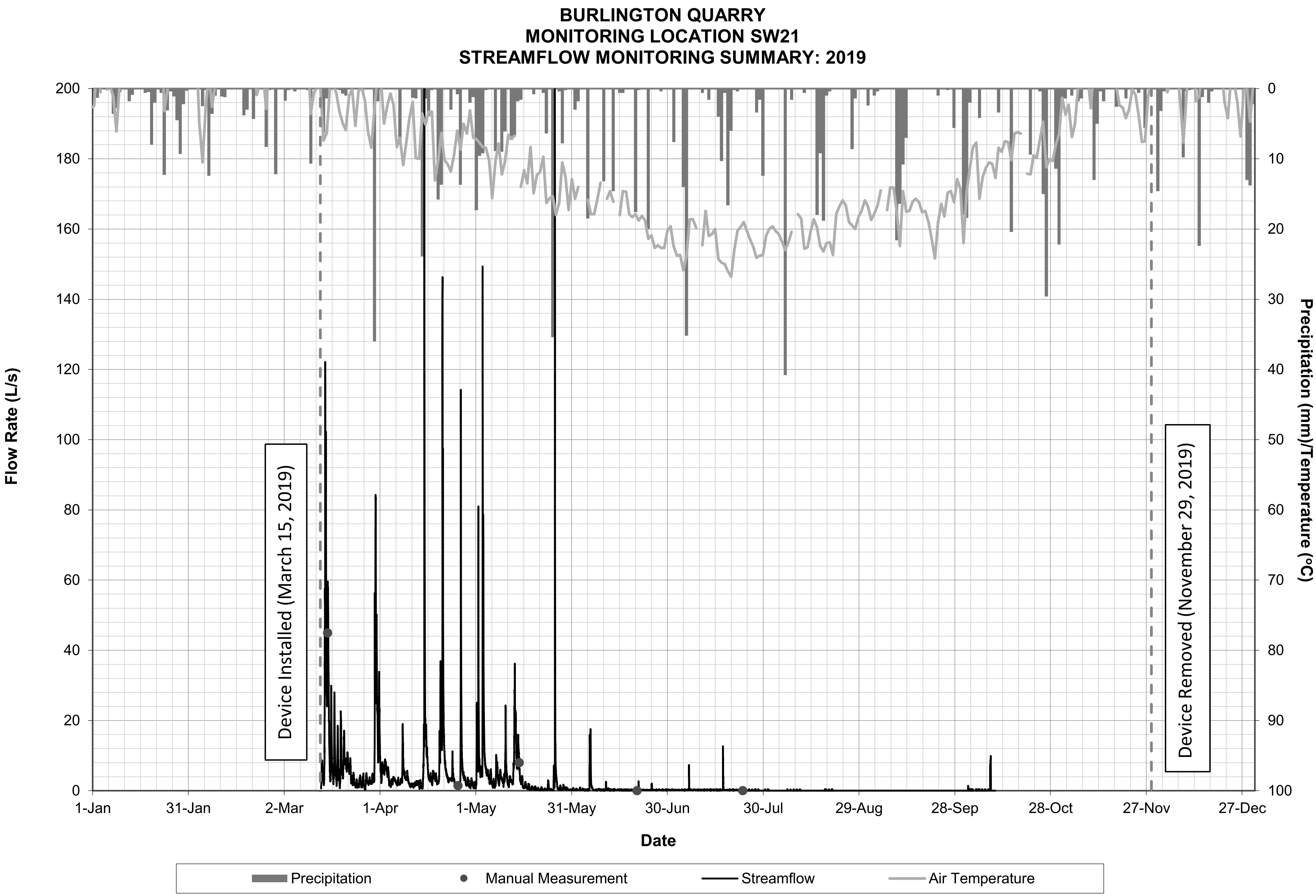




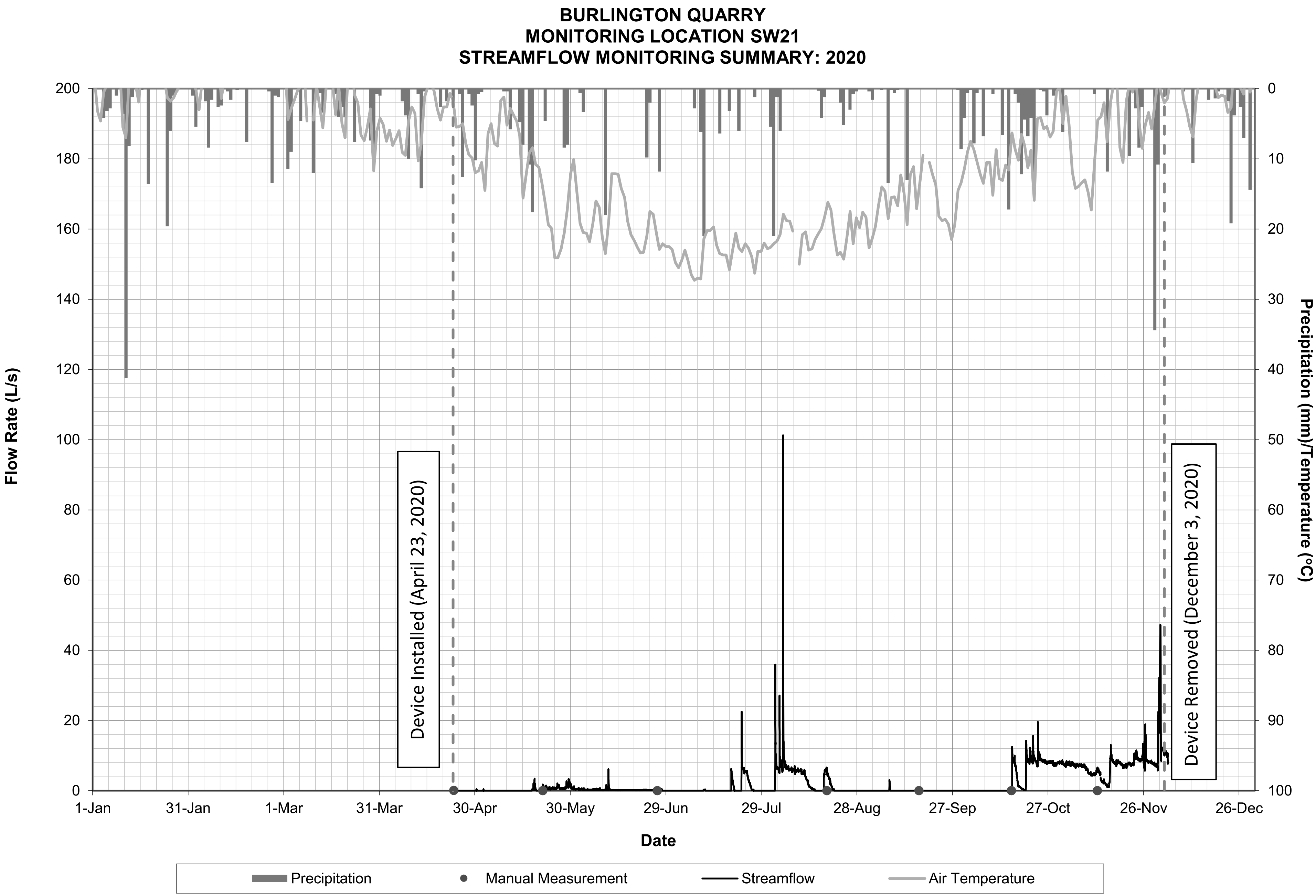
BURLINGTON QUARRY
MONITORING LOCATION SW21
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
Precipitation
Air Temperature
Water Temperature
Manual Measurement

BURLINGTON QUARRY
MONITORING LOCATION SW21
STREAM TEMPERATURE MONITORING SUMMARY: 2020

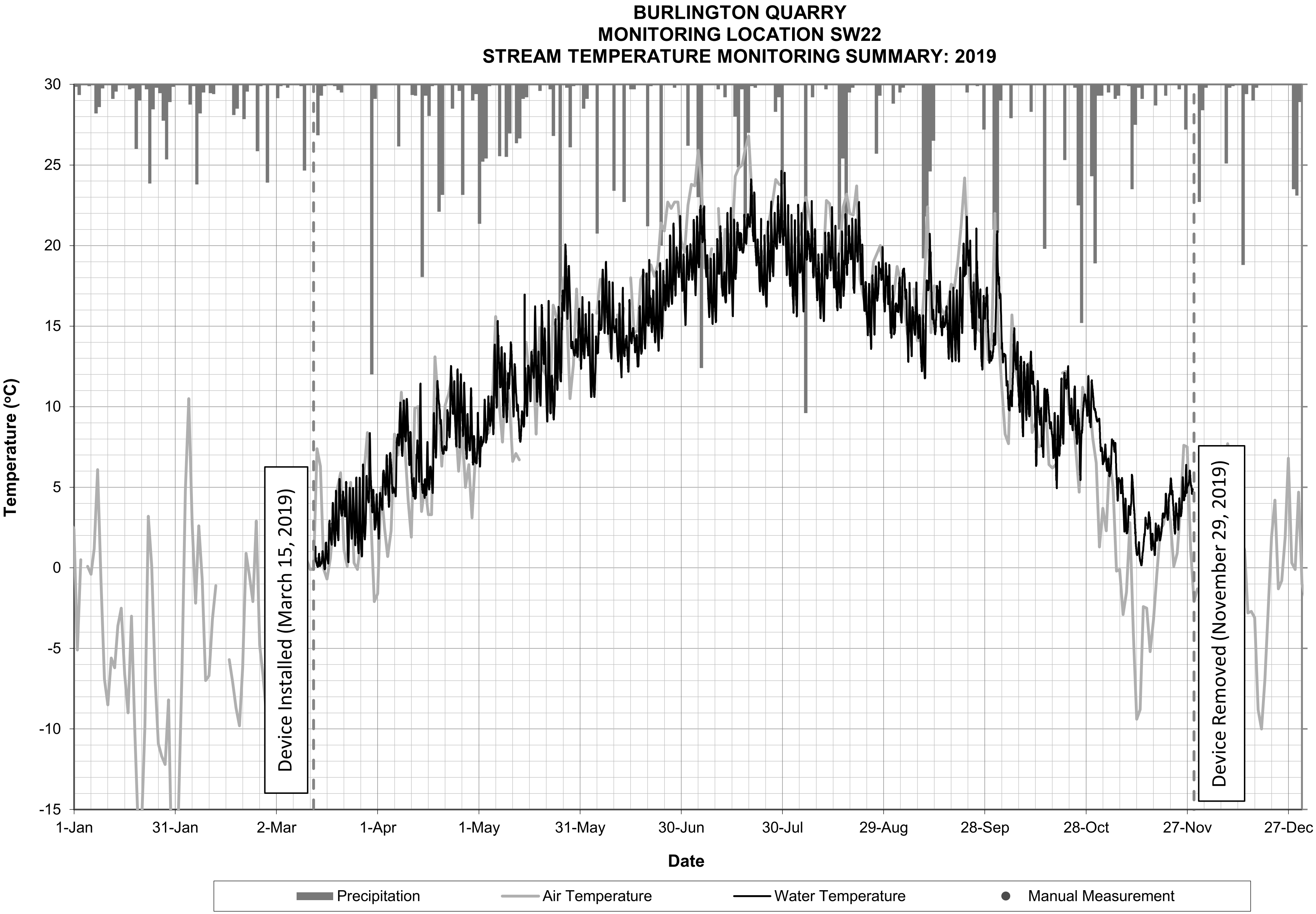




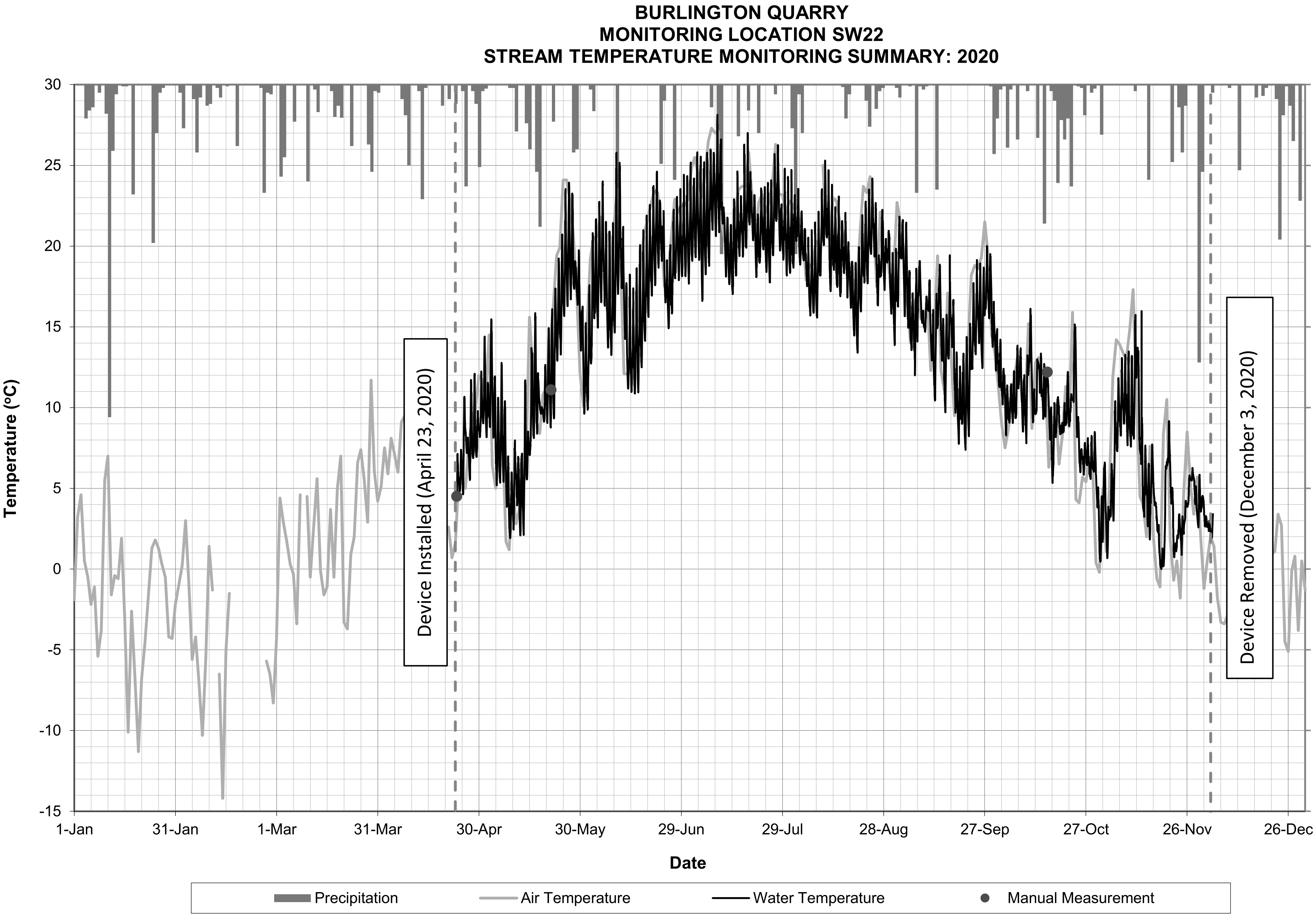
BURLINGTON QUARRY
MONITORING LOCATION SW21
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
Precipitation
Manual Measurement
Streamflow
Air Temperature



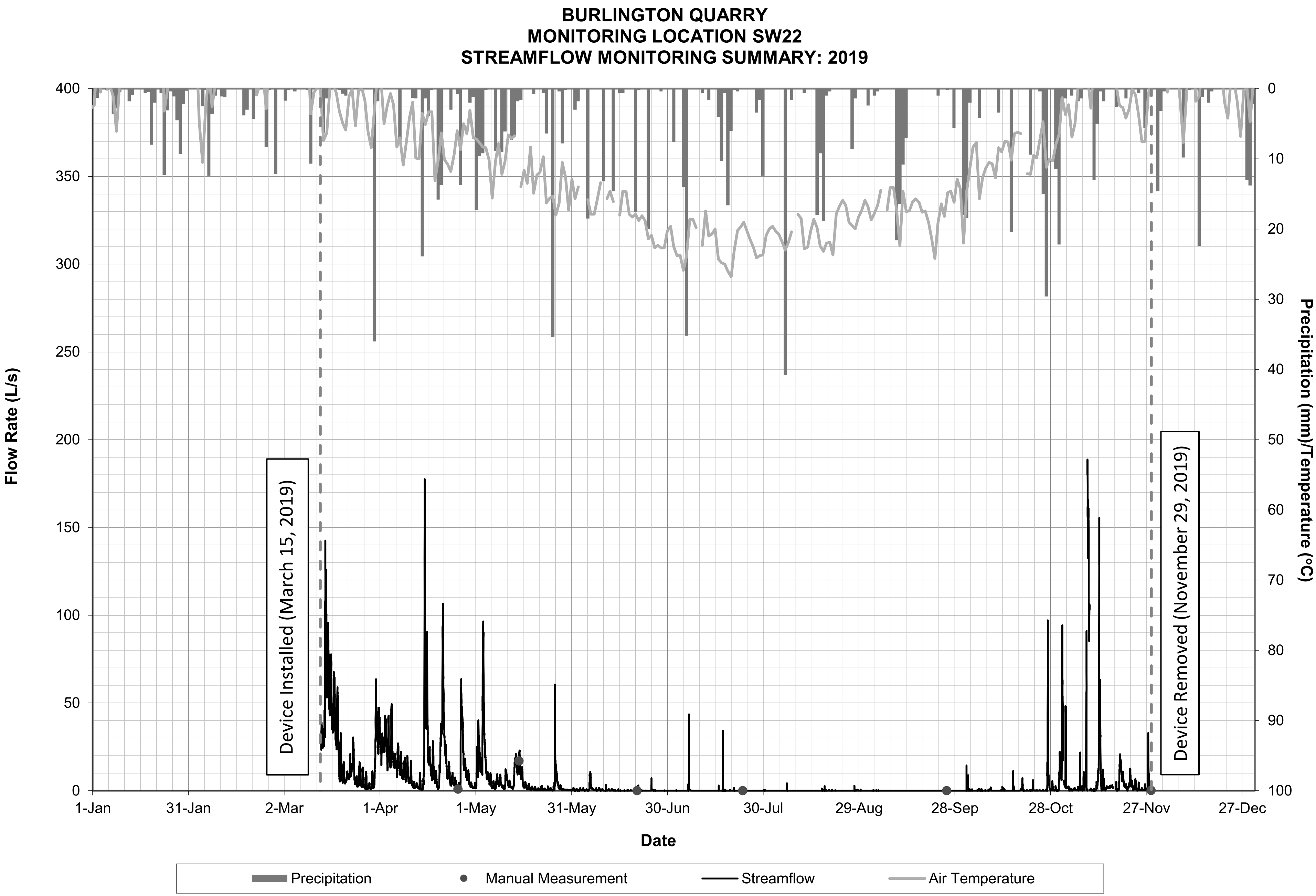
BURLINGTON QUARRY
MONITORING LOCATION SW21
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
200
180
160
140
120
100
80
60
40
20
0
10
30
50
70
90
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature



BURLINGTON QUARRY
MONITORING LOCATION SW22
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
Precipitation
Air Temperature
Water Temperature
Manual Measurement

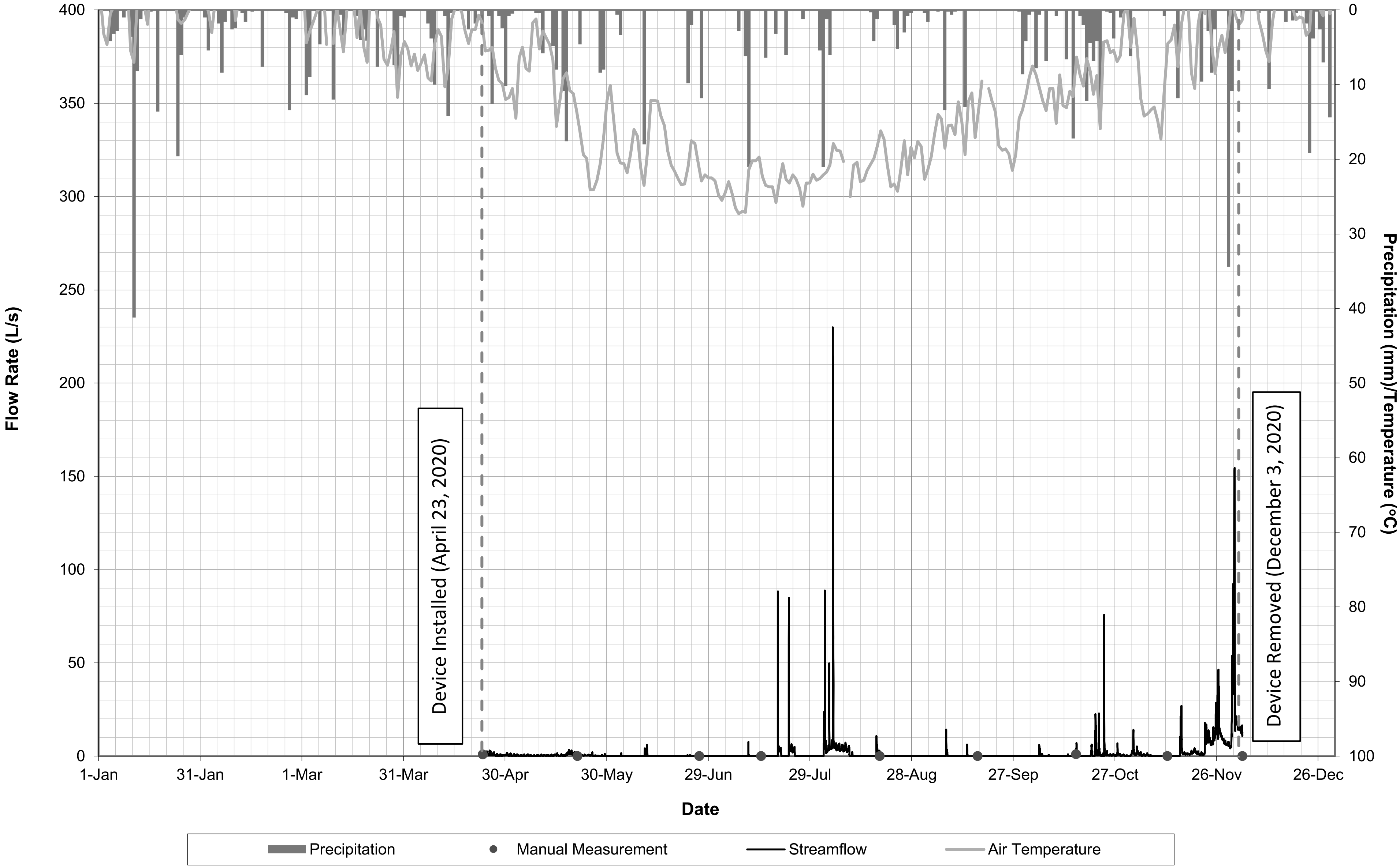


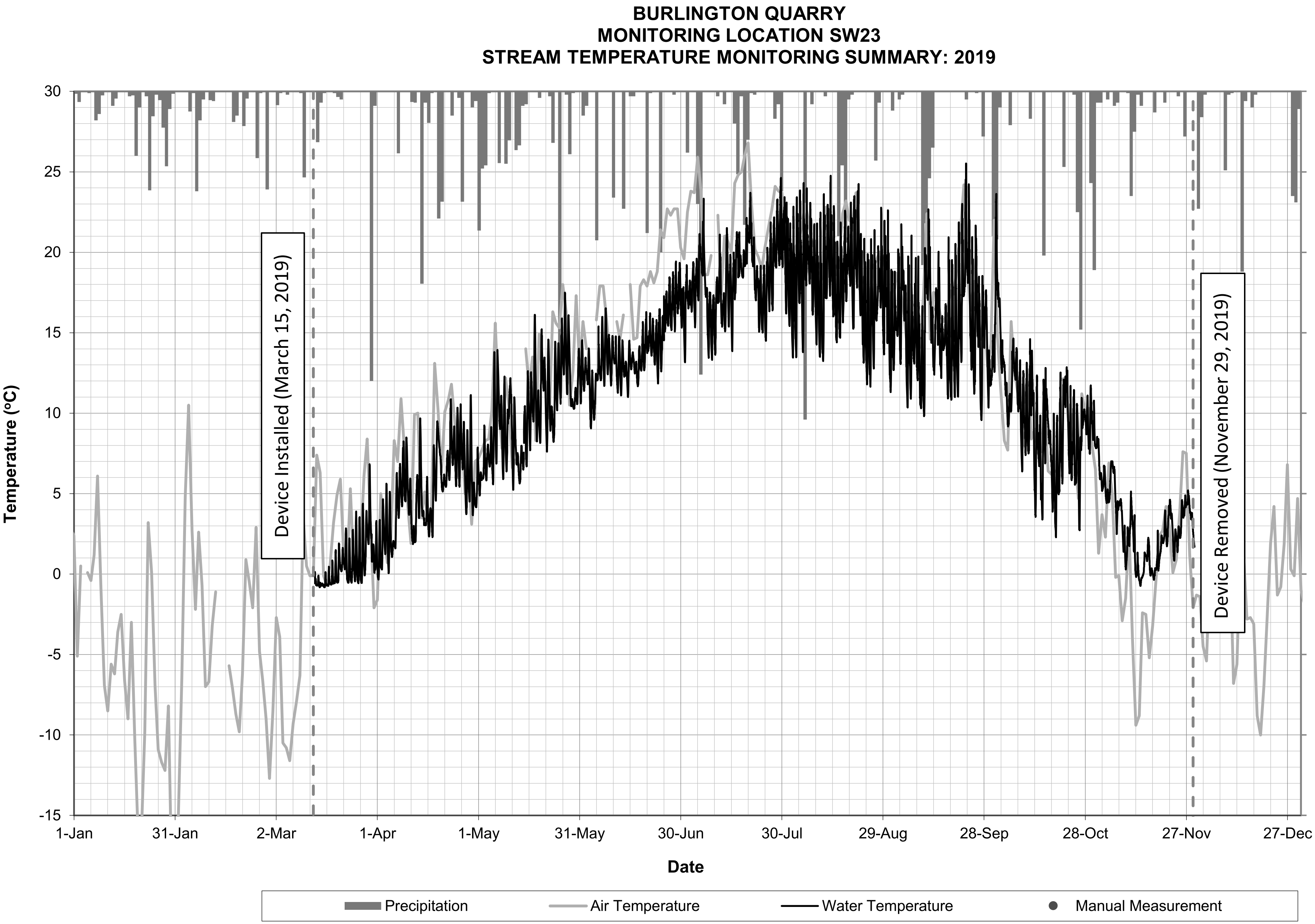
BURLINGTON QUARRY
MONITORING LOCATION SW22
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement



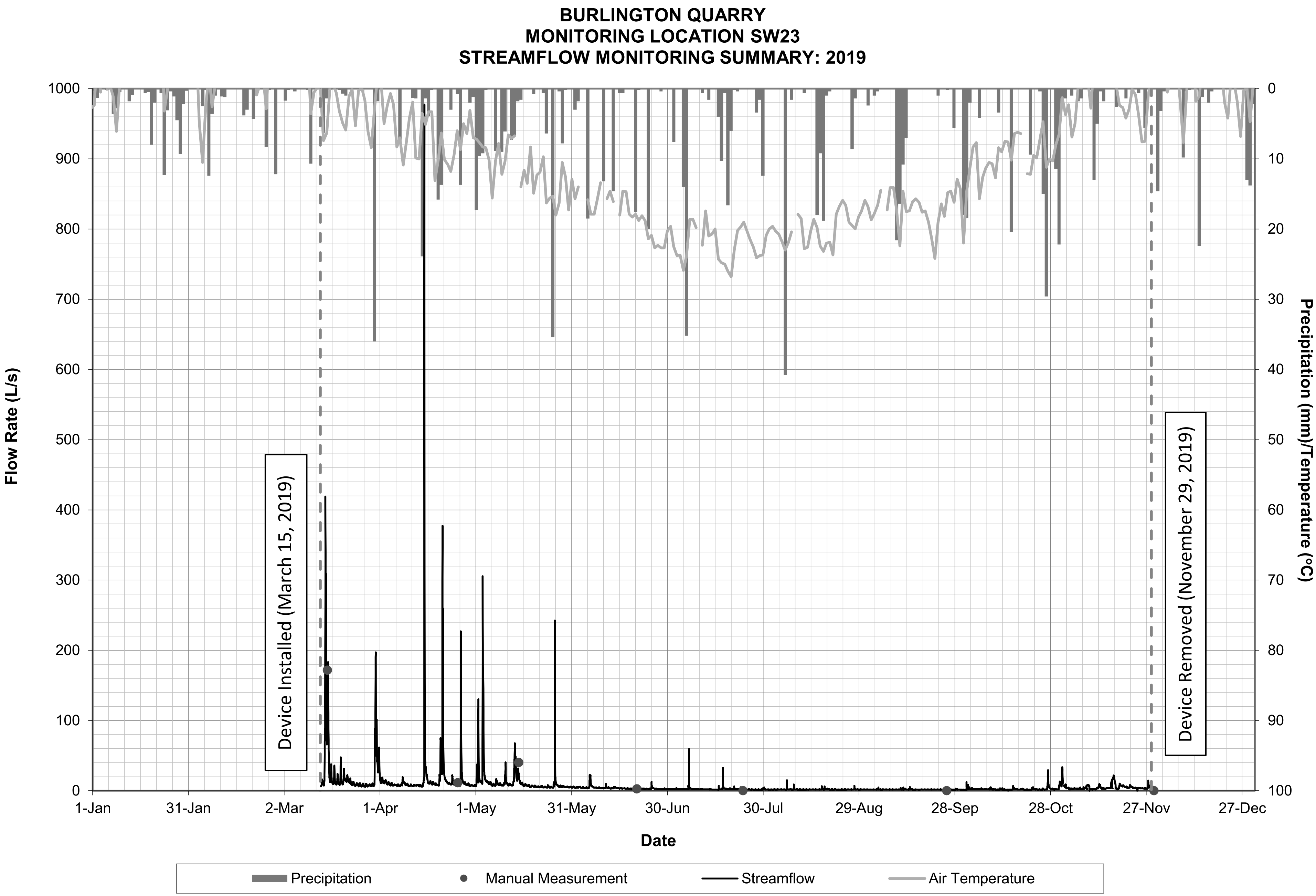
BURLINGTON QUARRY
MONITORING LOCATION SW22
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
400
350
300
250
200
150
100
50
0
10
20
30
40
60
70
80
90
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
Precipitation
Manual Measurement
Streamflow
Air Temperature

BURLINGTON QUARRY
MONITORING LOCATION SW22
STREAMFLOW MONITORING SUMMARY: 2020

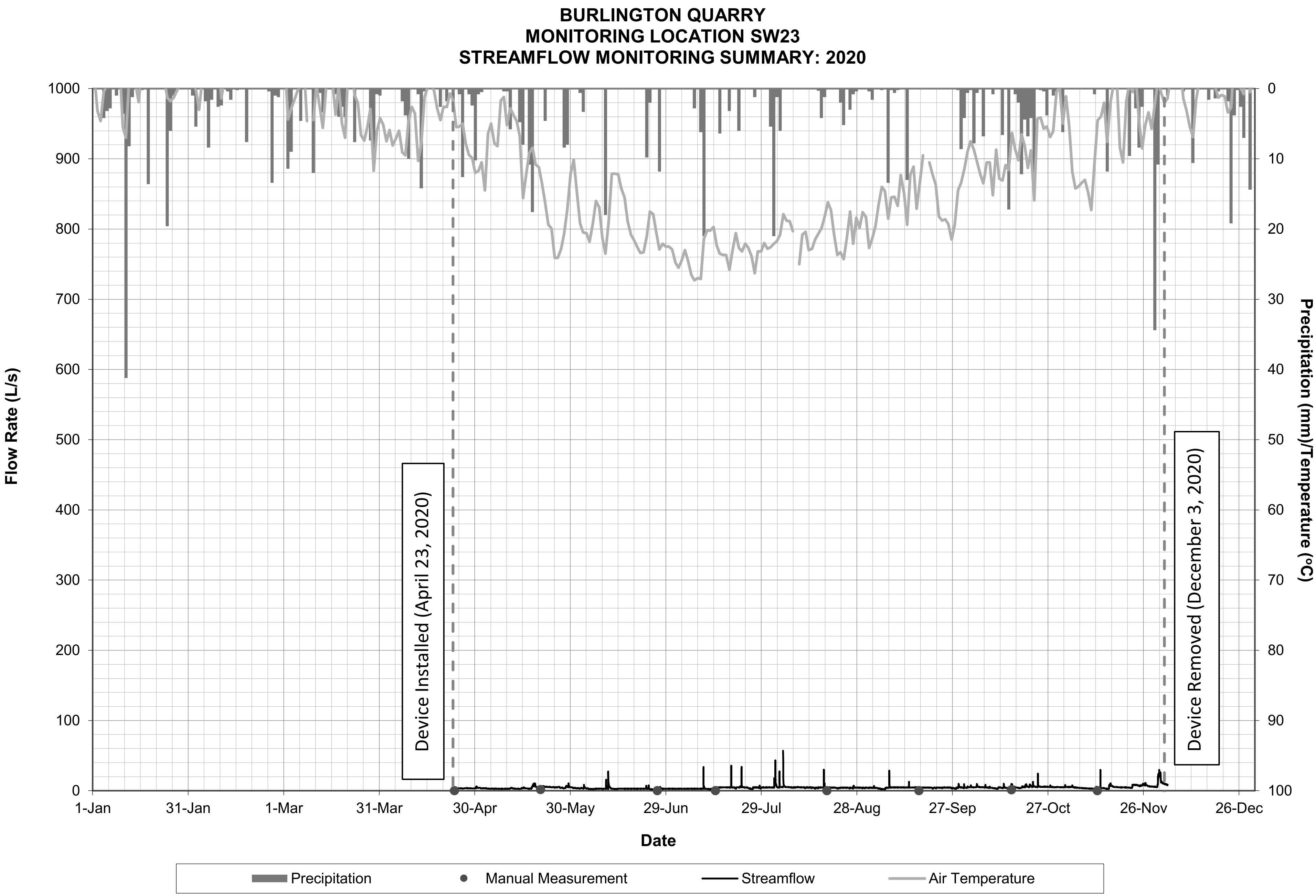




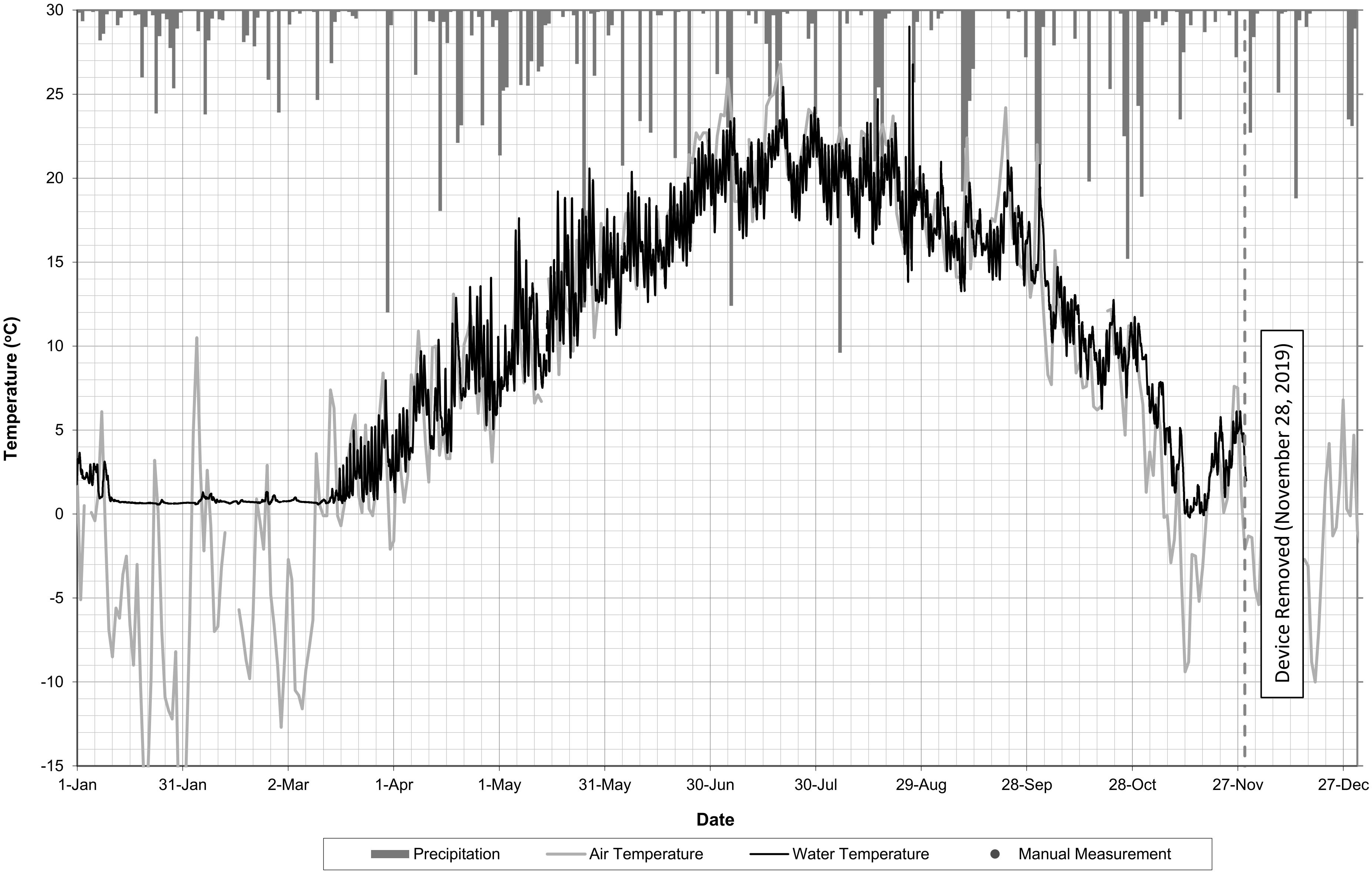
BURLINGTON QUARRY
MONITORING LOCATION SW23
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (°C)
Date
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement

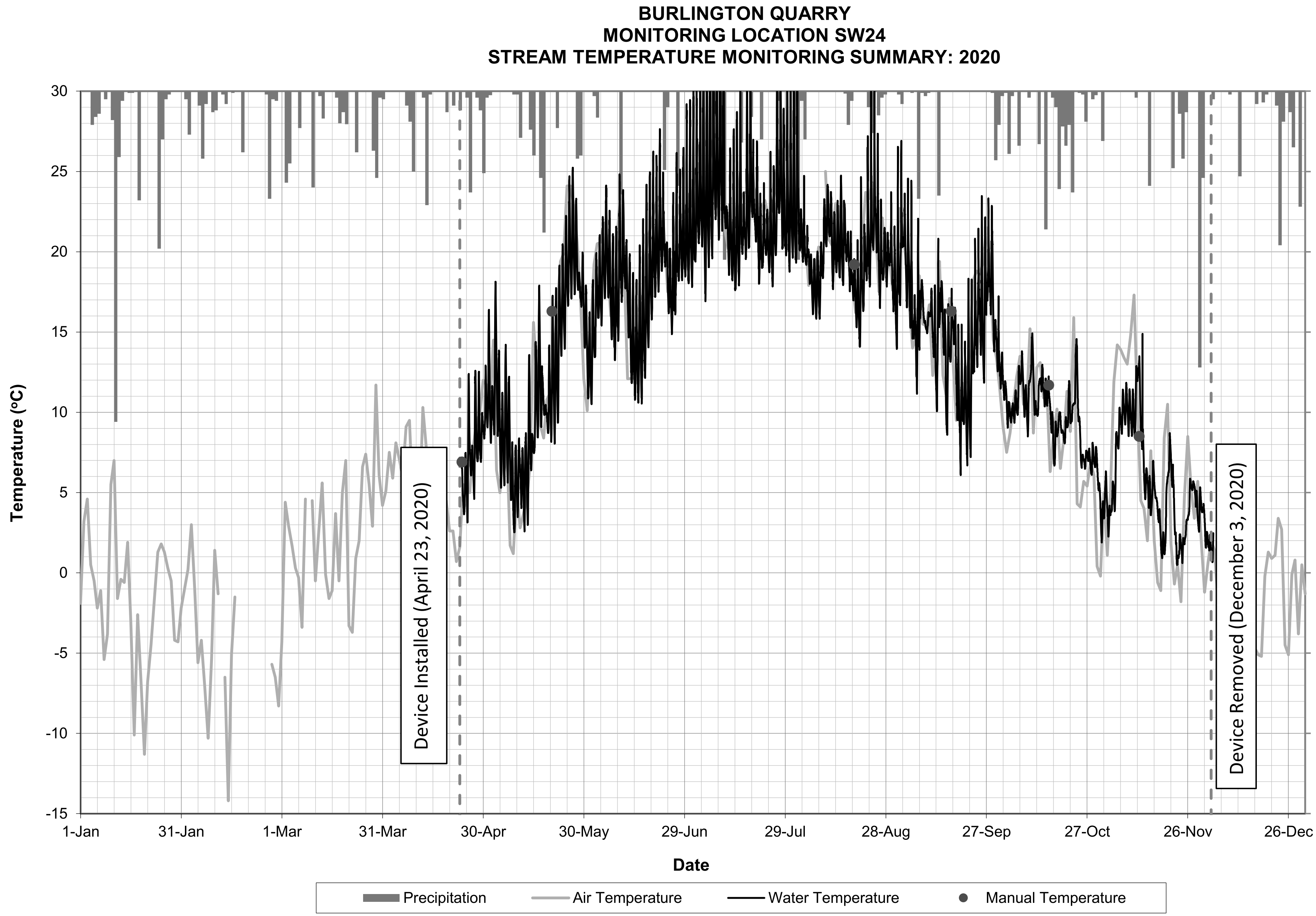


BURLINGTON QUARRY
MONITORING LOCATION SW23
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW23
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1000
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature

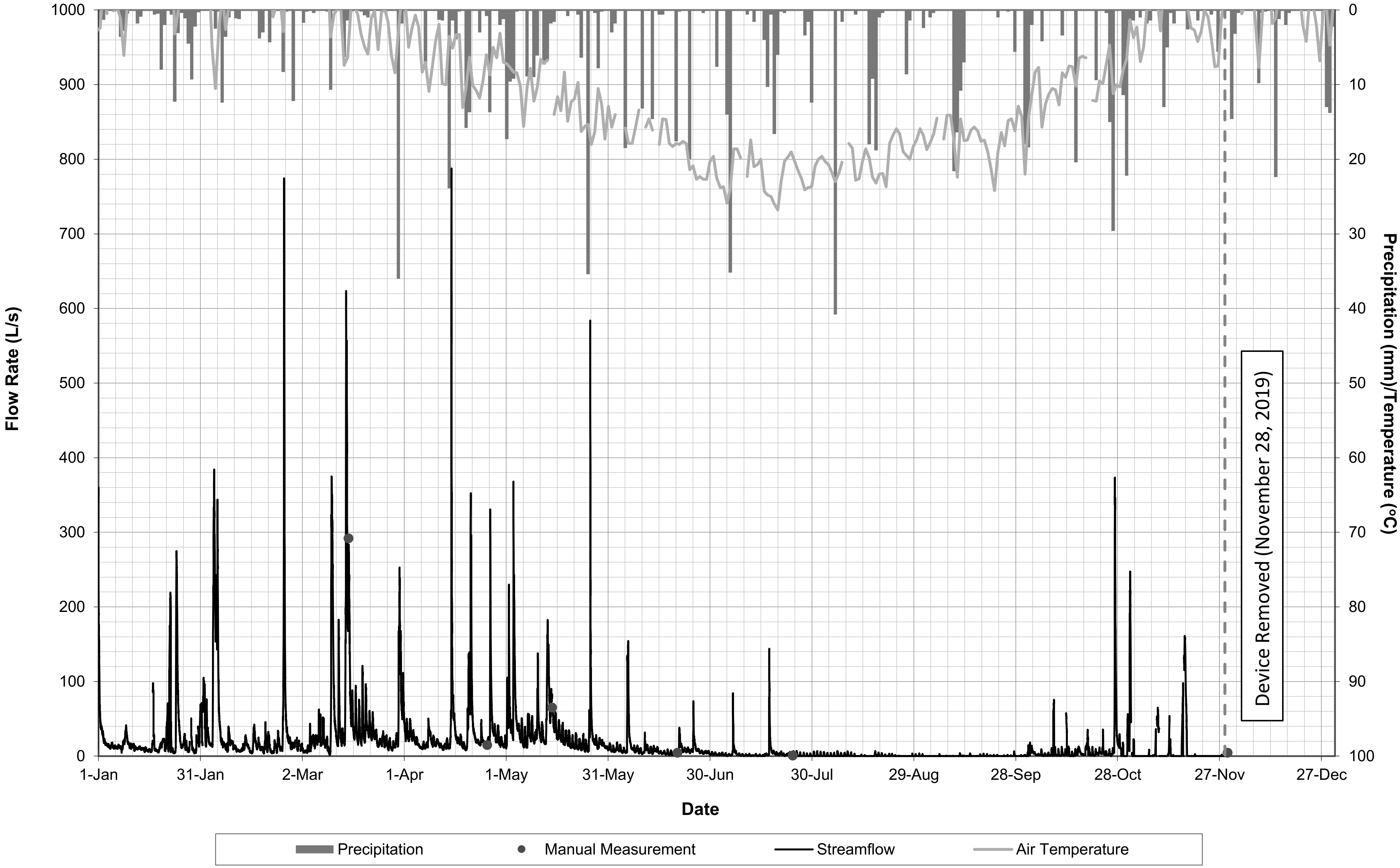
BURLINGTON QUARRY
MONITORING LOCATION SW24
STREAM TEMPERATURE MONITORING SUMMARY: 2019

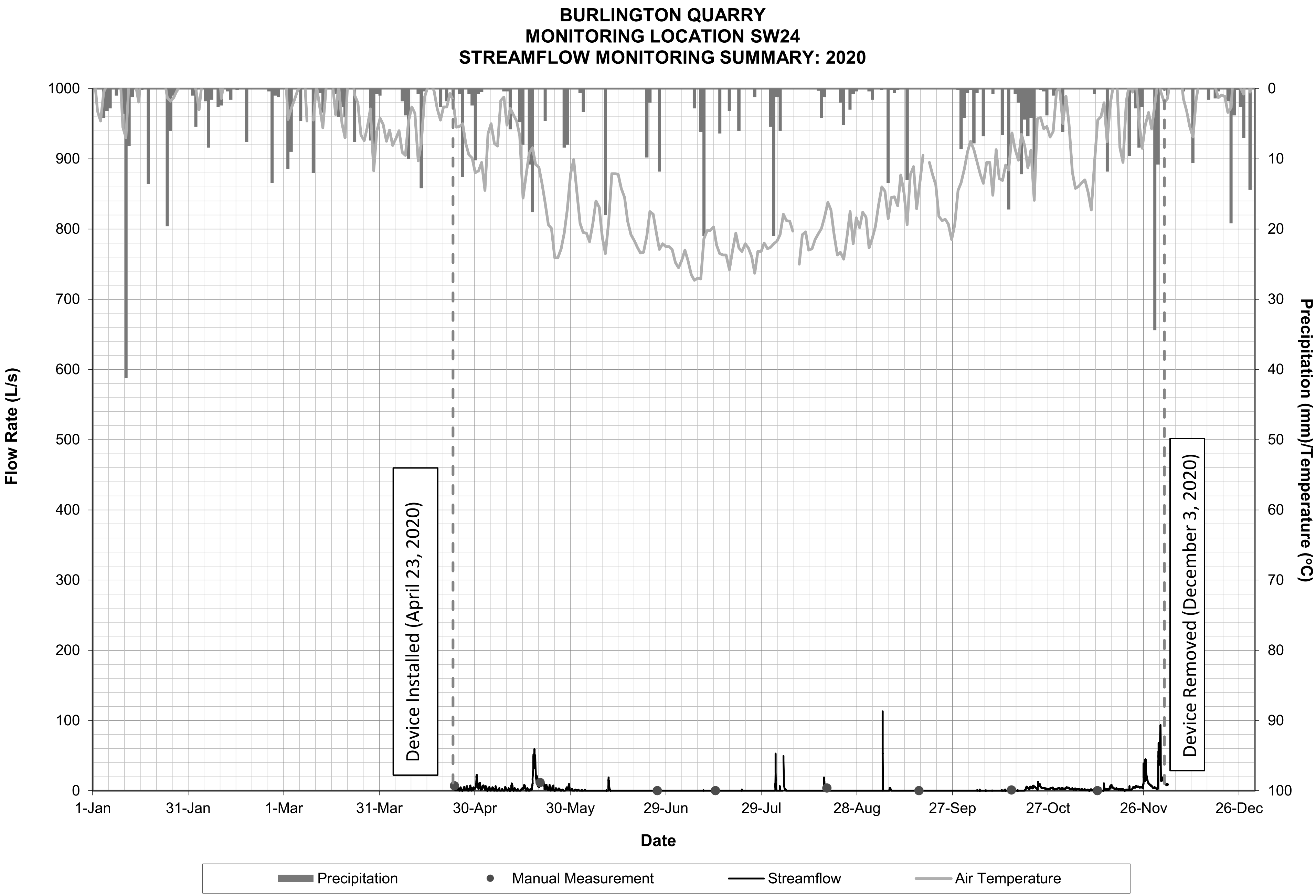




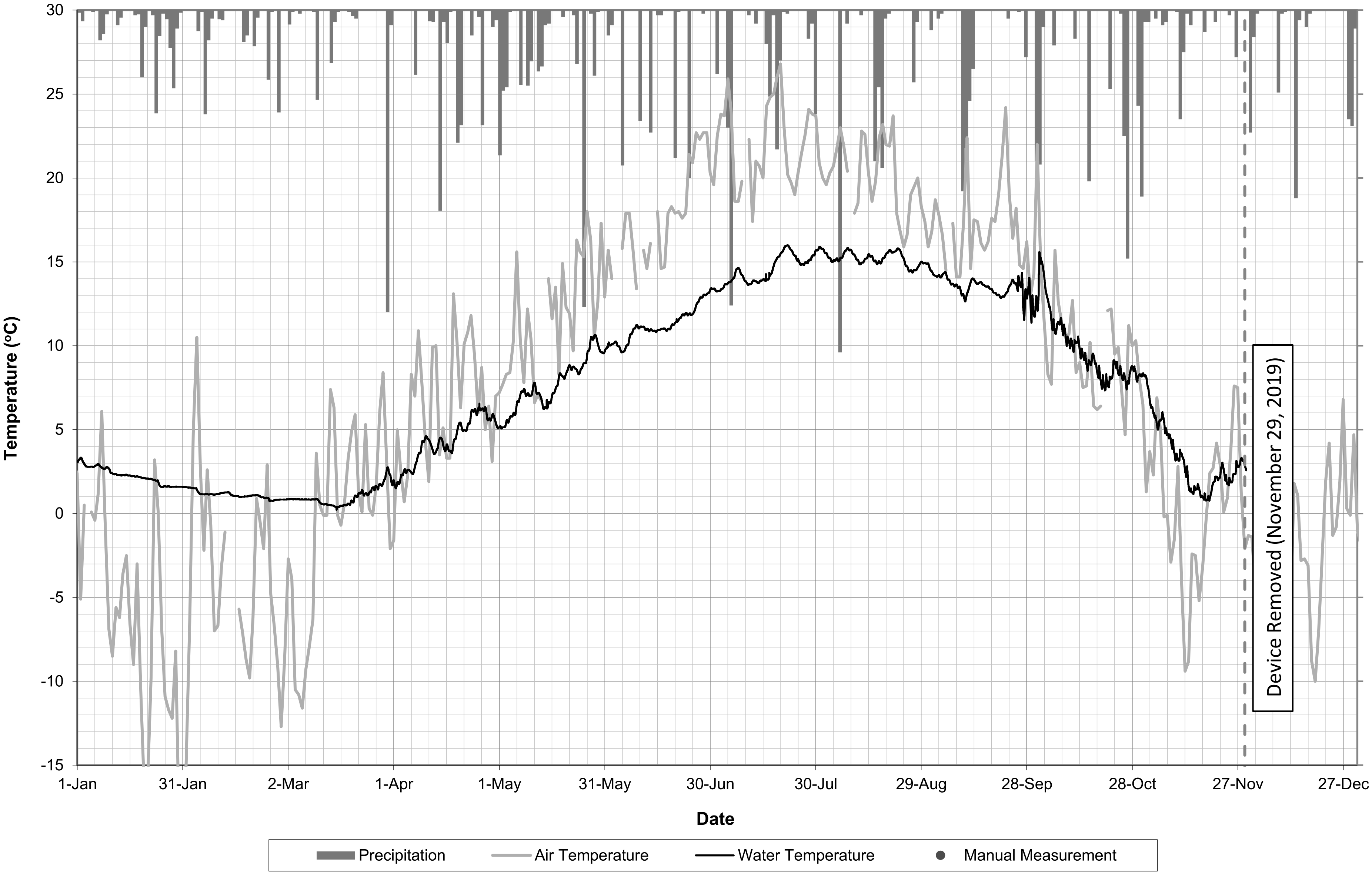
BURLINGTON QUARRY
MONITORING LOCATION SW24
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Precipitation
Air Temperature
Water Temperature
Manual Temperature

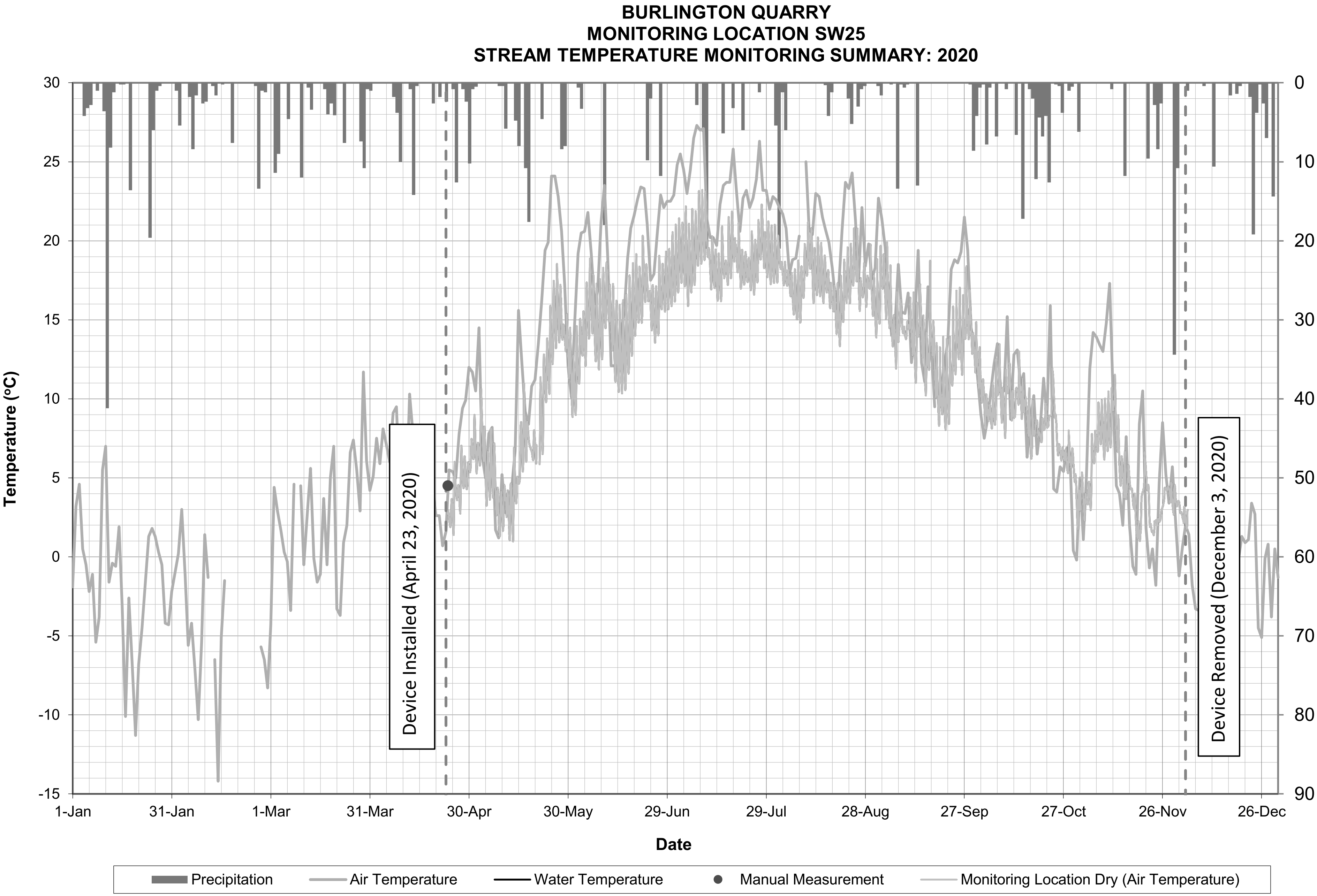
BURLINGTON QUARRY
MONITORING LOCATION SW24
STREAMFLOW MONITORING SUMMARY: 2019



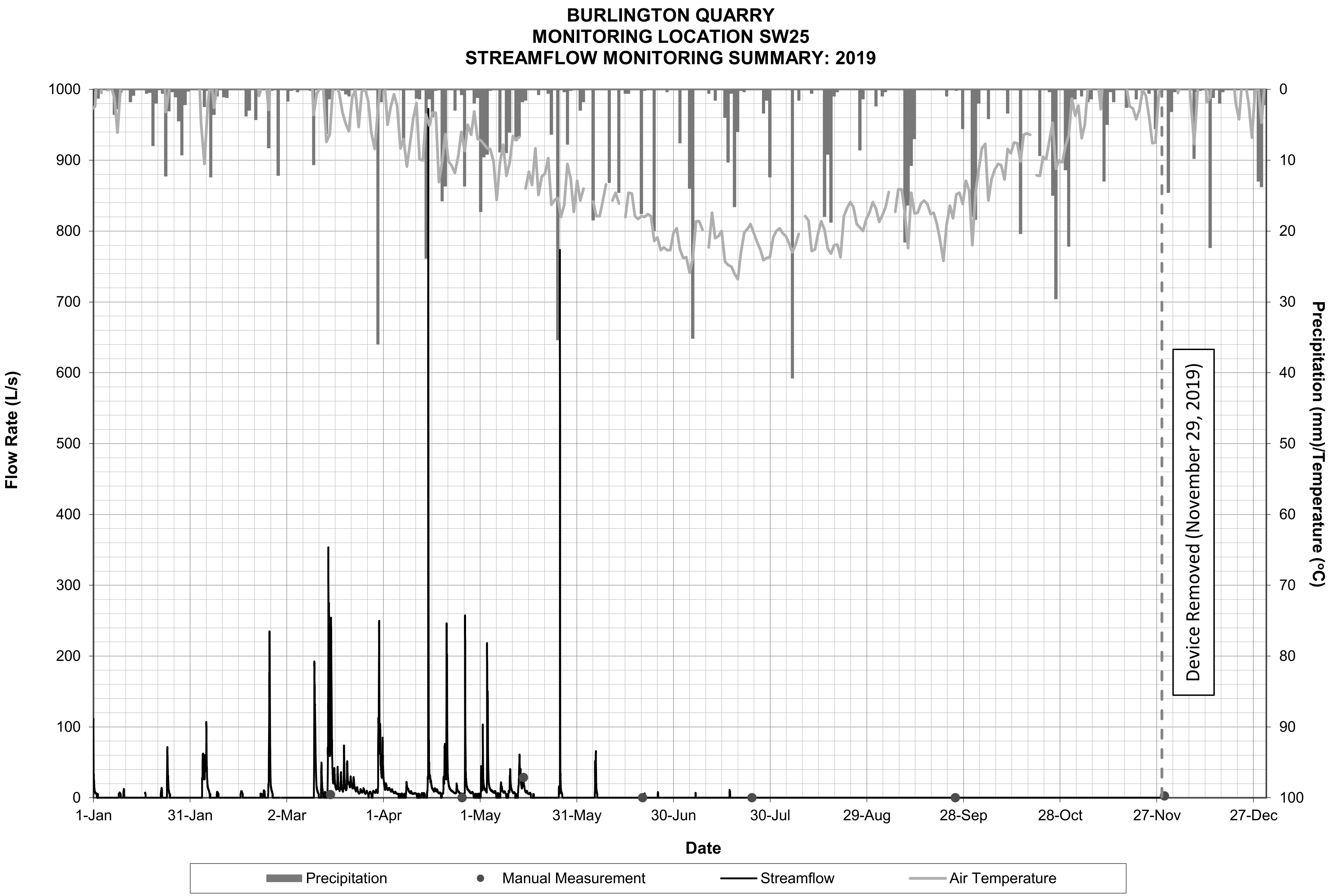

BURLINGTON QUARRY
MONITORING LOCATION SW24
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature

BURLINGTON QUARRY
MONITORING LOCATION SW25
STREAM TEMPERATURE MONITORING SUMMARY: 2019

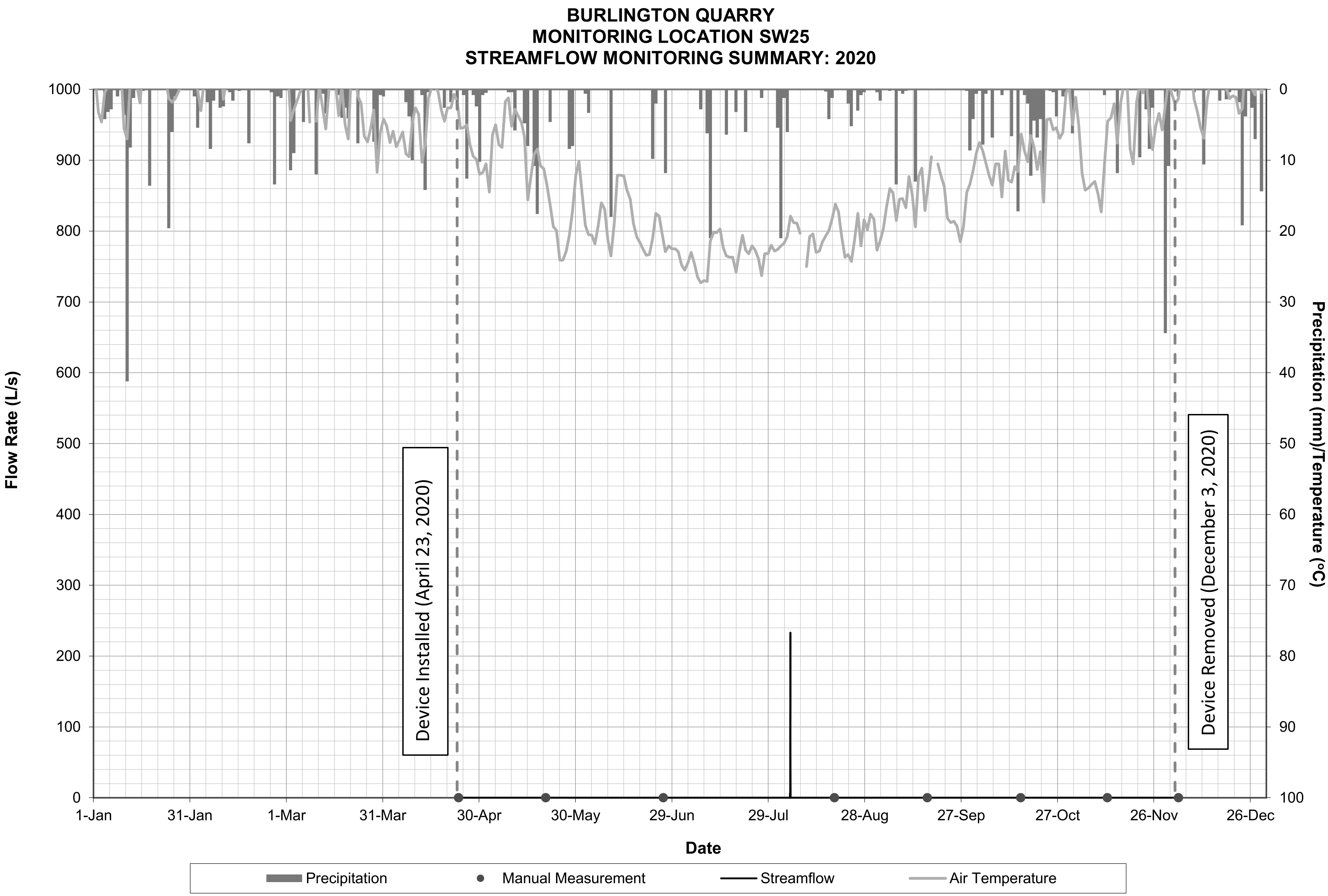


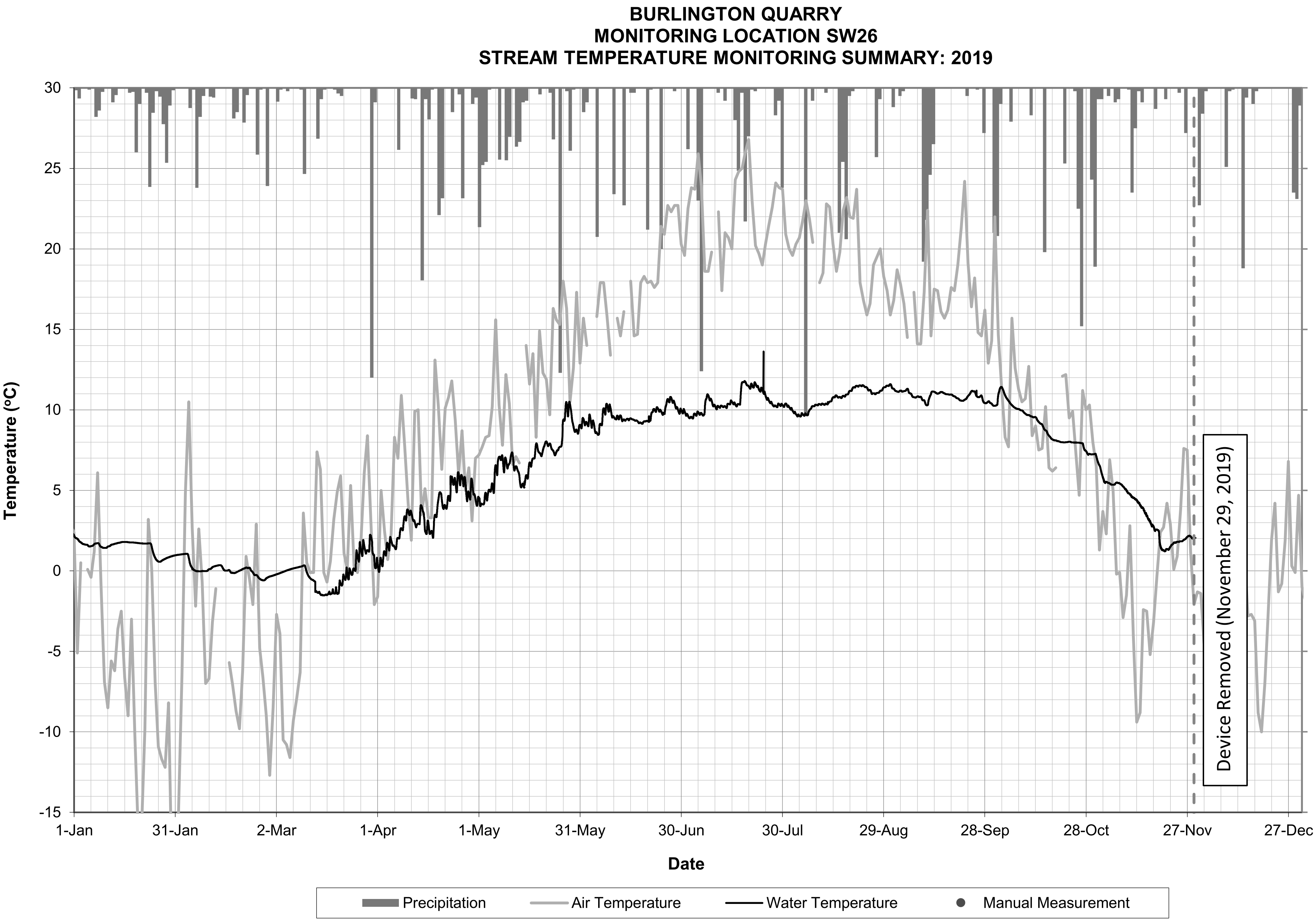


BURLINGTON QUARRY
MONITORING LOCATION SW25
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

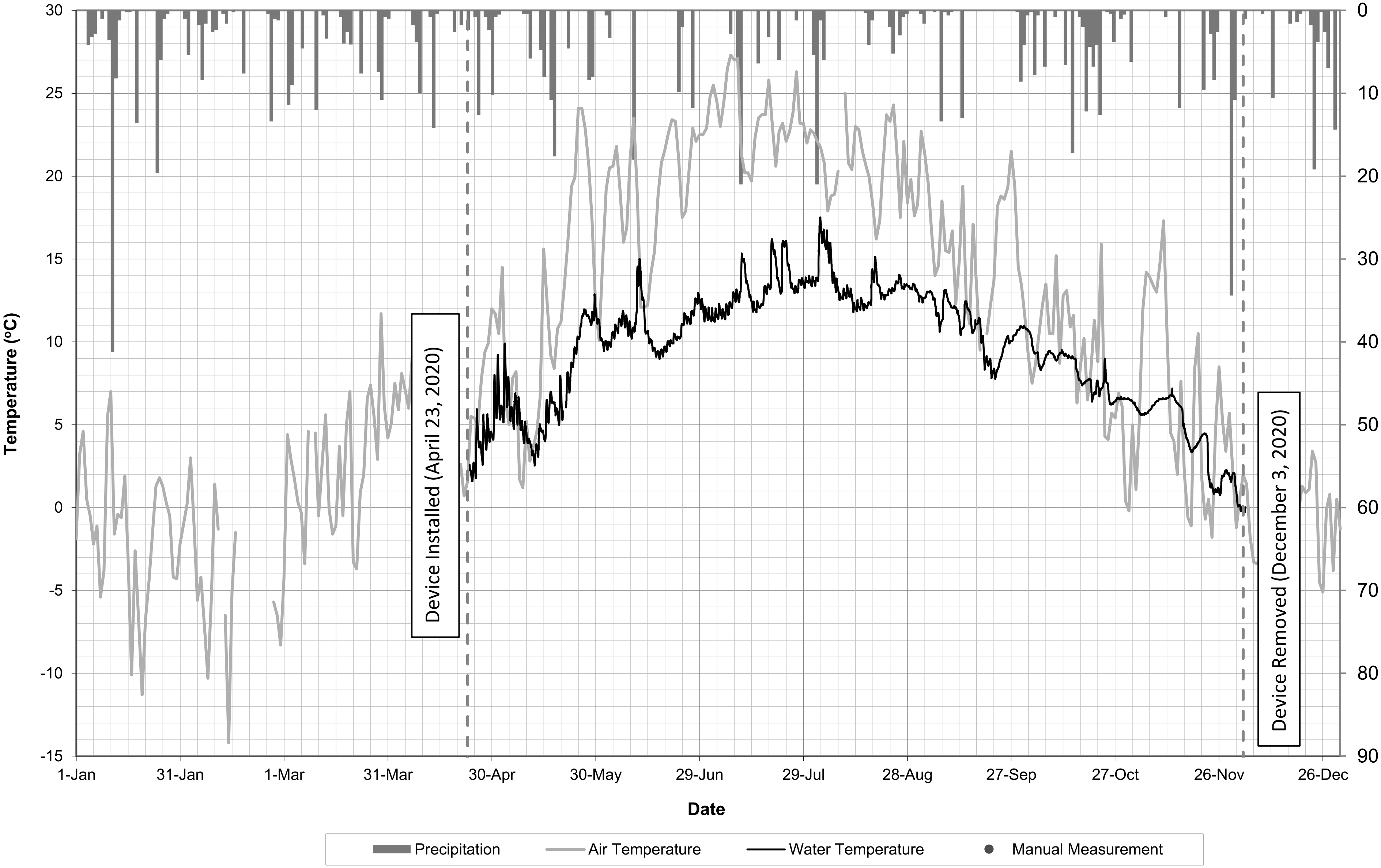


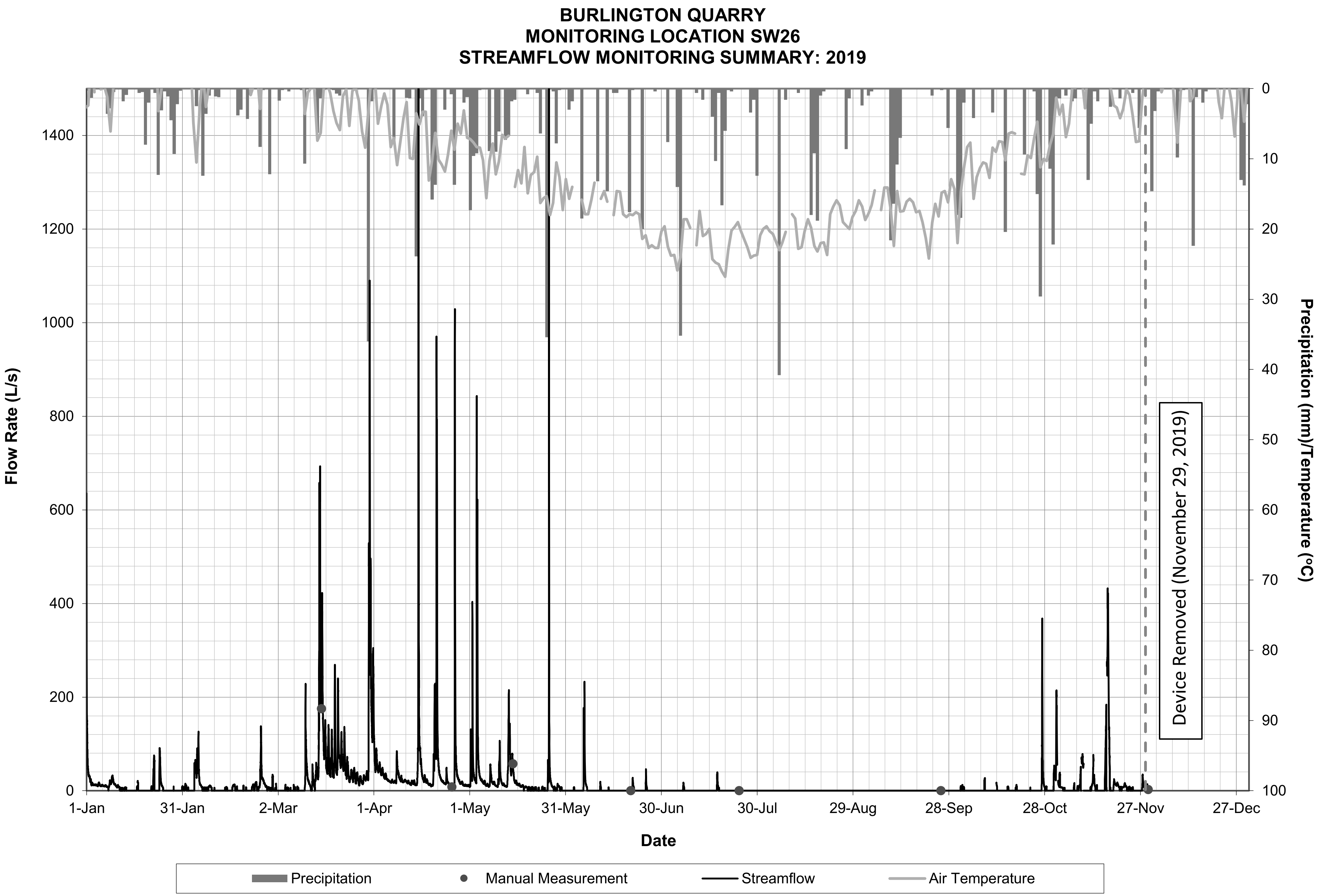
BURLINGTON QUARRY
MONITORING LOCATION SW25
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Removed (November 29, 2019)
Precipitation
Manual Measurement
Streamflow
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW25
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
1000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Precipitation
Manual Measurement
Streamflow
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW26
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Device Removed (November 29, 2019)
Precipitation
Air Temperature
Water Temperature
Manual Measurement

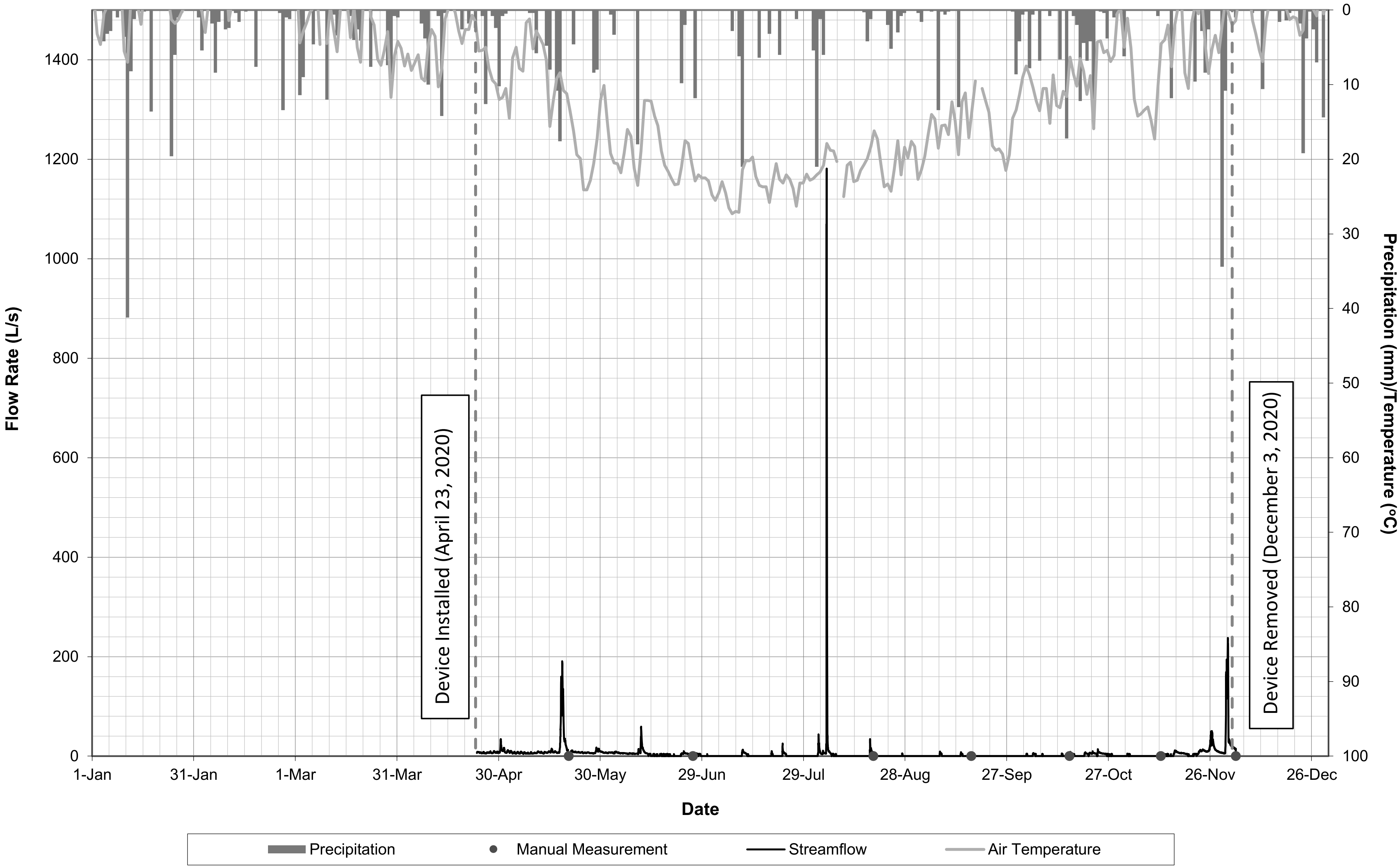
BURLINGTON QUARRY
MONITORING LOCATION SW26
STREAM TEMPERATURE MONITORING SUMMARY: 2020

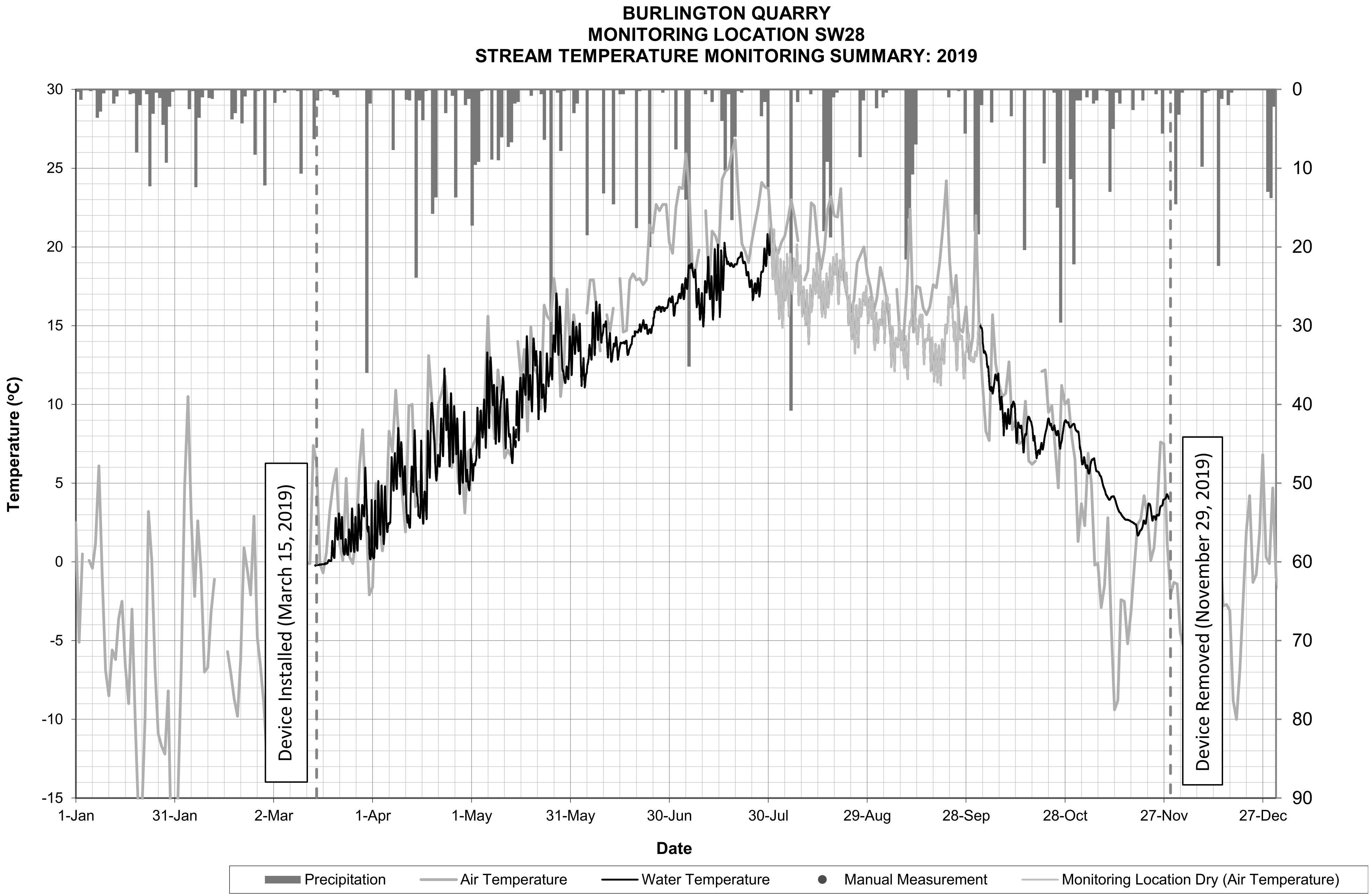


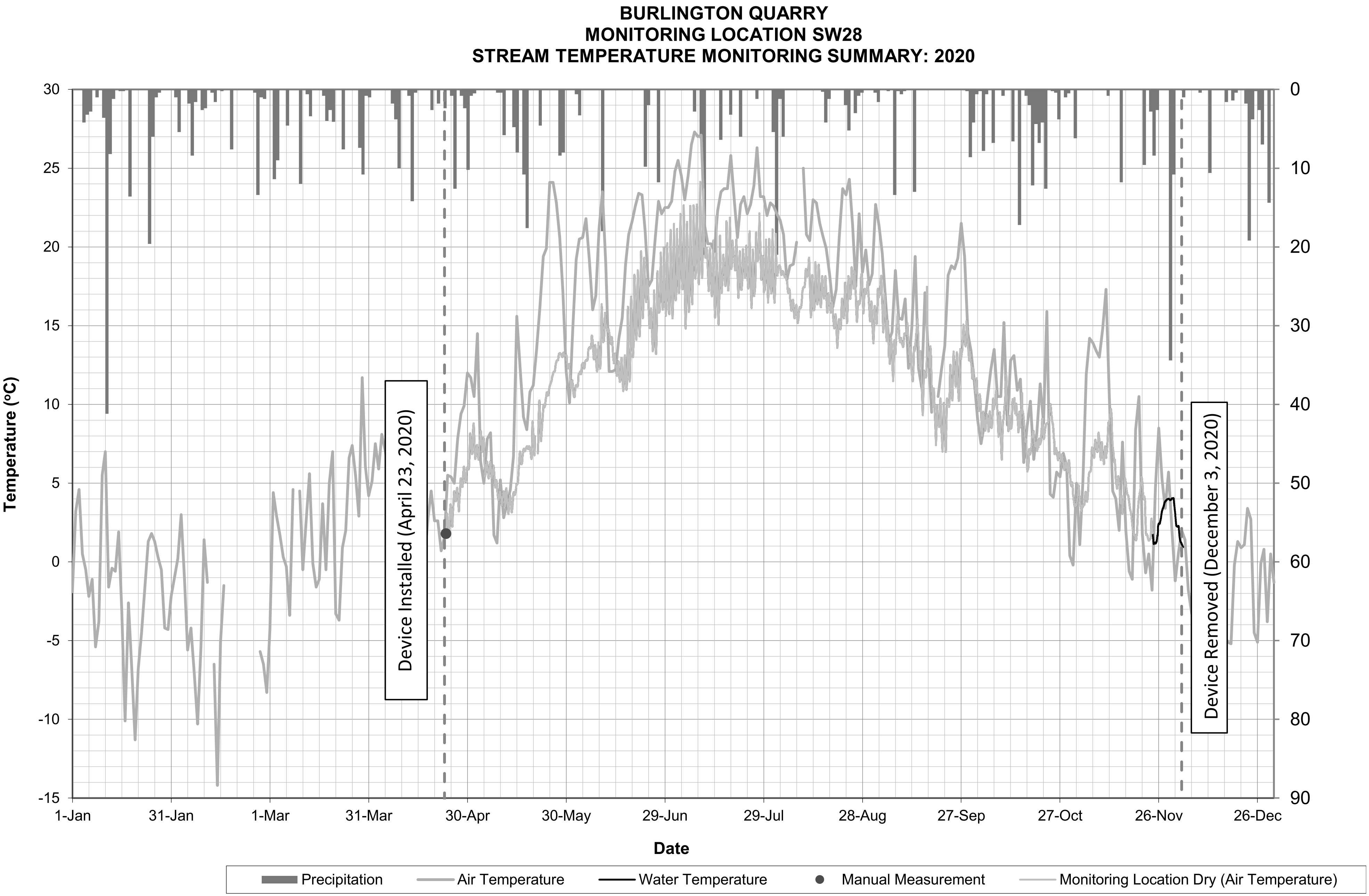


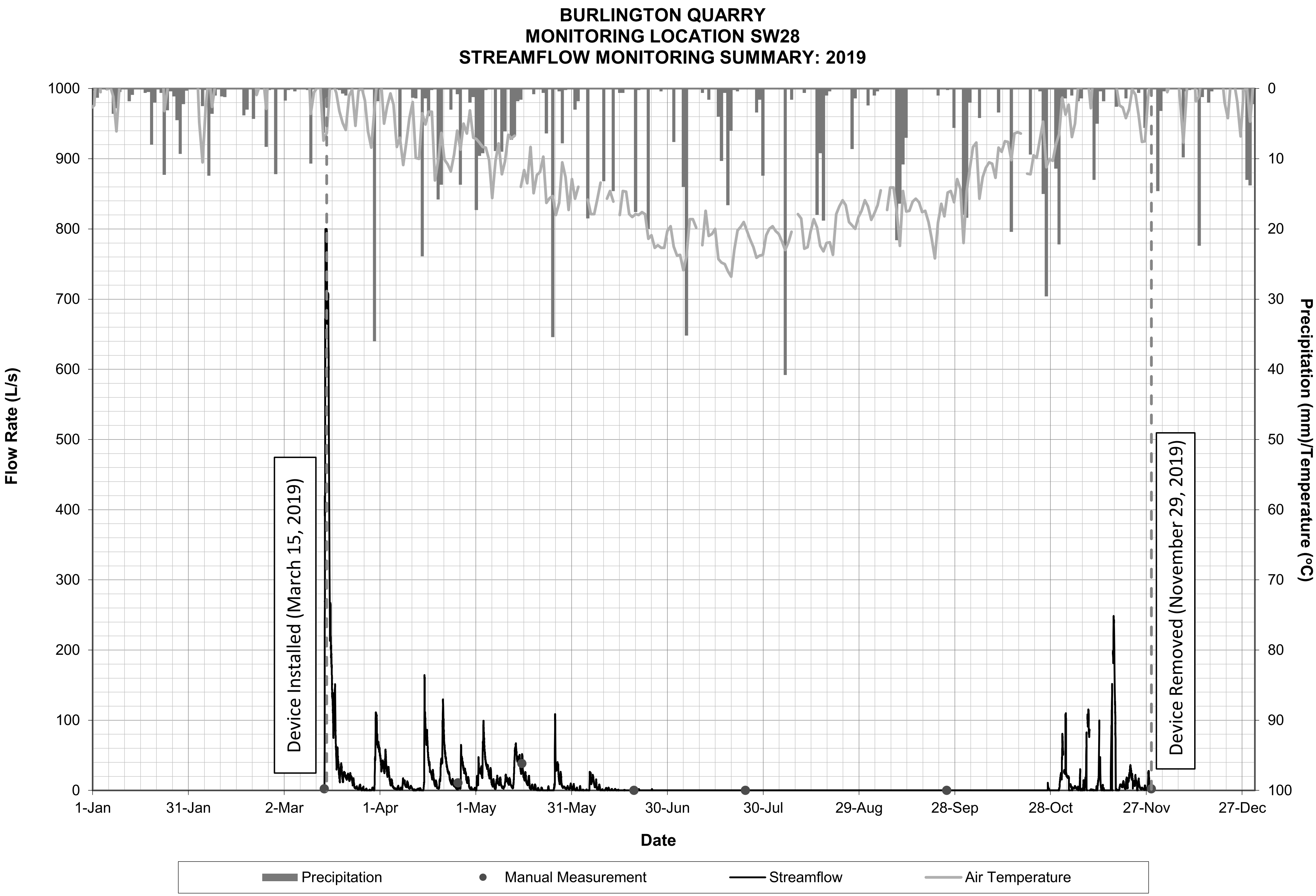
BURLINGTON QUARRY
MONITORING LOCATION SW26
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
0
200
400
600
800
1000
1200
1400
10
20
30
40
50
60
70
80
90
100
Device Removed (November 29, 2019)
Precipitation
Manual Measurement
Streamflow
Air Temperature

BURLINGTON QUARRY
MONITORING LOCATION SW26
STREAMFLOW MONITORING SUMMARY: 2020

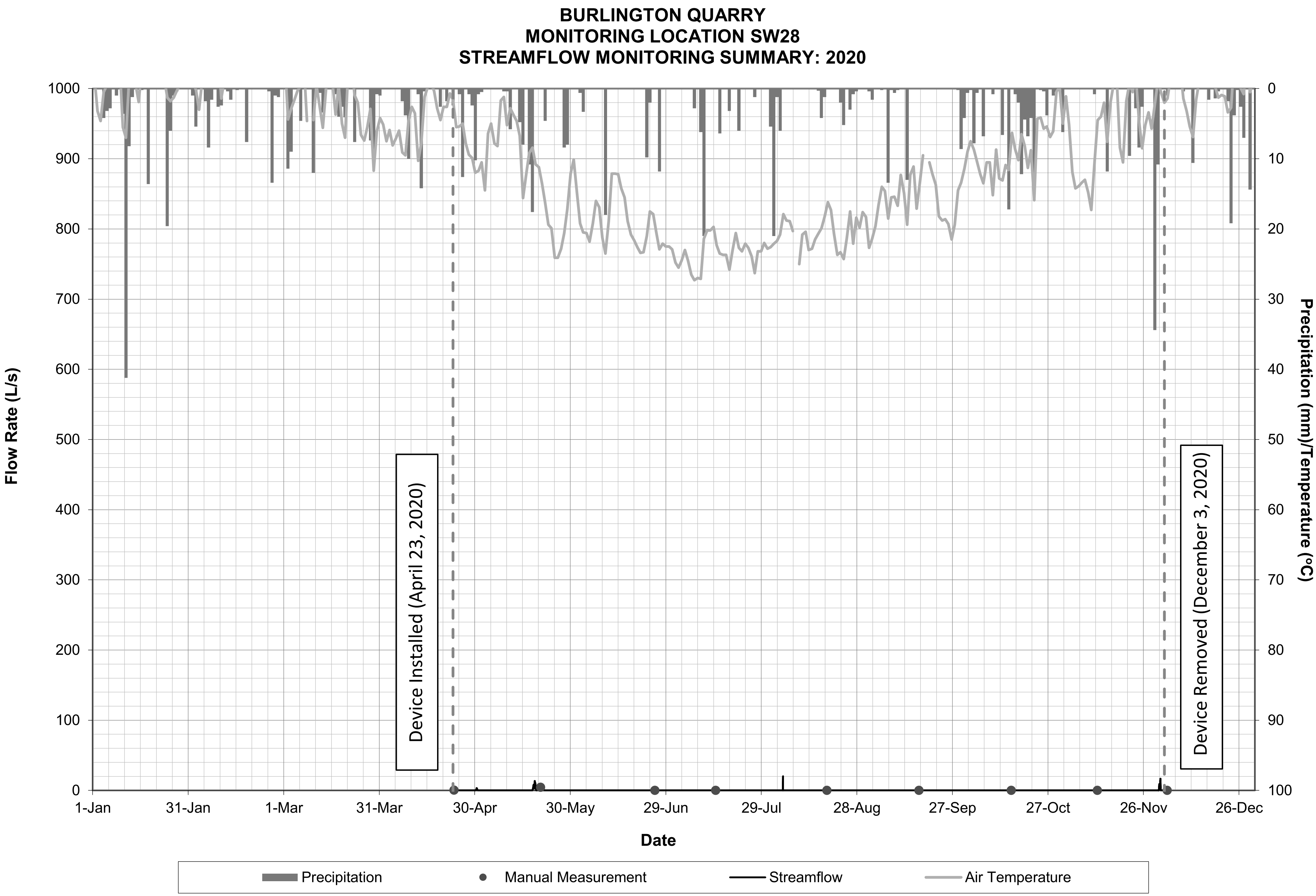



BURLINGTON QUARRY
MONITORING LOCATION SW28
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

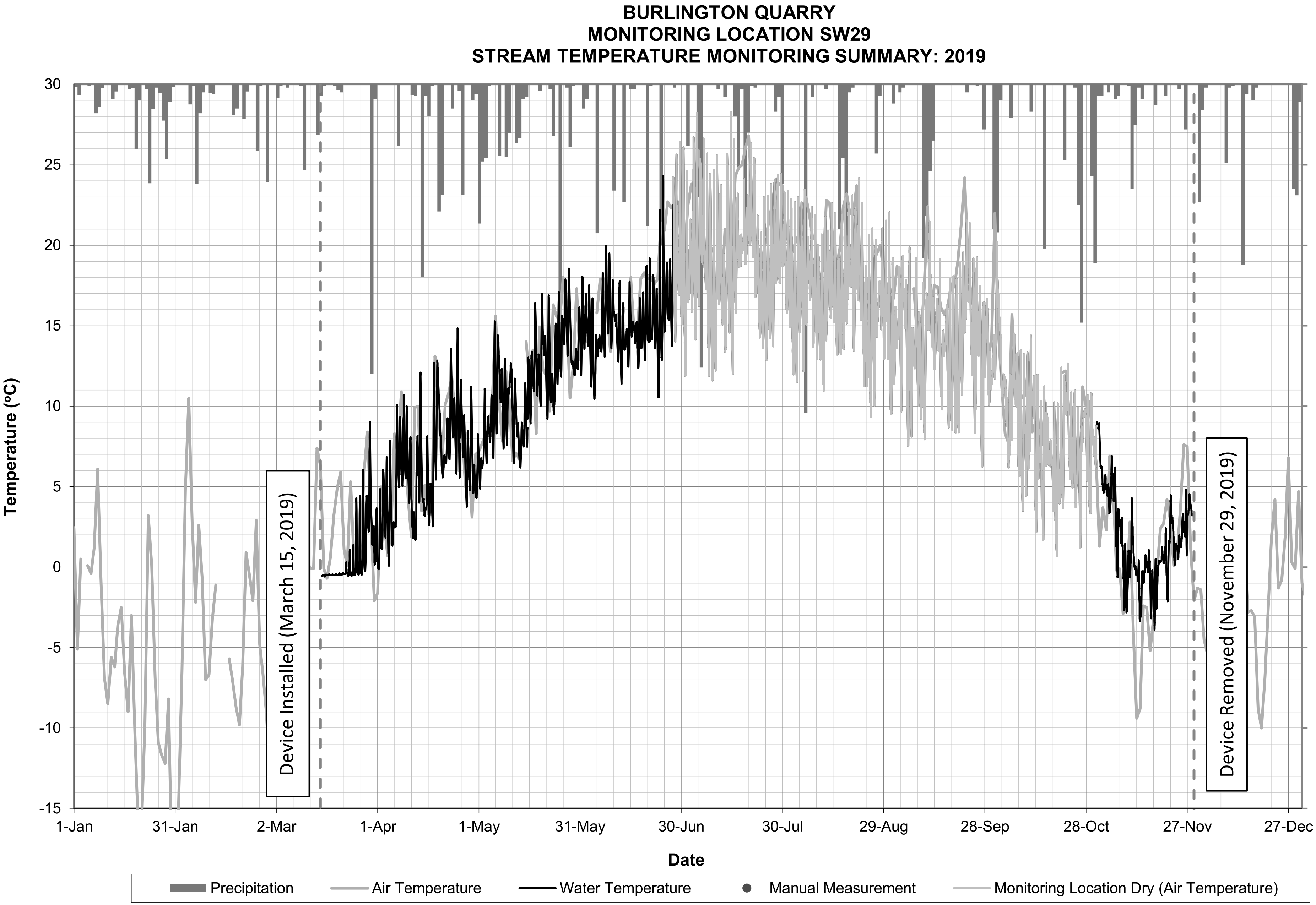

BURLINGTON QUARRY
MONITORING LOCATION SW28
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



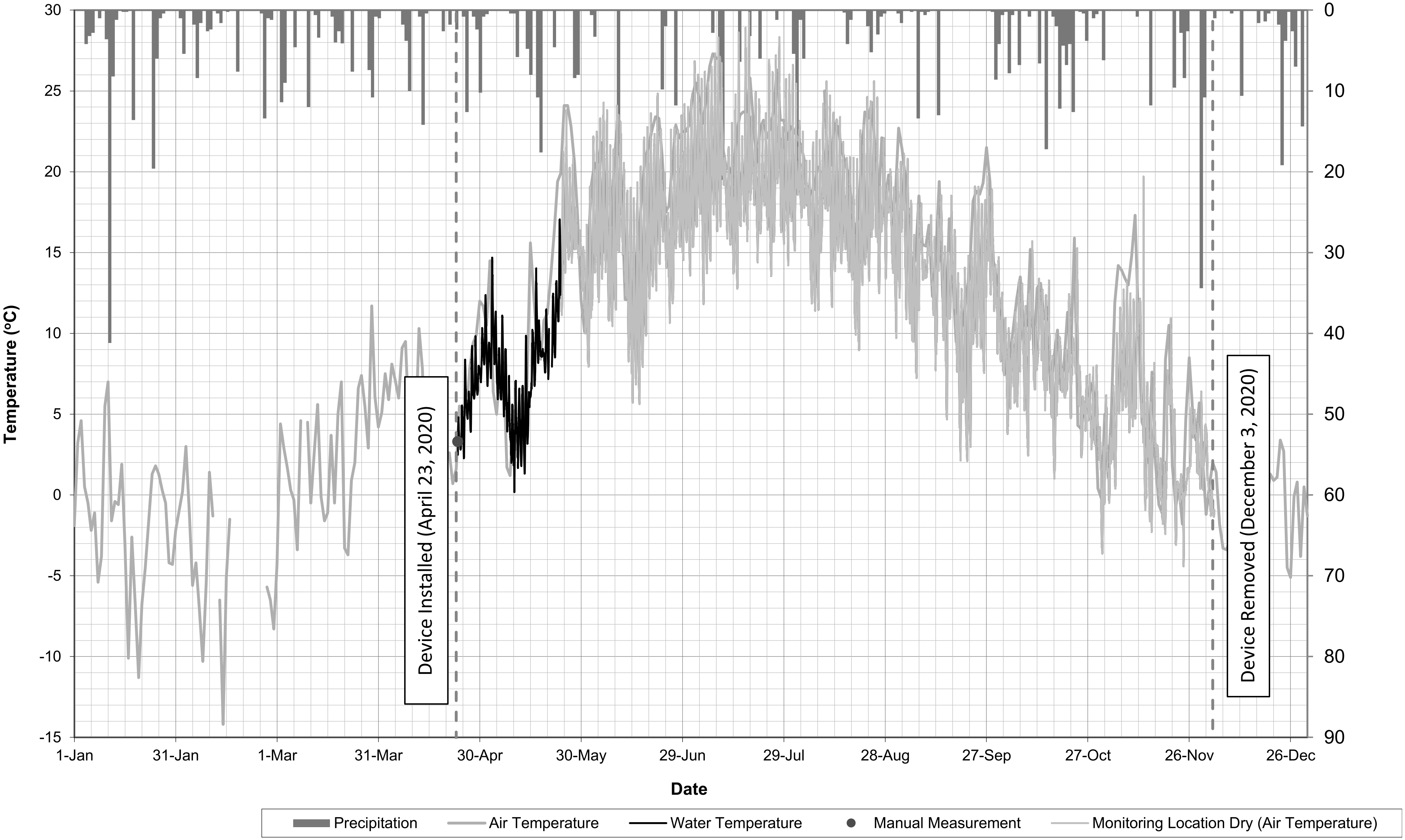
BURLINGTON QUARRY
MONITORING LOCATION SW28
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
1000
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature

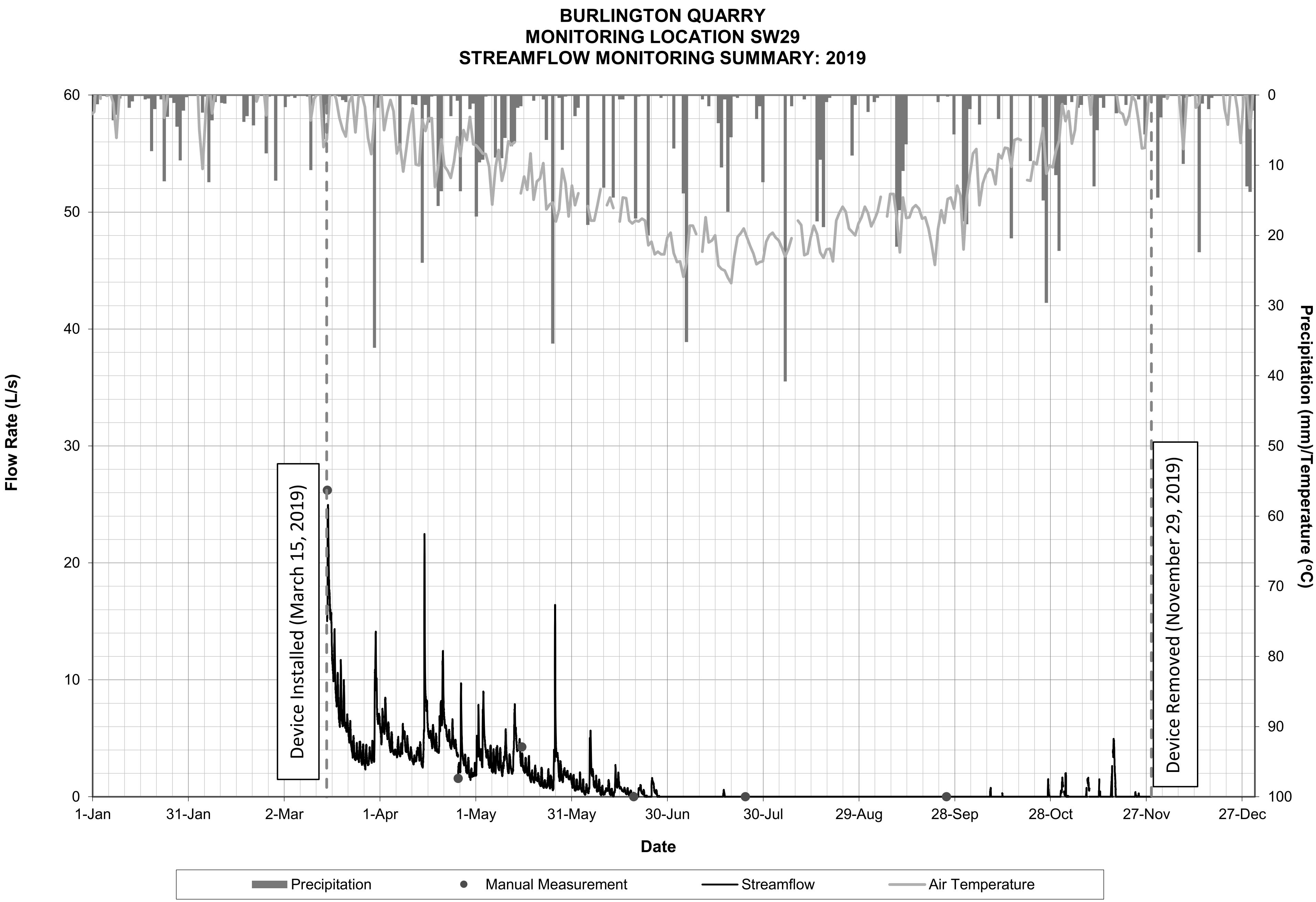


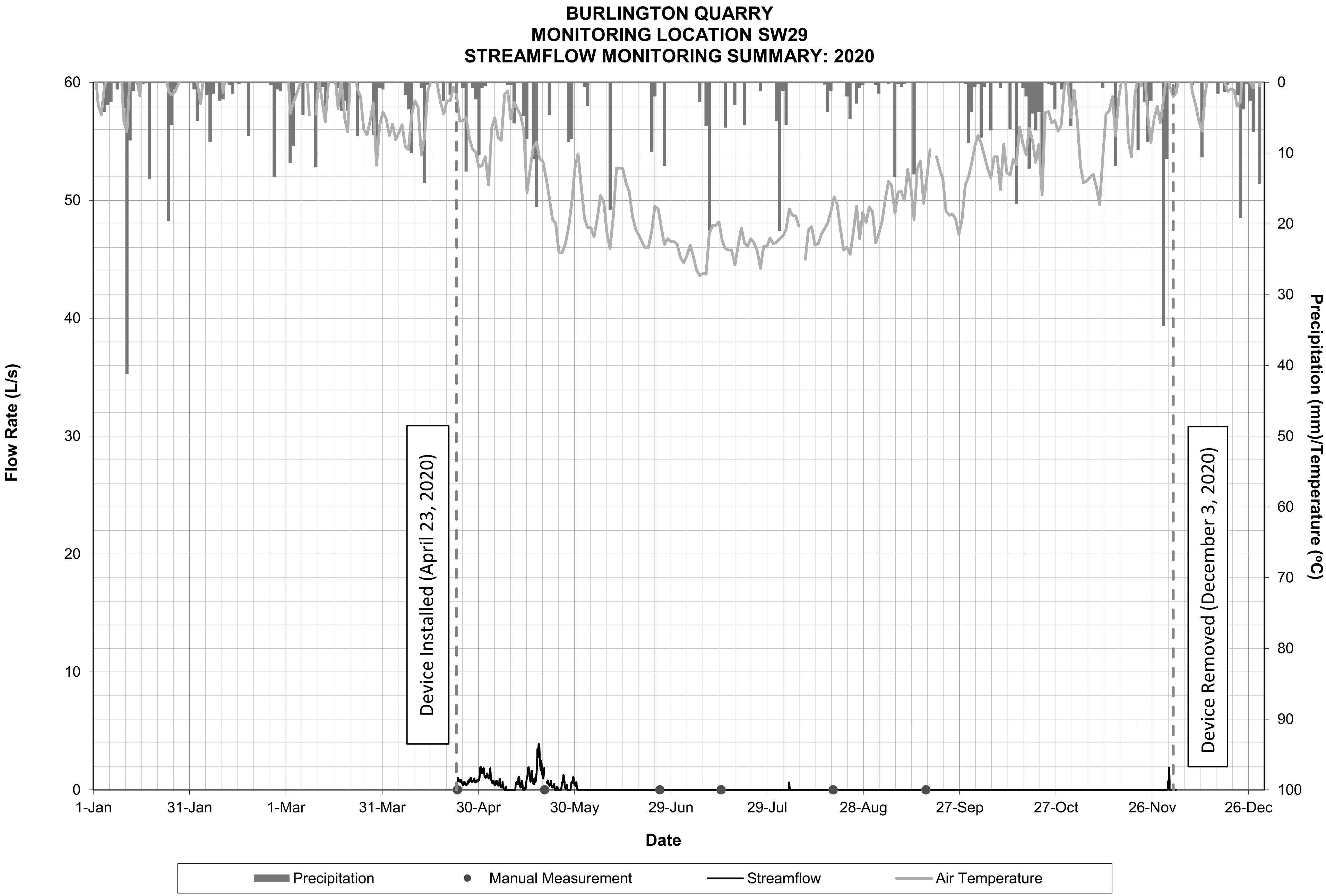
BURLINGTON QUARRY
MONITORING LOCATION SW28
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1000
900
800
700
600
500
400
300
200
100
0
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW29
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Date
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

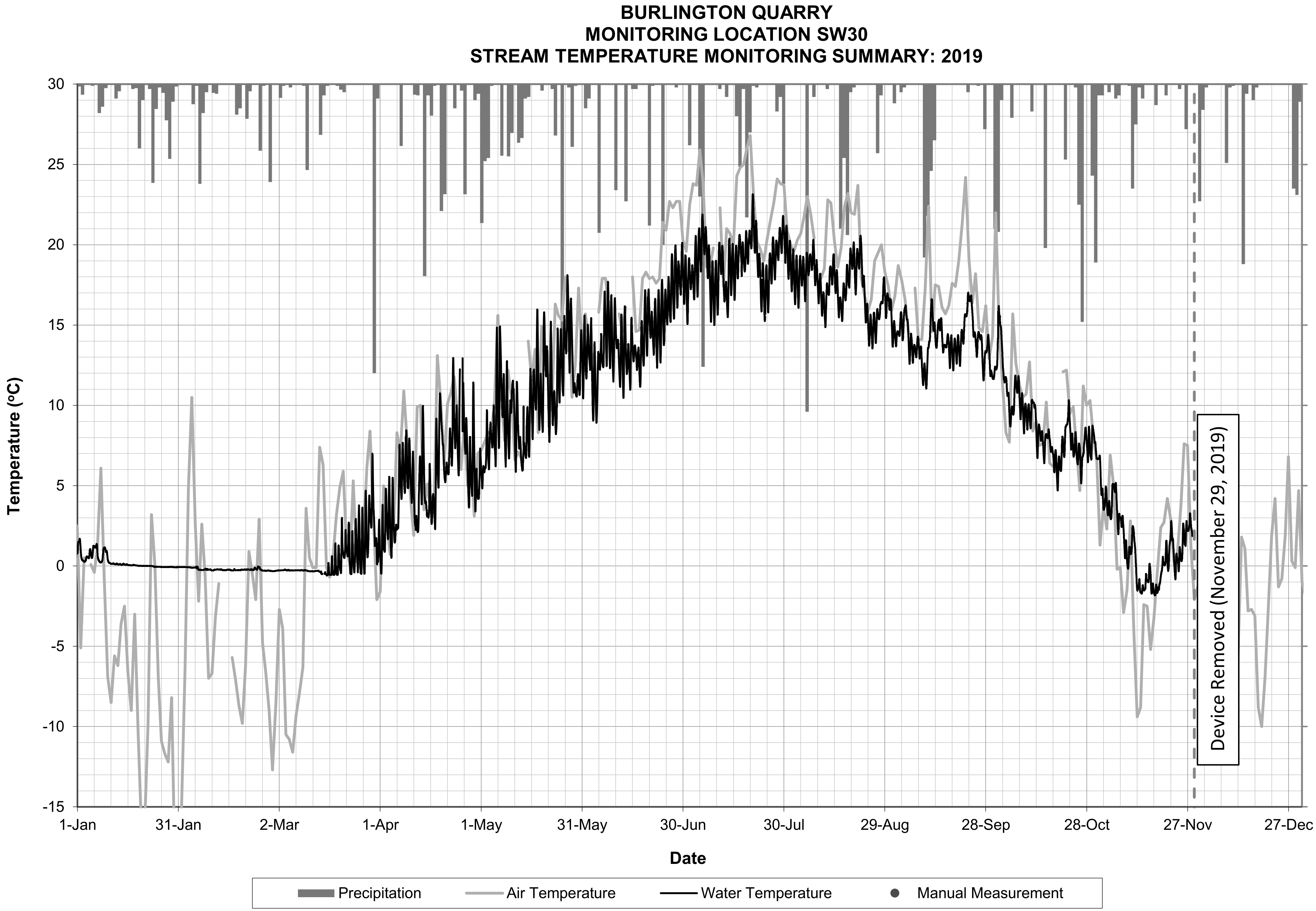
BURLINGTON QUARRY
MONITORING LOCATION SW29
STREAM TEMPERATURE MONITORING SUMMARY: 2020



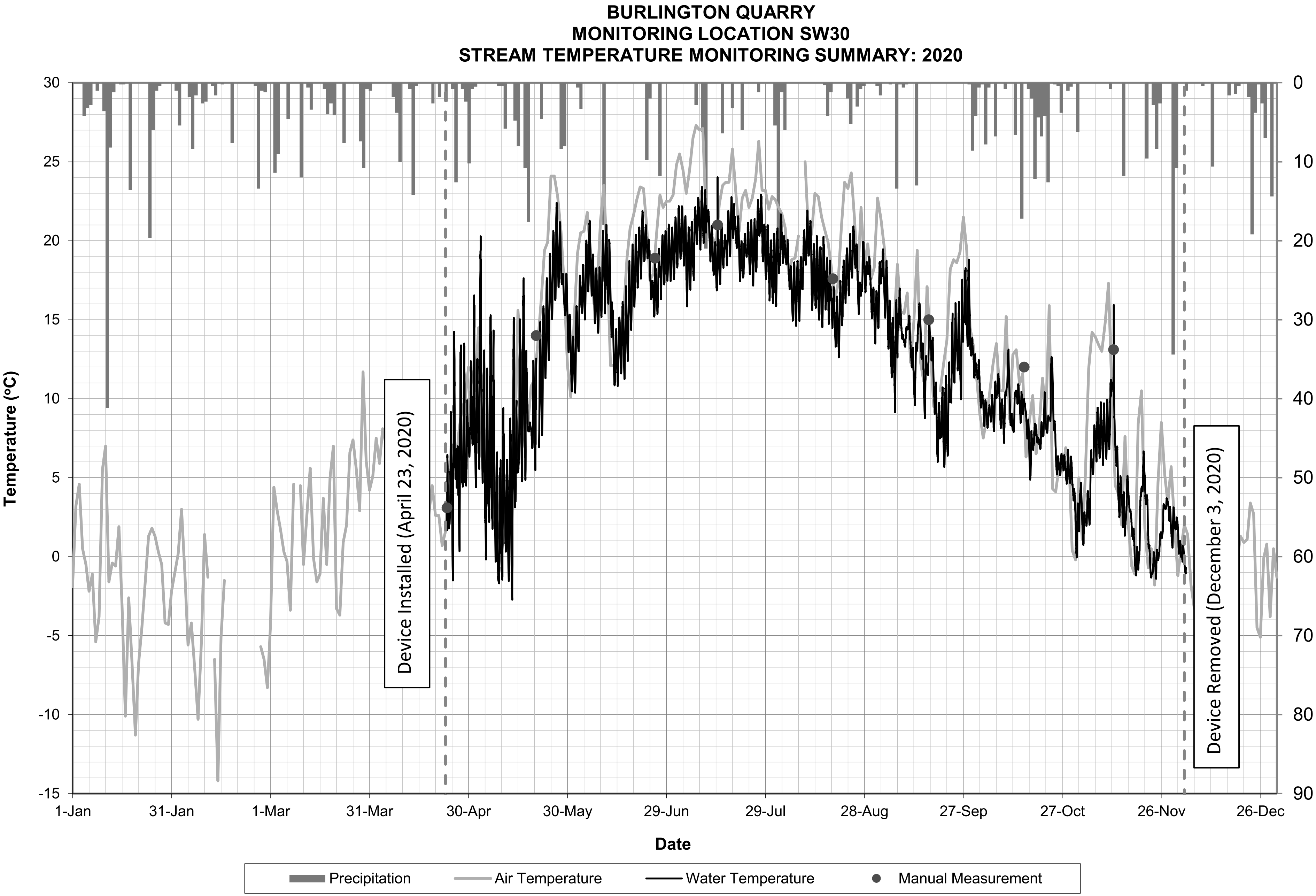

BURLINGTON QUARRY
MONITORING LOCATION SW29
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 15, 2019)
Device Removed (November 29, 2019)
Precipitation
Manual Measurement
Streamflow
Air Temperature



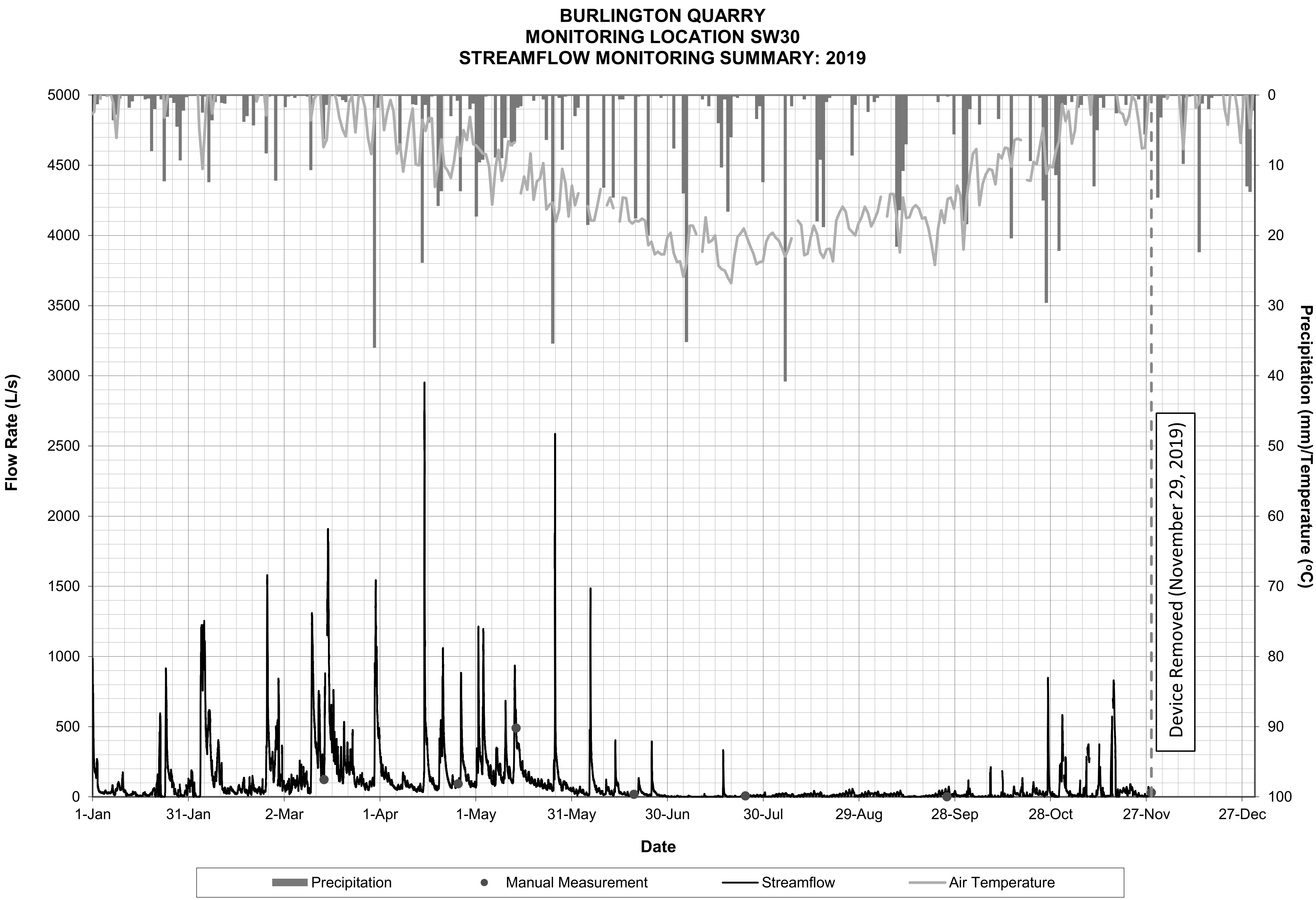
BURLINGTON QUARRY
MONITORING LOCATION SW29
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
Precipitation
Manual Measurement
Streamflow
Air Temperature



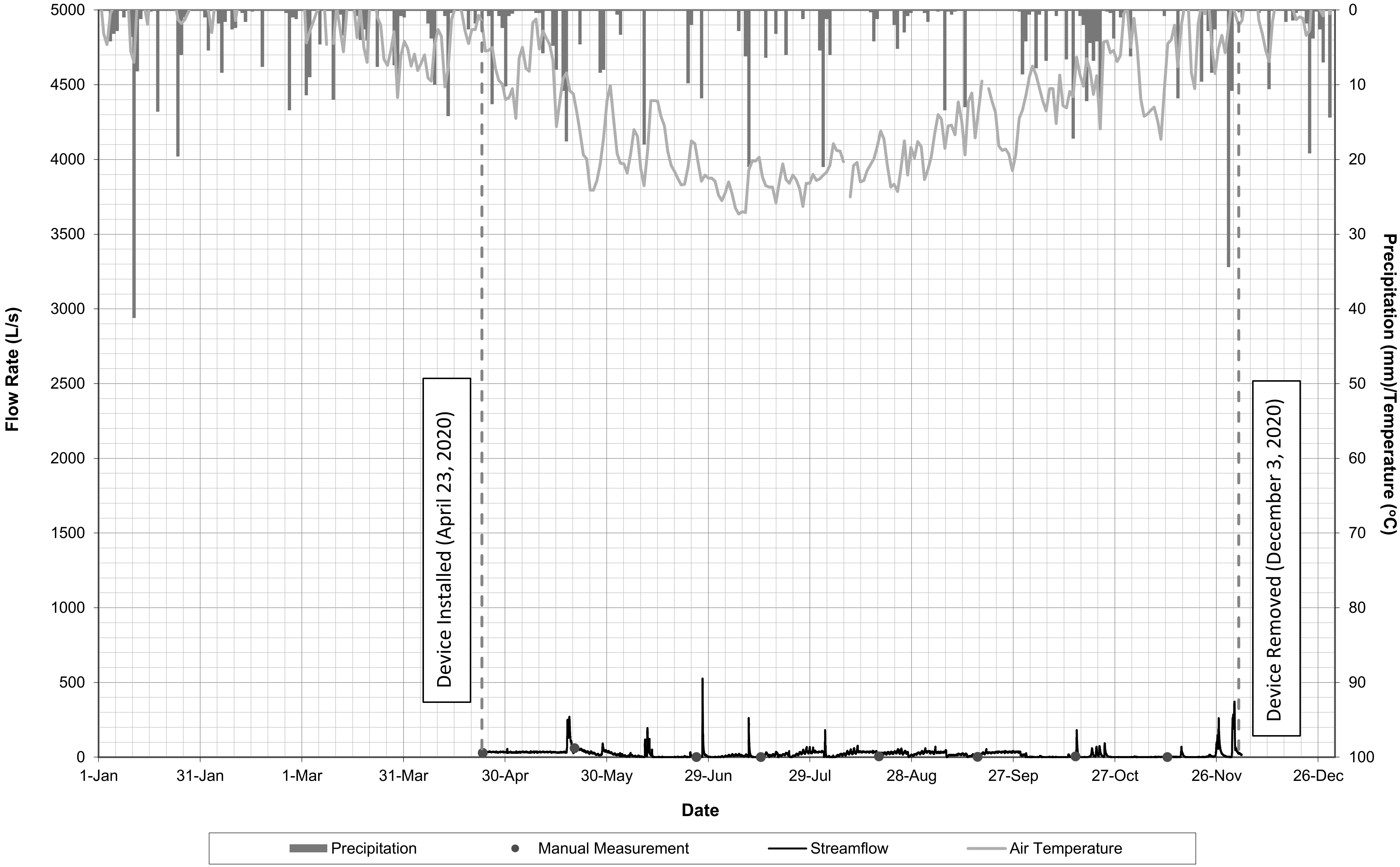
BURLINGTON QUARRY
MONITORING LOCATION SW30
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Date
Device Removed (November 29, 2019)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
Precipitation
Air Temperature
Water Temperature
Manual Measurement

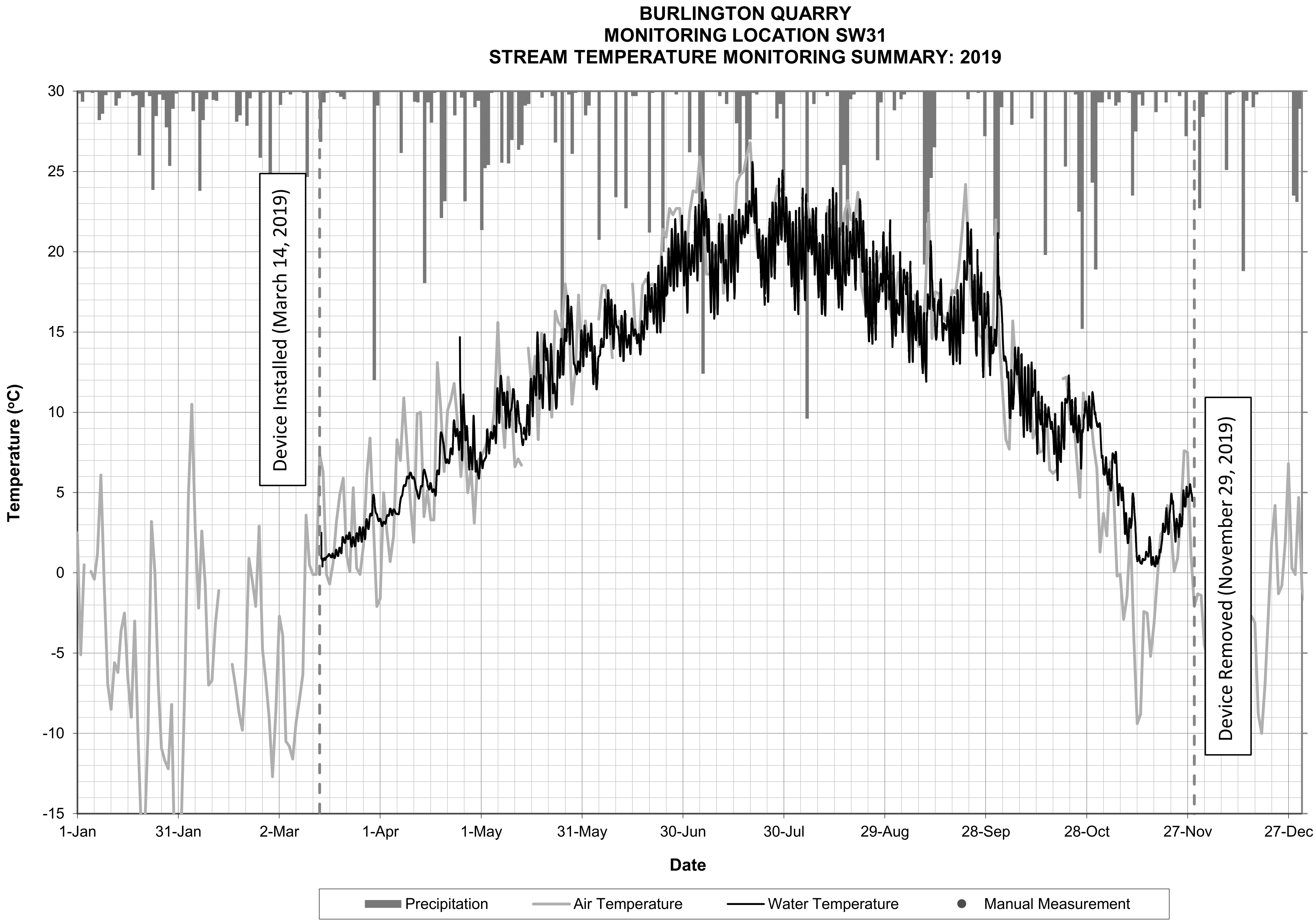


BURLINGTON QUARRY
MONITORING LOCATION SW30
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Precipitation
Air Temperature
Water Temperature
Manual Measurement

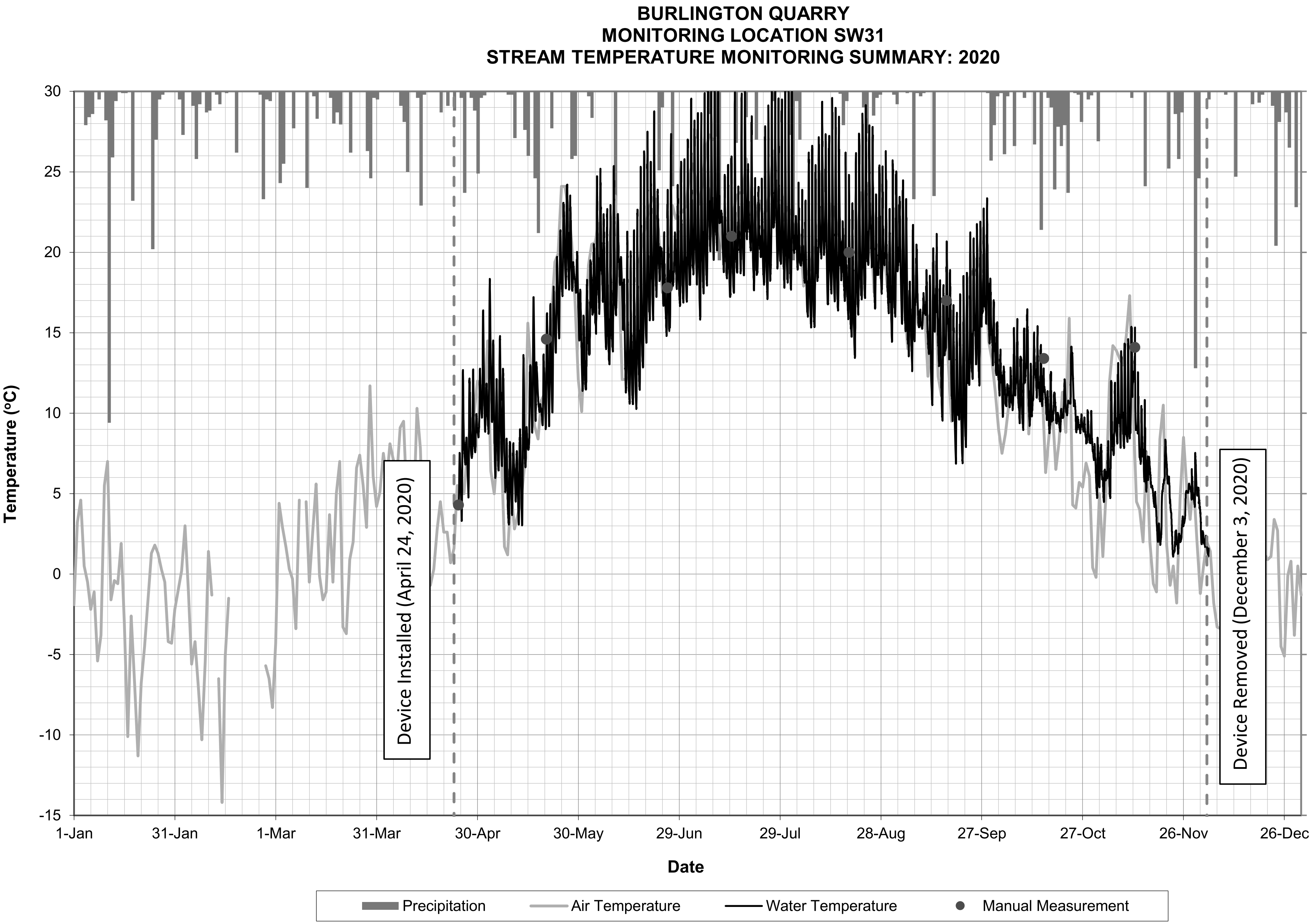

BURLINGTON QUARRY
MONITORING LOCATION SW30
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Removed (November 29, 2019)
Precipitation
Manual Measurement
Streamflow
Air Temperature

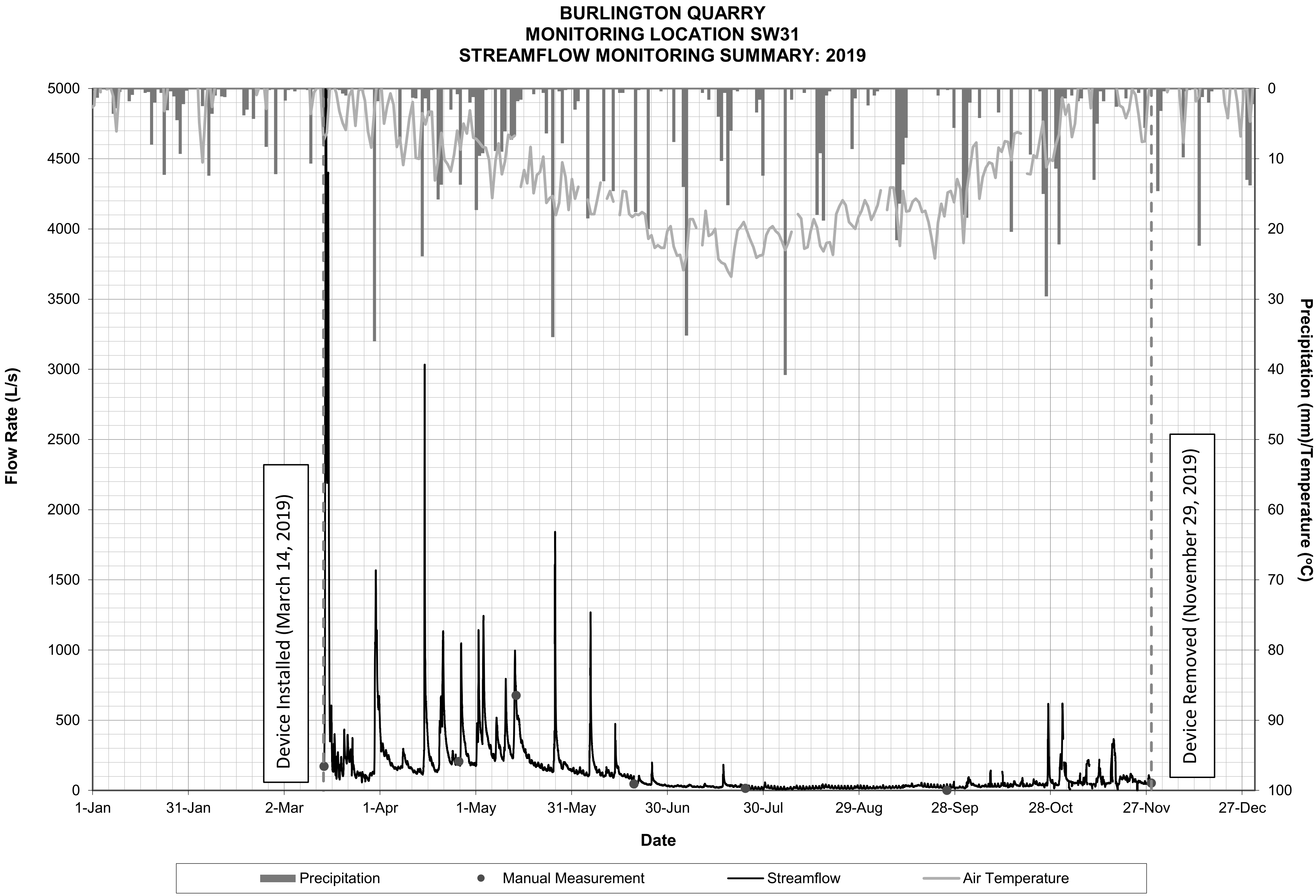
BURLINGTON QUARRY
MONITORING LOCATION SW30
STREAMFLOW MONITORING SUMMARY: 2020

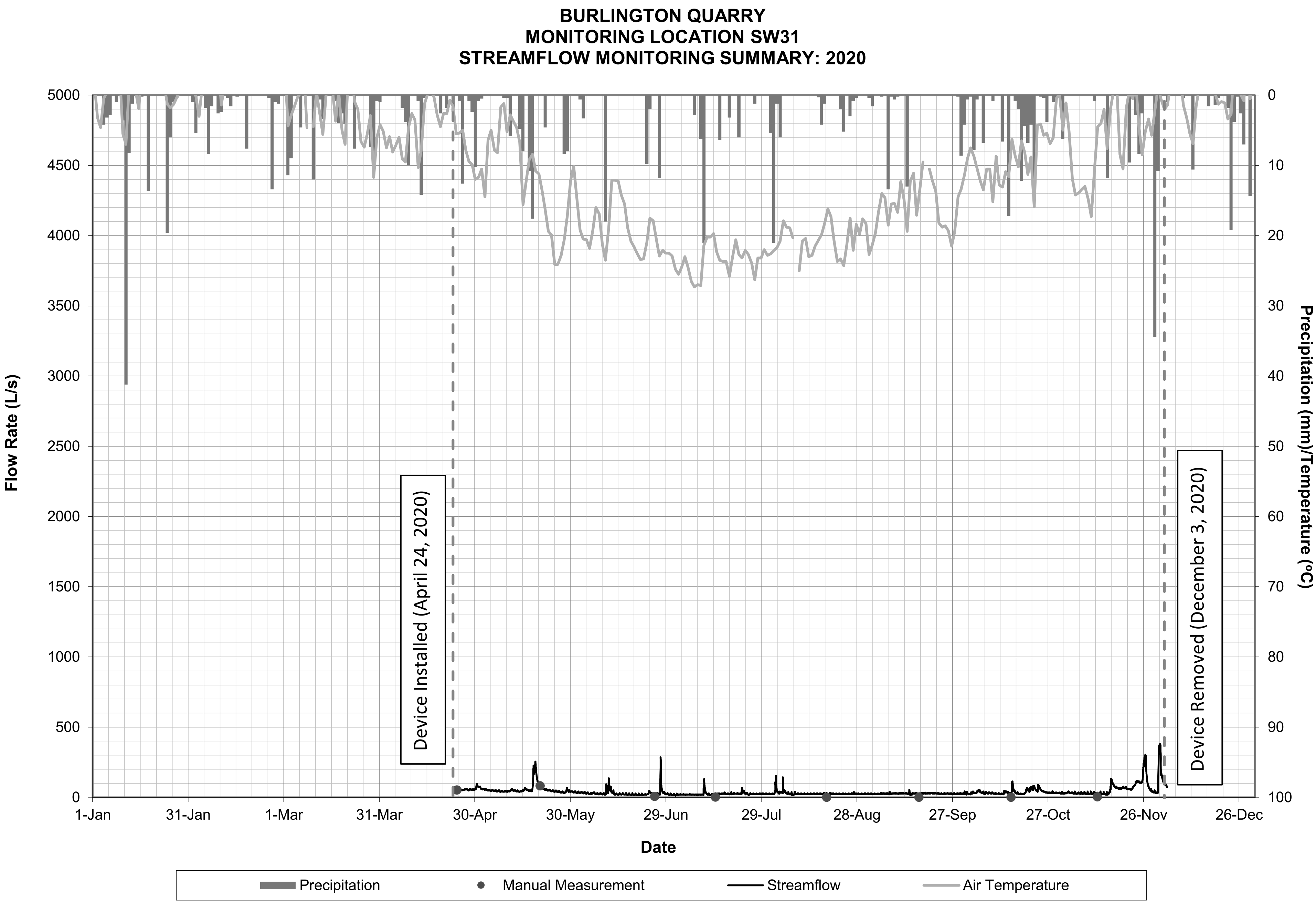




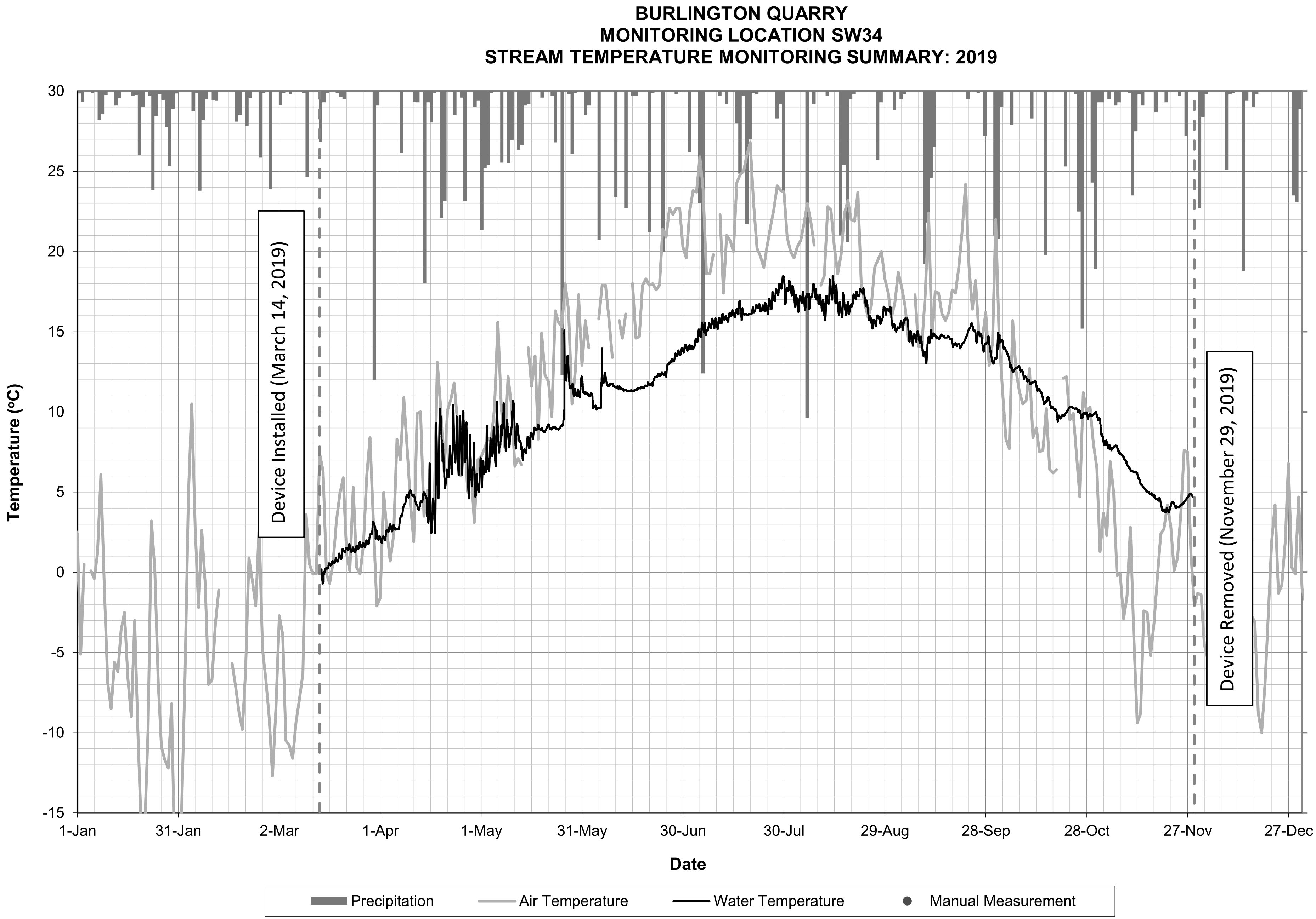
BURLINGTON QUARRY
MONITORING LOCATION SW31
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
Device Installed (March 14, 2019)
Device Removed (November 29, 2019)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Precipitation
Air Temperature
Water Temperature
Manual Measurement


BURLINGTON QUARRY
MONITORING LOCATION SW31
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Device Installed (April 24, 2020)
Device Removed (December 3, 2020)
Precipitation
Air Temperature
Water Temperature
Manual Measurement

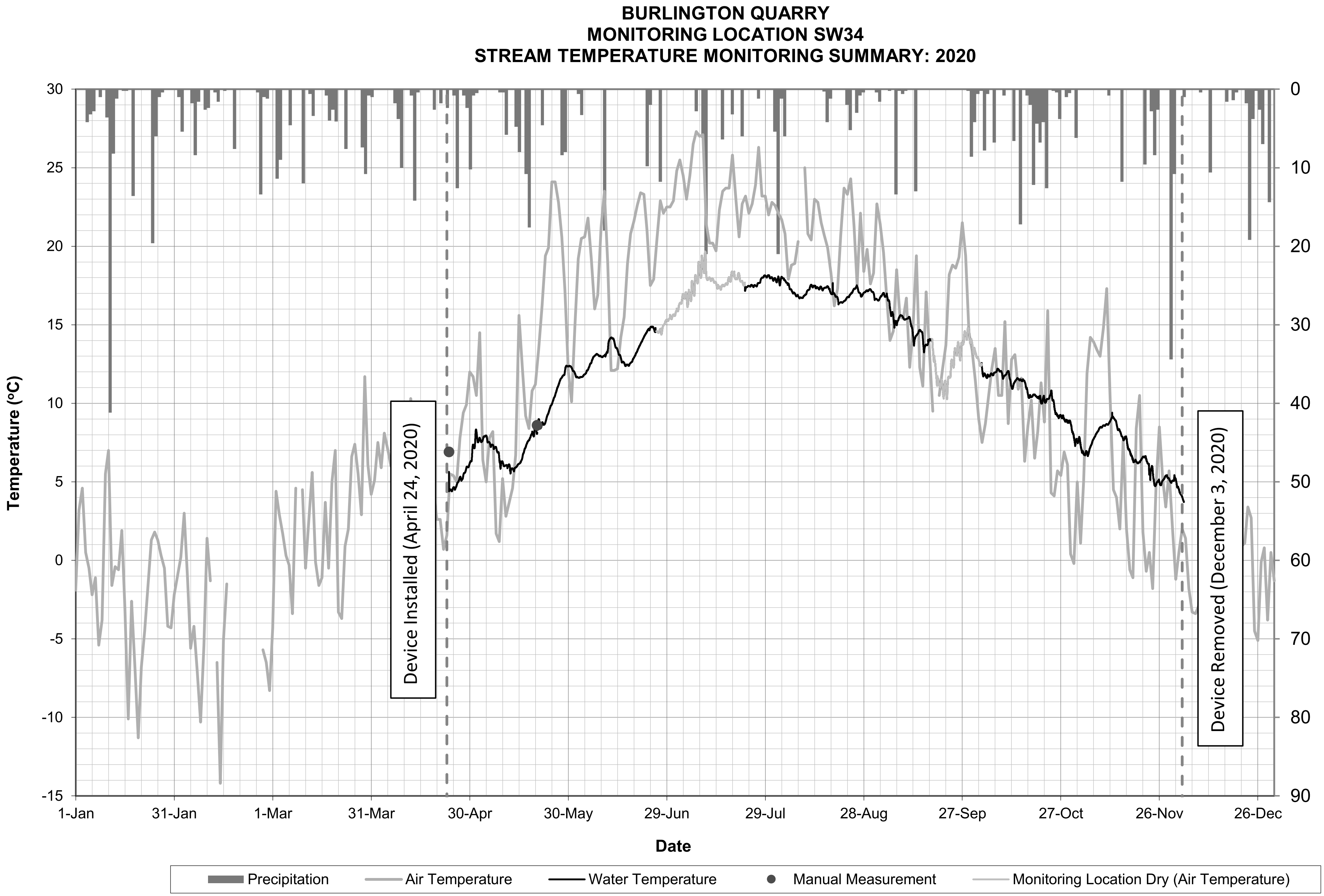

BURLINGTON QUARRY
MONITORING LOCATION SW31
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (March 14, 2019)
Device Removed (November 29, 2019)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature



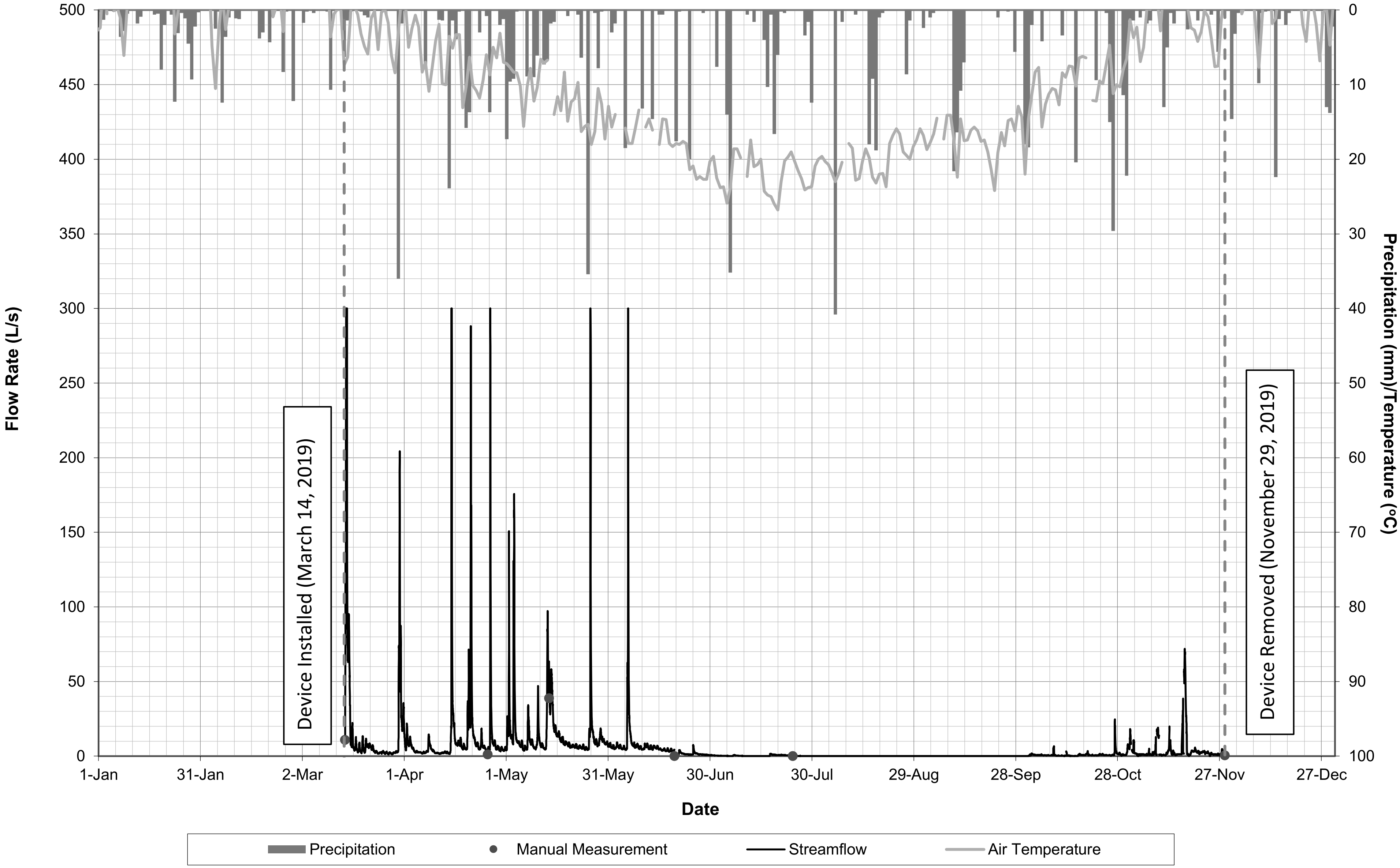
BURLINGTON QUARRY
MONITORING LOCATION SW31
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (April 24, 2020)
Device Removed (December 3, 2020)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature

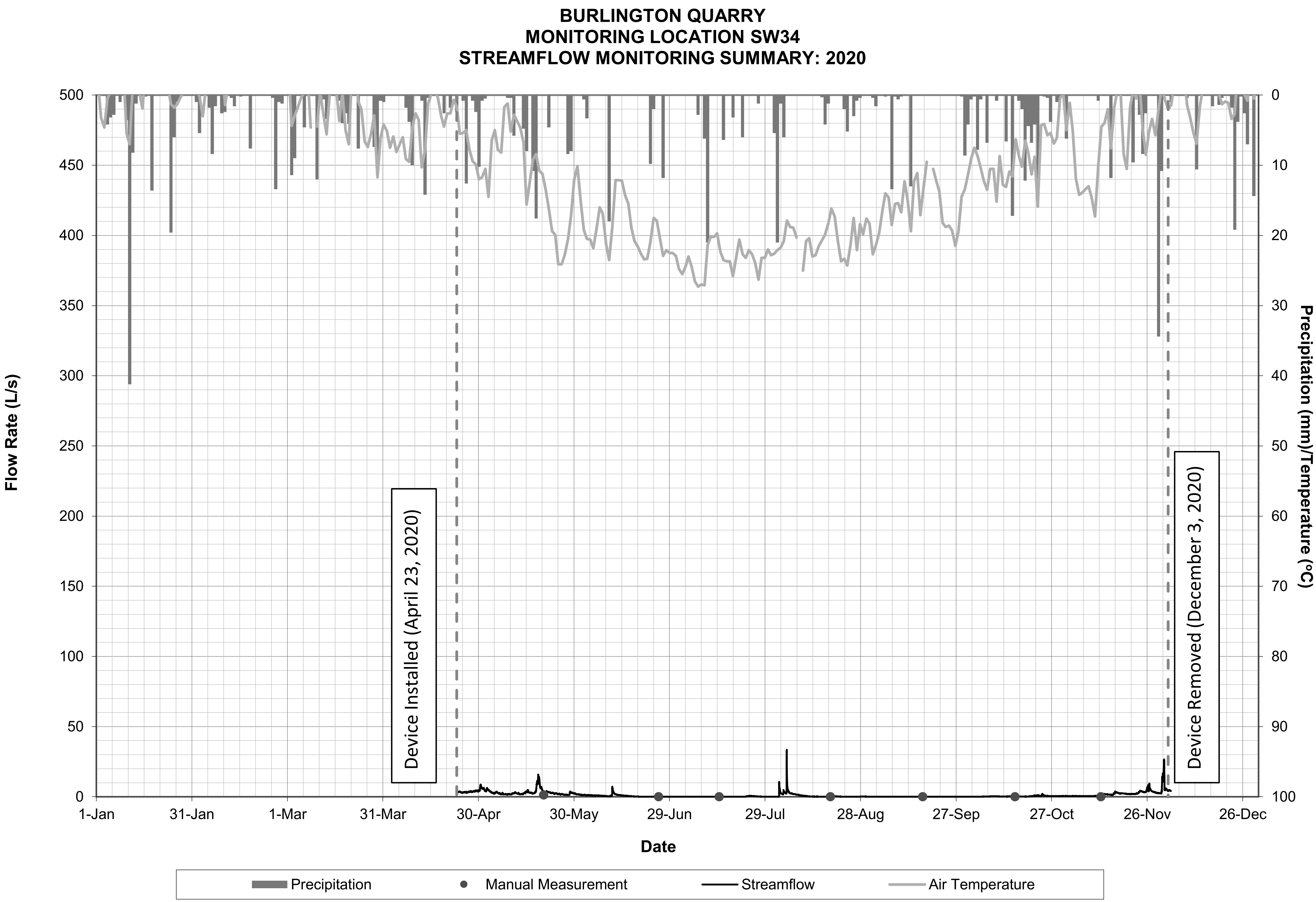


BURLINGTON QUARRY
MONITORING LOCATION SW34
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
Date
Device Installed (March 14, 2019)
Device Removed (November 29, 2019)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement

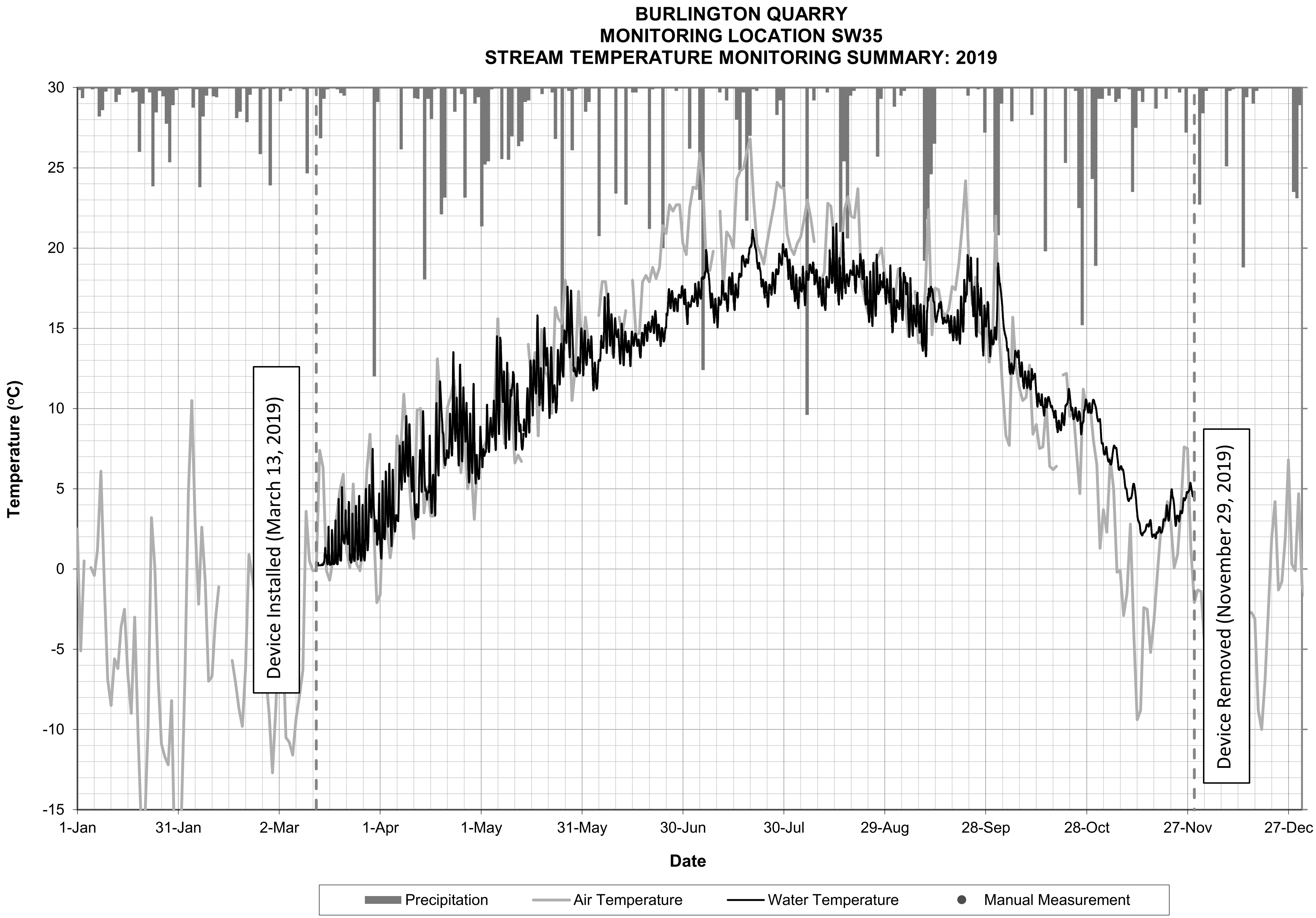

BURLINGTON QUARRY
MONITORING LOCATION SW34
STREAM TEMPERATURE MONITORING SUMMARY: 2020
Temperature (ºC)
Date
Device Installed (April 24, 2020)
Device Removed (December 3, 2020)
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)

BURLINGTON QUARRY
MONITORING LOCATION SW34
STREAMFLOW MONITORING SUMMARY: 2019

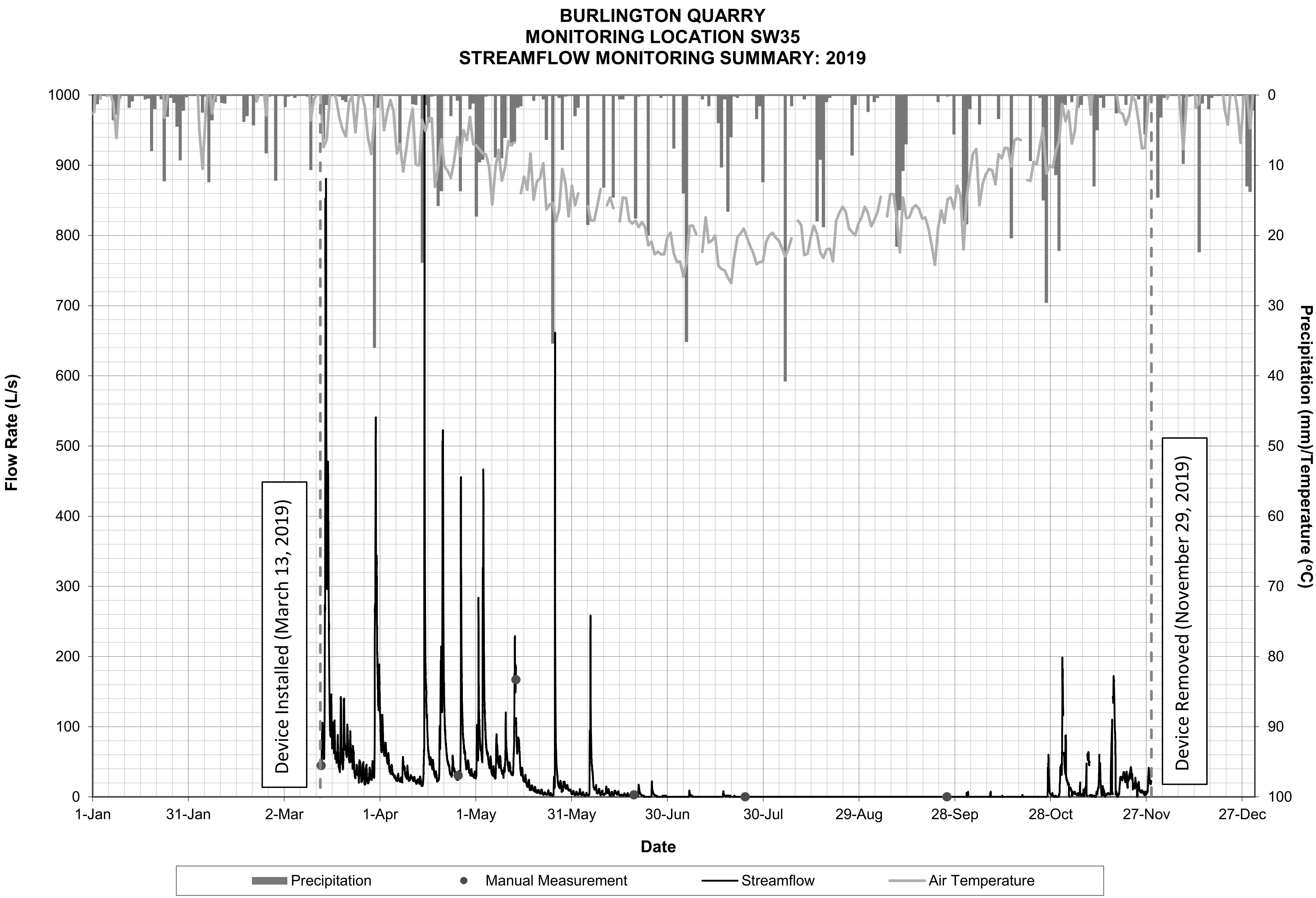


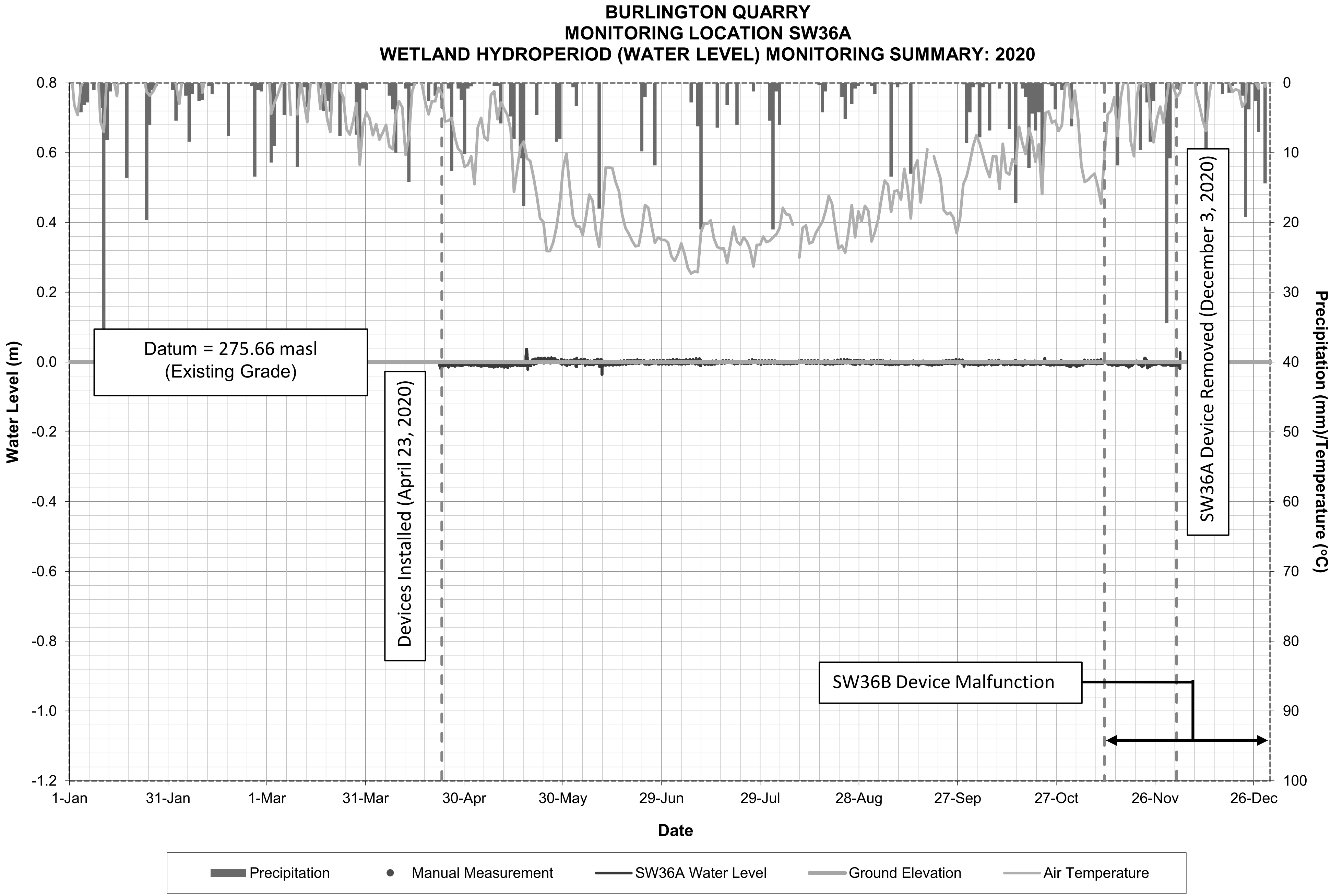


BURLINGTON QUARRY
MONITORING LOCATION SW34
STREAMFLOW MONITORING SUMMARY: 2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (April 23, 2020)
Device Removed (December 3, 2020)
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Manual Measurement
Streamflow
Air Temperature



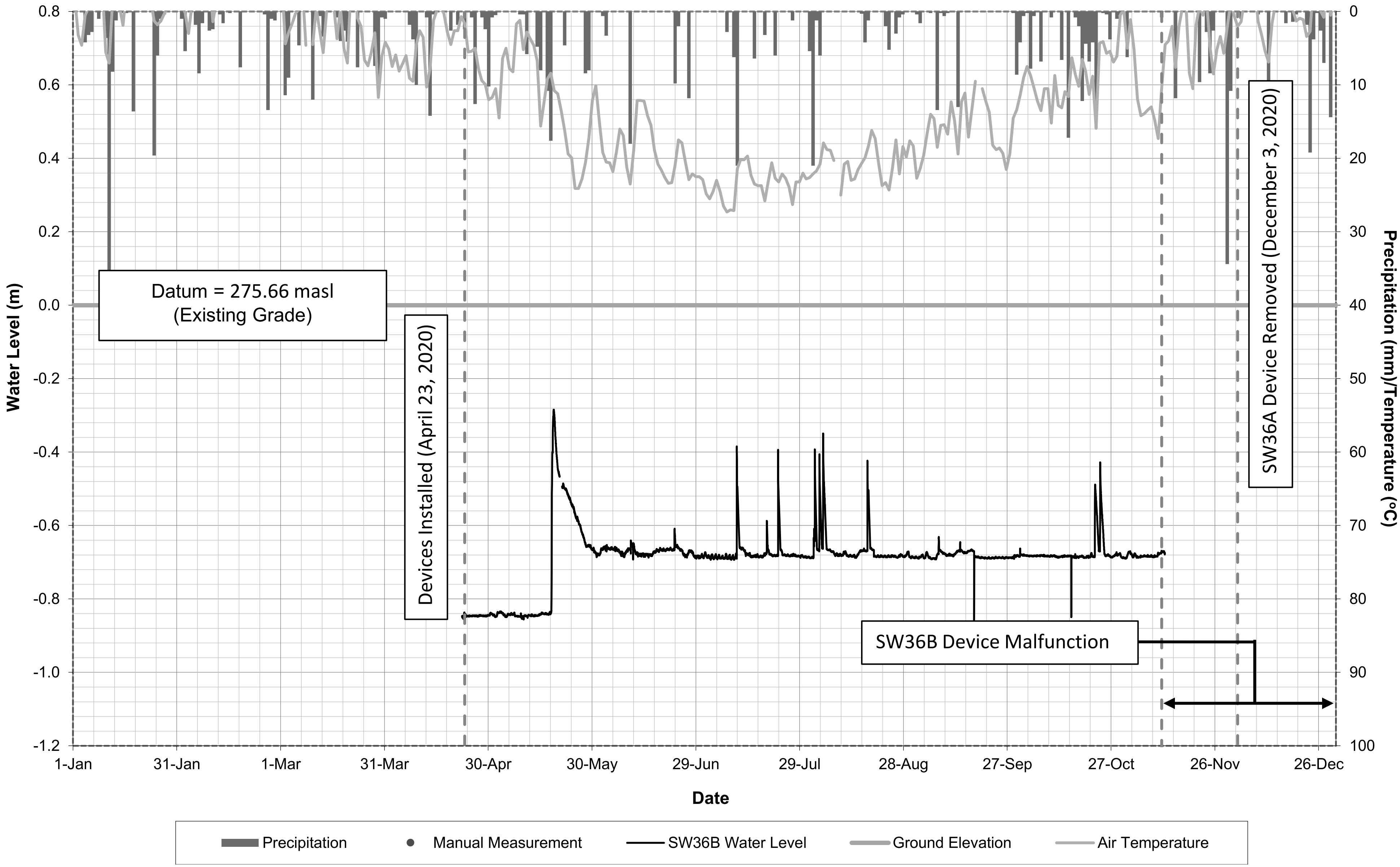
BURLINGTON QUARRY
MONITORING LOCATION SW35
STREAM TEMPERATURE MONITORING SUMMARY: 2019
Temperature (ºC)
30
25
20
15
10
5
0
-5
-10
-15
0
10
20
30
40
50
60
70
80
90
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Device Installed (March 13, 2019)
Device Removed (November 29, 2019)
Precipitation
Air Temperature
Water Temperature
Manual Measurement


BURLINGTON QUARRY
MONITORING LOCATION SW35
STREAMFLOW MONITORING SUMMARY: 2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Device Installed (March 13, 2019)
Device Removed (November 29, 2019)
Precipitation
Manual Measurement
Streamflow
Air Temperature

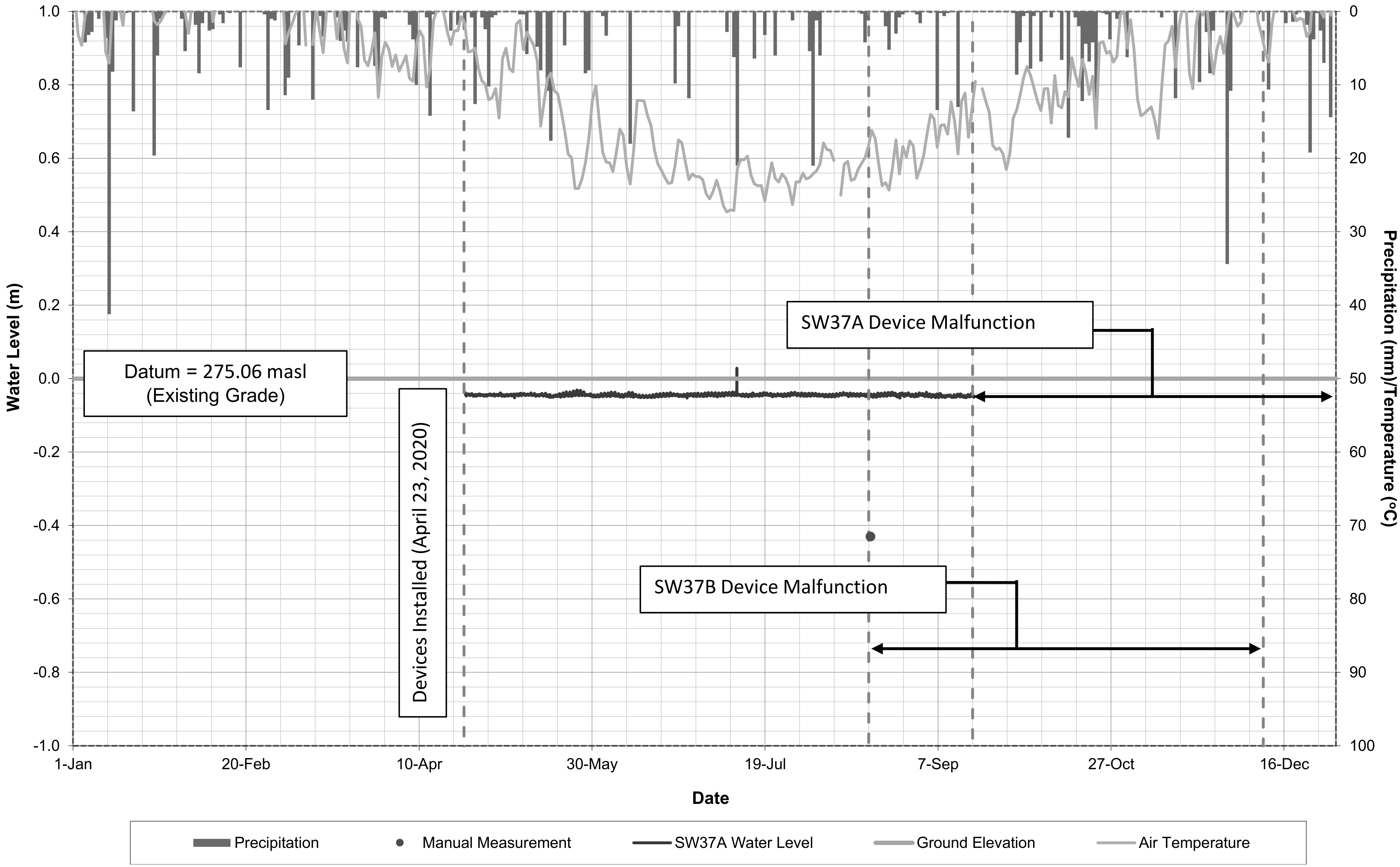


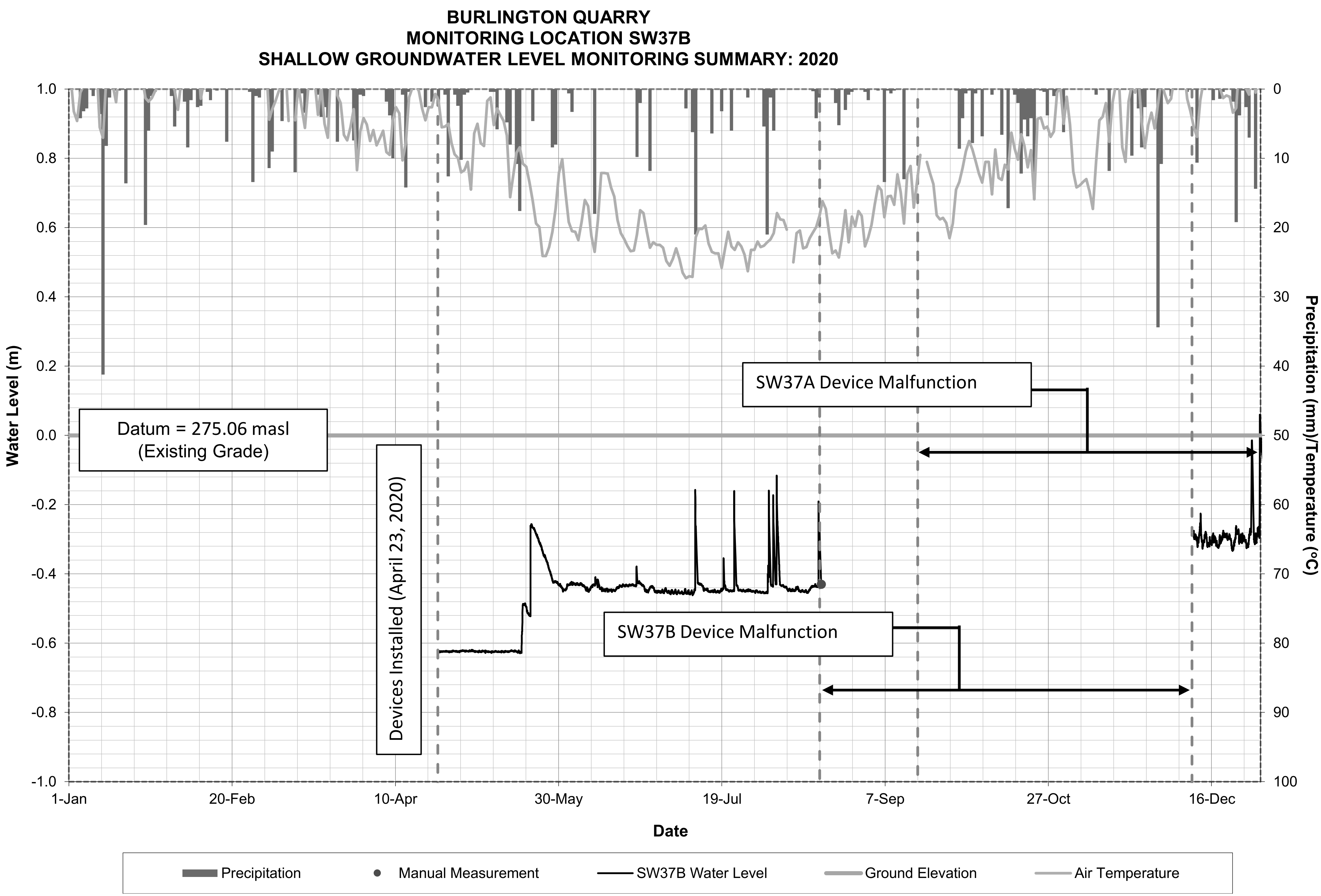
BURLINGTON QUARRY
MONITORING LOCATION SW36A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2020
Water Level (m)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
Precipitation (mm)/Temperature (°C)
0
10
20
30
40
50
60
70
80
90
100
Datum = 275.66 masl
(Existing Grade)
Devices Installed (April 23, 2020)
SW36A Device Removed (December 3, 2020)
SW36B Device Malfunction
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Date
Precipitation
Manual Measurement
SW36A Water Level
Ground Elevation
Air Temperature

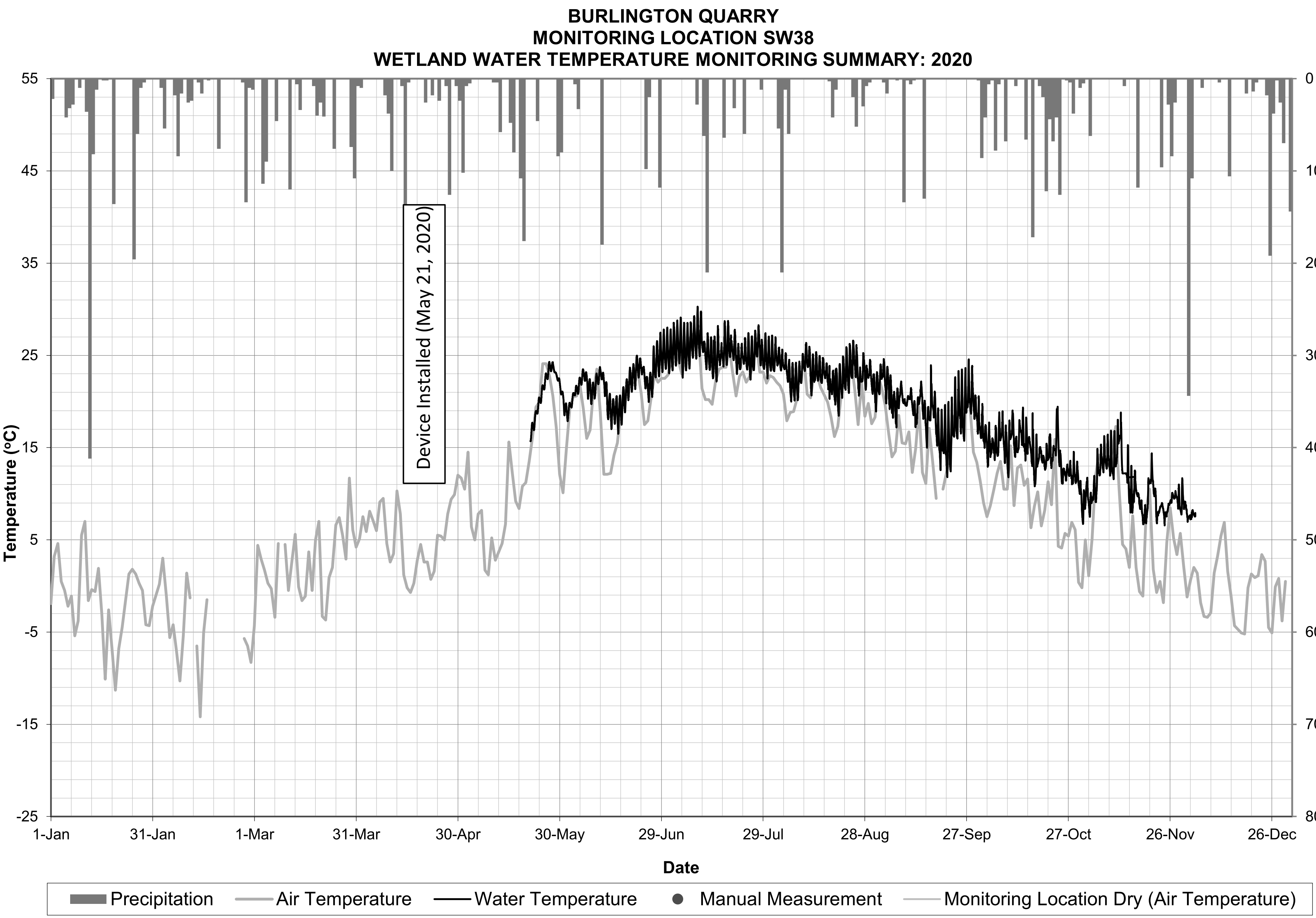
BURLINGTON QUARRY
MONITORING LOCATION SW36B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2020



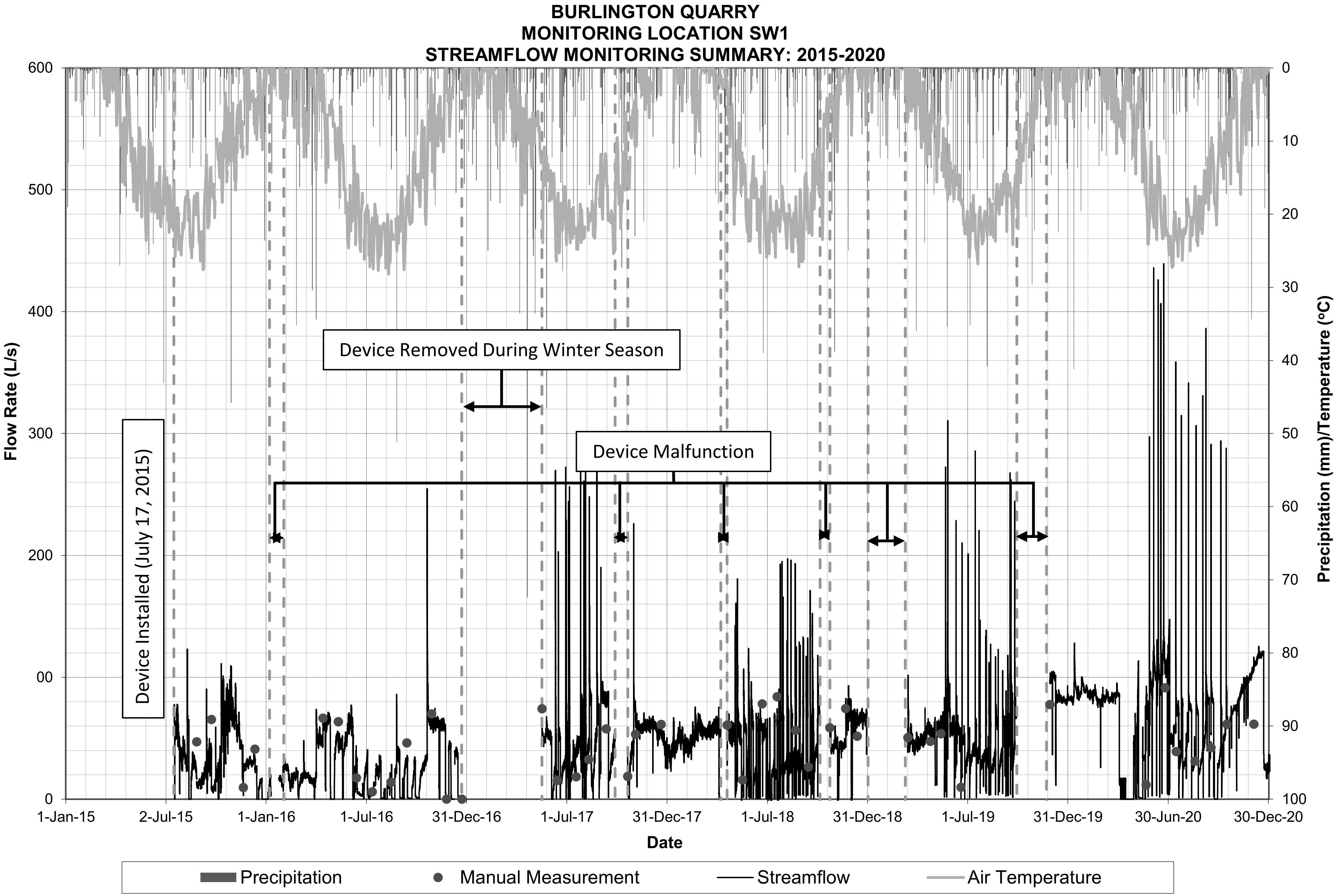
BURLINGTON QUARRY
MONITORING LOCATION SW37A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2020



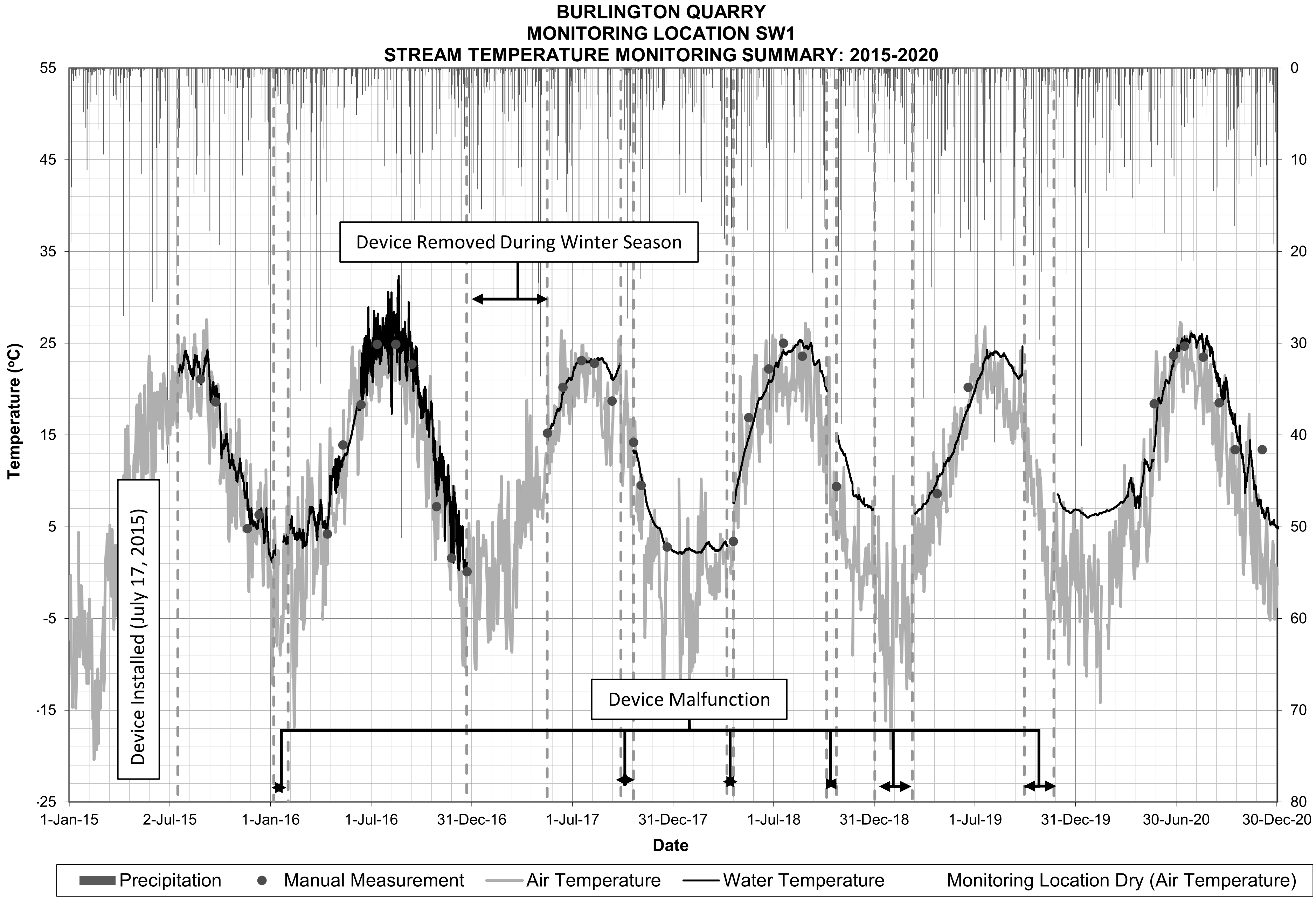

BURLINGTON QUARRY
MONITORING LOCATION SW37B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
20-Feb
10-Apr
30-May
19-Jul
7-Sep
27-Oct
16-Dec
Datum = 275.06 masl
(Existing Grade)
Devices Installed (April 23, 2020)
SW37A Device Malfunction
SW37B Device Malfunction
Precipitation
Manual Measurement
SW37B Water Level
Ground Elevation
Air Temperature



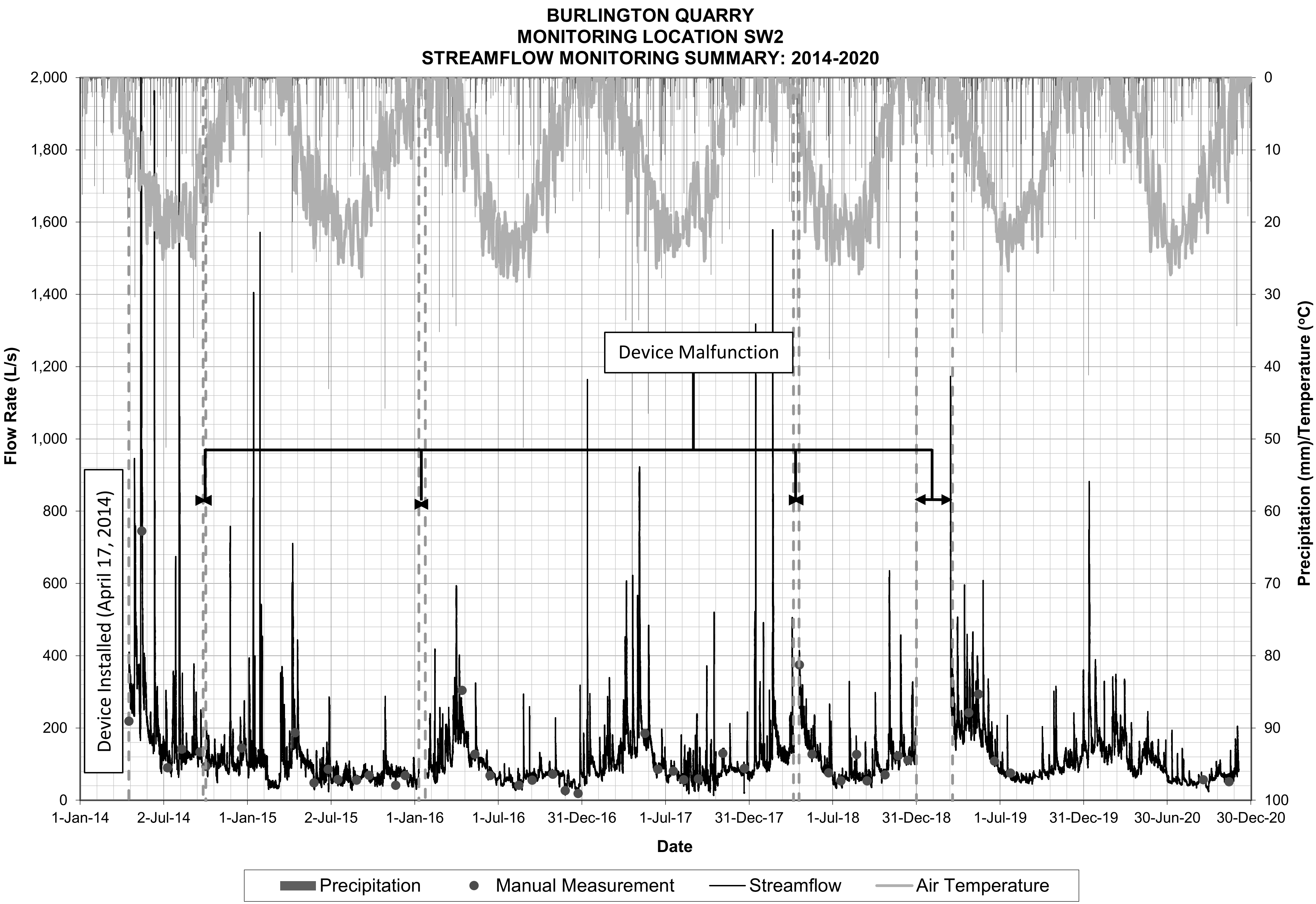
BURLINGTON QUARRY
MONITORING LOCATION SW38
WETLAND WATER TEMPERATURE MONITORING SUMMARY: 2020
Device Installed (May 21, 2020)
Temperature (ºC)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Air Temperature
Water Temperature
Manual Measurement
Monitoring Location Dry (Air Temperature)



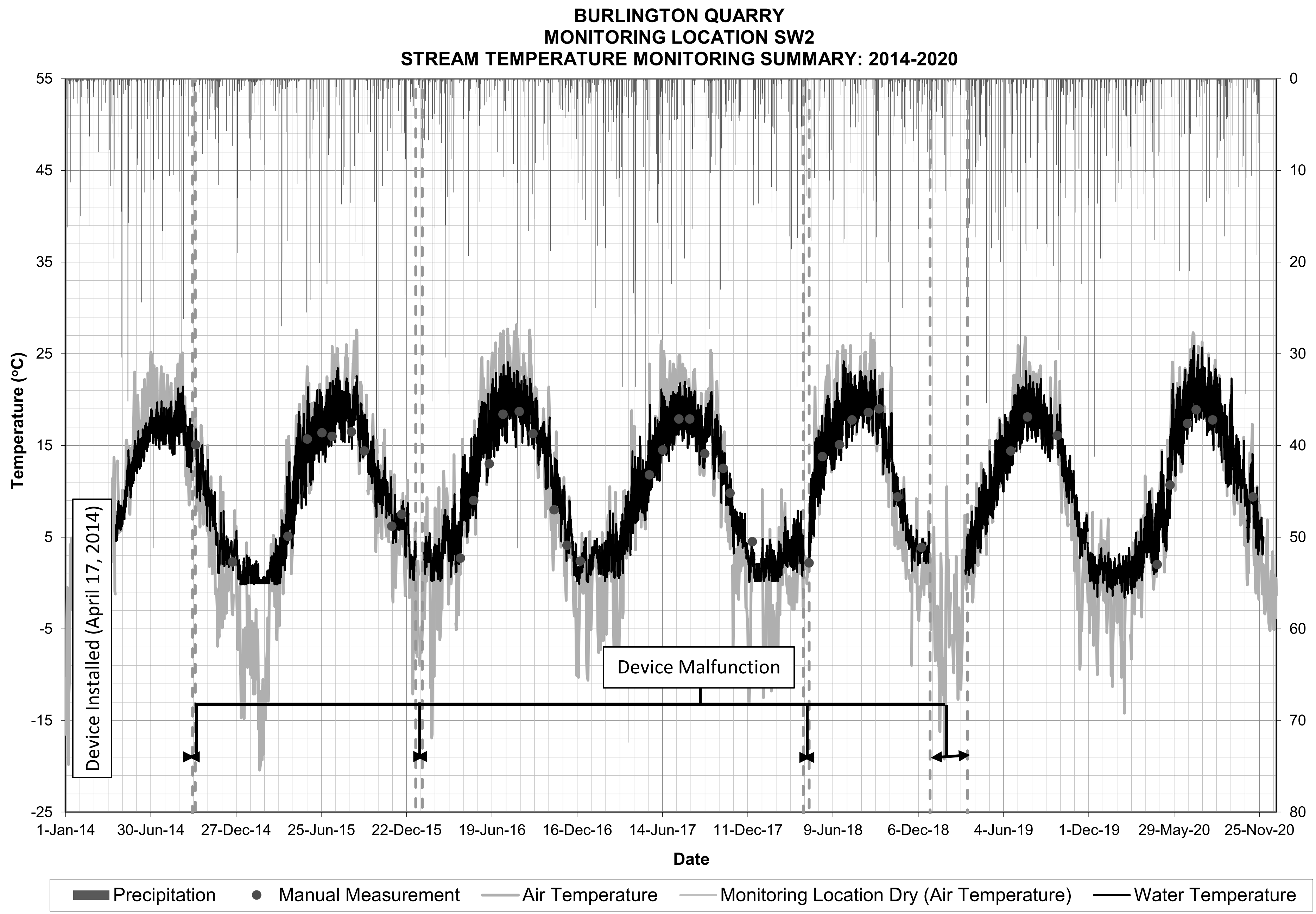
BURLINGTON QUARRY
MONITORING LOCATION SW1
STREAMFLOW MONITORING SUMMARY: 2015-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (ºC)
Date
Device Removed During Winter Season
Device Malfunction
Device Installed (July 17, 2015)
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature

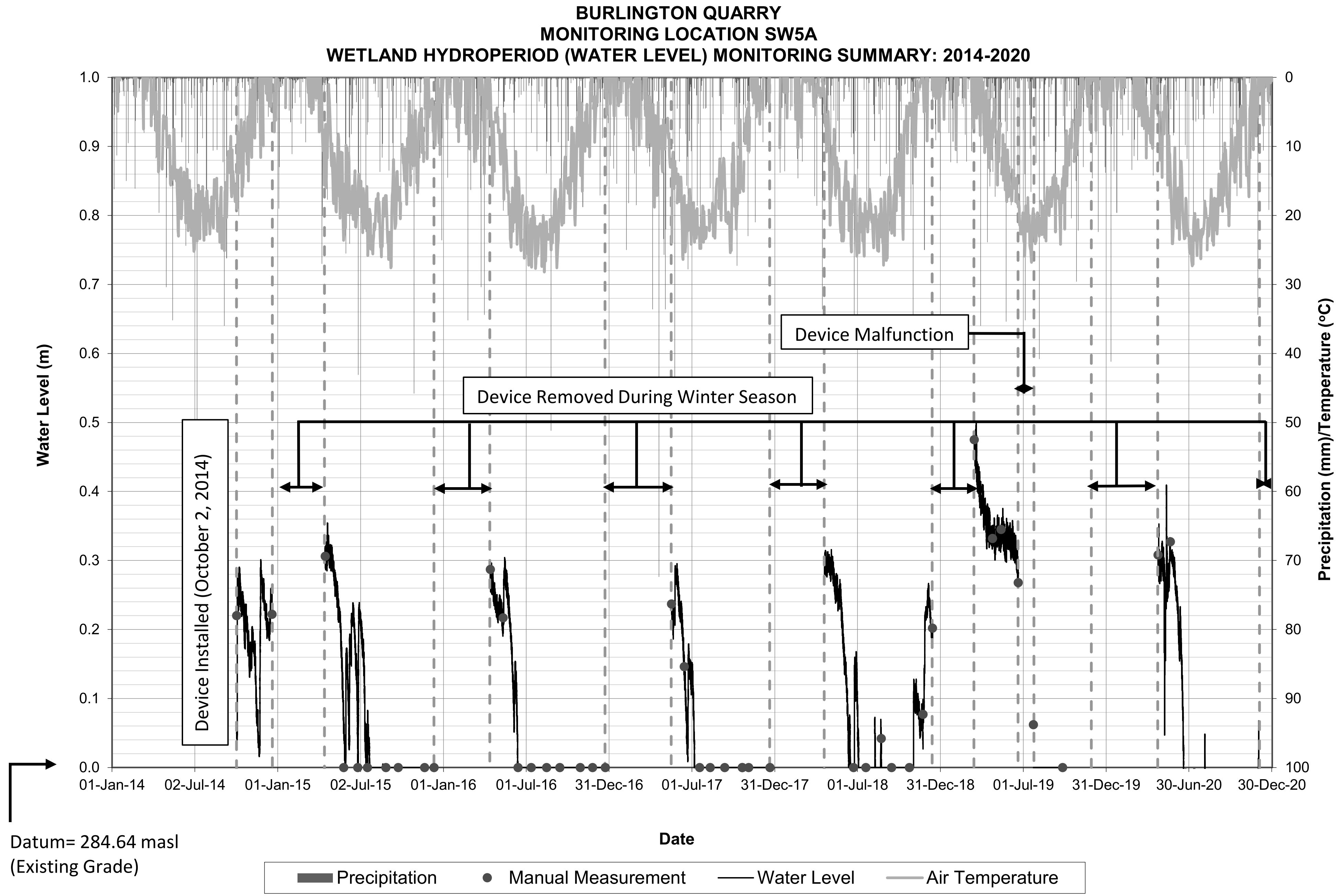


BURLINGTON QUARRY
MONITORING LOCATION SW1
STREAM TEMPERATURE MONITORING SUMMARY: 2015-2020
Device Removed During Winter Season
Device Installed (July 17, 2015)
Device Malfunction
Temperature (°C)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)

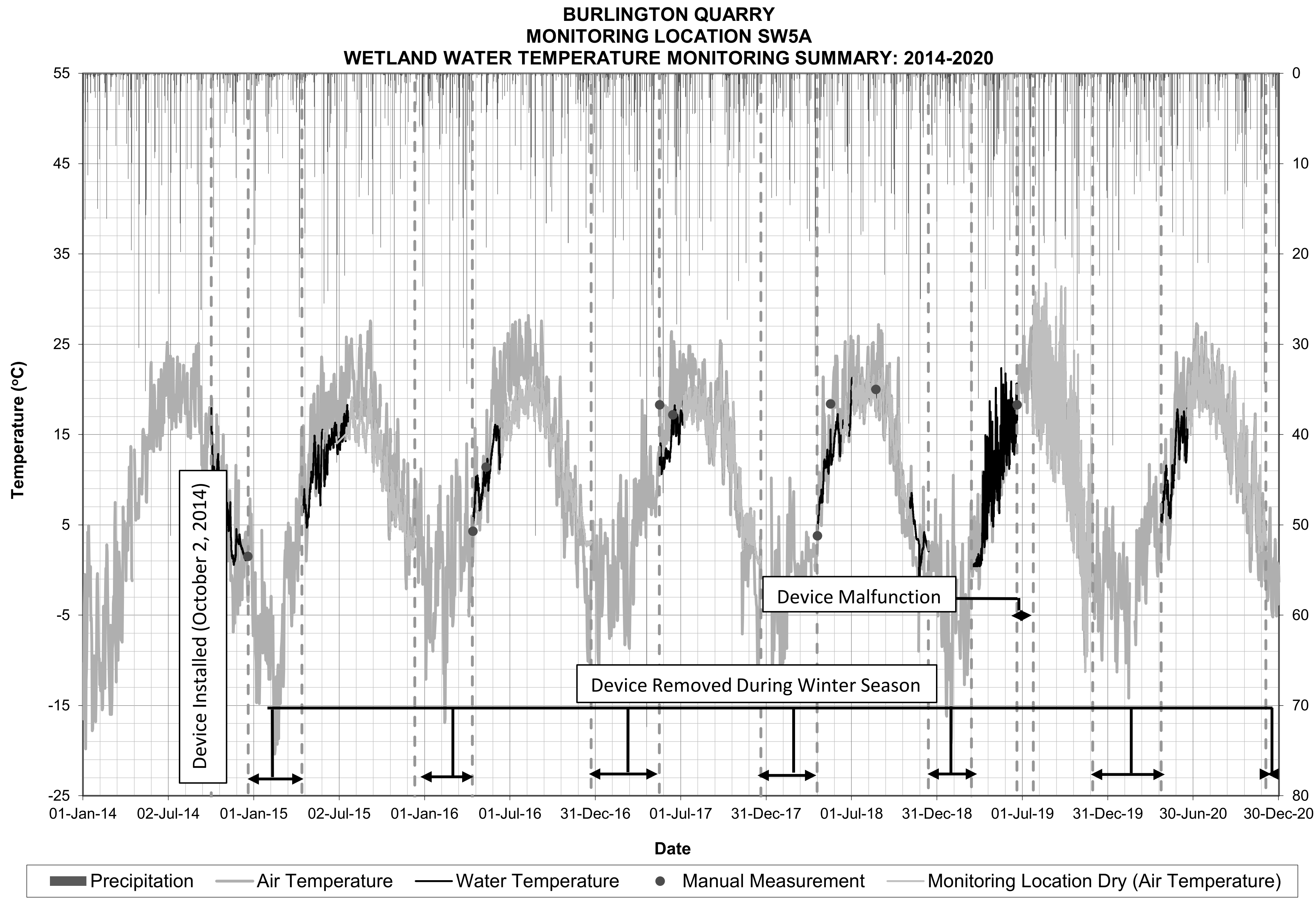


BURLINGTON QUARRY
MONITORING LOCATION SW2
STREAMFLOW MONITORING SUMMARY: 2014-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (April 17, 2014)
Device Malfunction
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan-14
2-Jul-14
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW2
STREAM TEMPERATURE MONITORING SUMMARY: 2014-2020
Temperature (°C)
Precipitation (mm)
Date
Device Installed (April 17, 2014)
Device Malfunction
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan-14
30-Jun-14
27-Dec-14
25-Jun-15
22-Dec-15
19-Jun-16
16-Dec-16
14-Jun-17
11-Dec-17
9-Jun-18
6-Dec-18
4-Jun-19
1-Dec-19
29-May-20
25-Nov-20
Precipitation
Manual Measurement
Air Temperature
Monitoring Location Dry (Air Temperature)
Water Temperature

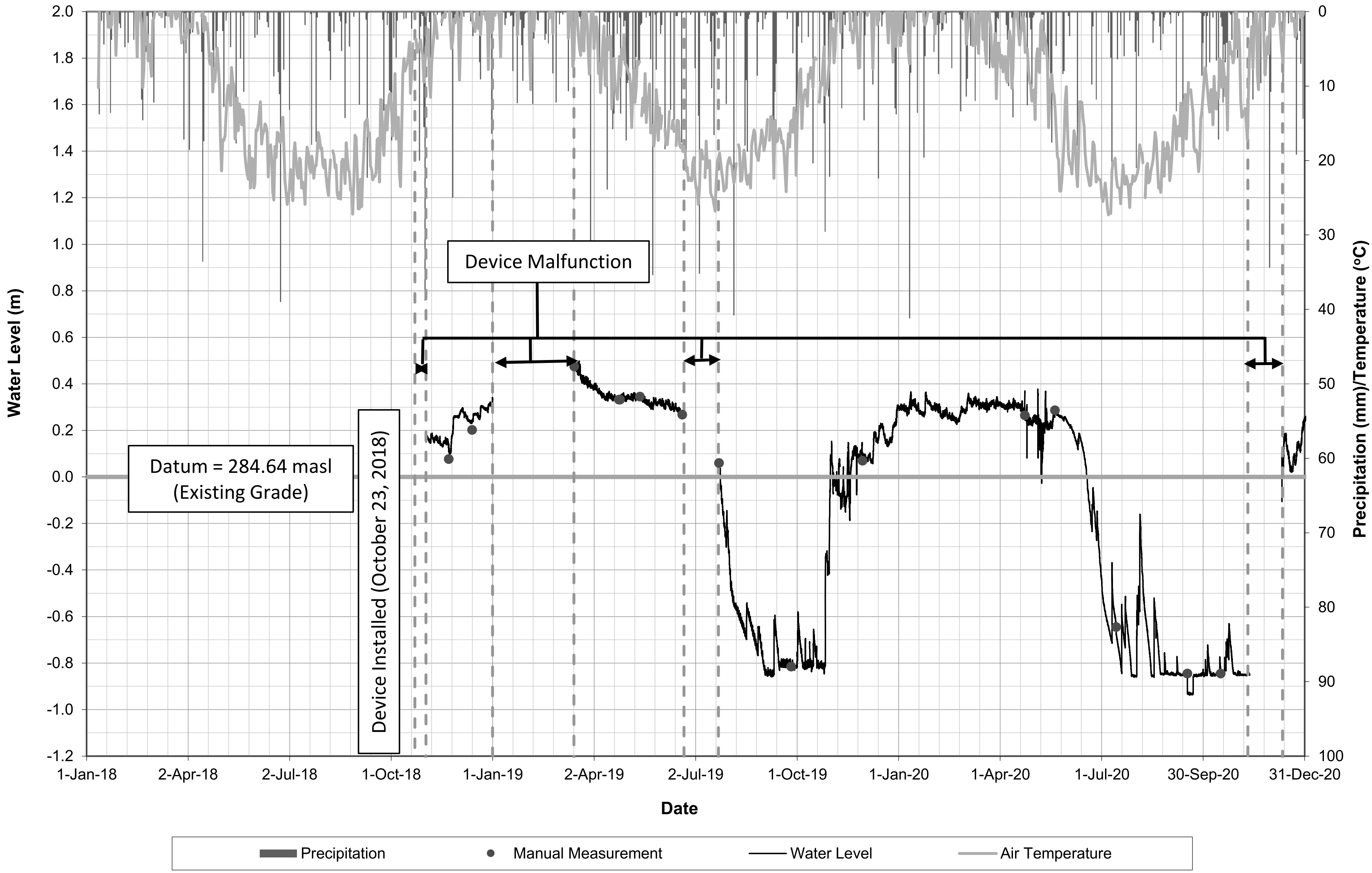


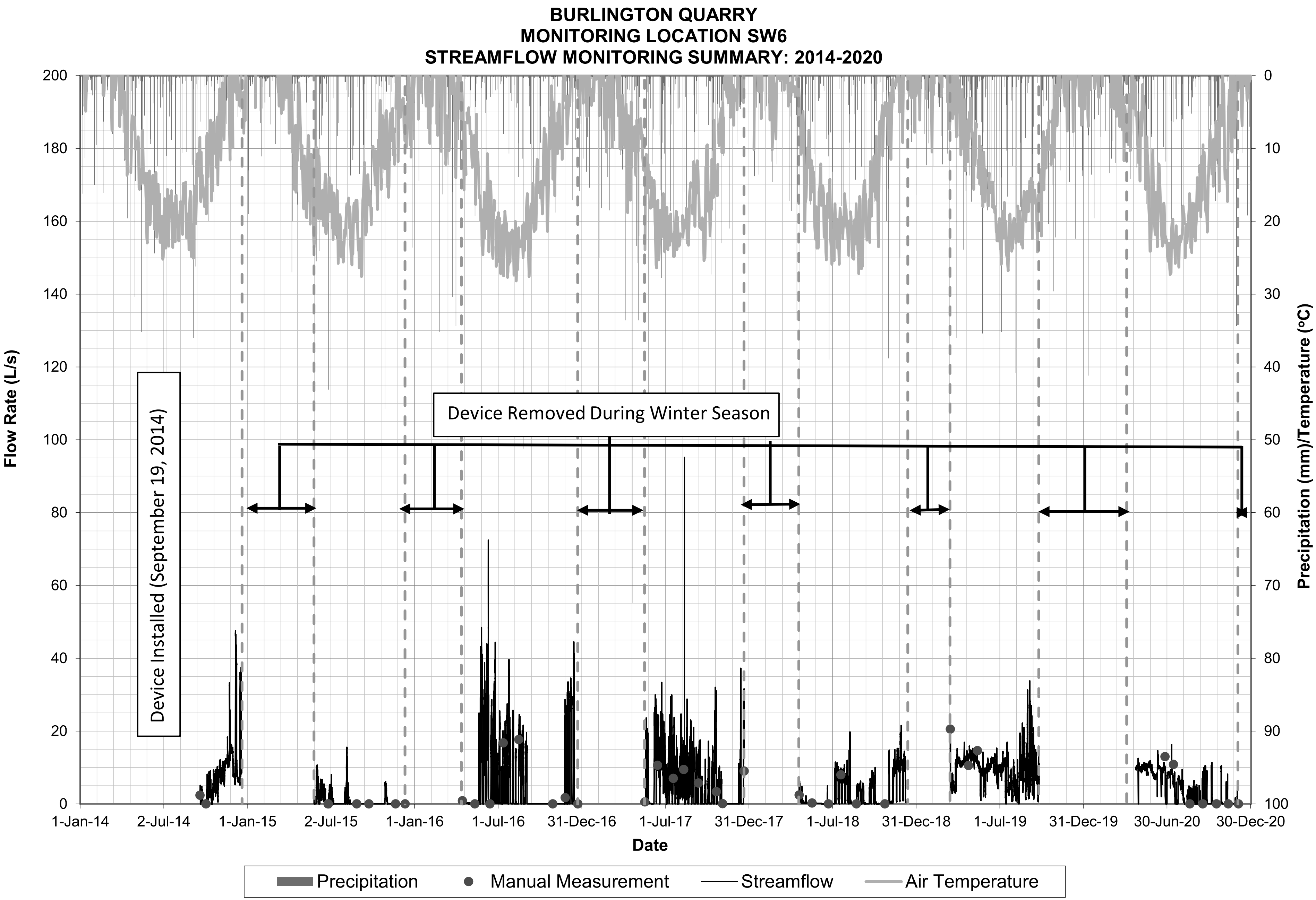
BURLINGTON QUARRY
MONITORING LOCATION SW5A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2014-2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
Device Malfunction
Device Removed During Winter Season
Device Installed (October 2, 2014)
Datum= 284.64 masl
(Existing Grade)
Precipitation
Manual Measurement
Water Level
Air Temperature
01-Jan-14
02-Jul-14
01-Jan-15
02-Jul-15
01-Jan-16
01-Jul-16
31-Dec-16
01-Jul-17
31-Dec-17
01-Jul-18
31-Dec-18
01-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20



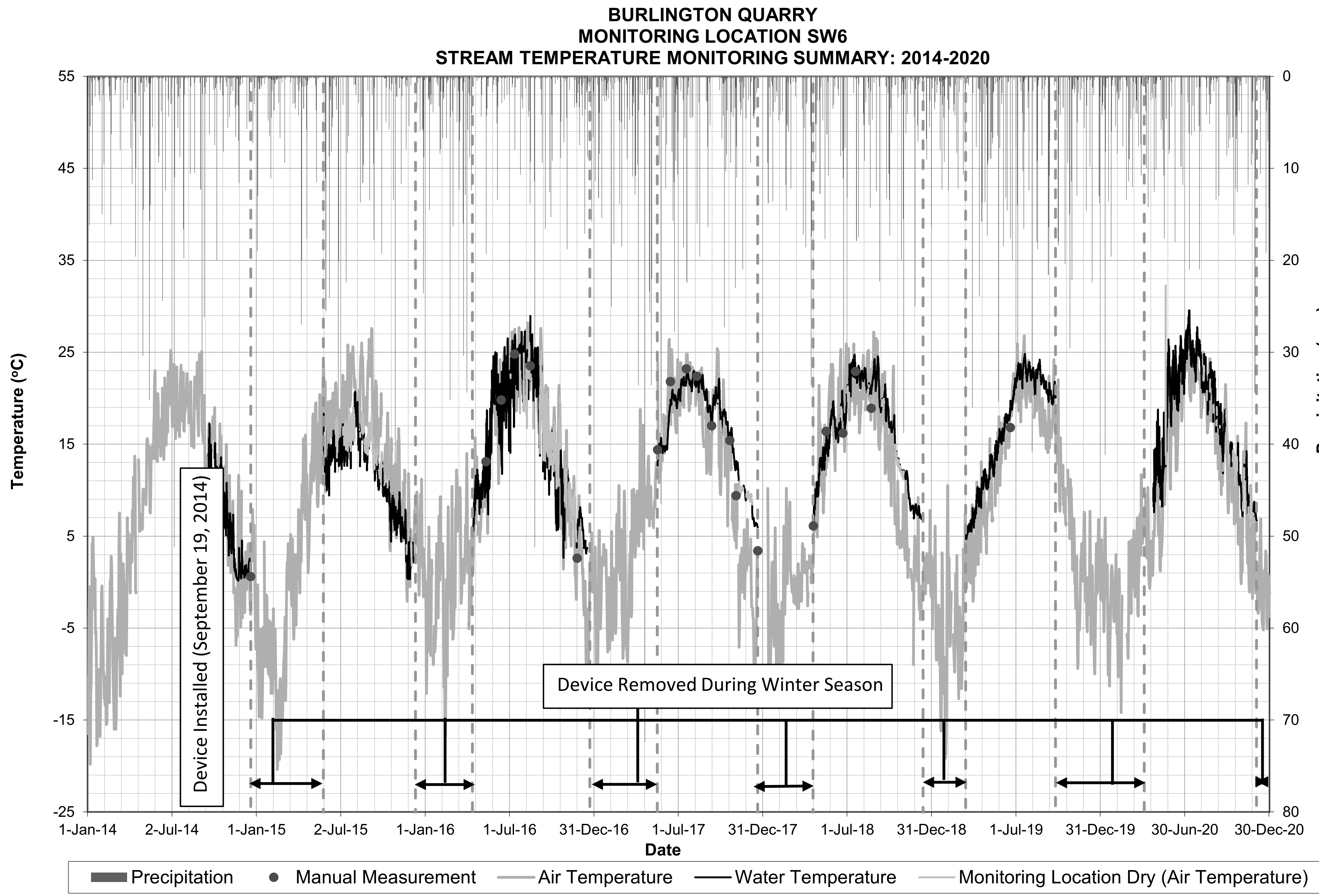
* Grey data indicates the monitoring location was dry and therefore the recorded values are representative of the air temperature.

BURLINGTON QUARRY
MONITORING LOCATION SW5B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2018-2020

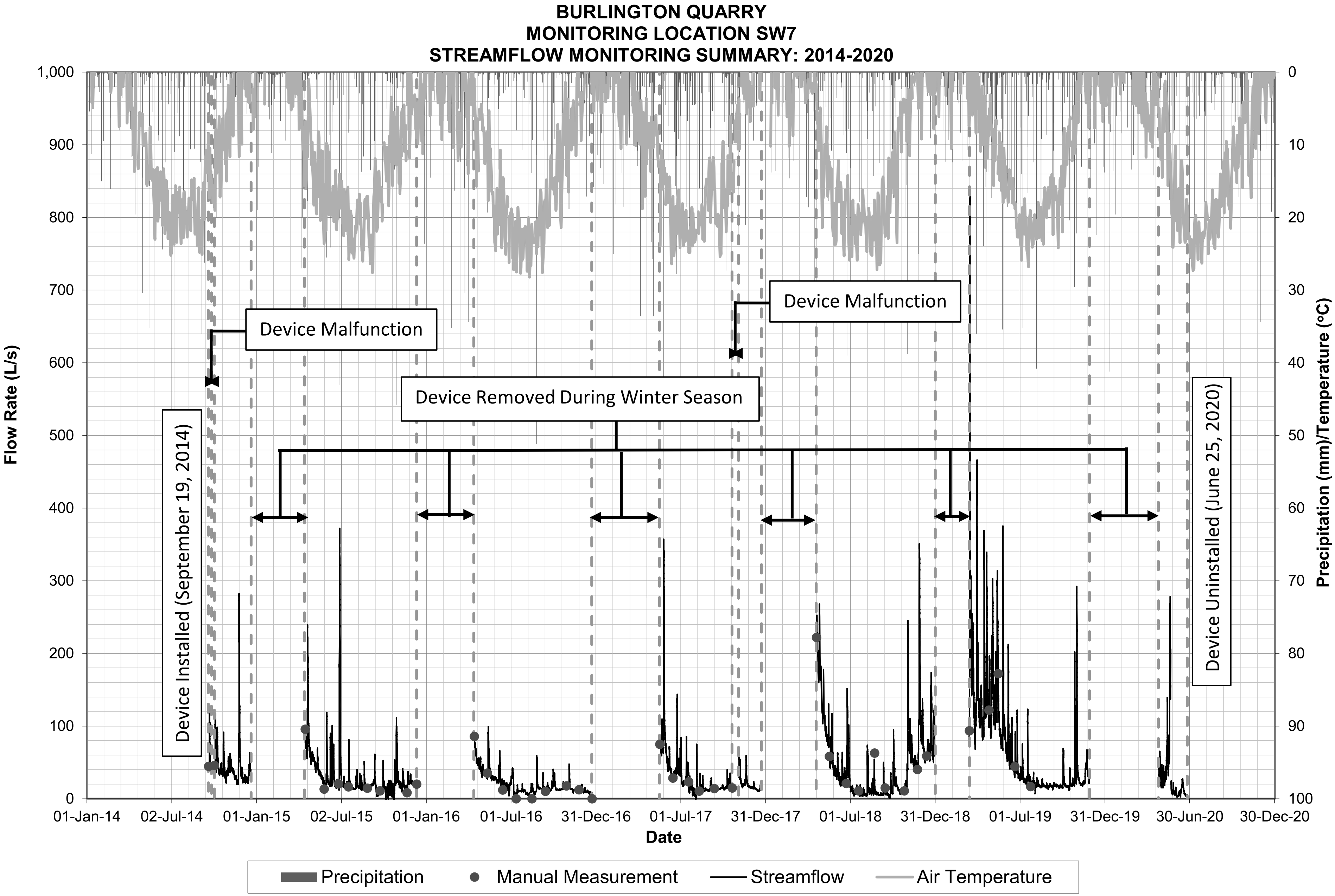




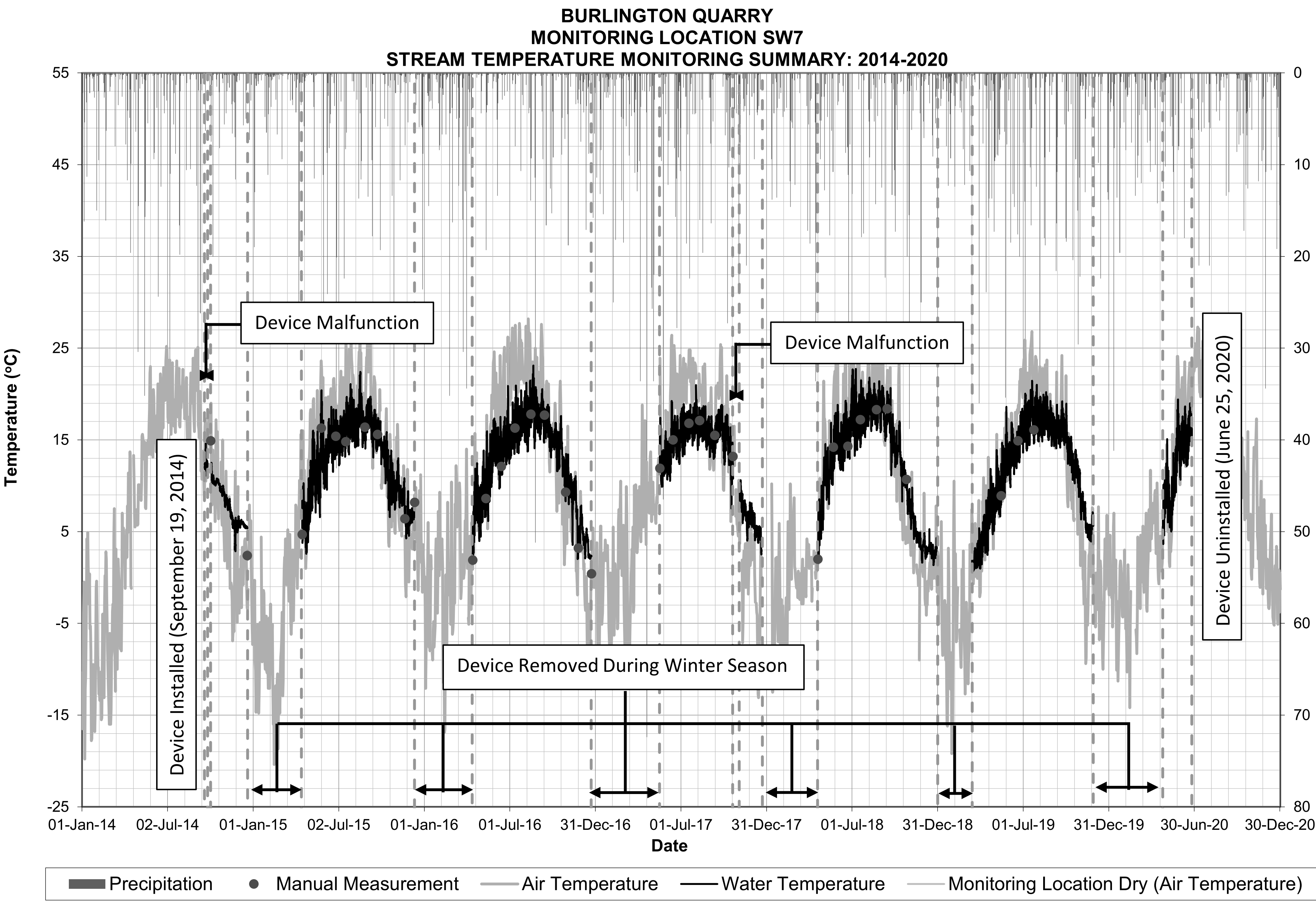
BURLINGTON QUARRY
MONITORING LOCATION SW6
STREAMFLOW MONITORING SUMMARY: 2014-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (September 19, 2014)
Device Removed During Winter Season
0
20
40
60
80
100
120
140
160
180
200
10
30
50
70
90
1-Jan-14
2-Jul-14
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature



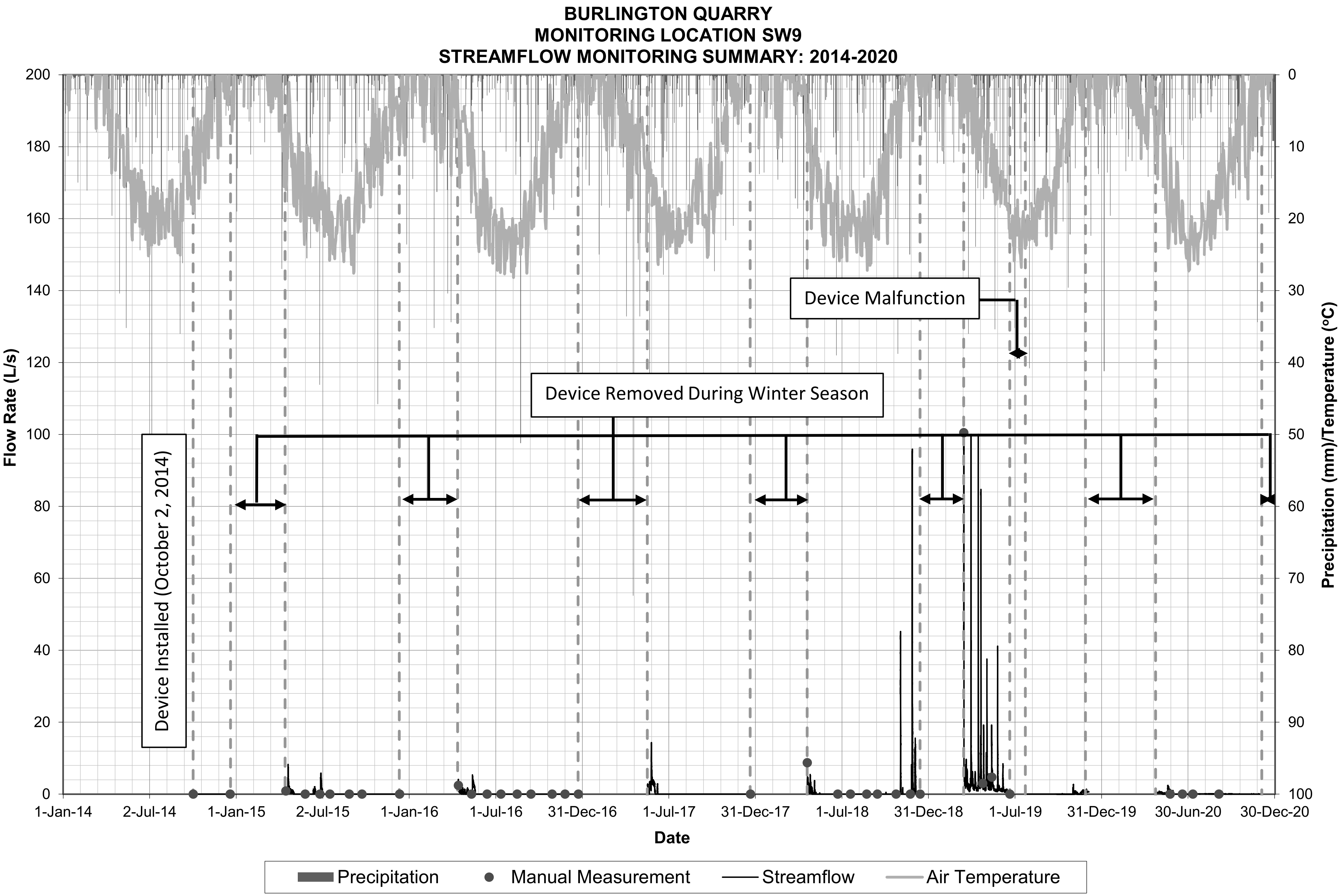
* Grey data indicates the monitoring location was dry and therefore the recorded values are respresentative of the air temperature.



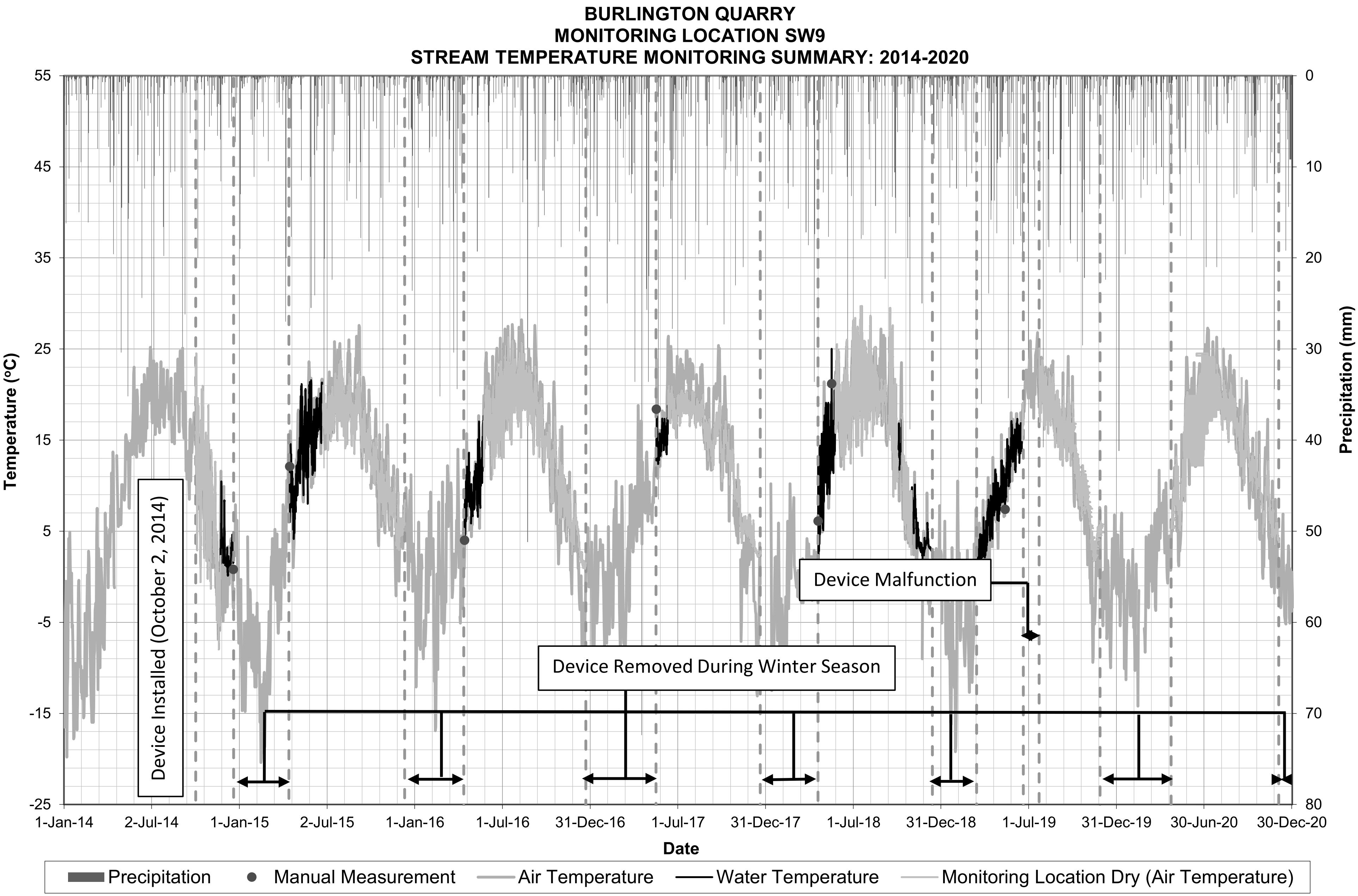
BURLINGTON QUARRY
MONITORING LOCATION SW7
STREAMFLOW MONITORING SUMMARY: 2014-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Malfunction
Device Malfunction
Device Removed During Winter Season
Device Installed (September 19, 2014)
Device Uninstalled (June 25, 2020)
01-Jan-14
02-Jul-14
01-Jan-15
02-Jul-15
01-Jan-16
01-Jul-16
31-Dec-16
01-Jul-17
31-Dec-17
01-Jul-18
31-Dec-18
01-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature



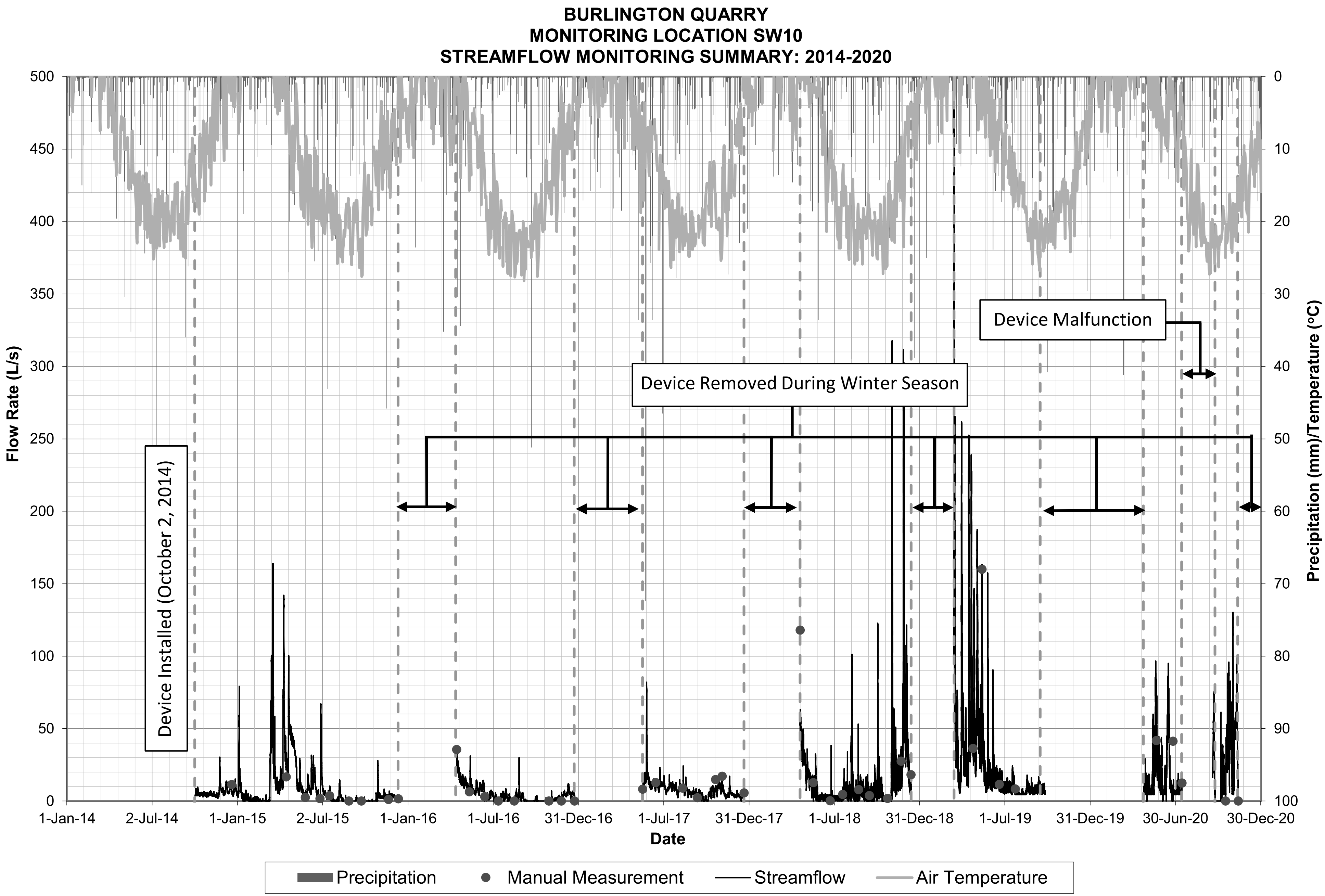
BURLINGTON QUARRY
MONITORING LOCATION SW7
STREAM TEMPERATURE MONITORING SUMMARY: 2014-2020
Temperature (ºC)
Precipitation (mm)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
Device Malfunction
Device Malfunction
Device Installed (September 19, 2014)
Device Uninstalled (June 25, 2020)
Device Removed During Winter Season
01-Jan-14
02-Jul-14
01-Jan-15
02-Jul-15
01-Jan-16
01-Jul-16
31-Dec-16
01-Jul-17
31-Dec-17
01-Jul-18
31-Dec-18
01-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Date
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)



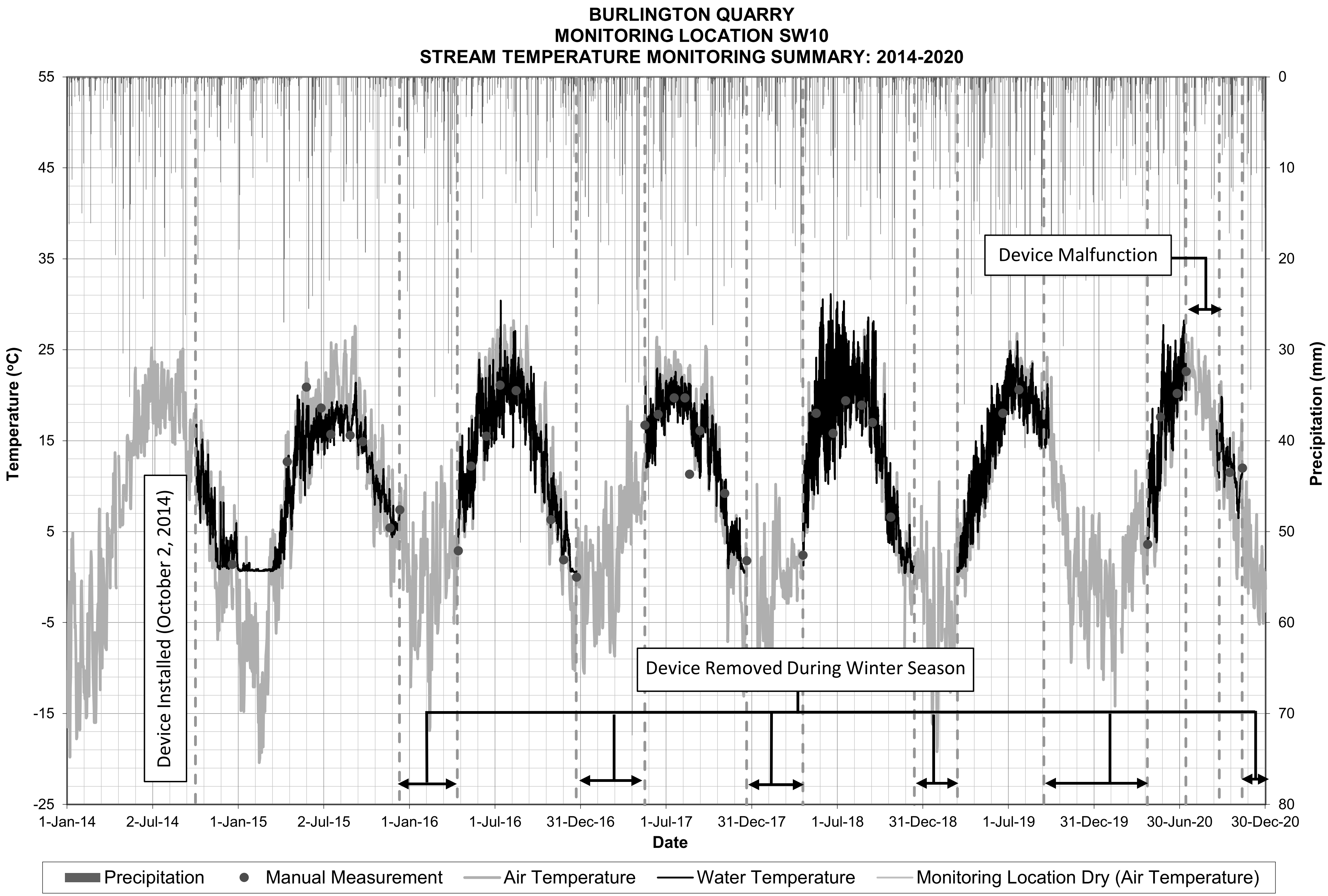
BURLINGTON QUARRY
MONITORING LOCATION SW9
STREAMFLOW MONITORING SUMMARY: 2014-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (ºC)
Date
200
180
160
140
120
100
80
60
40
20
0
10
30
50
70
90
1-Jan-14
2-Jul-14
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Device Malfunction
Device Removed During Winter Season
Device Installed (October 2, 2014)
Precipitation
Manual Measurement
Streamflow
Air Temperature



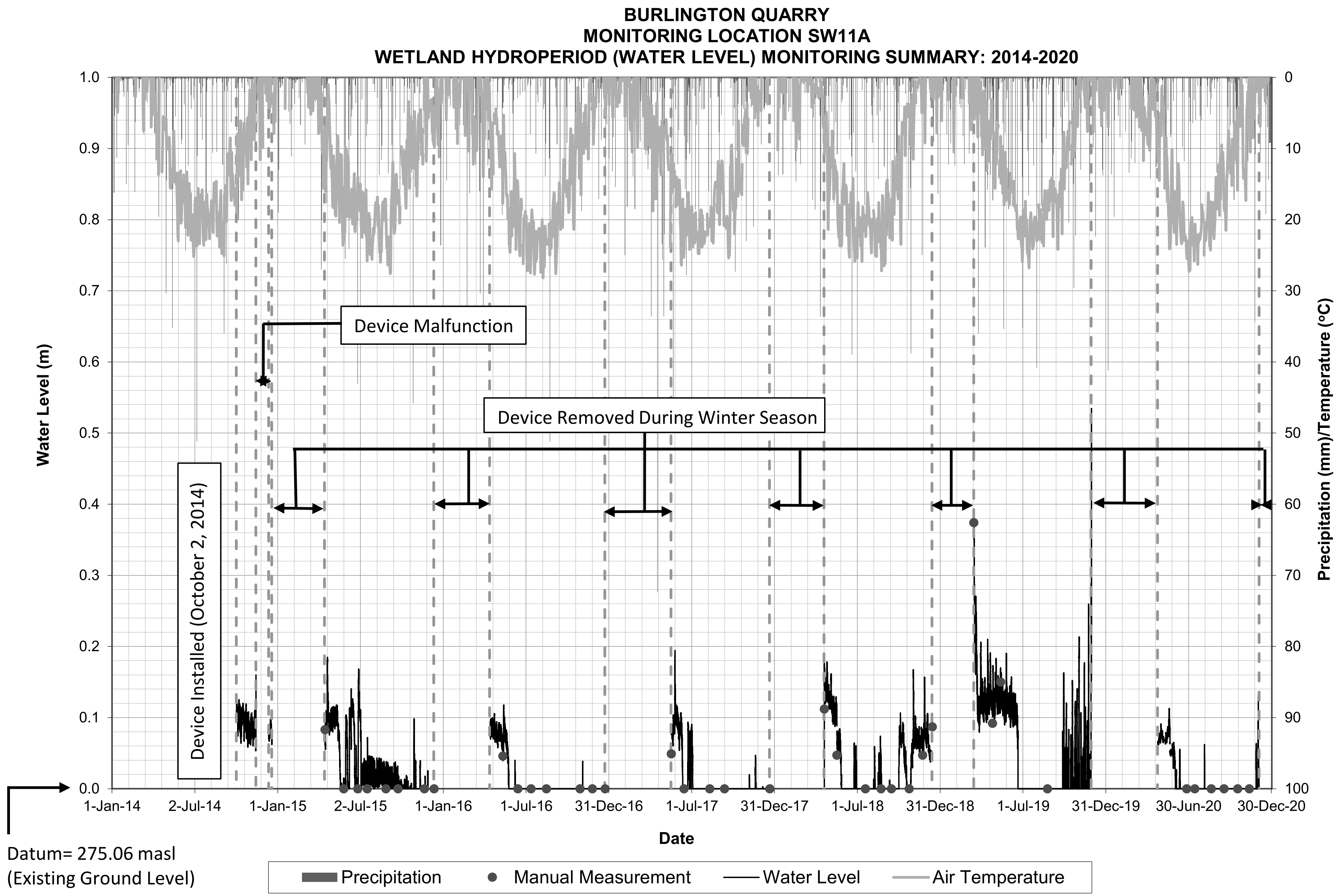
* Grey data indicates the monitoring location was dry and therefore the recorded values are representative of the air temperature.



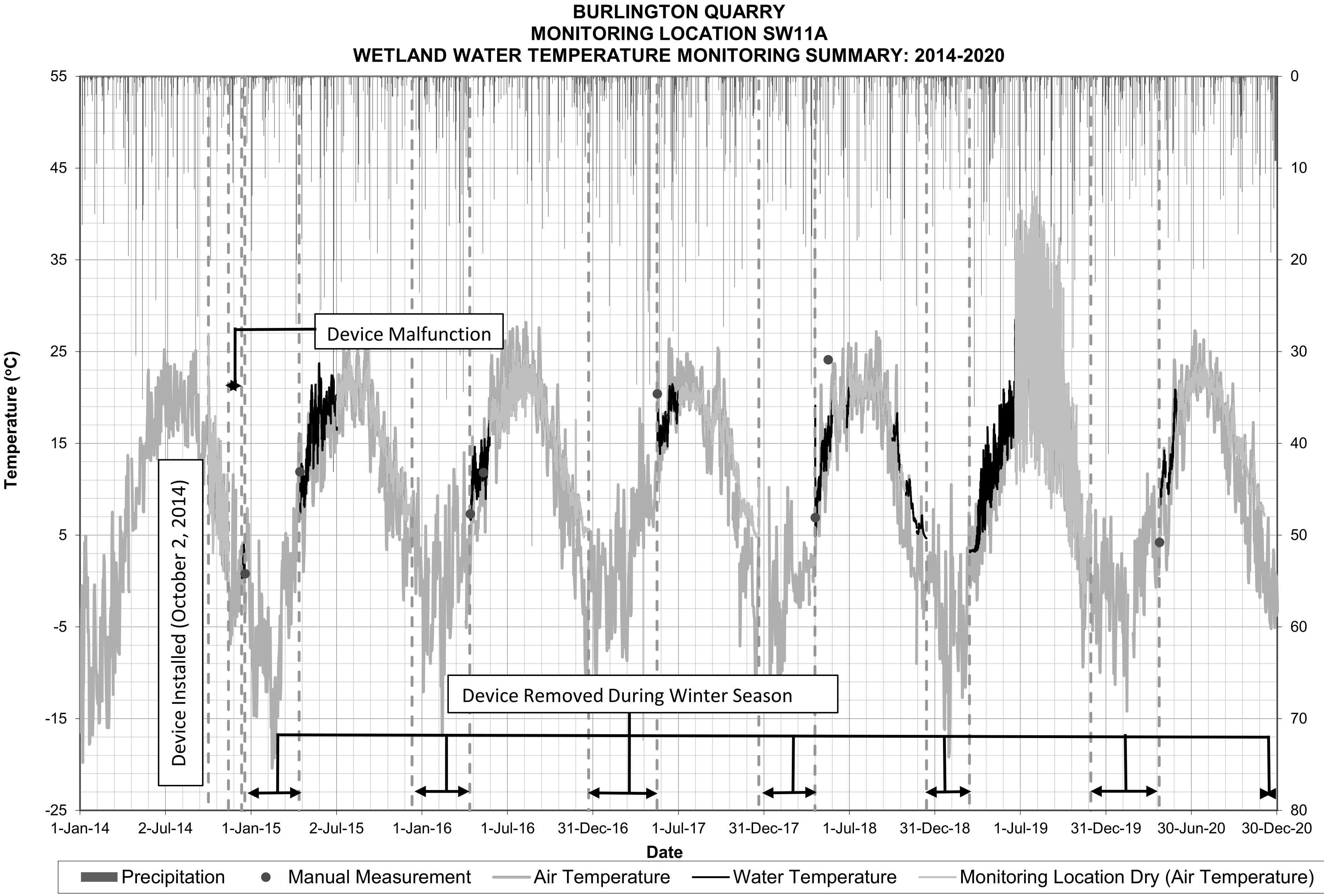
BURLINGTON QUARRY
MONITORING LOCATION SW10
STREAMFLOW MONITORING SUMMARY: 2014-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (ºC)
Date
Device Installed (October 2, 2014)
Device Removed During Winter Season
Device Malfunction
1-Jan-14
2-Jul-14
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature



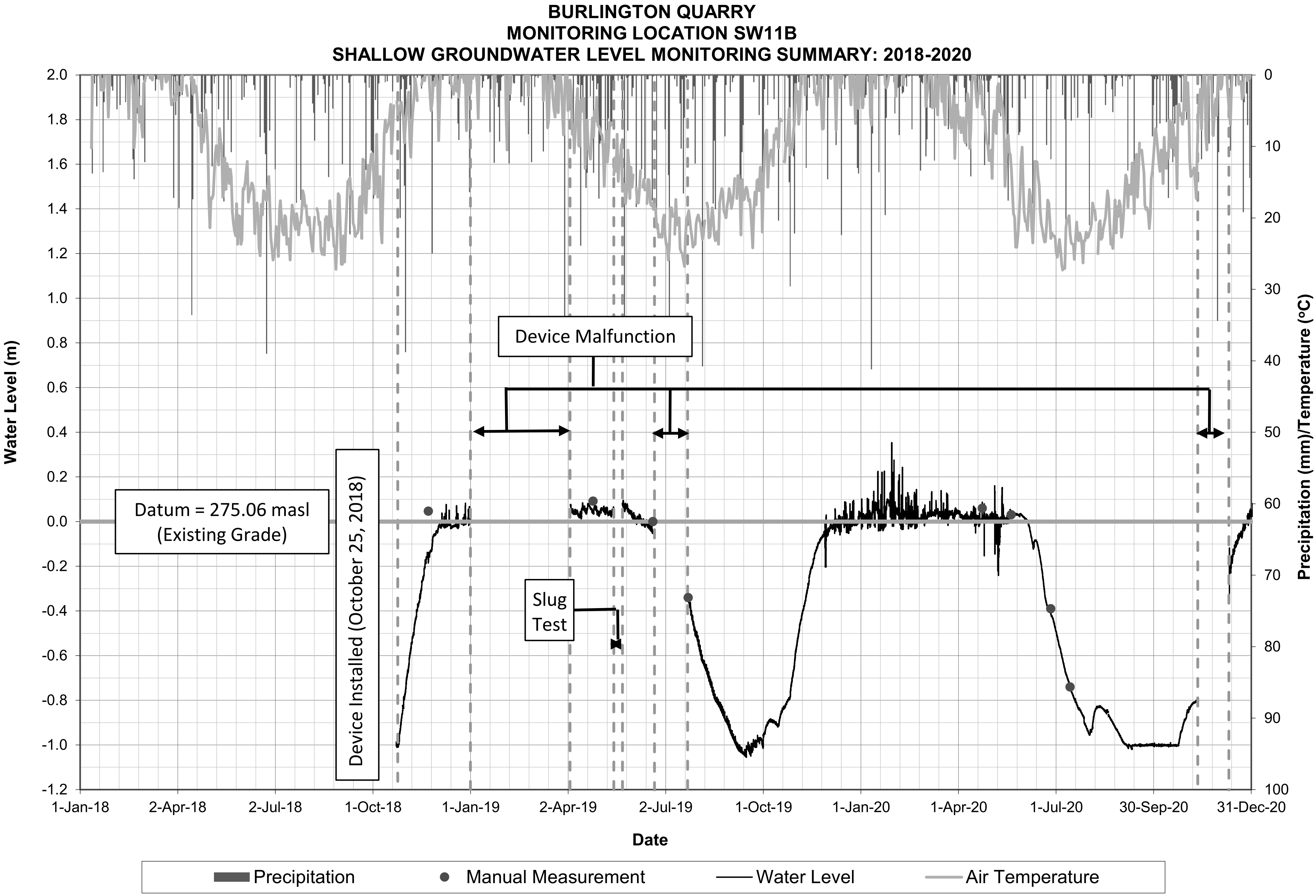
BURLINGTON QUARRY
MONITORING LOCATION SW10
STREAM TEMPERATURE MONITORING SUMMARY: 2014-2020
Temperature (°C)
Precipitation (mm)
Date
Device Installed (October 2, 2014)
Device Malfunction
Device Removed During Winter Season
1-Jan-14
2-Jul-14
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)



BURLINGTON QUARRY
MONITORING LOCATION SW11A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2014-2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
1-Jan-14
2-Jul-14
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Device Malfunction
Device Removed During Winter Season
Device Installed (October 2, 2014)
Datum= 275.06 masl
(Existing Ground Level)
Precipitation
Manual Measurement
Water Level
Air Temperature

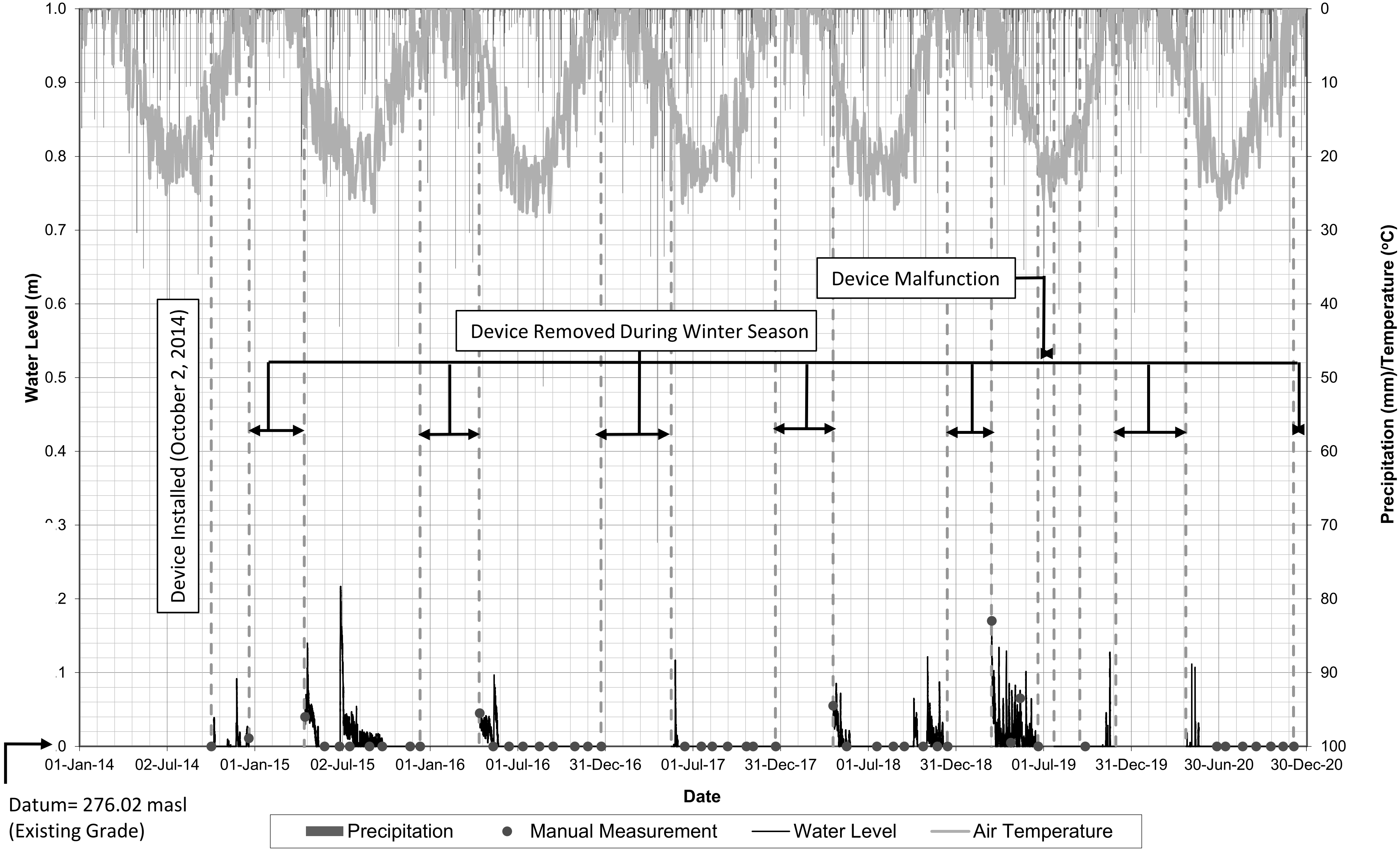


* Grey data indicates the monitoring location was dry and therefore the recorded values are respresentative of the air temperature.

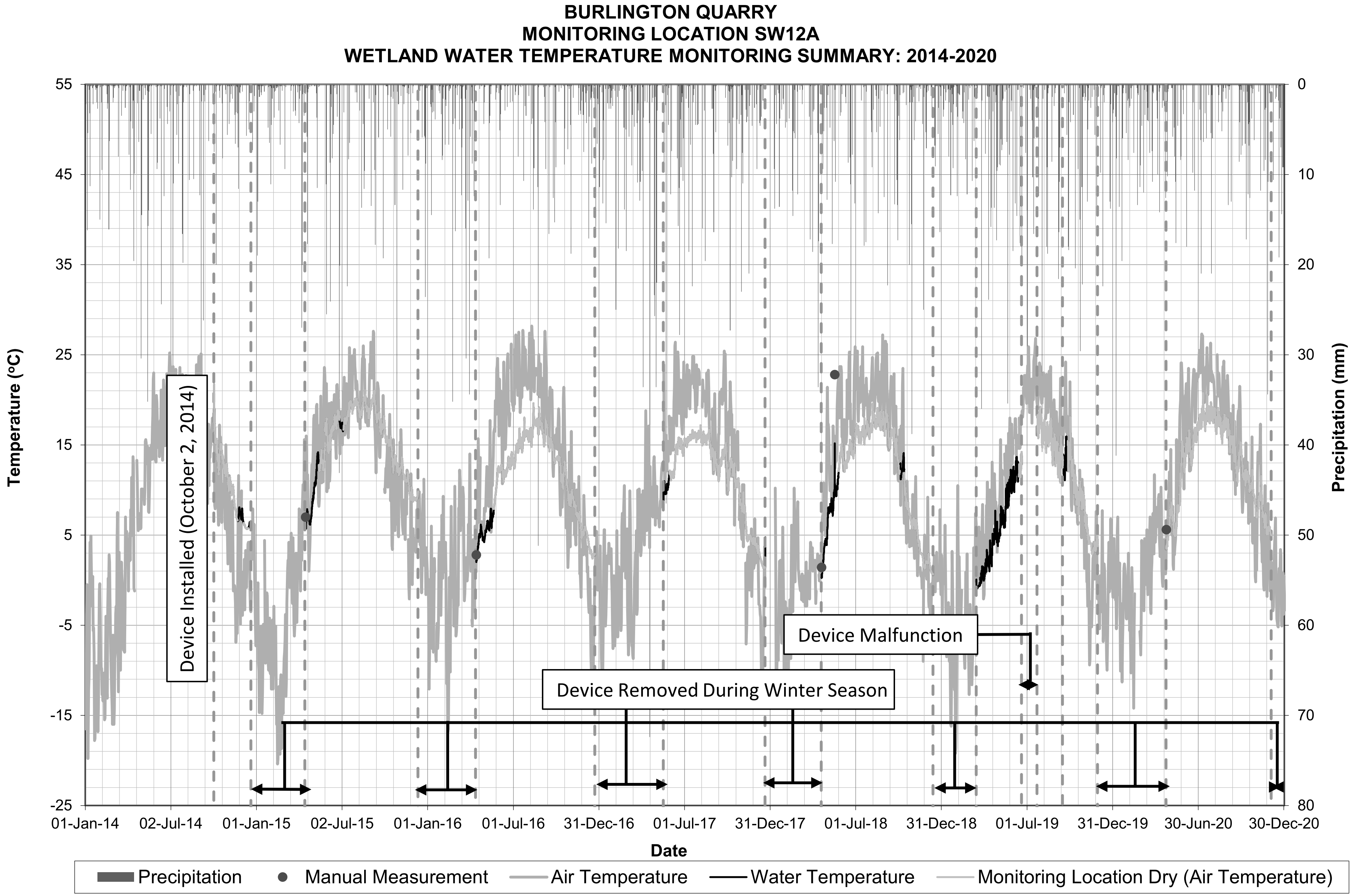


BURLINGTON QUARRY
MONITORING LOCATION SW11B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2018-2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
Device Malfunction
Datum = 275.06 masl (Existing Grade)
Device Installed (October 25, 2018)
Slug Test
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0
10
20
30
40
50
60
70
80
90
100
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Water Level
Air Temperature

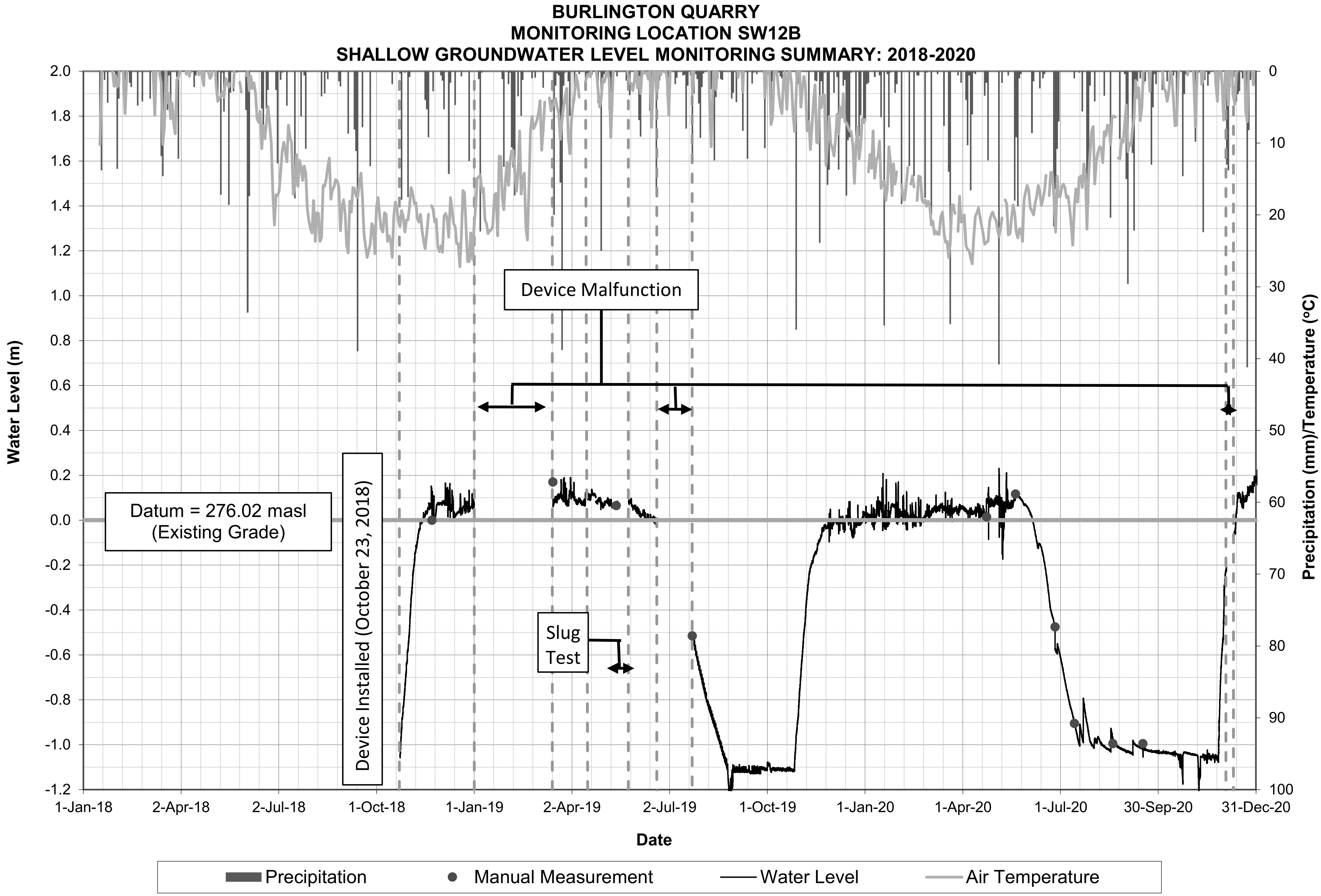
BURLINGTON QUARRY
MONITORING LOCATION SW12A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2014-2020



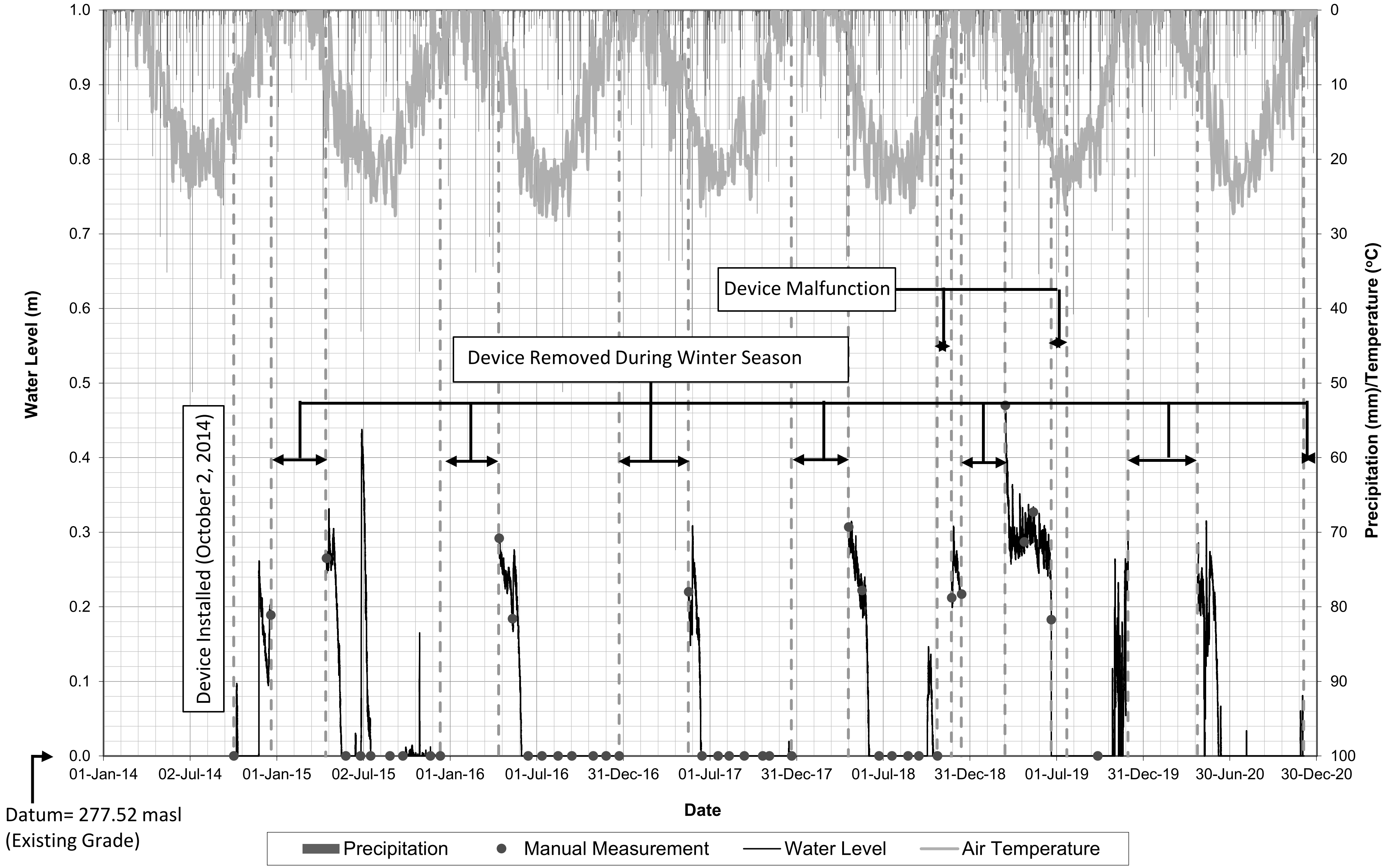
Datum= 276.02 masl
(Existing Grade)

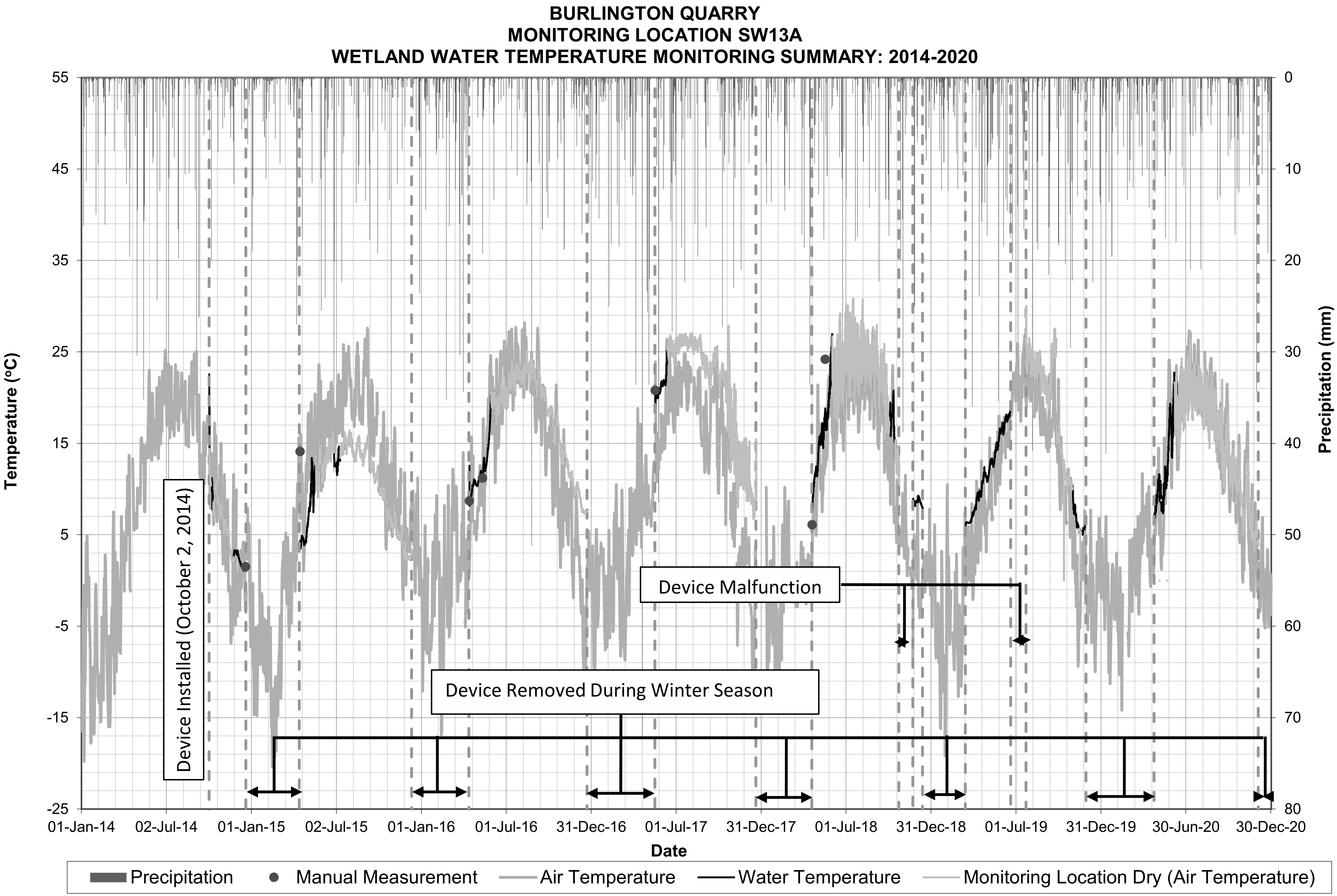


* Grey data indicates the monitoring location was dry and therefore the recorded values are representative of the air temperature.

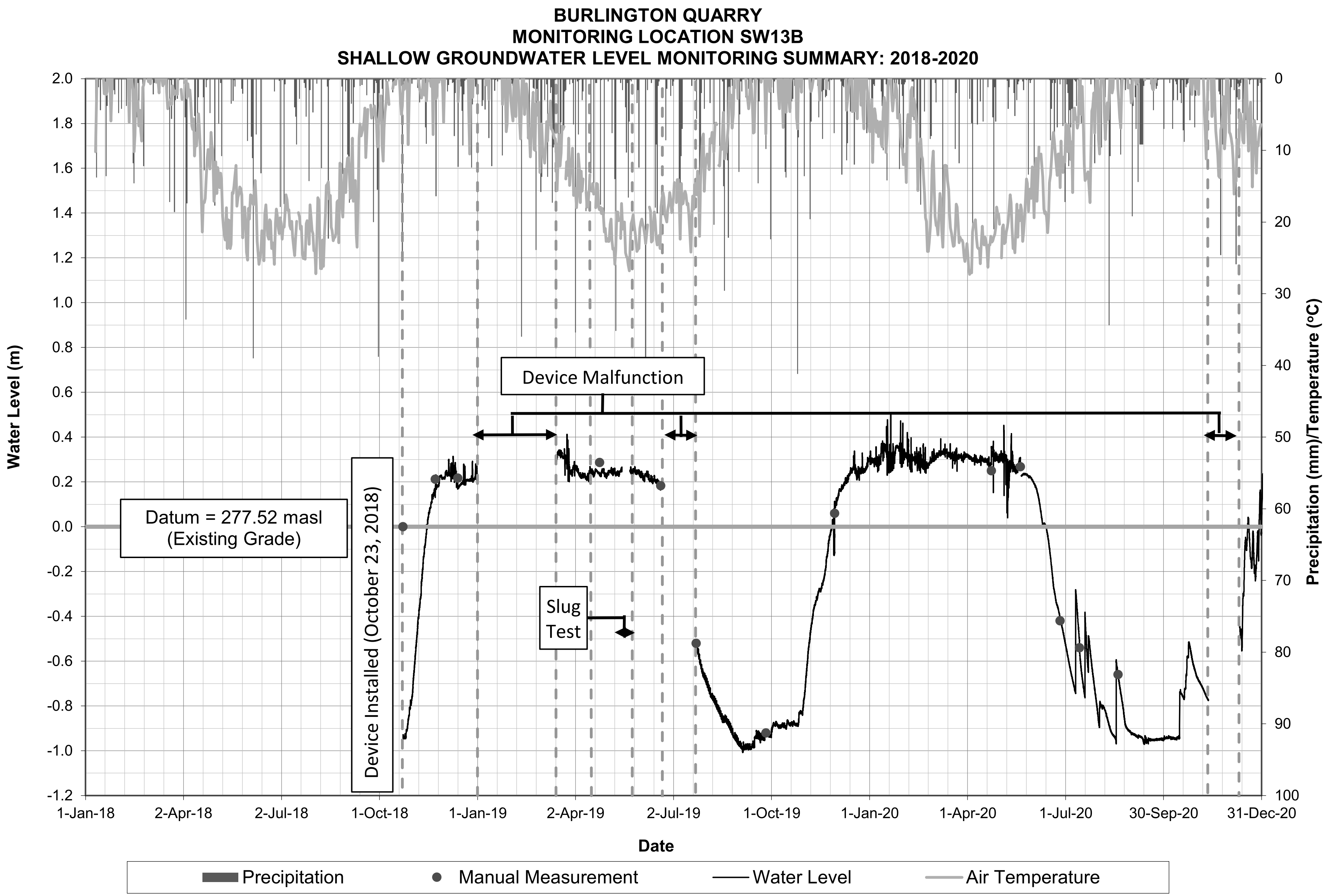

BURLINGTON QUARRY
MONITORING LOCATION SW12B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2018-2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
Device Malfunction
Datum = 276.02 masl (Existing Grade)
Device Installed (October 23, 2018)
Slug Test
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Water Level
Air Temperature

BURLINGTON QUARRY
MONITORING LOCATION SW13A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2014-2020

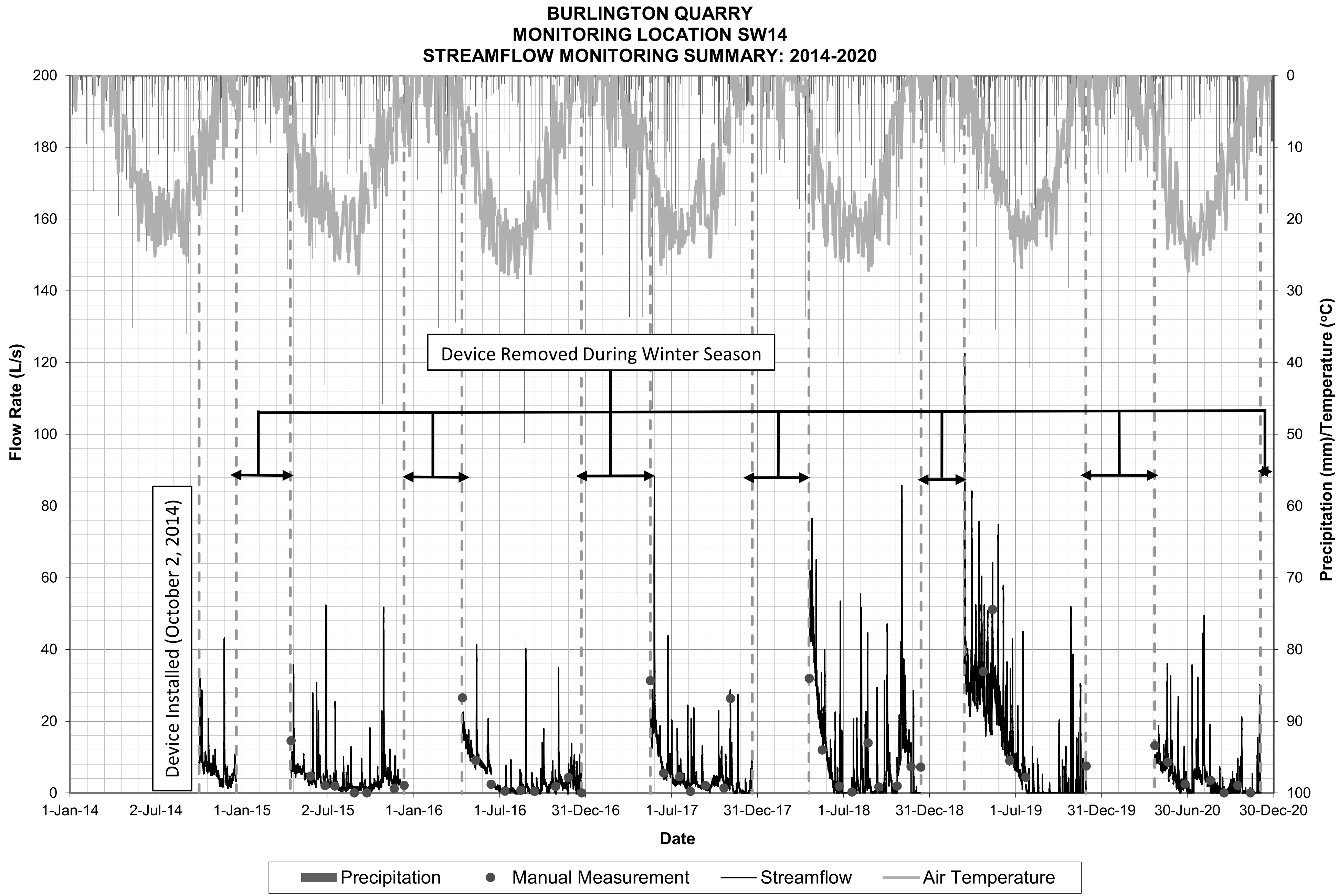


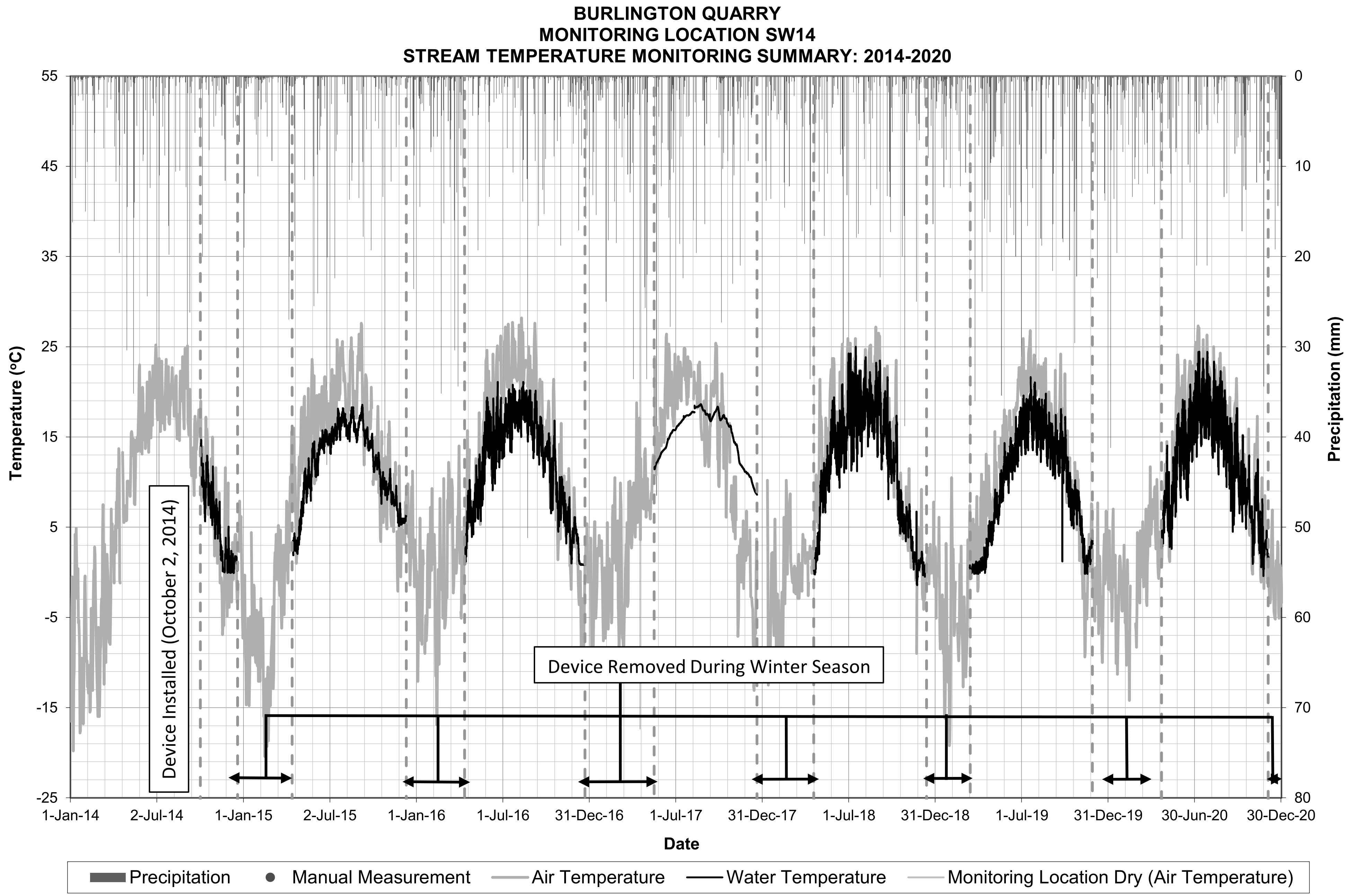


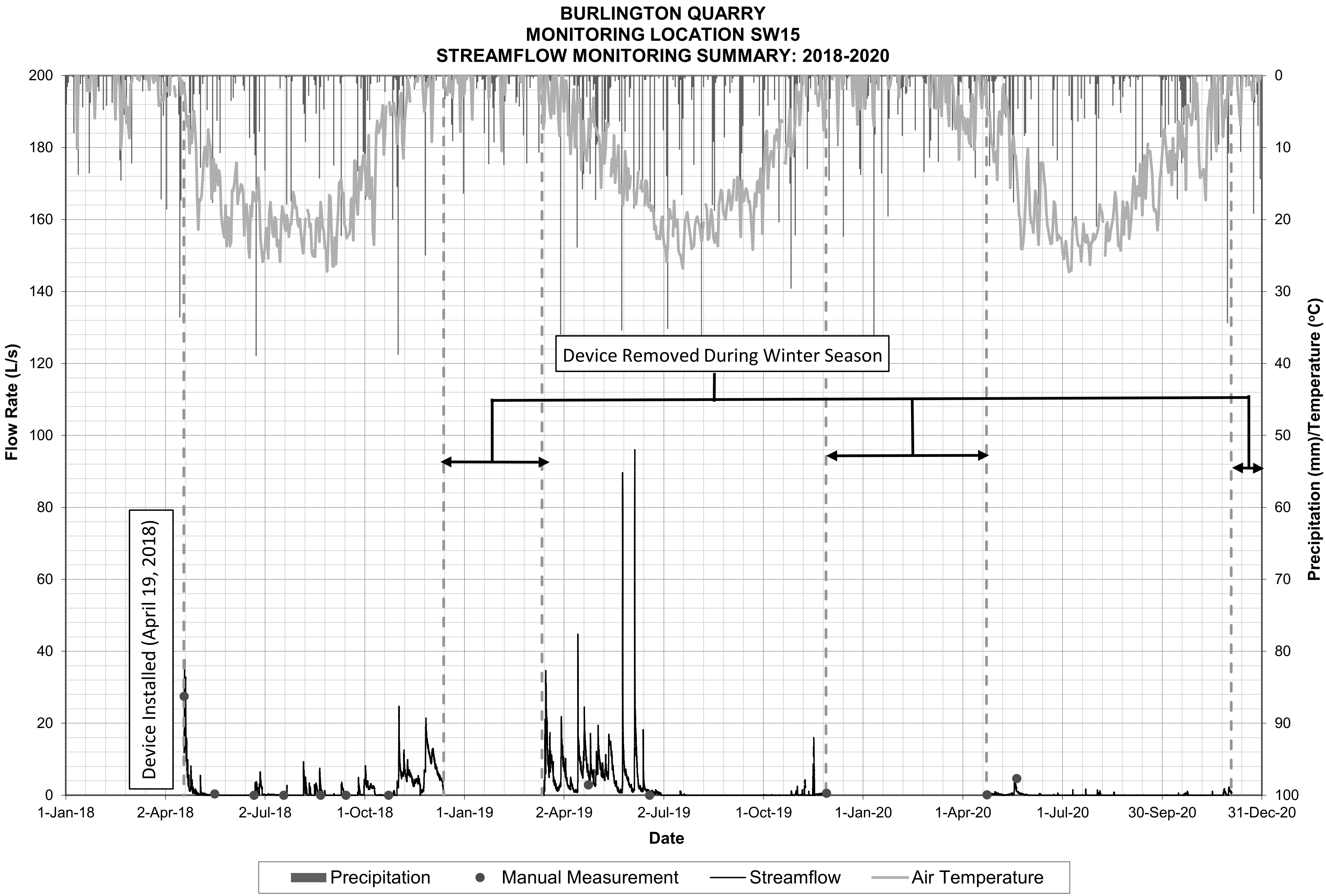
* Grey data indicates the monitoring location was dry and therefore the recorded values are respresentative of the air temperature.

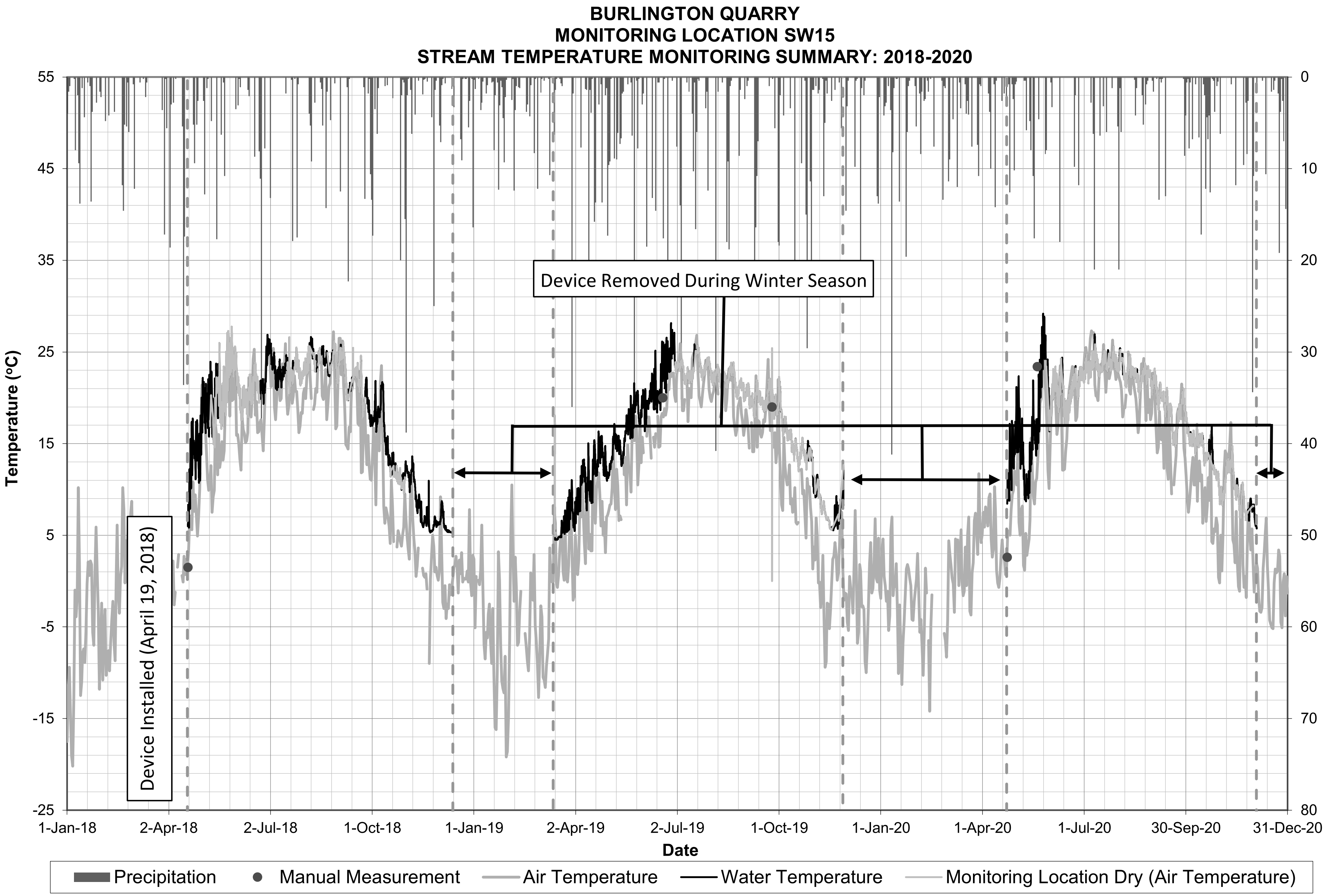


BURLINGTON QUARRY
MONITORING LOCATION SW13B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2018-2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
Device Malfunction
Datum = 277.52 masl (Existing Grade)
Device Installed (October 23, 2018)
Slug Test
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0
10
20
30
40
50
60
70
80
90
100
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Water Level
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW14
STREAMFLOW MONITORING SUMMARY: 2014-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Device Removed During Winter Season
Device Installed (October 2, 2014)
Date
1-Jan-14
2-Jul-14
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature

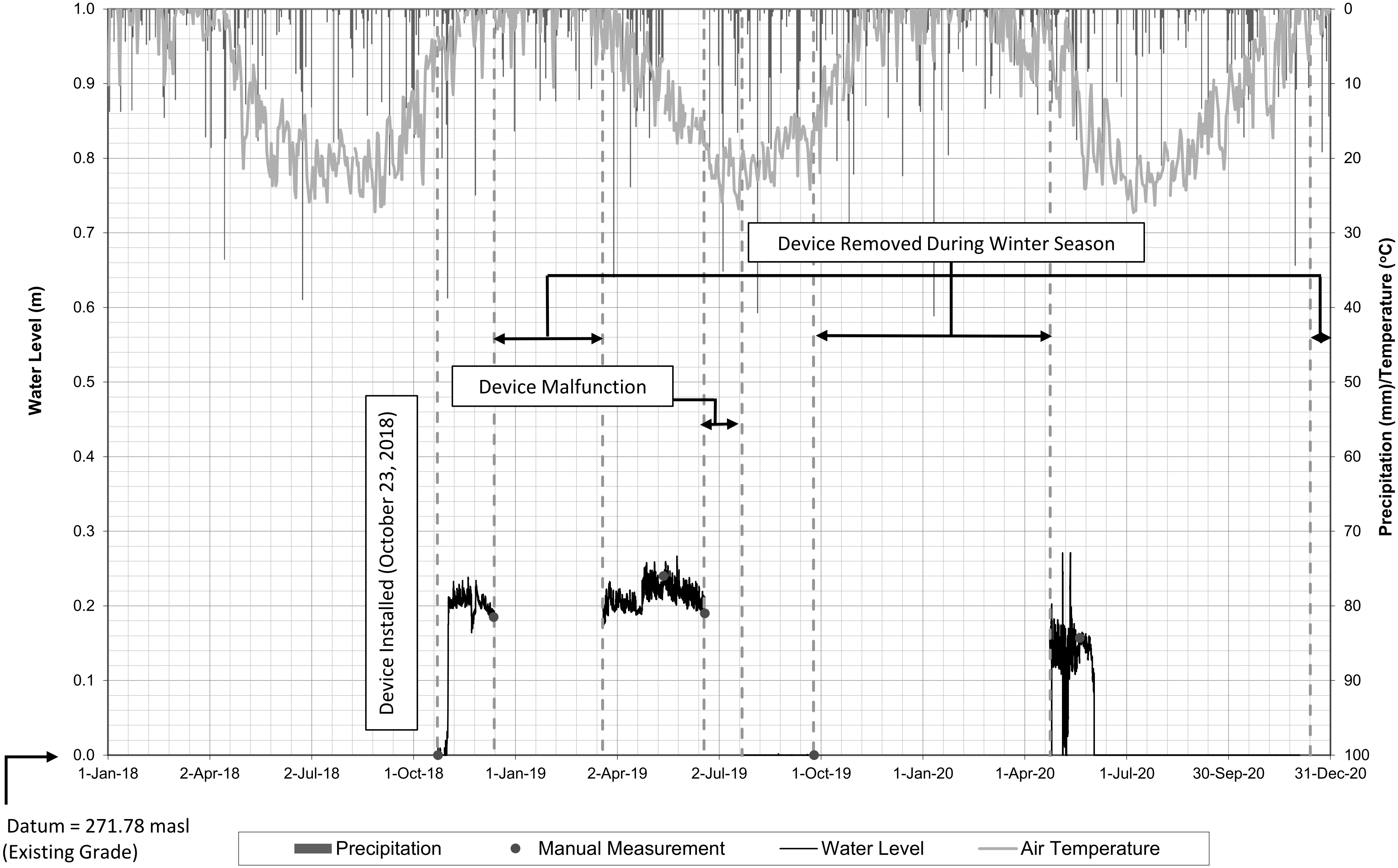

BURLINGTON QUARRY
MONITORING LOCATION SW14
STREAM TEMPERATURE MONITORING SUMMARY: 2014-2020
Temperature (°C)
Precipitation (mm)
Date
Device Installed (October 2, 2014)
Device Removed During Winter Season
1-Jan-14
2-Jul-14
1-Jan-15
2-Jul-15
1-Jan-16
1-Jul-16
31-Dec-16
1-Jul-17
31-Dec-17
1-Jul-18
31-Dec-18
1-Jul-19
31-Dec-19
30-Jun-20
30-Dec-20
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)

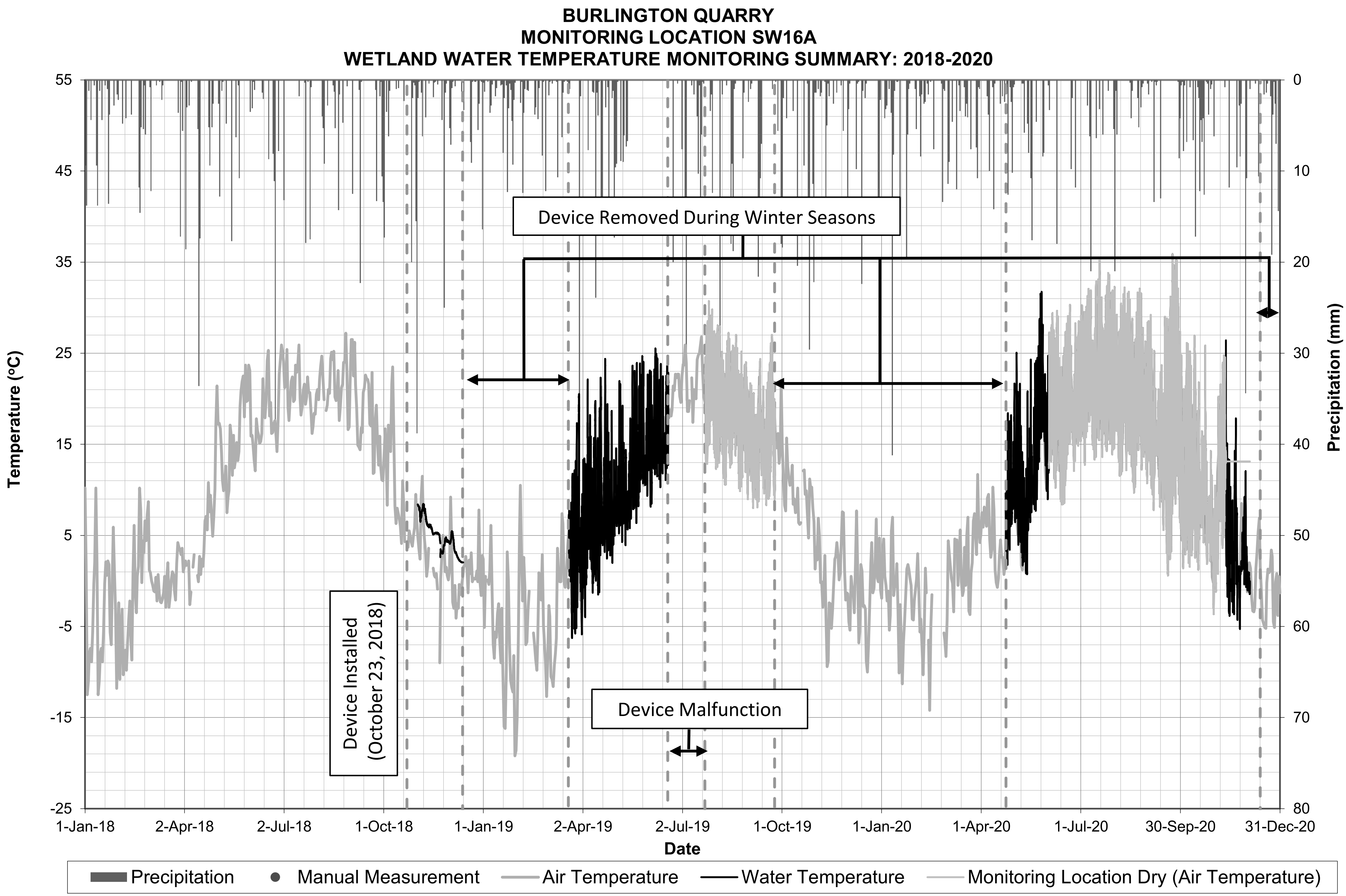

BURLINGTON QUARRY
MONITORING LOCATION SW15
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Removed During Winter Season
Device Installed (April 19, 2018)
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature



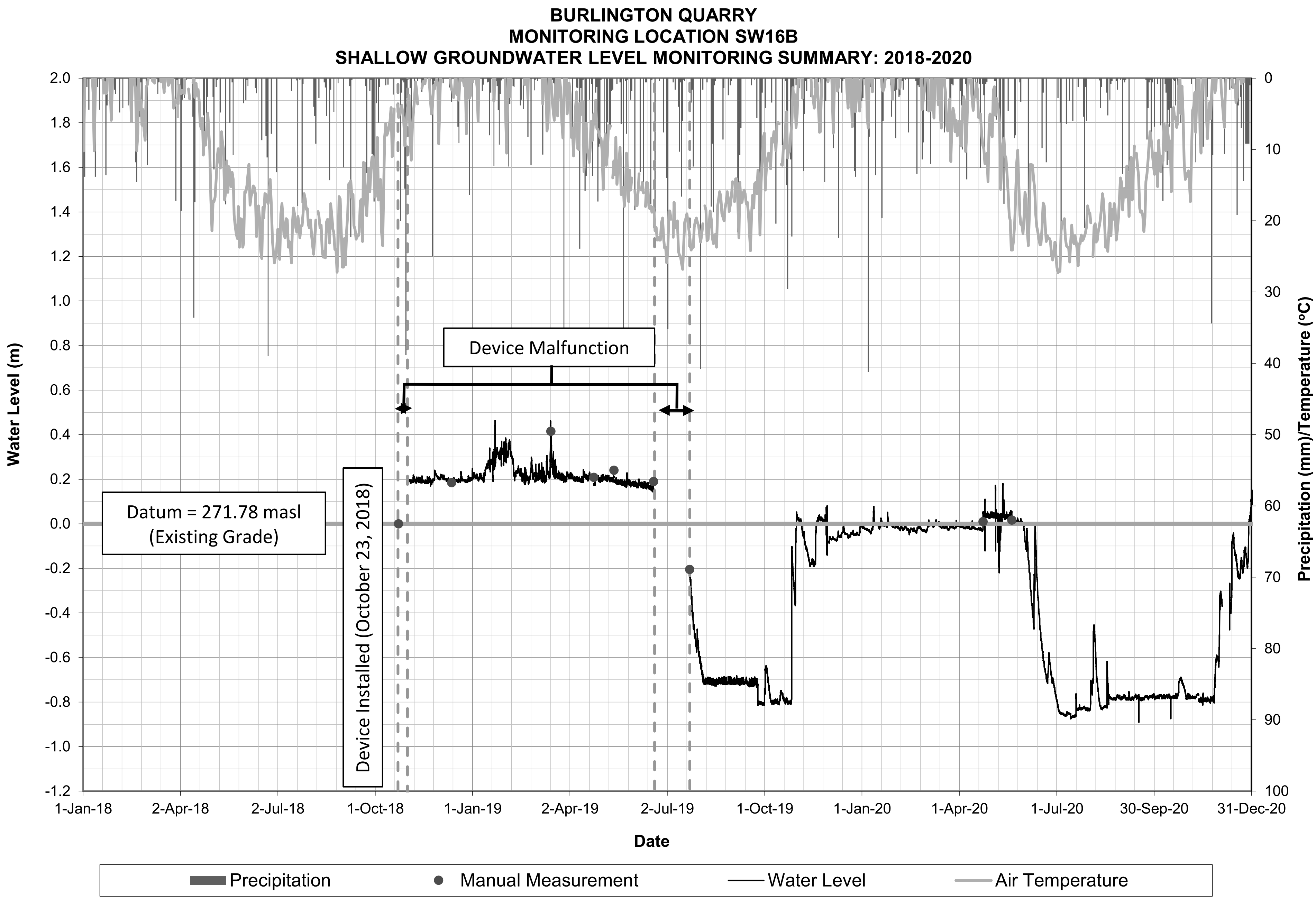
* Grey data indicates the monitoring location was dry and therefore the recorded values are respresentative of the air temperature.

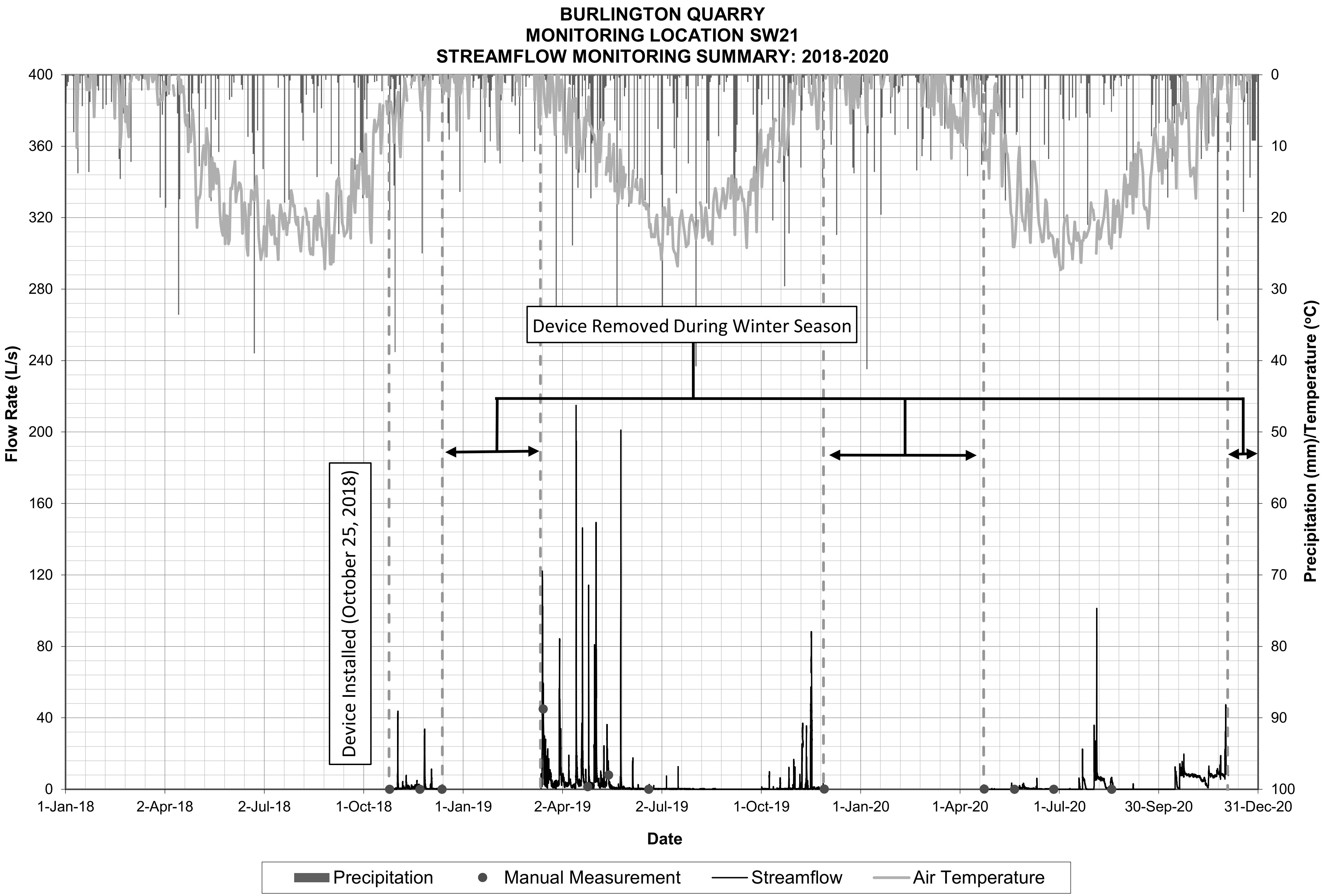
BURLINGTON QUARRY
MONITORING LOCATION SW16A
WETLAND HYDROPERIOD (WATER LEVEL) MONITORING SUMMARY: 2018-2020



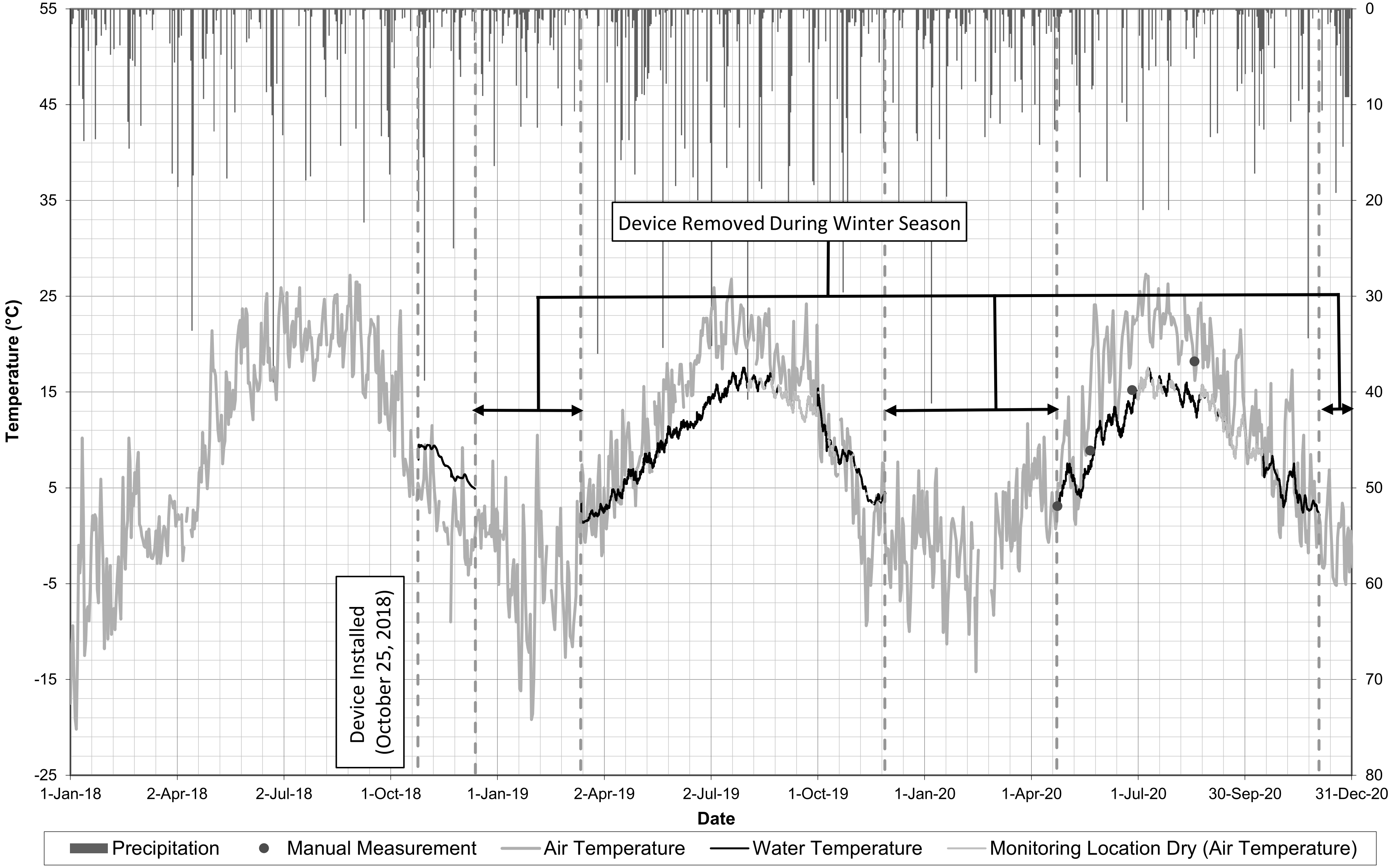


* Grey data indicates the monitoring location was dry and therefor the recorded values are respresentative of the air temperature at the time.

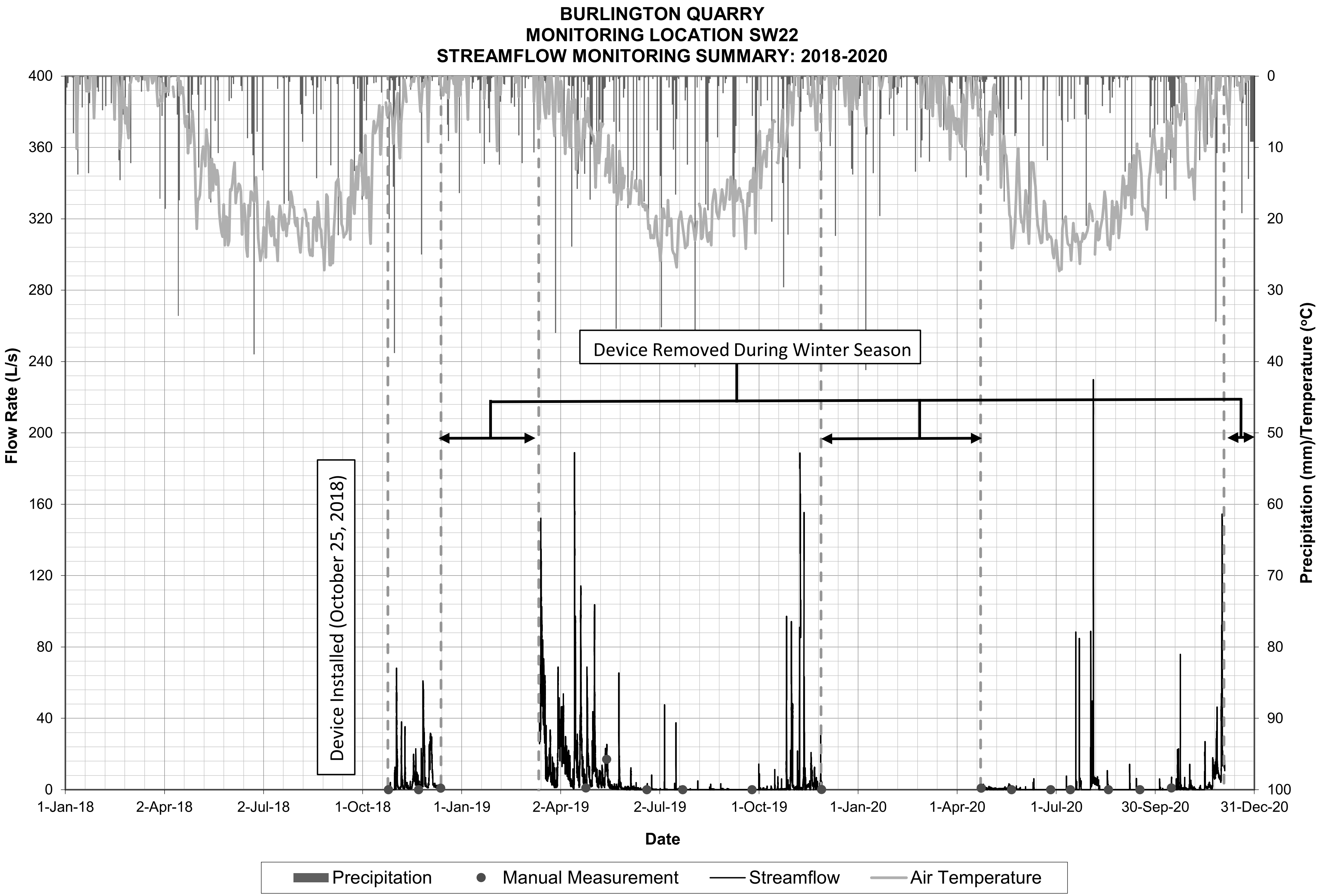

BURLINGTON QUARRY
MONITORING LOCATION SW16B
SHALLOW GROUNDWATER LEVEL MONITORING SUMMARY: 2018-2020
Water Level (m)
Precipitation (mm)/Temperature (°C)
Date
Device Malfunction
Datum = 271.78 masl
(Existing Grade)
Device Installed (October 23, 2018)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
0
10
20
30
40
50
60
70
80
90
100
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Water Level
Air Temperature

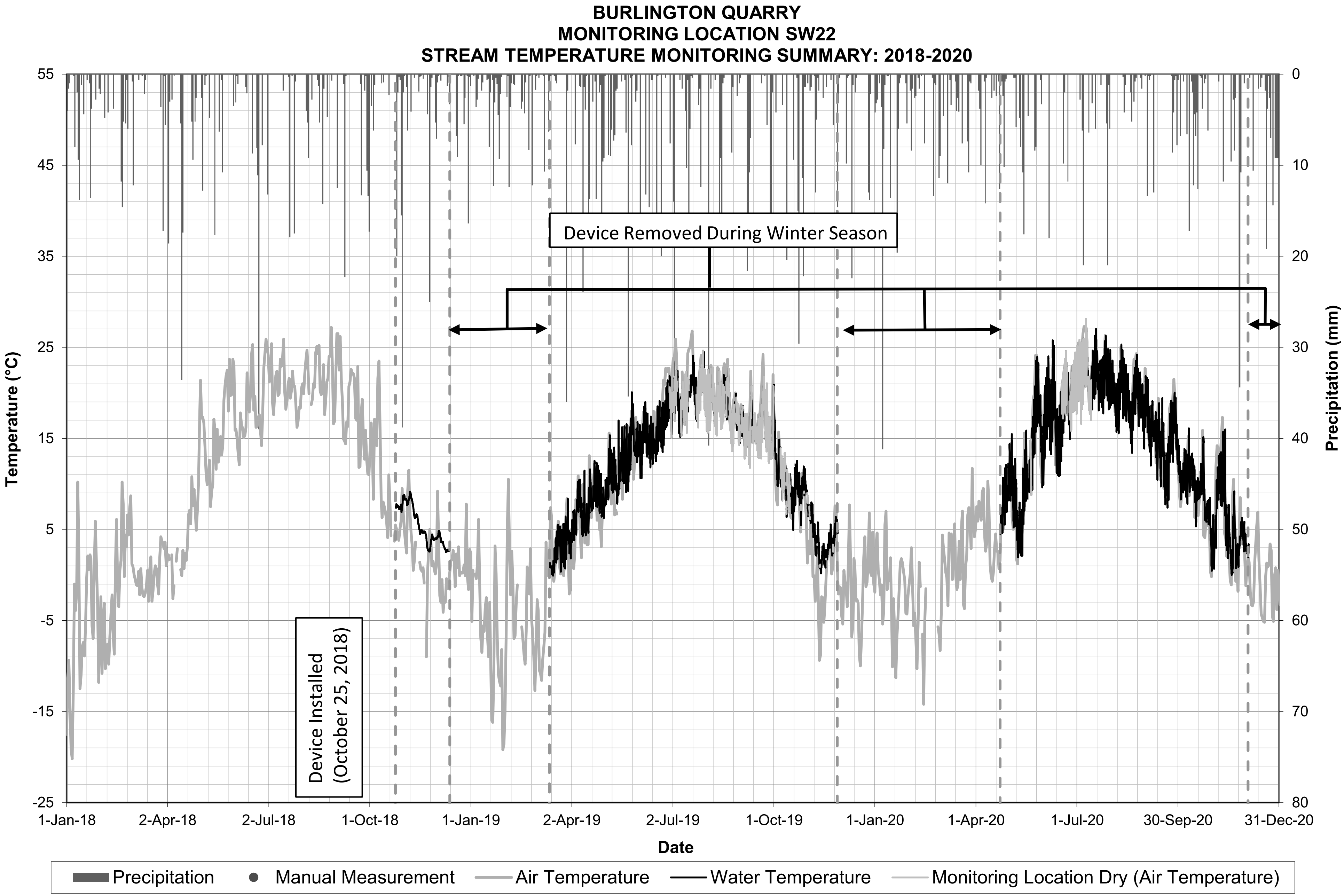

BURLINGTON QUARRY
MONITORING LOCATION SW21
STREAMFLOW MONITORING SUMMARY: 2018-2020
Device Removed During Winter Season
Device Installed (October 25, 2018)
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature

BURLINGTON QUARRY
MONITORING LOCATION SW21
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2020

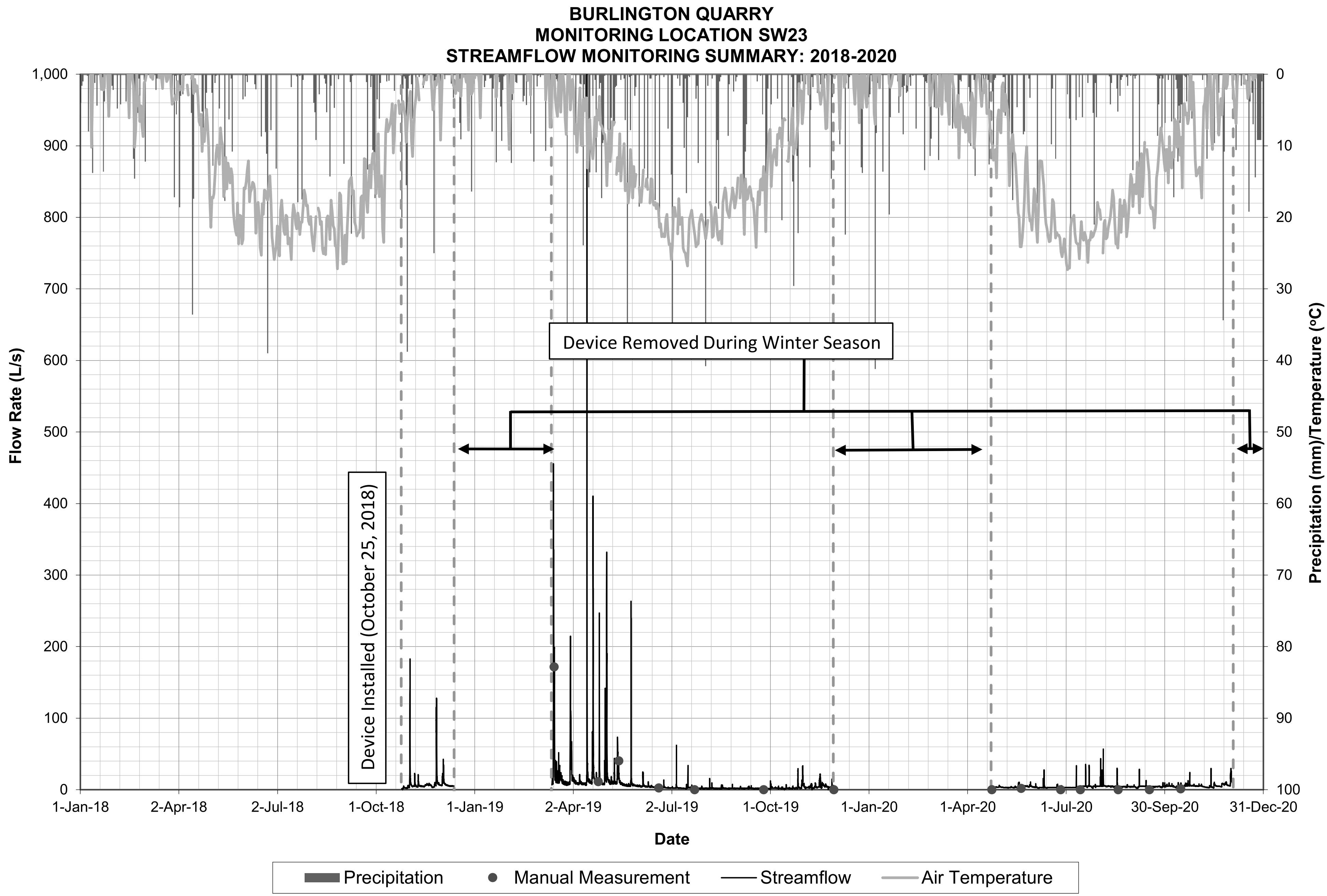


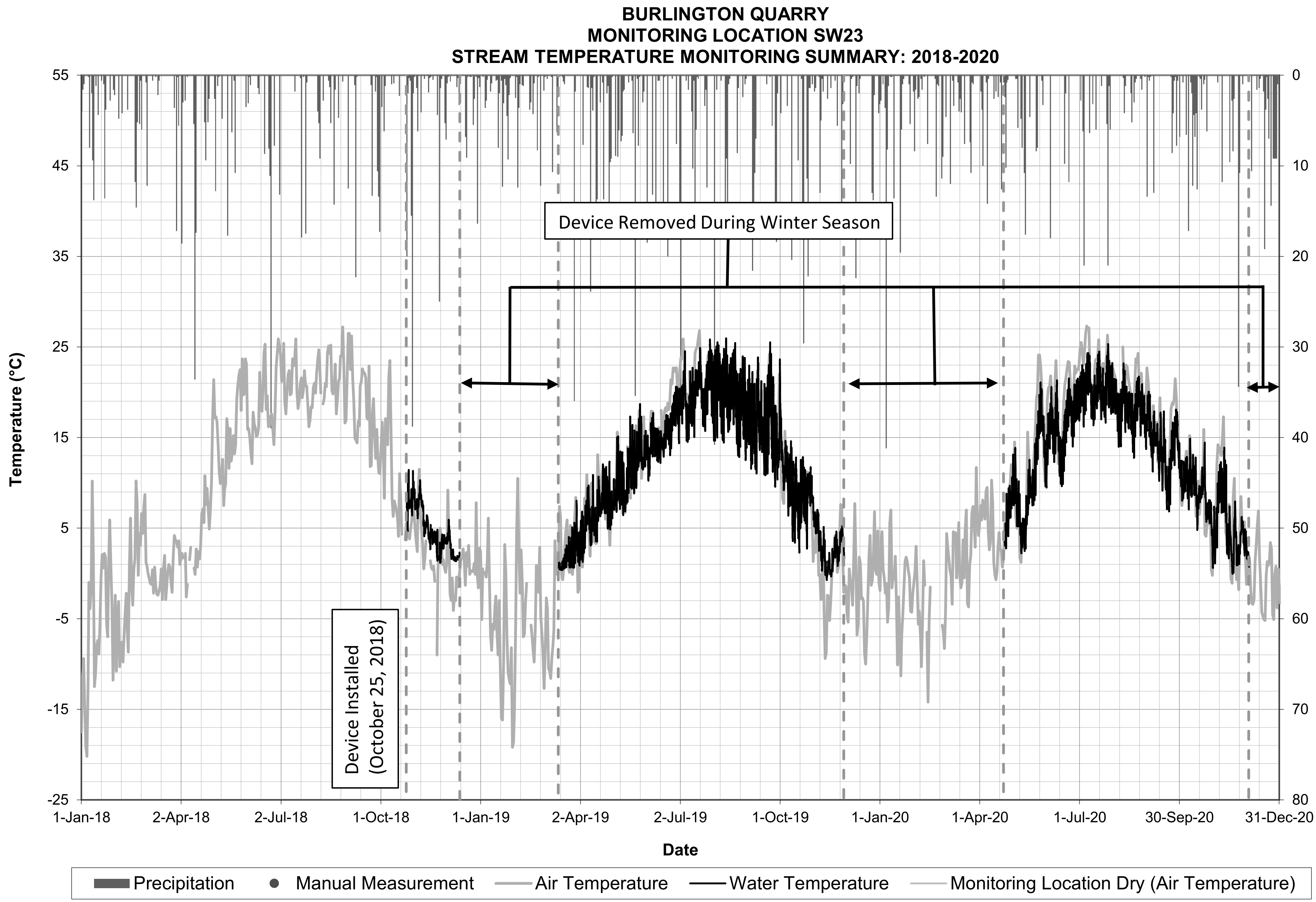
* Grey data indicates the monitoring location was dry and therefore the recorded values are respresentative of the air temperature.

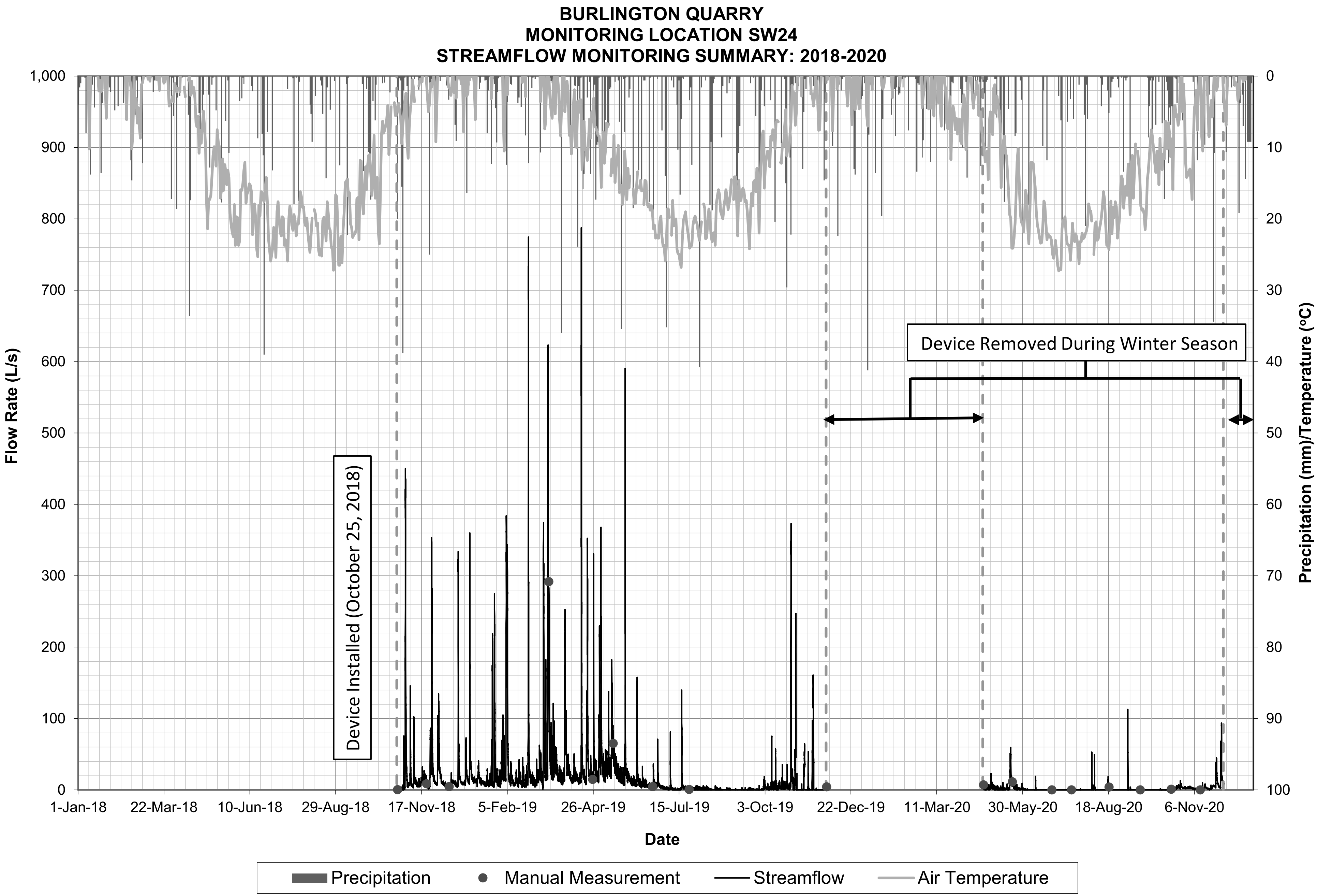

BURLINGTON QUARRY
MONITORING LOCATION SW22
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Removed During Winter Season
Device Installed (October 25, 2018)
Precipitation
Manual Measurement
Streamflow
Air Temperature
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20



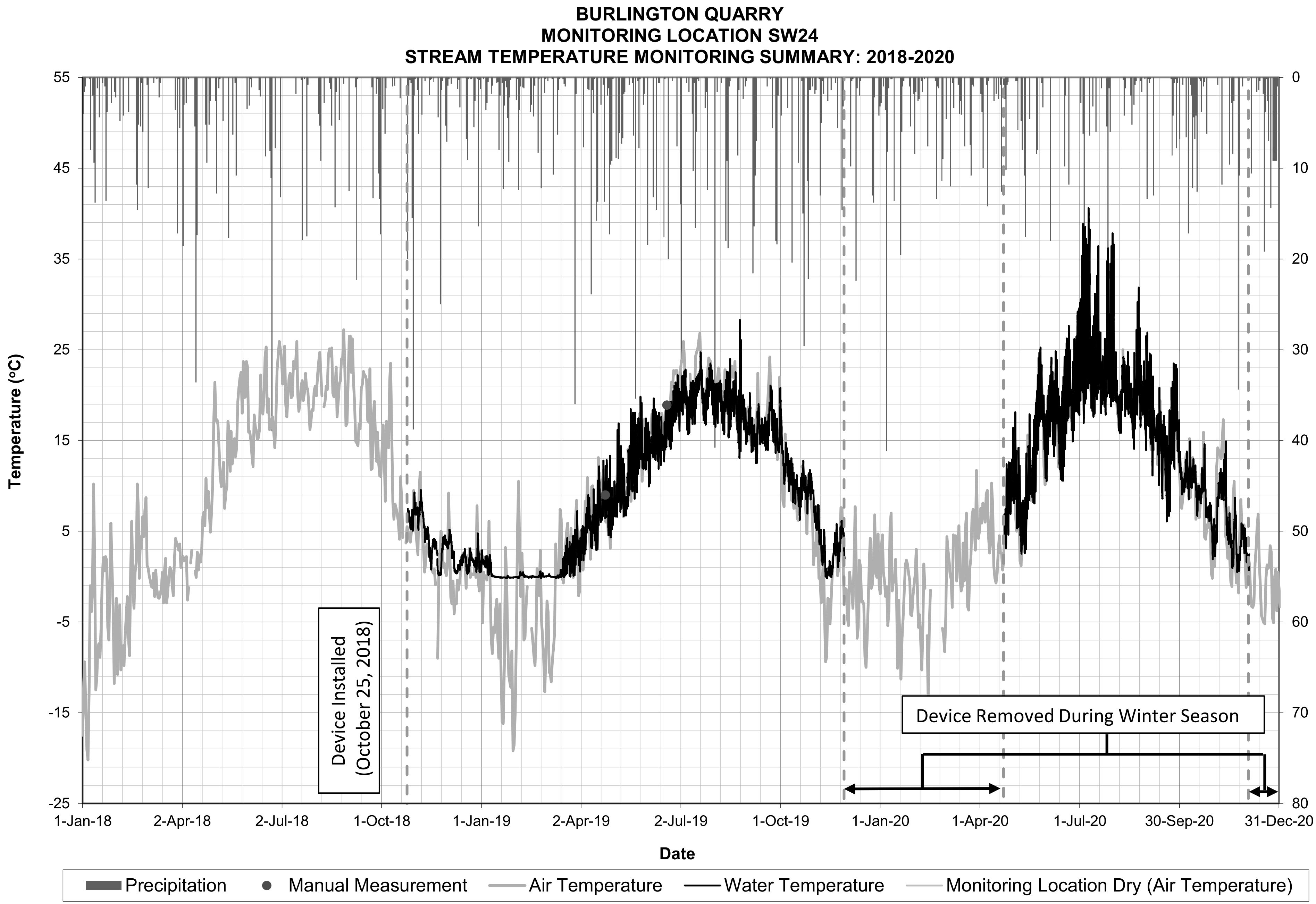
* Grey data indicates the monitoring location was dry and therefore the recorded values are respresentative of the air temperature.


BURLINGTON QUARRY
MONITORING LOCATION SW23
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Device Removed During Winter Season
Device Installed (October 25, 2018)
1,000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Date
Precipitation
Manual Measurement
Streamflow
Air Temperature

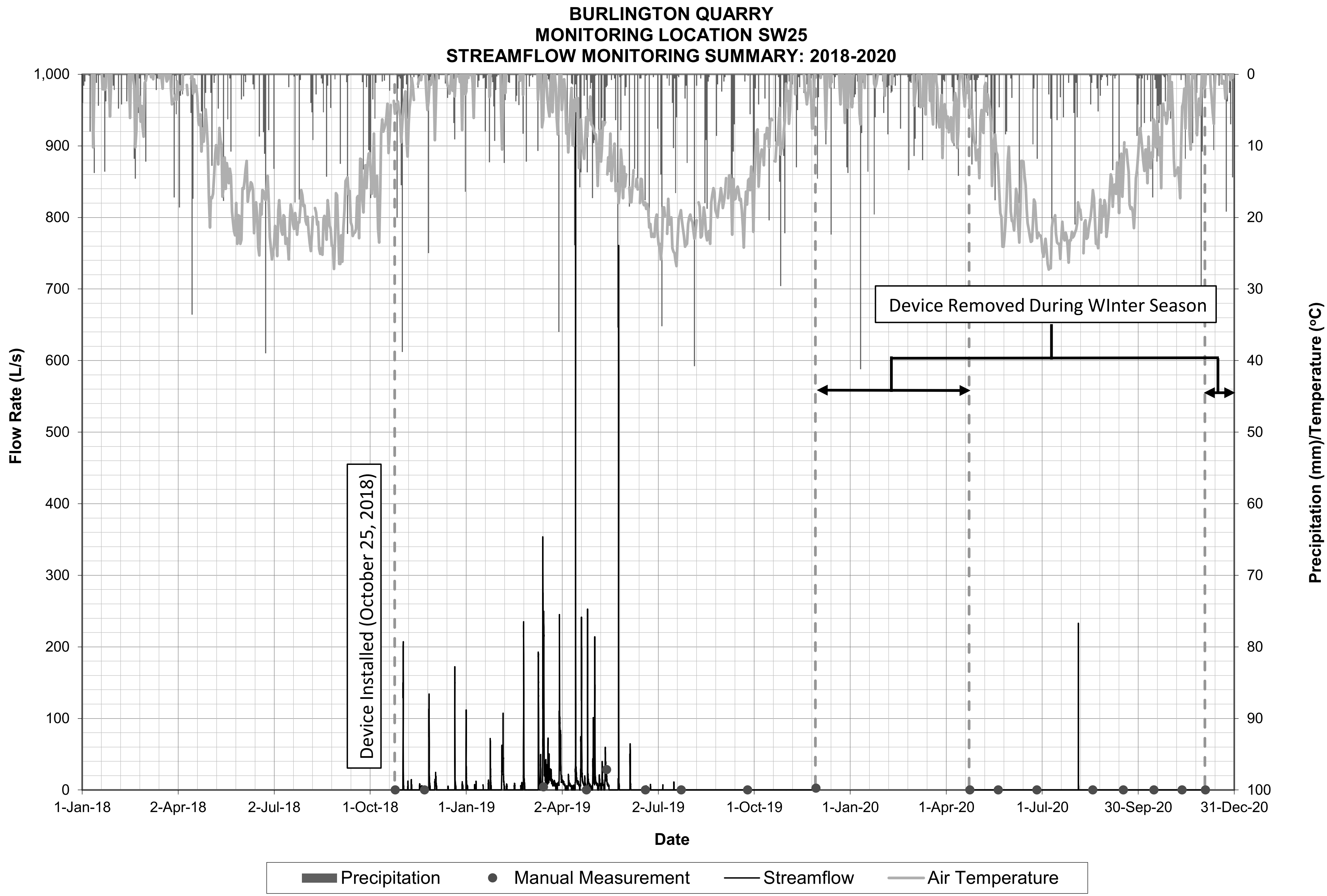

BURLINGTON QUARRY
MONITORING LOCATION SW23
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2020
Device Removed During Winter Season
Device Installed
(October 25, 2018)
Temperature (°C)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)

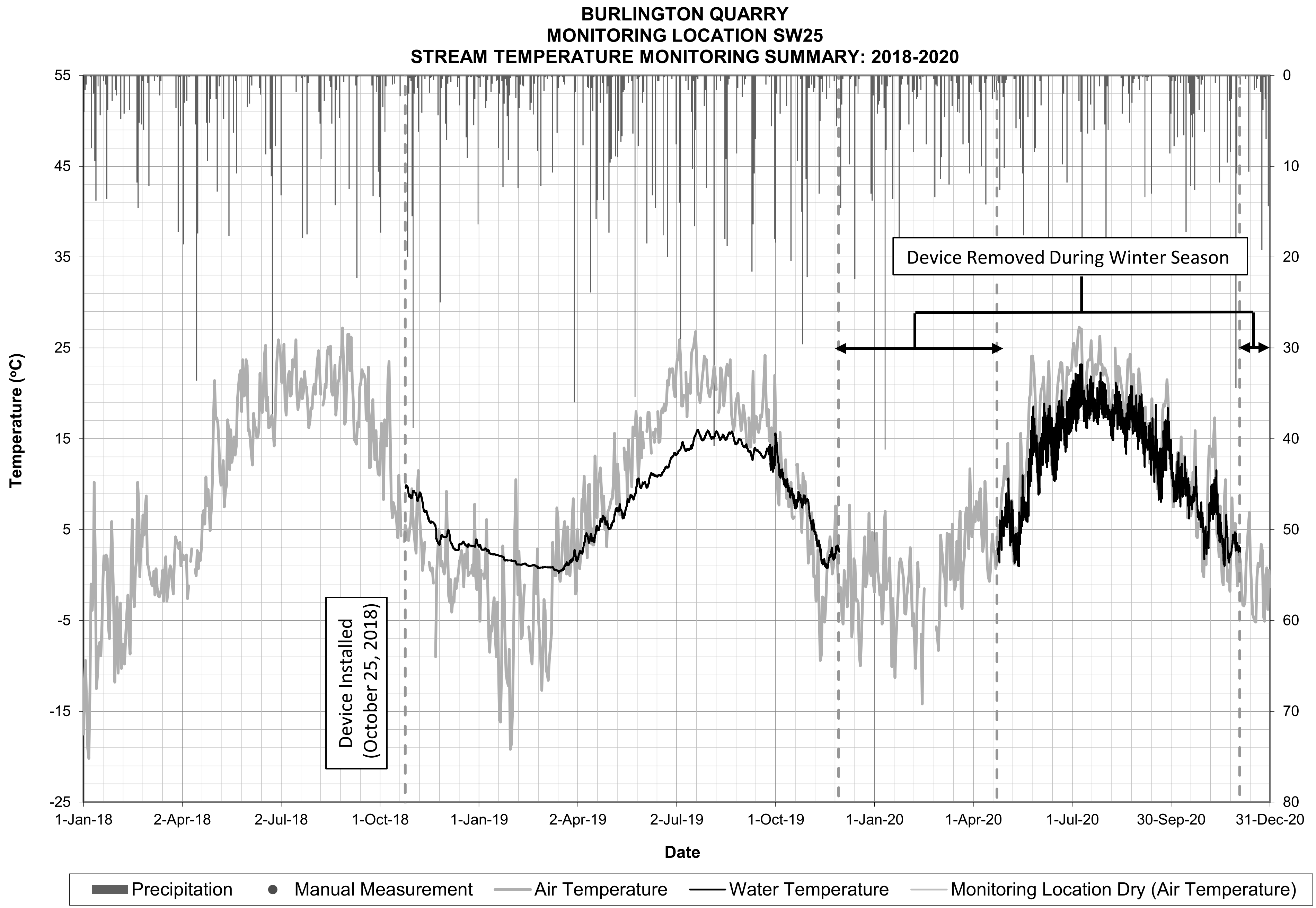


BURLINGTON QUARRY
MONITORING LOCATION SW24
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (October 25, 2018)
Device Removed During Winter Season
1,000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
100
1-Jan-18
22-Mar-18
10-Jun-18
29-Aug-18
17-Nov-18
5-Feb-19
26-Apr-19
15-Jul-19
3-Oct-19
22-Dec-19
11-Mar-20
30-May-20
18-Aug-20
6-Nov-20
Precipitation
Manual Measurement
Streamflow
Air Temperature

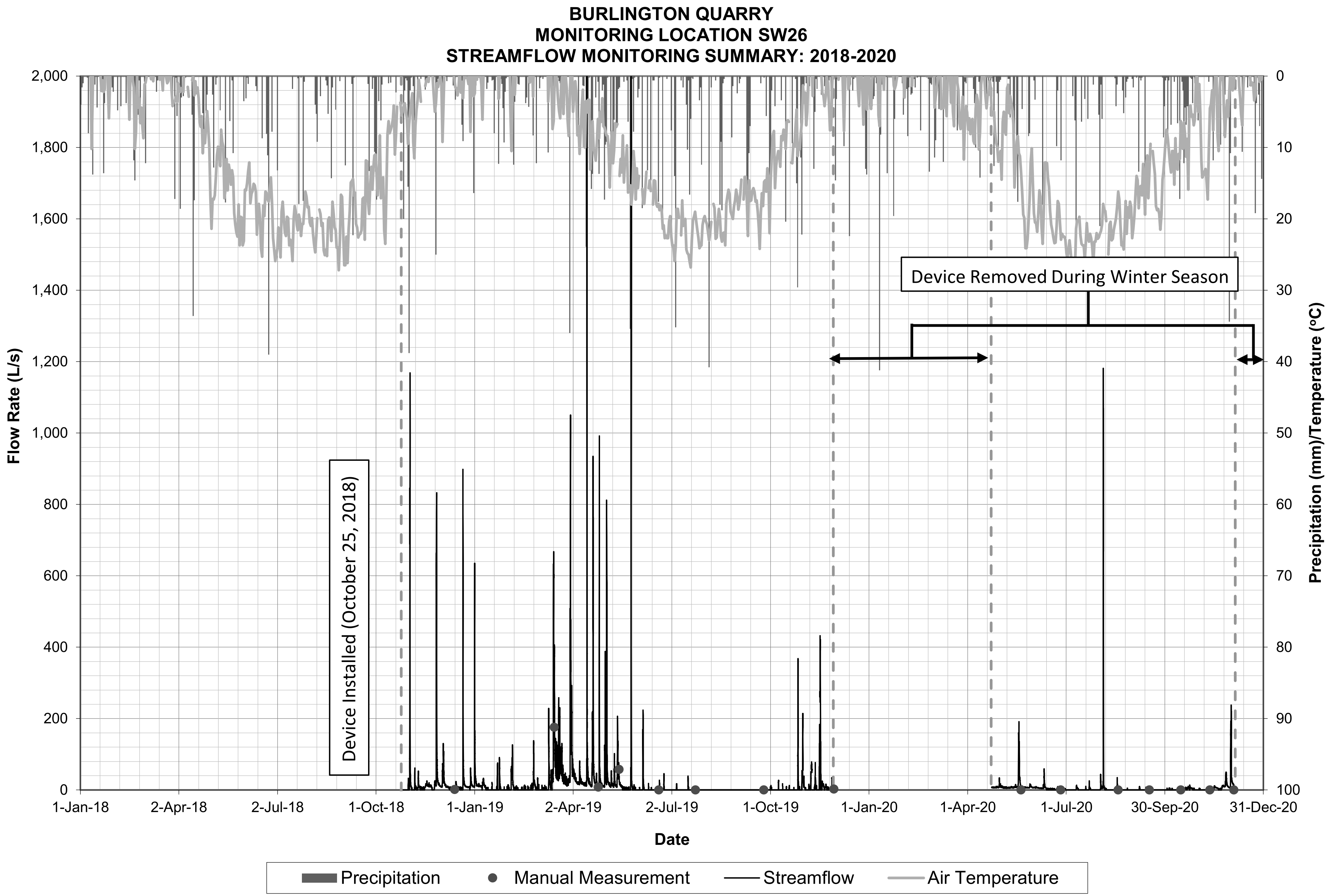


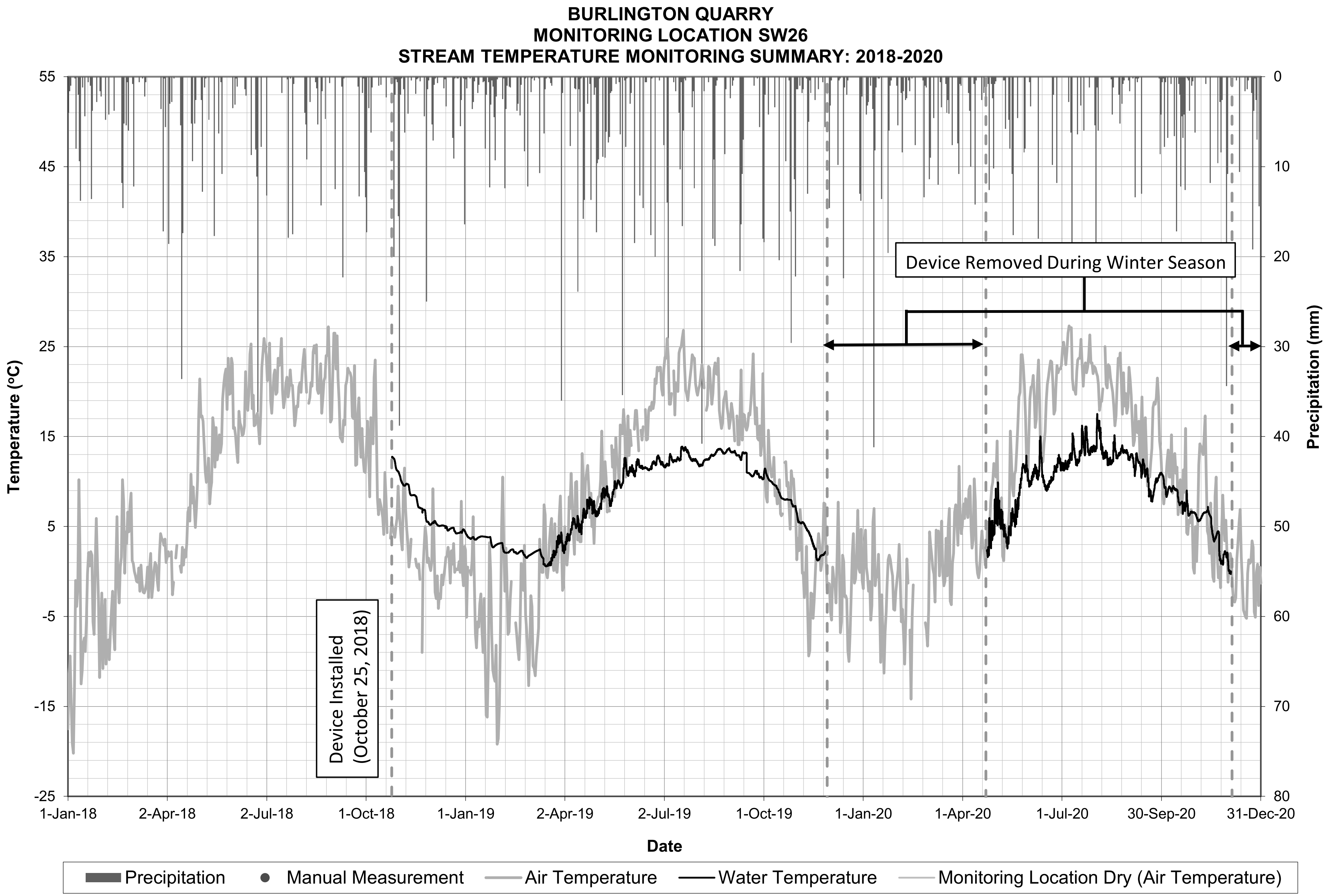
BURLINGTON QUARRY
MONITORING LOCATION SW24
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2020
Temperature (°C)
Precipitation (mm)
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
Device Installed (October 25, 2018)
Device Removed During Winter Season
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Date
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)

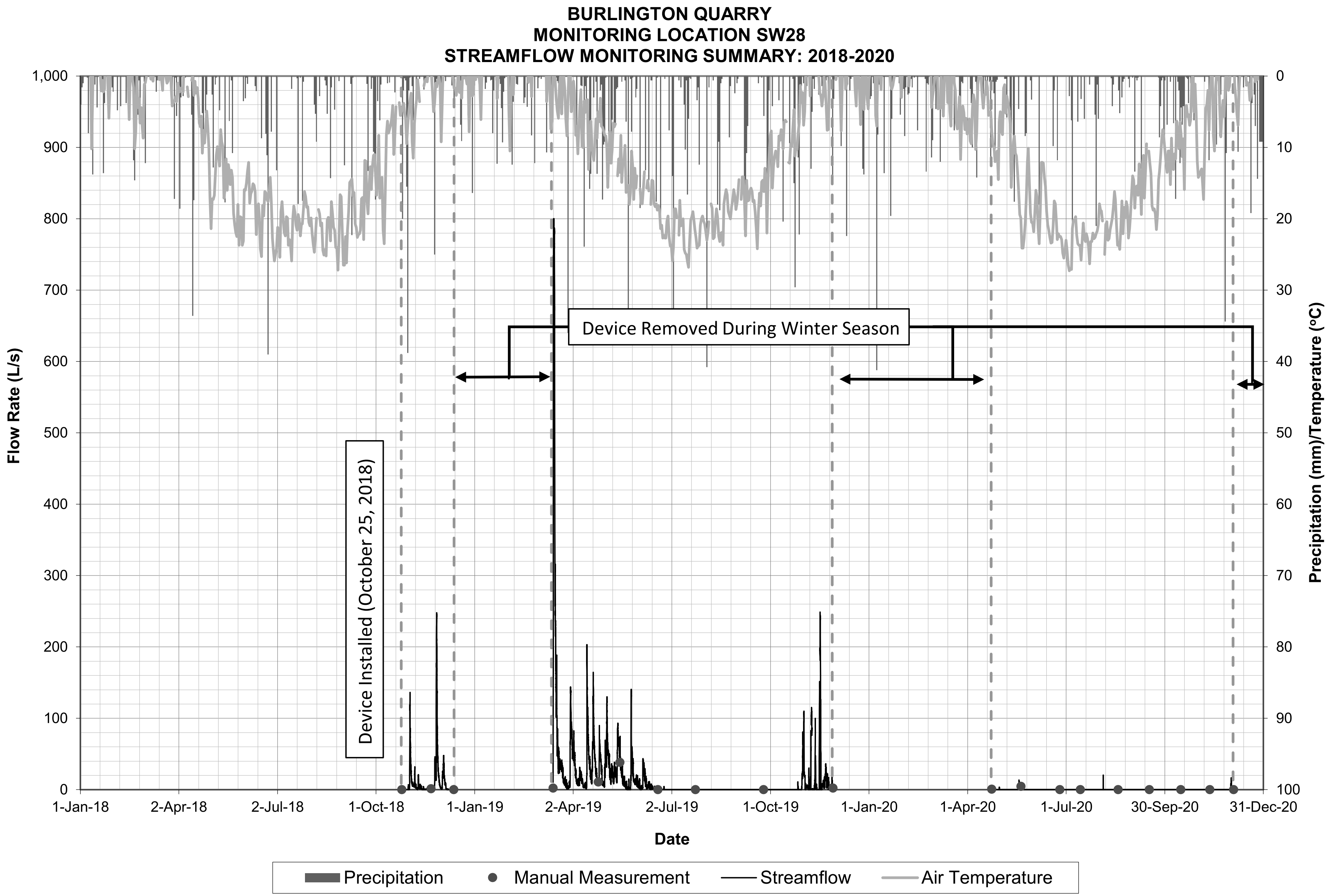

BURLINGTON QUARRY
MONITORING LOCATION SW25
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Device Installed (October 25, 2018)
Device Removed During WInter Season
Precipitation
Manual Measurement
Streamflow
Air Temperature



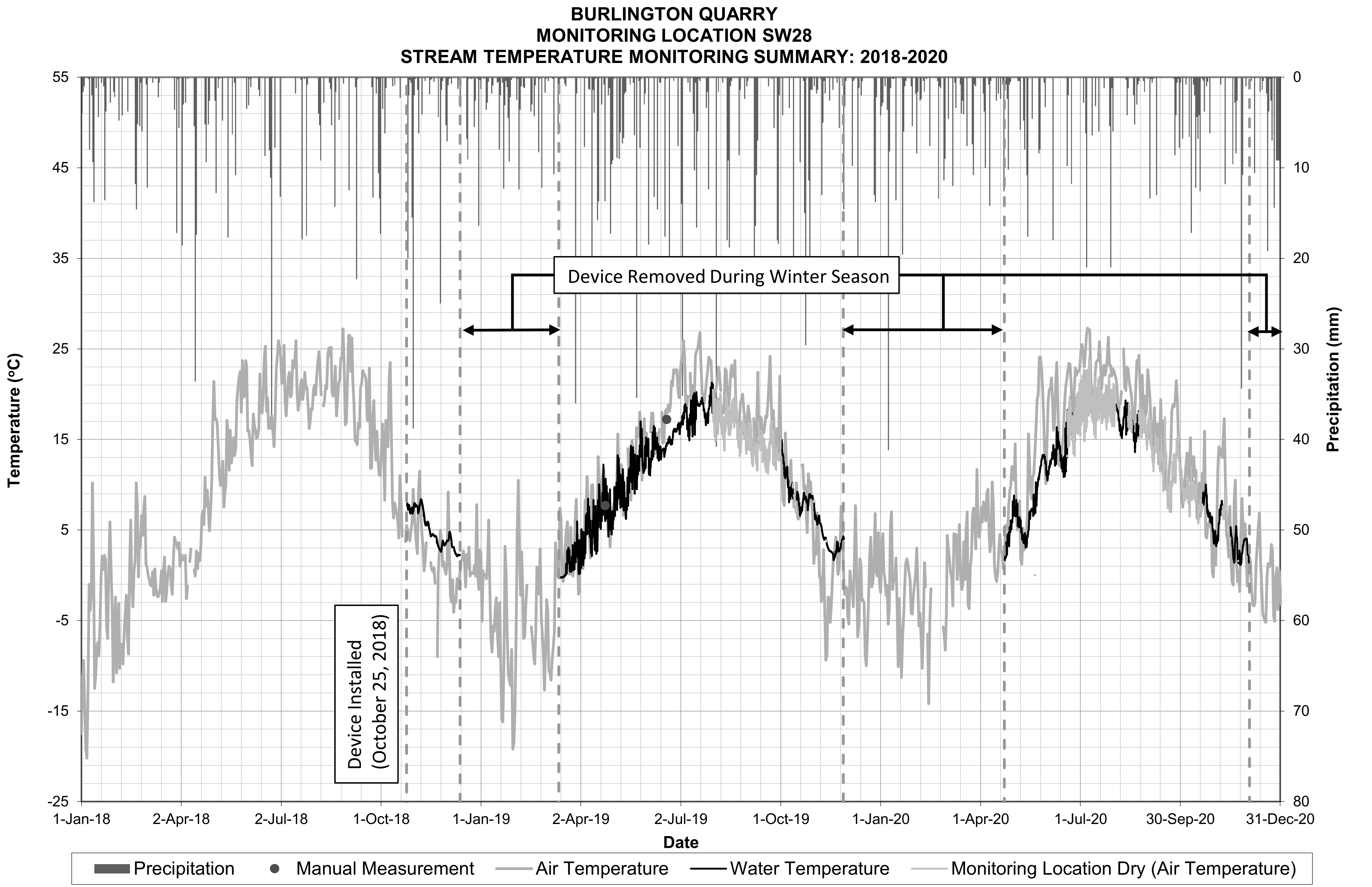
BURLINGTON QUARRY
MONITORING LOCATION SW25
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2020
Temperature (°C)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Device Installed (October 25, 2018)
Device Removed During Winter Season
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)


BURLINGTON QUARRY
MONITORING LOCATION SW26
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (October 25, 2018)
Device Removed During Winter Season
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature

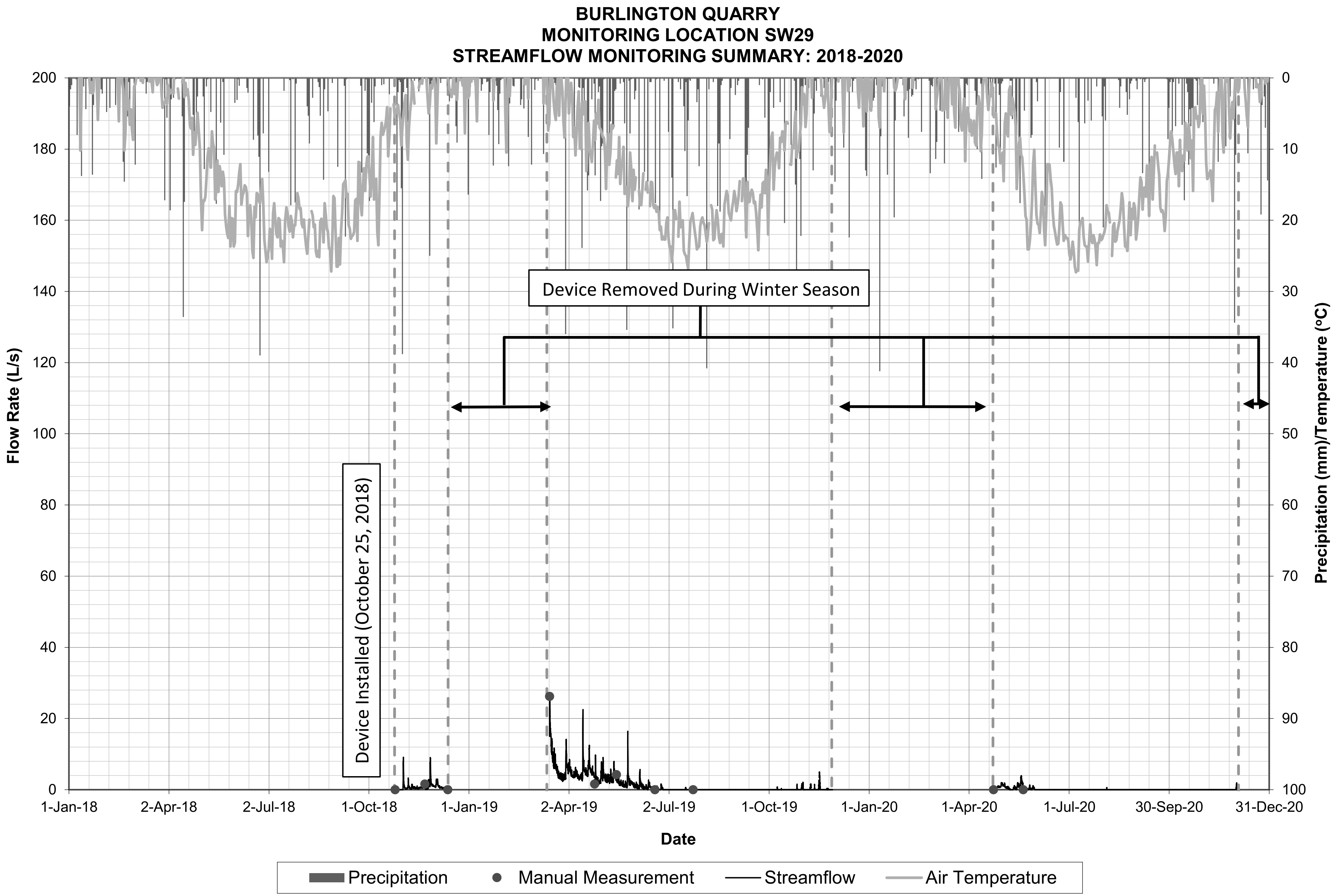

BURLINGTON QUARRY
MONITORING LOCATION SW26
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2020
Temperature (°C)
Precipitation (mm)
Date
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
Device Installed
(October 25, 2018)
Device Removed During Winter Season
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)



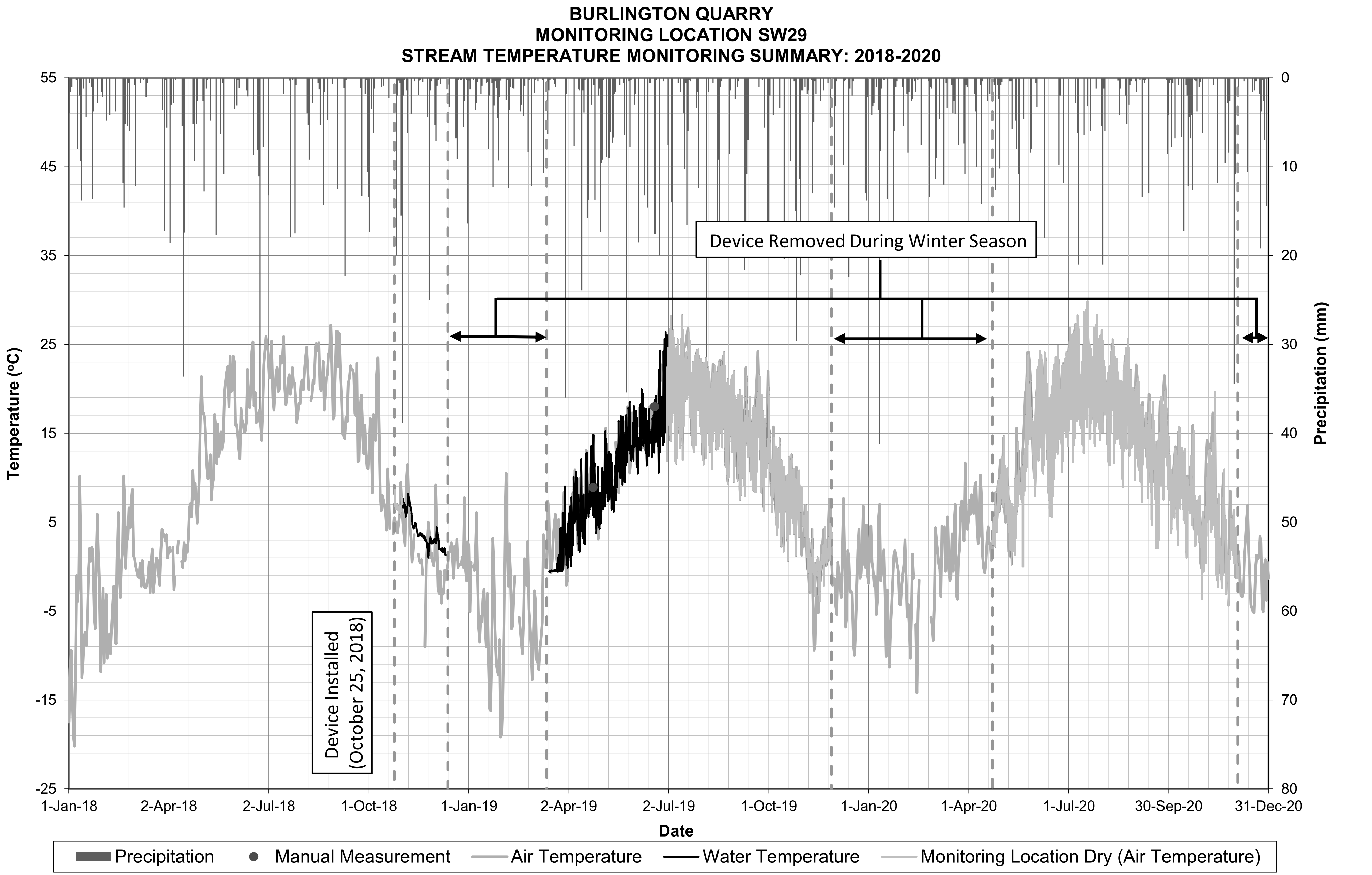
BURLINGTON QUARRY
MONITORING LOCATION SW28
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Removed During Winter Season
Device Installed (October 25, 2018)
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature



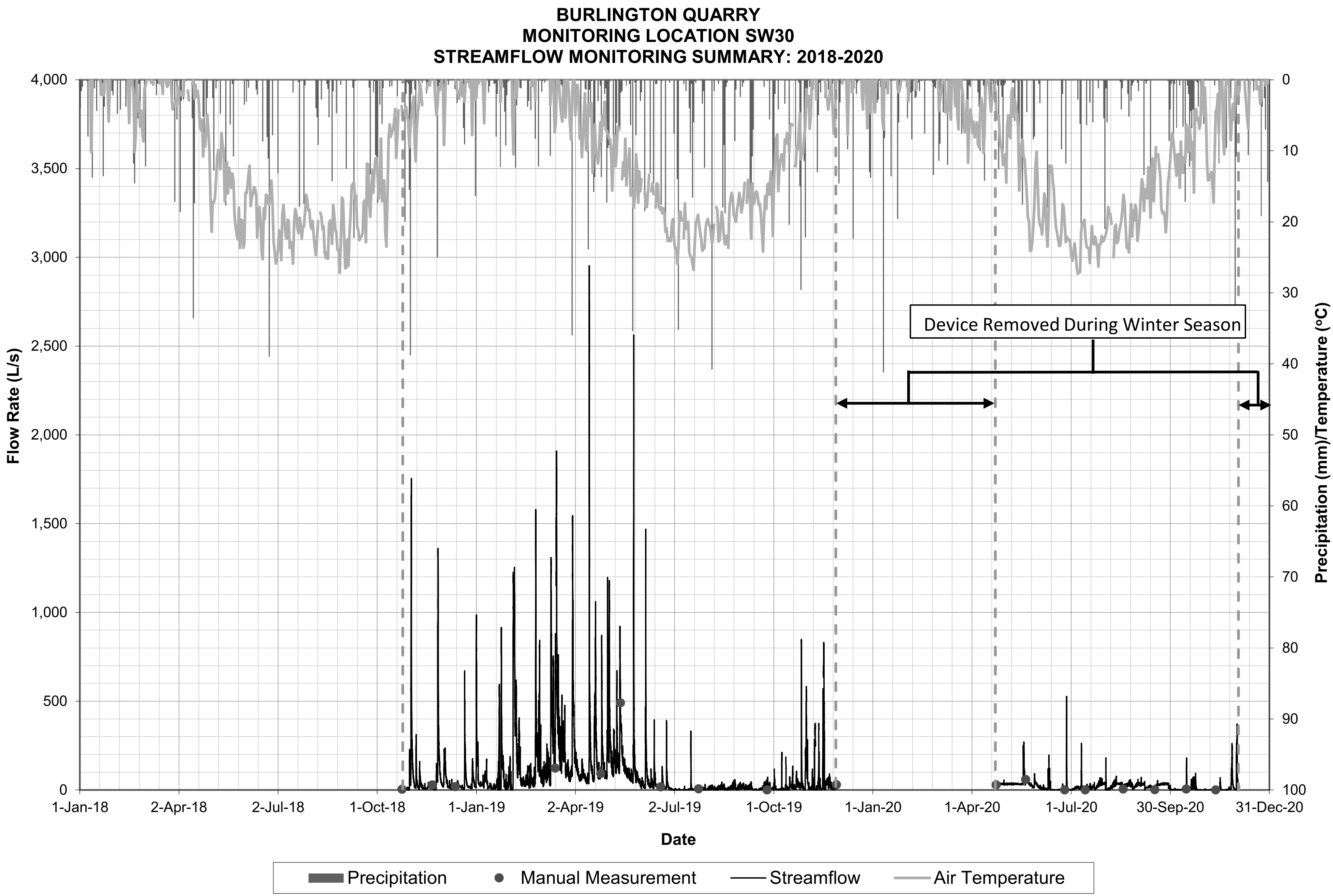
* Grey data indicates the monitoring location was dry and therefore the recorded values are respresentative of the air temperature.



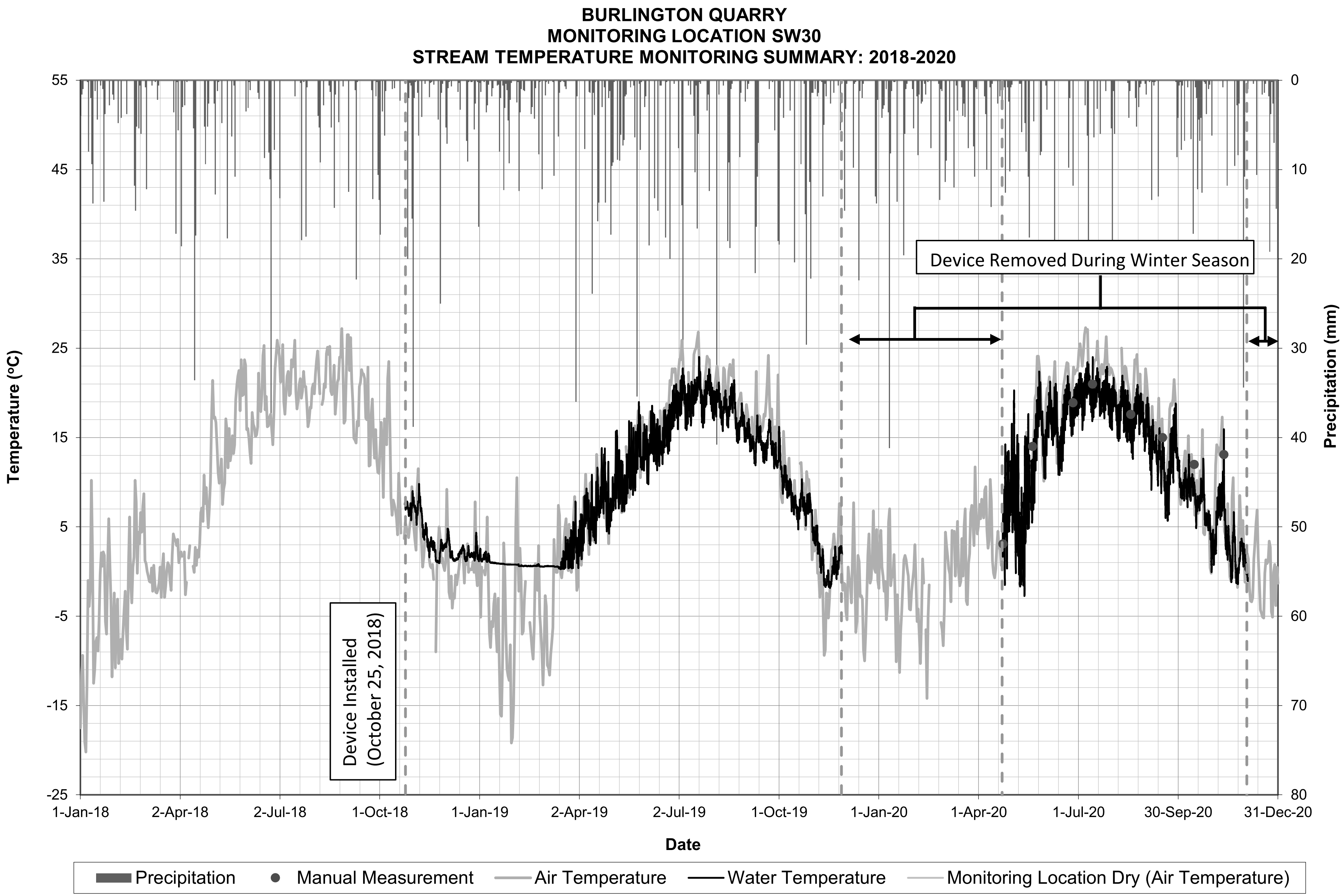
BURLINGTON QUARRY
MONITORING LOCATION SW29
STREAMFLOW MONITORING SUMMARY: 2018-2020
Device Removed During Winter Season
Device Installed (October 25, 2018)
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
0
20
40
60
80
100
120
140
160
180
200
10
30
50
70
90
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Streamflow
Air Temperature



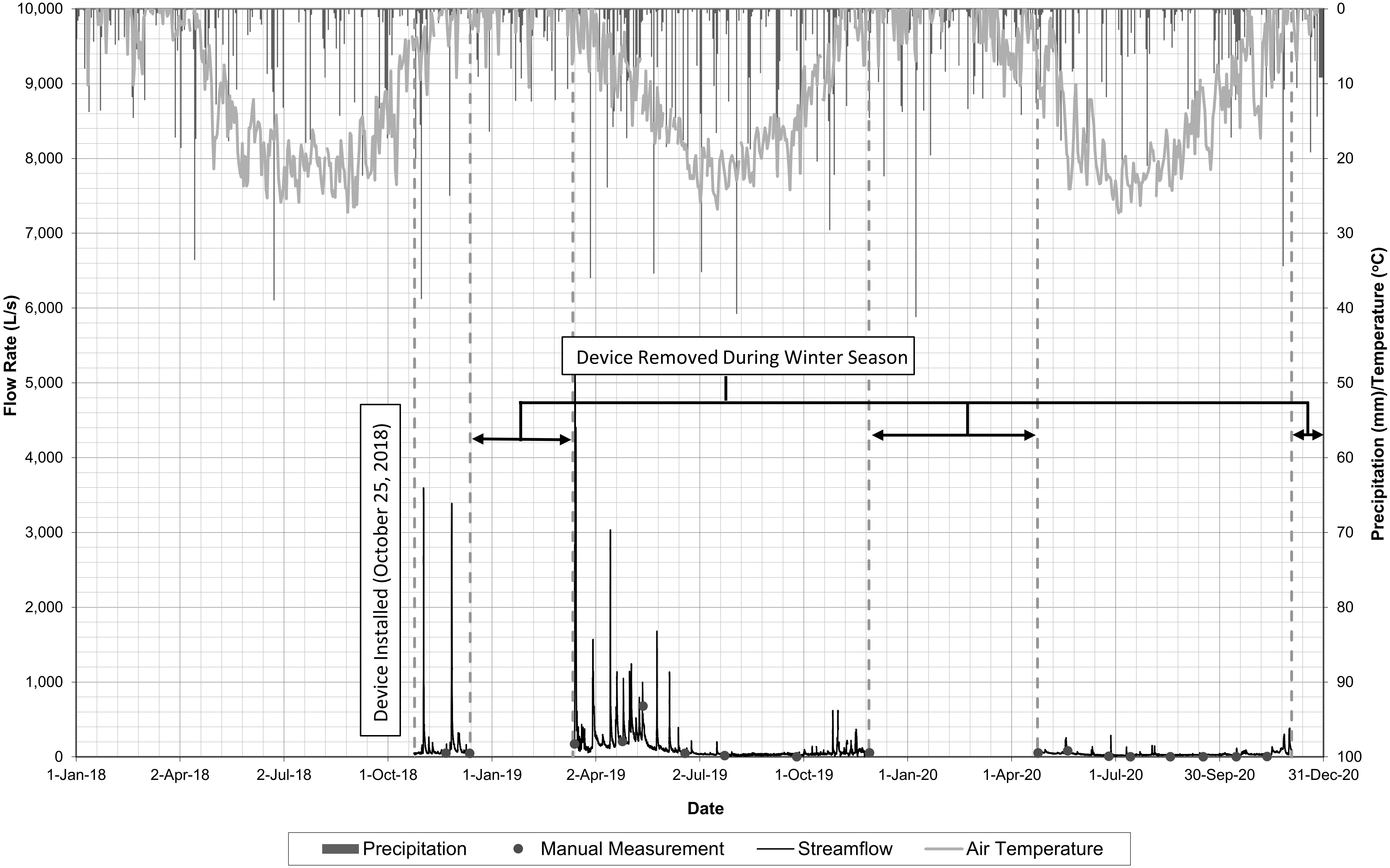
* Grey data indicates the monitoring location was dry and therefore the recorded values are respresentative of the air temperature.



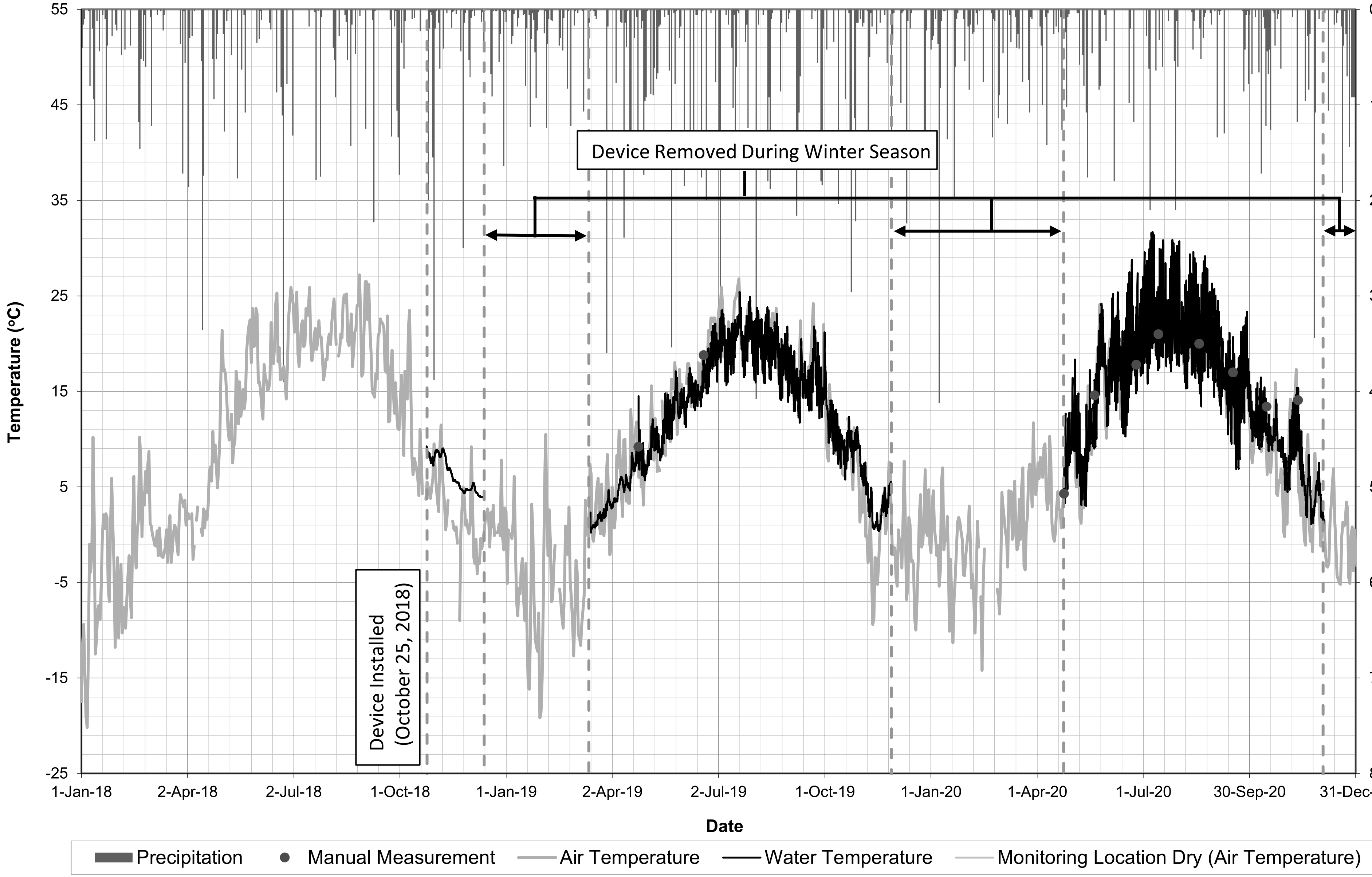
BURLINGTON QUARRY
MONITORING LOCATION SW30
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Precipitation (mm)/Temperature (°C)
0
10
20
30
40
50
60
70
80
90
100
Device Removed During Winter Season
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Date
Precipitation
Manual Measurement
Streamflow
Air Temperature

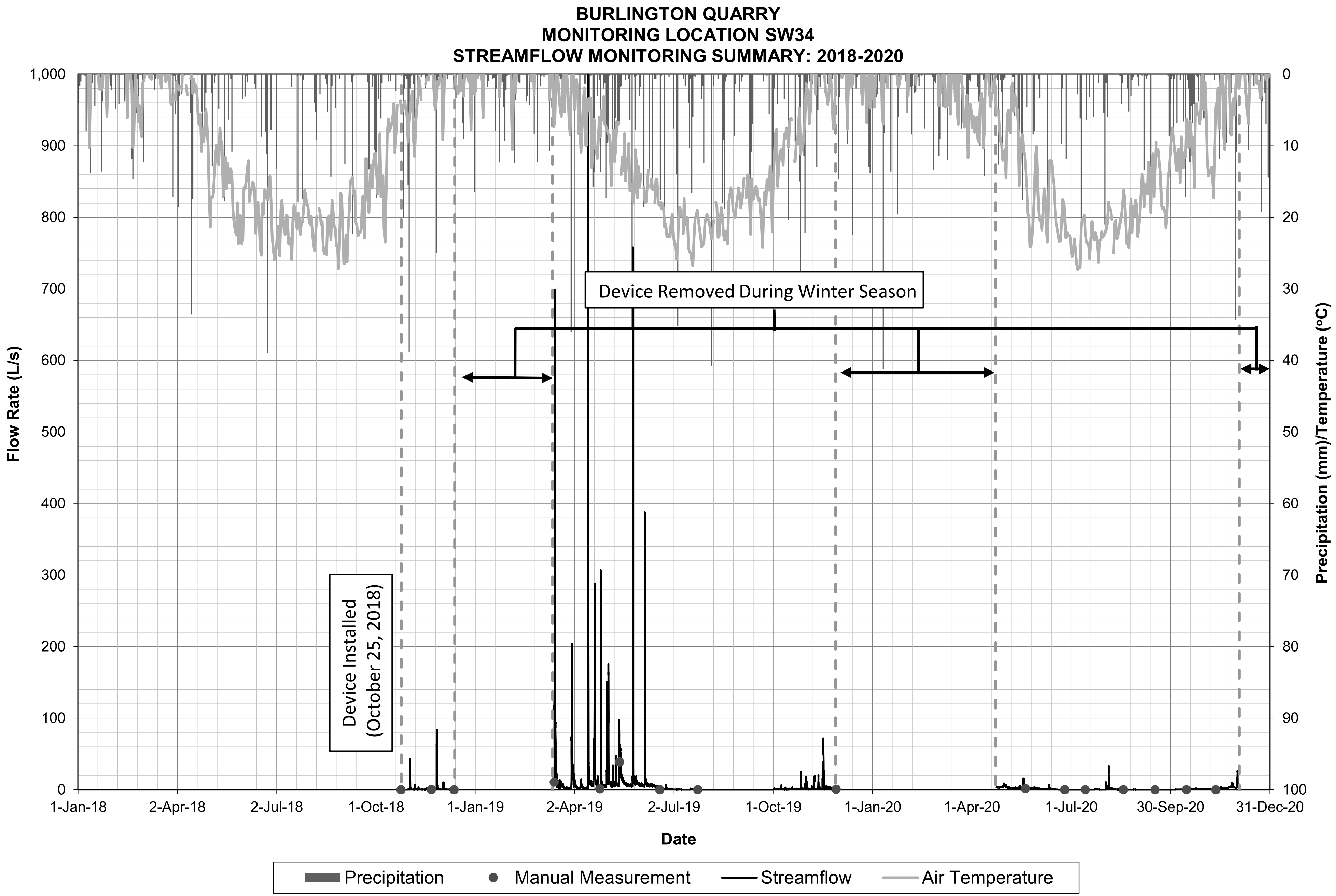

BURLINGTON QUARRY
MONITORING LOCATION SW30
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2020
Device Removed During Winter Season
Device Installed
(October 25, 2018)
Temperature (°C)
Precipitation (mm)
Date
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)

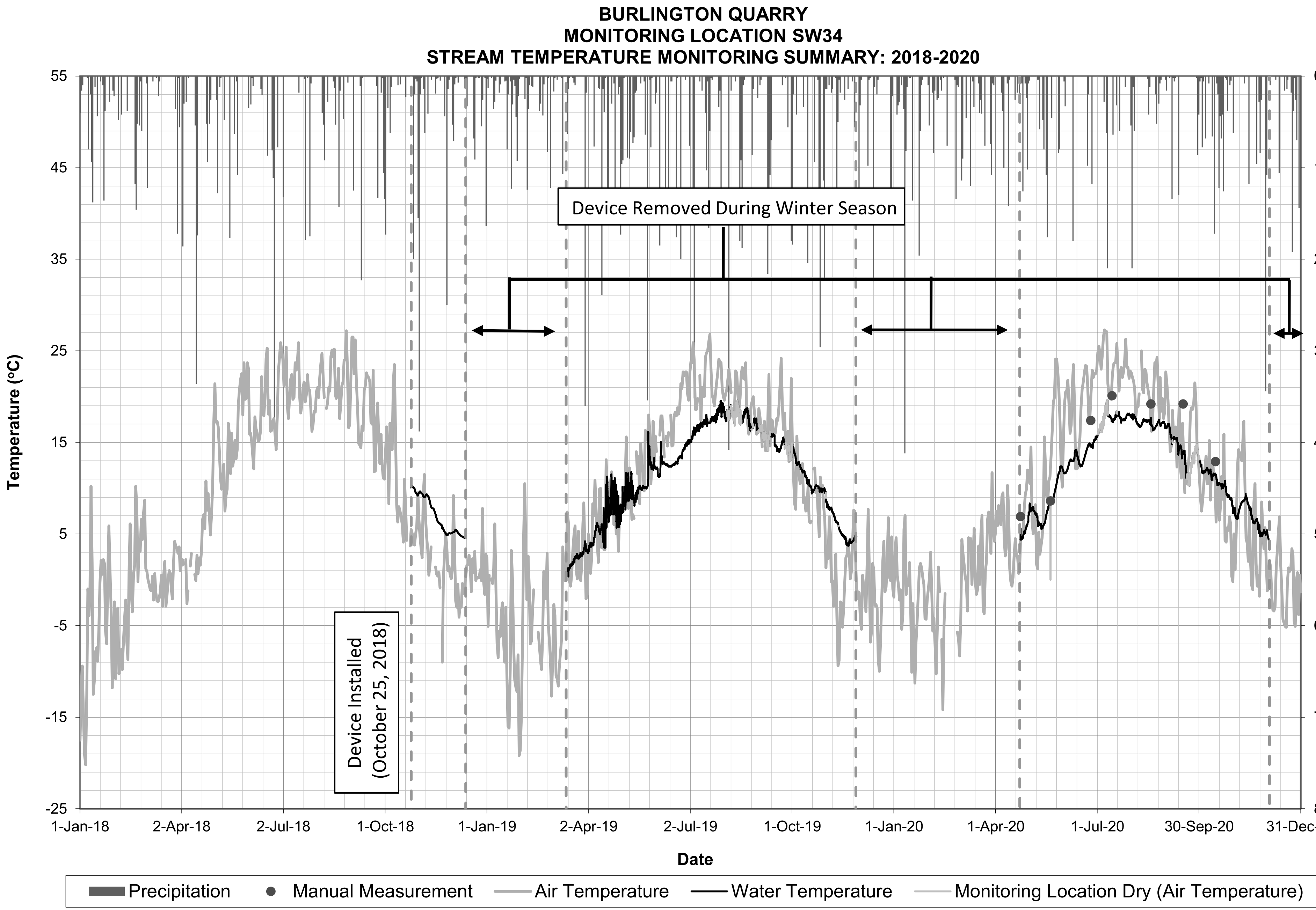
BURLINGTON QUARRY
MONITORING LOCATION SW31
STREAMFLOW MONITORING SUMMARY: 2018-2020



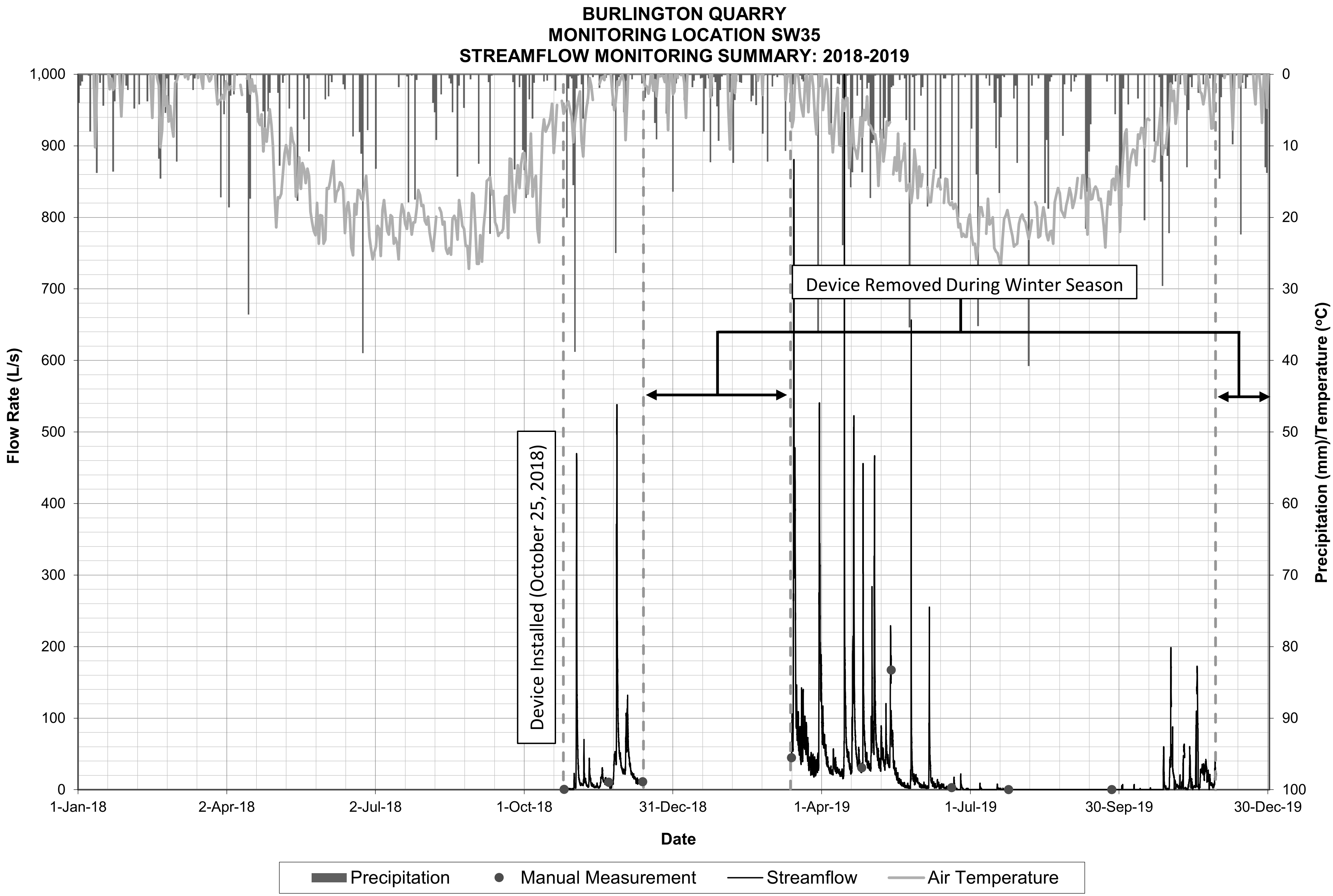
BURLINGTON QUARRY
MONITORING LOCATION SW31
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2020

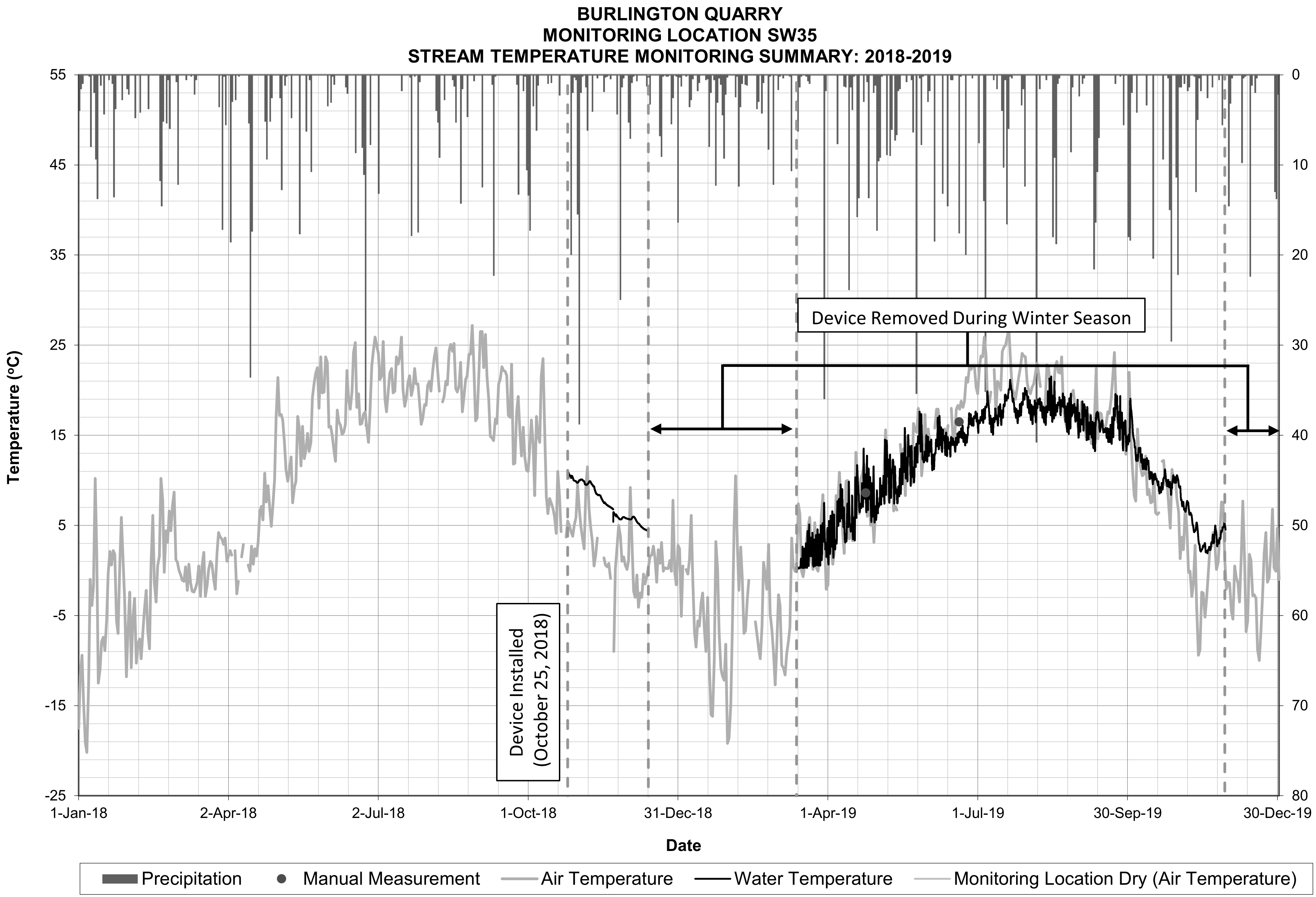



BURLINGTON QUARRY
MONITORING LOCATION SW34
STREAMFLOW MONITORING SUMMARY: 2018-2020
Flow Rate (L/s)
Precipitation (mm)/Temperature (ºC)
Date
1,000
900
800
700
600
500
400
300
200
100
0
10
20
30
40
50
60
70
80
90
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Device Removed During Winter Season
Device Installed (October 25, 2018)
Precipitation
Manual Measurement
Streamflow
Air Temperature

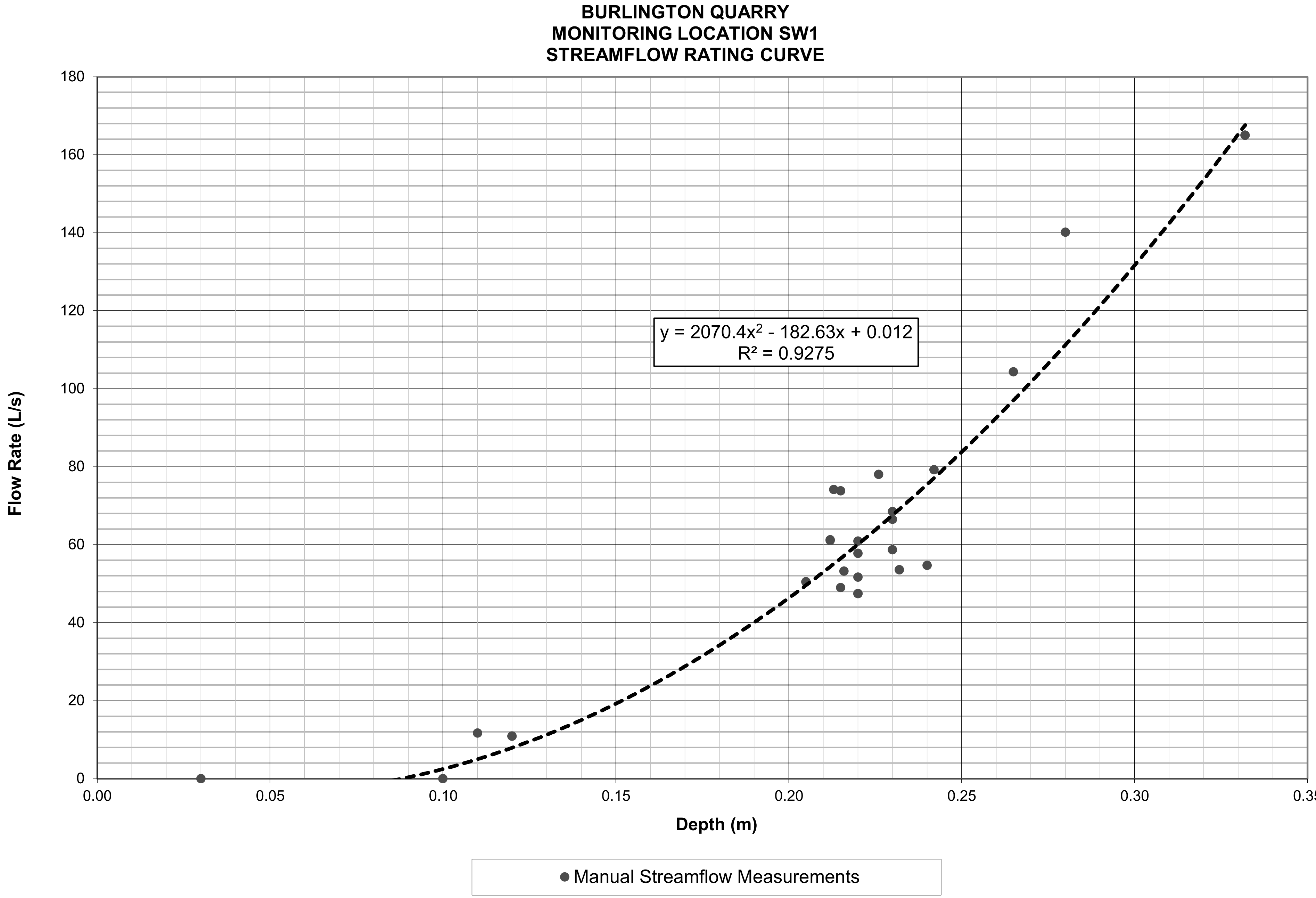


BURLINGTON QUARRY
MONITORING LOCATION SW34
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2020
Device Removed During Winter Season
Device Installed (October 25, 2018)
Temperature (°C)
Precipitation (mm)
Date
55
45
35
25
15
5
-5
-15
-25
0
10
20
30
40
50
60
70
80
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
1-Jan-19
2-Apr-19
2-Jul-19
1-Oct-19
1-Jan-20
1-Apr-20
1-Jul-20
30-Sep-20
31-Dec-20
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)

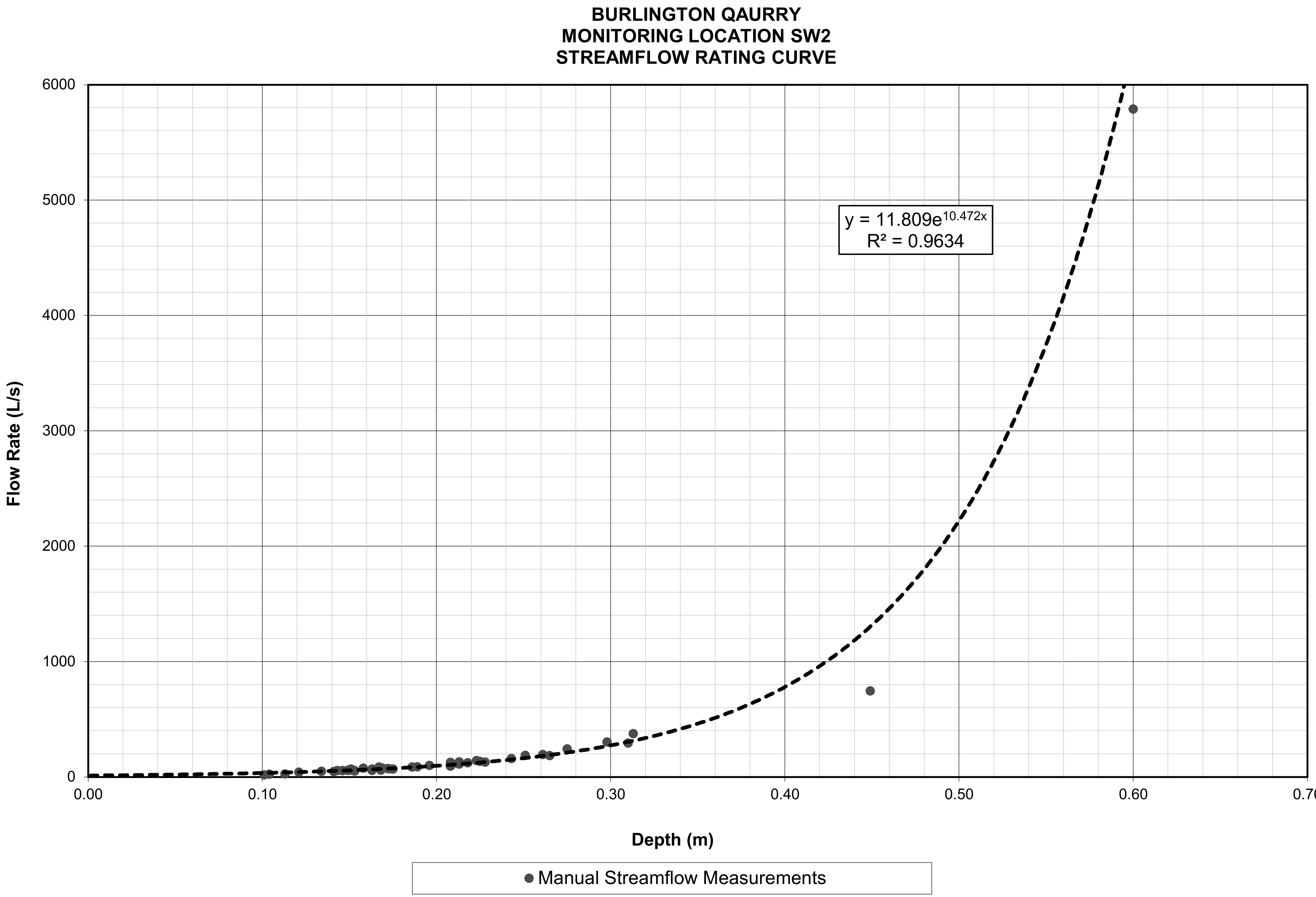

BURLINGTON QUARRY
MONITORING LOCATION SW35
STREAMFLOW MONITORING SUMMARY: 2018-2019
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (October 25, 2018)
Device Removed During Winter Season
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
31-Dec-18
1-Apr-19
1-Jul-19
30-Sep-19
30-Dec-19
Precipitation
Manual Measurement
Streamflow
Air Temperature



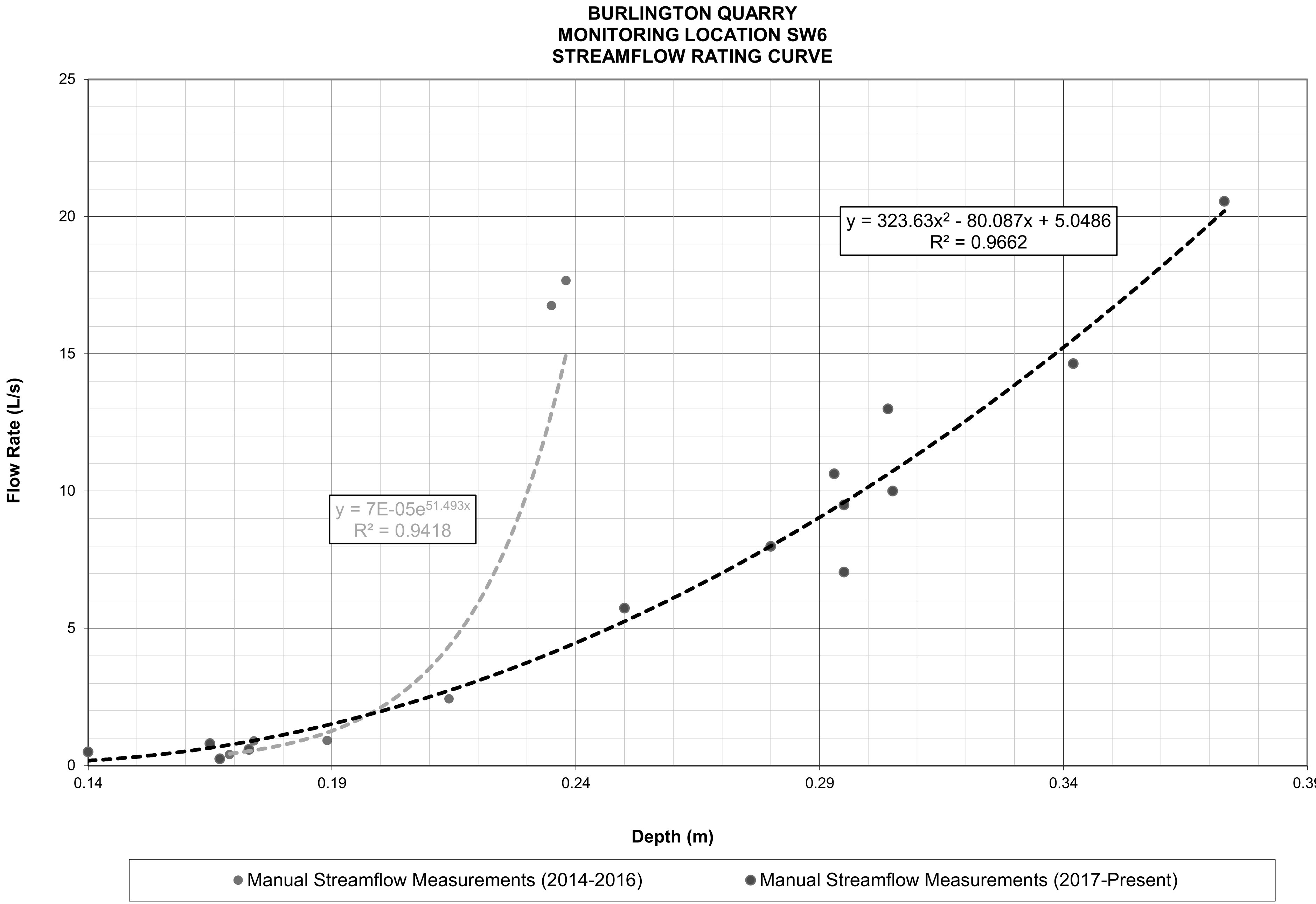
BURLINGTON QUARRY
MONITORING LOCATION SW35
STREAM TEMPERATURE MONITORING SUMMARY: 2018-2019
Temperature (°C)
Precipitation (mm)
Date
Device Removed During Winter Season
Device Installed (October 25, 2018)
1-Jan-18
2-Apr-18
2-Jul-18
1-Oct-18
31-Dec-18
1-Apr-19
1-Jul-19
30-Sep-19
30-Dec-19
Precipitation
Manual Measurement
Air Temperature
Water Temperature
Monitoring Location Dry (Air Temperature)

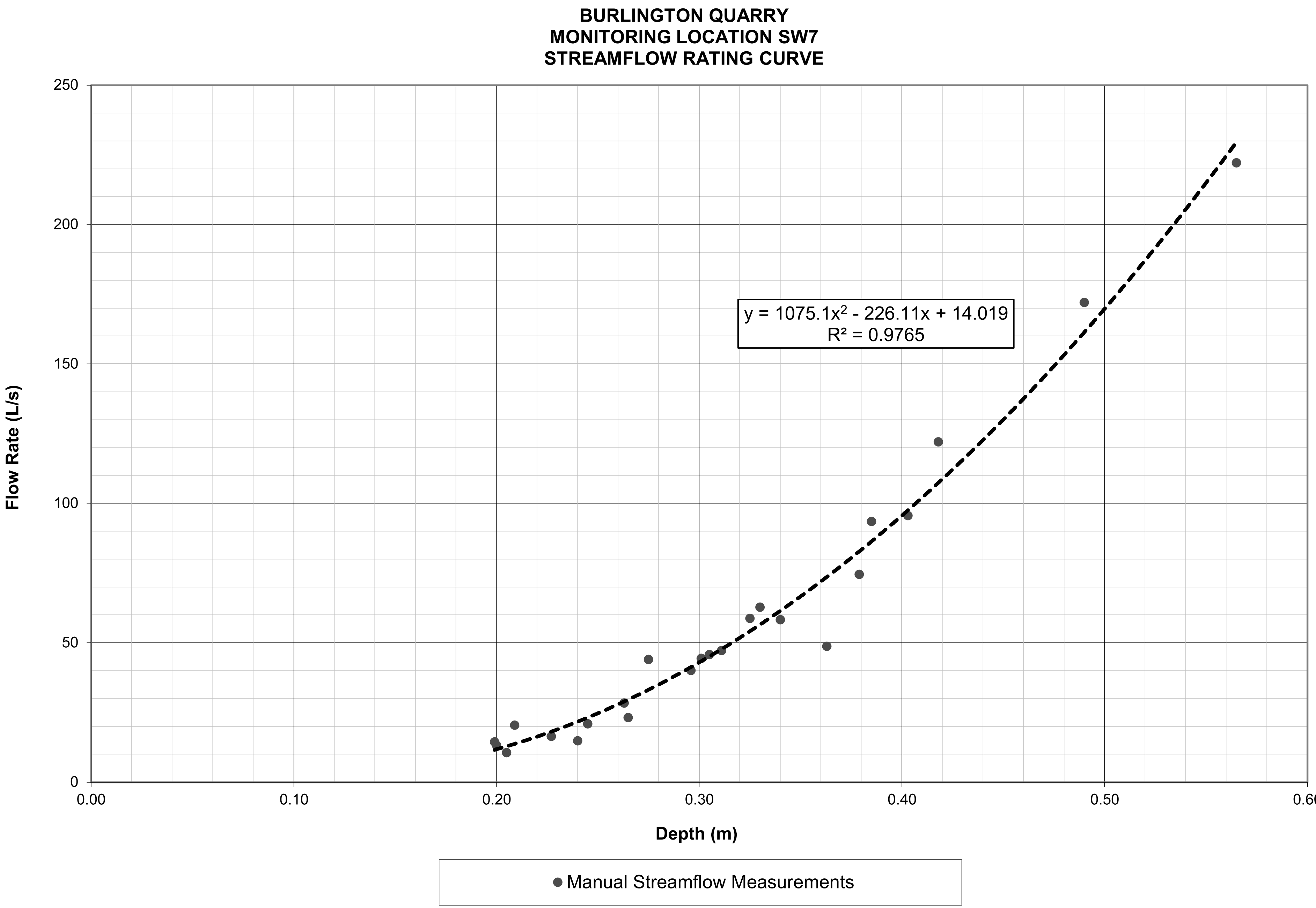


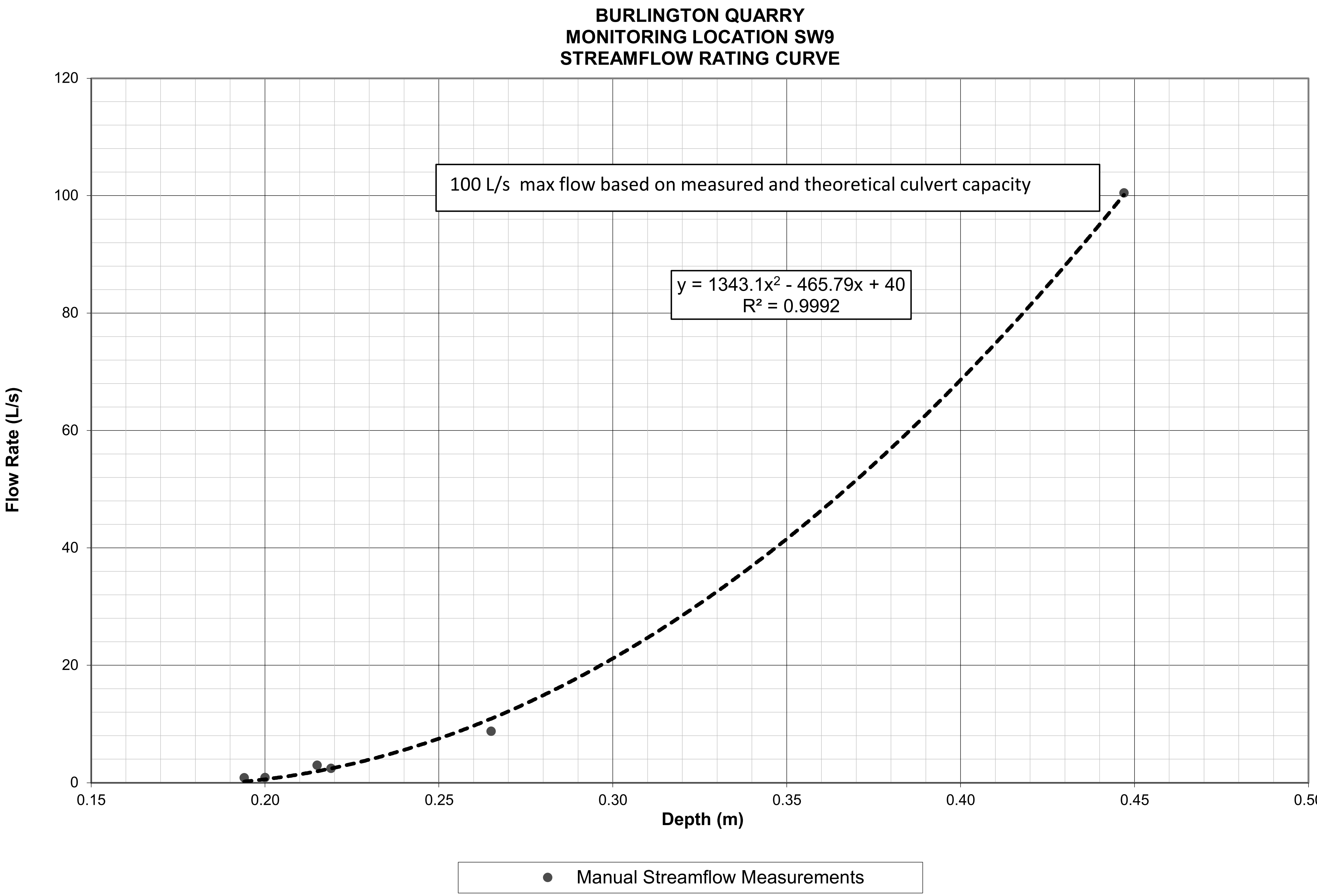
BURLINGTON QUARRY
MONITORING LOCATION SW1
STREAMFLOW RATING CURVE
y = 2070.4x² - 182.63x + 0.012
R² = 0.9275
Flow Rate (L/s)
0
20
40
60
80
100
120
140
160
180
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Depth (m)
Manual Streamflow Measurements



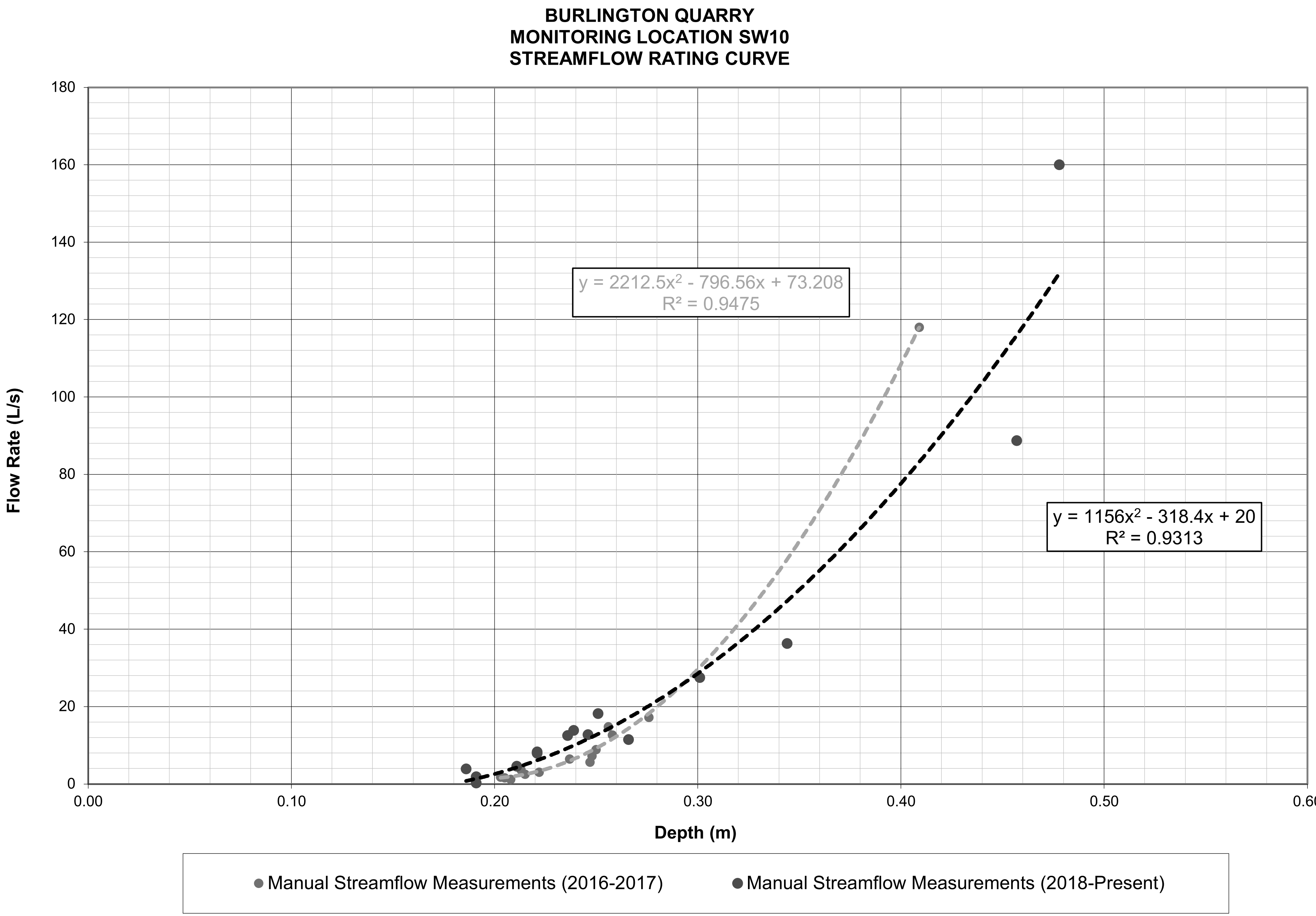
BURLINGTON QAURRY
MONITORING LOCATION SW2
STREAMFLOW RATING CURVE
y = 11.809e^10.472x
R² = 0.9634
Flow Rate (L/s)
0
1000
2000
3000
4000
5000
6000
Depth (m)
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
Manual Streamflow Measurements

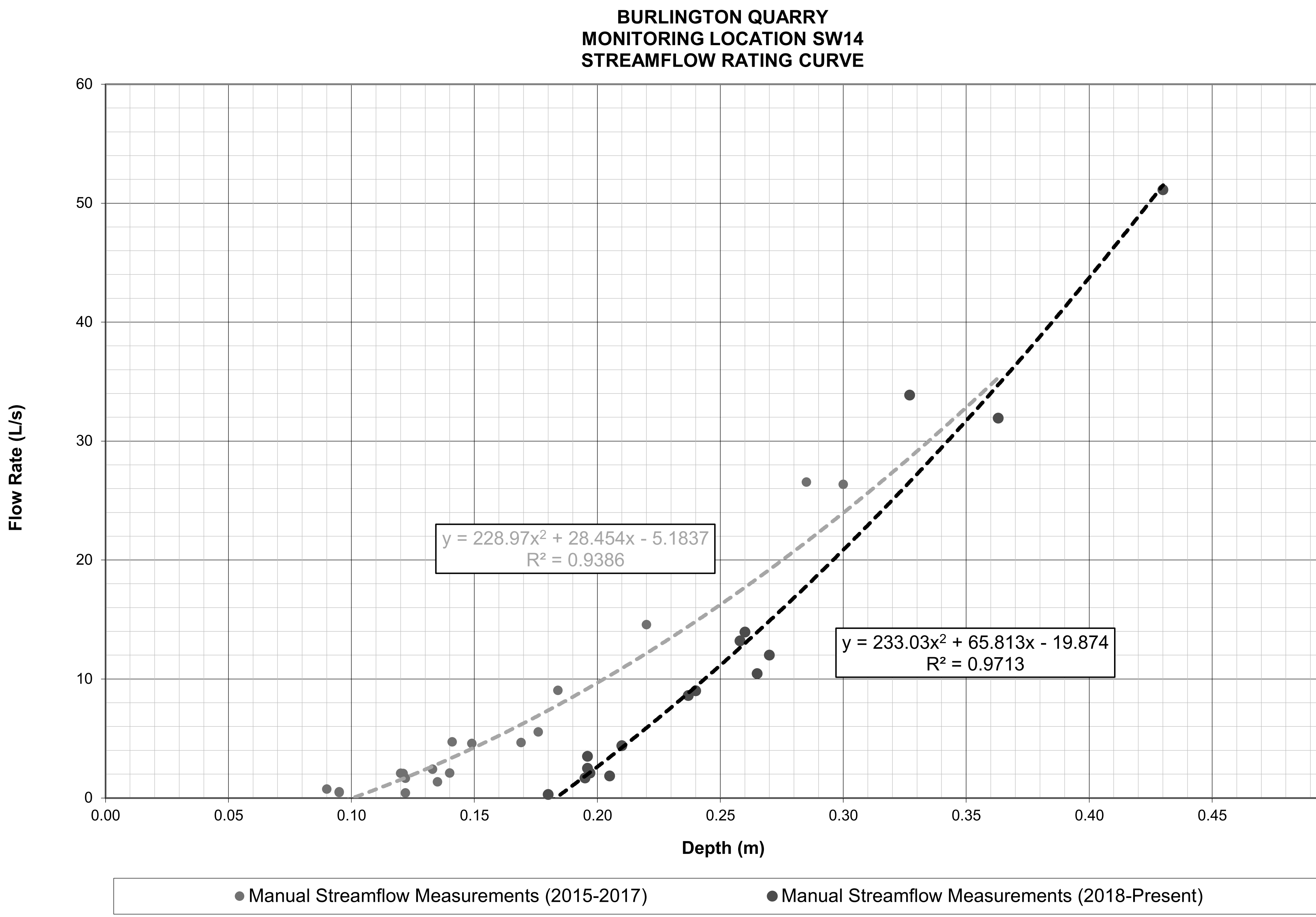

BURLINGTON QUARRY
MONITORING LOCATION SW6
STREAMFLOW RATING CURVE
Flow Rate (L/s)
Depth (m)
25
20
15
10
5
0
0.14
0.19
0.24
0.29
0.34
0.39
y = 323.63x² - 80.087x + 5.0486
R² = 0.9662
y = 7E-05e^51.493x
R² = 0.9418
Manual Streamflow Measurements (2014-2016)
Manual Streamflow Measurements (2017-Present)


BURLINGTON QUARRY
MONITORING LOCATION SW7
STREAMFLOW RATING CURVE
y = 1075.1x2 - 226.11x + 14.019
R² = 0.9765
Flow Rate (L/s)
Depth (m)
0
50
100
150
200
250
0.00
0.10
0.20
0.30
0.40
0.50
0.60
Manual Streamflow Measurements

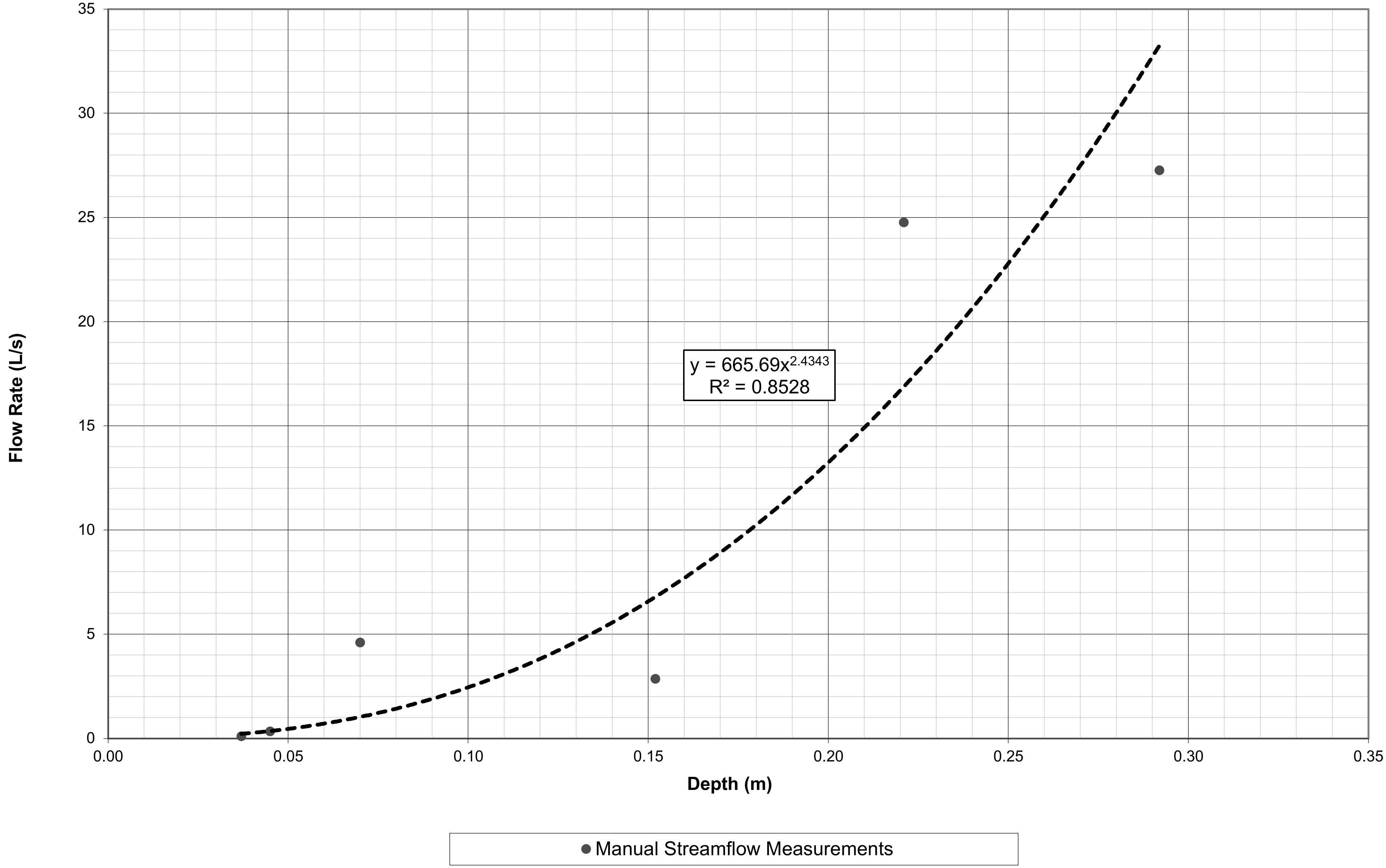


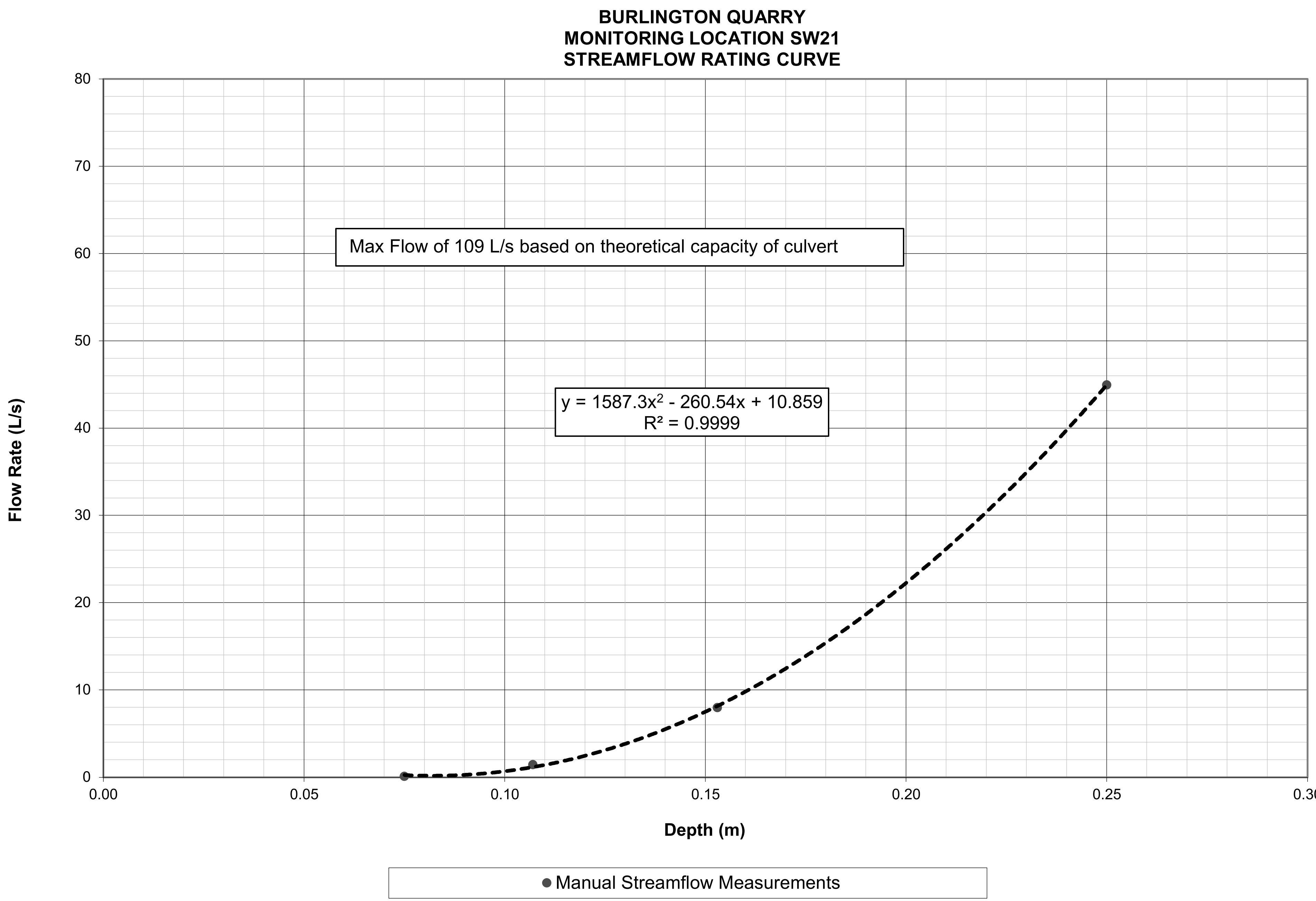
BURLINGTON QUARRY
MONITORING LOCATION SW9
STREAMFLOW RATING CURVE
100 L/s max flow based on measured and theoretical culvert capacity
y = 1343.1x² - 465.79x + 40
R² = 0.9992
Flow Rate (L/s)
Depth (m)
0
20
40
60
80
100
120
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Manual Streamflow Measurements

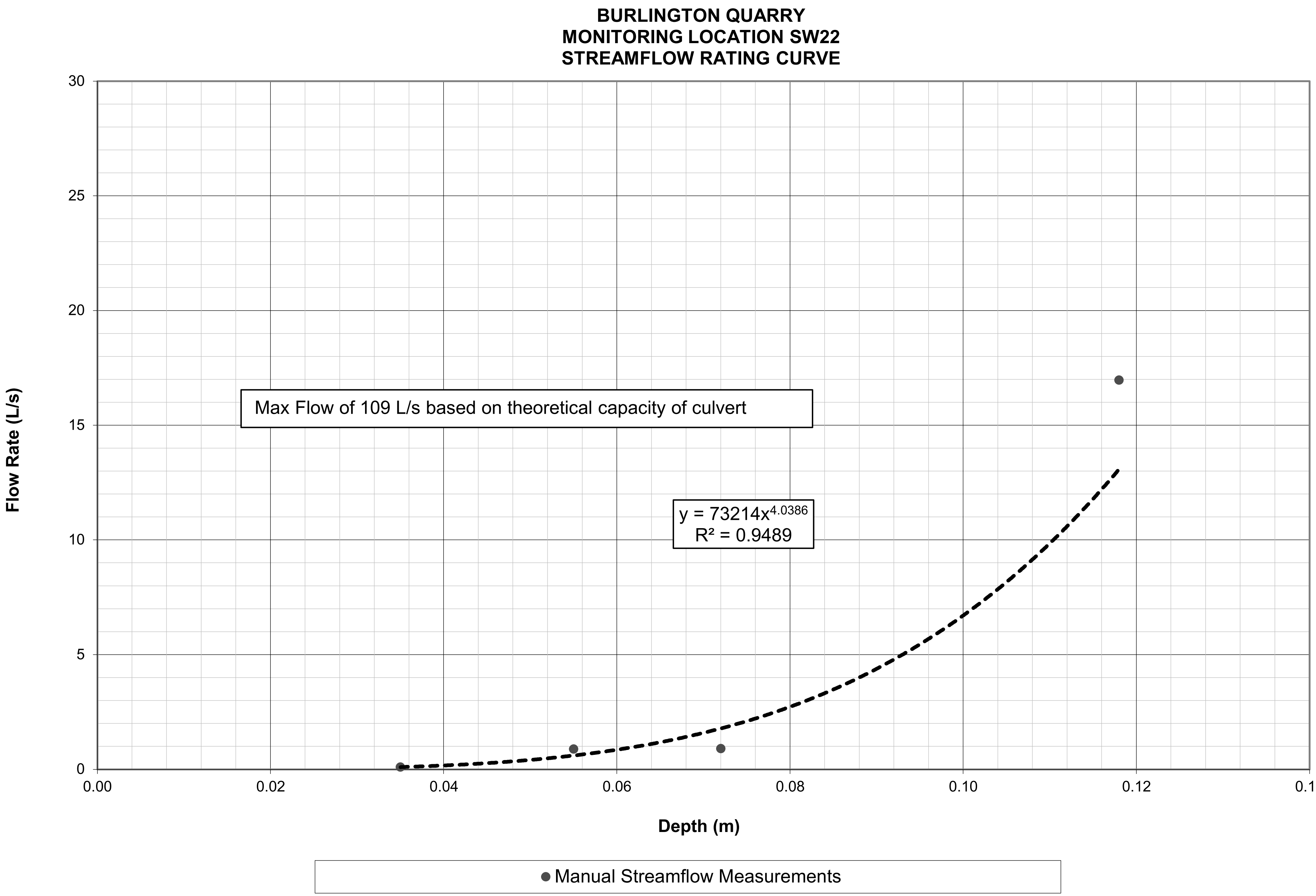

BURLINGTON QUARRY
MONITORING LOCATION SW10
STREAMFLOW RATING CURVE
Flow Rate (L/s)
Depth (m)
0
20
40
60
80
100
120
140
160
180
0.00
0.10
0.20
0.30
0.40
0.50
0.60
y = 2212.5x² - 796.56x + 73.208
R² = 0.9475
y = 1156x² - 318.4x + 20
R² = 0.9313
Manual Streamflow Measurements (2016-2017)
Manual Streamflow Measurements (2018-Present)


BURLINGTON QUARRY
MONITORING LOCATION SW14
STREAMFLOW RATING CURVE
Flow Rate (L/s)
Depth (m)
0
10
20
30
40
50
60
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
y = 228.97x² + 28.454x - 5.1837
R² = 0.9386
y = 233.03x² + 65.813x - 19.874
R² = 0.9713
Manual Streamflow Measurements (2015-2017)
Manual Streamflow Measurements (2018-Present)

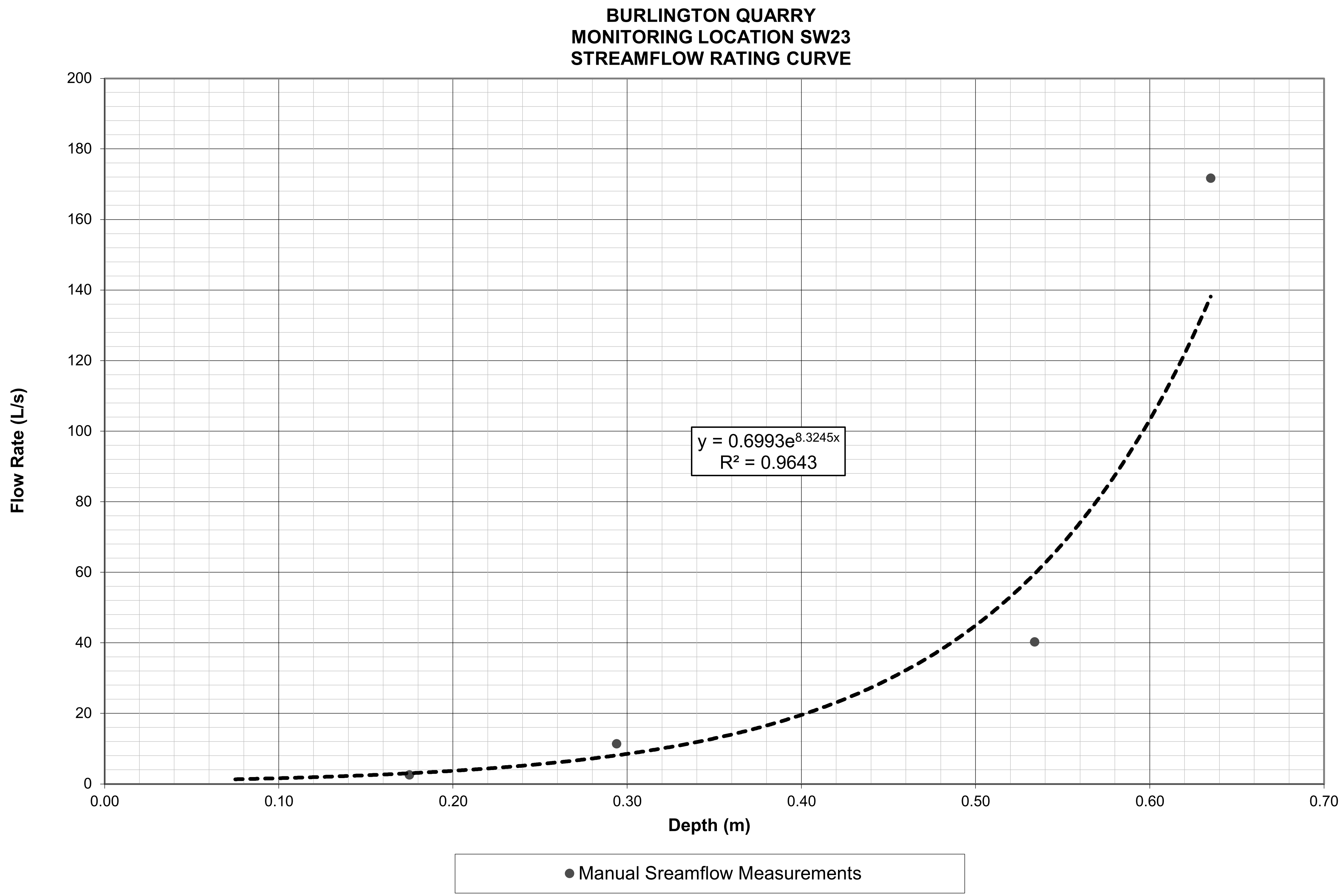
BURLINGTON QUARRY
MONITORING LOCATION SW15
STREAMFLOW RATING CURVE



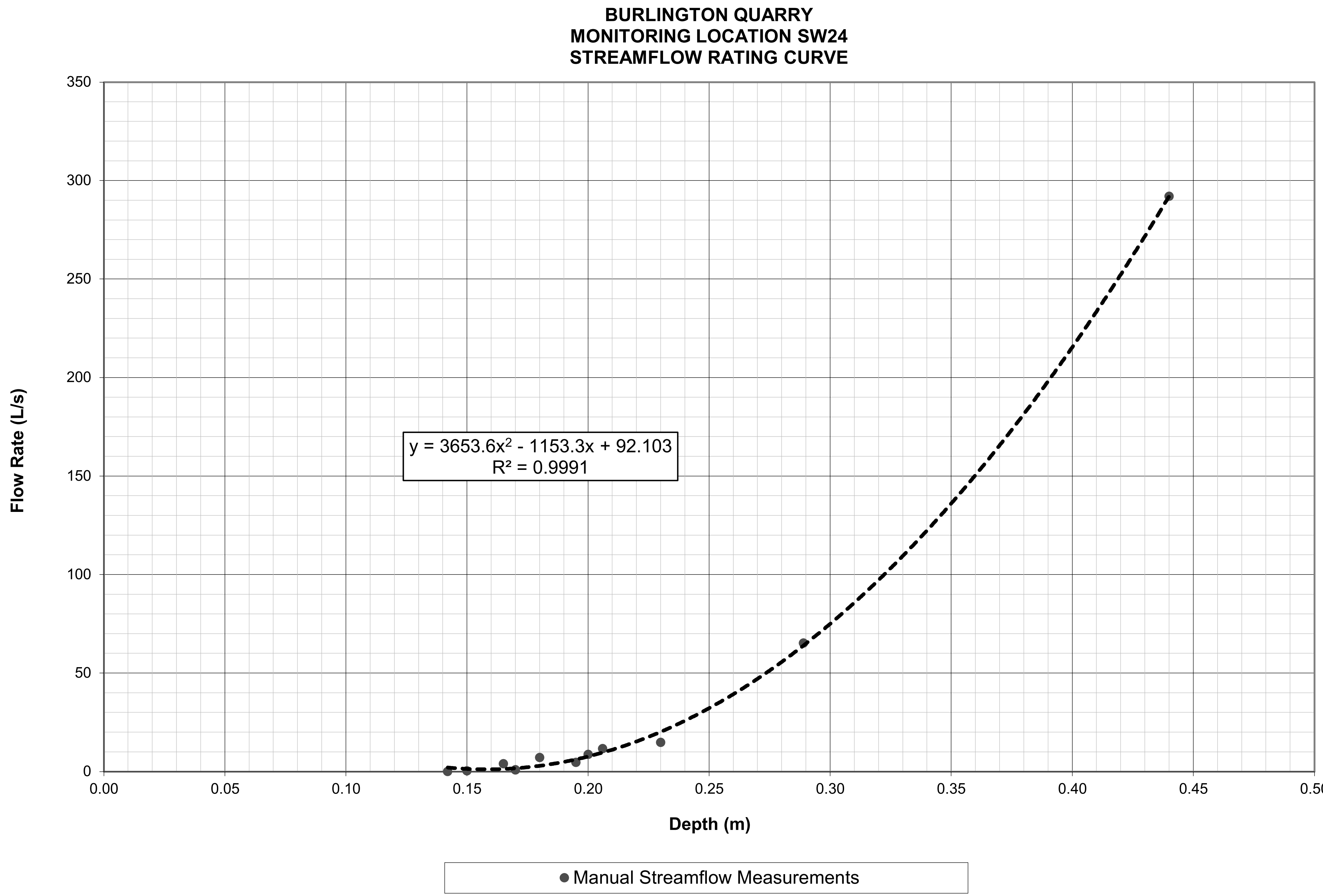

BURLINGTON QUARRY
MONITORING LOCATION SW21
STREAMFLOW RATING CURVE
Max Flow of 109 L/s based on theoretical capacity of culvert
y = 1587.3x² - 260.54x + 10.859
R² = 0.9999
Flow Rate (L/s)
Depth (m)
0
10
20
30
40
50
60
70
80
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Manual Streamflow Measurements



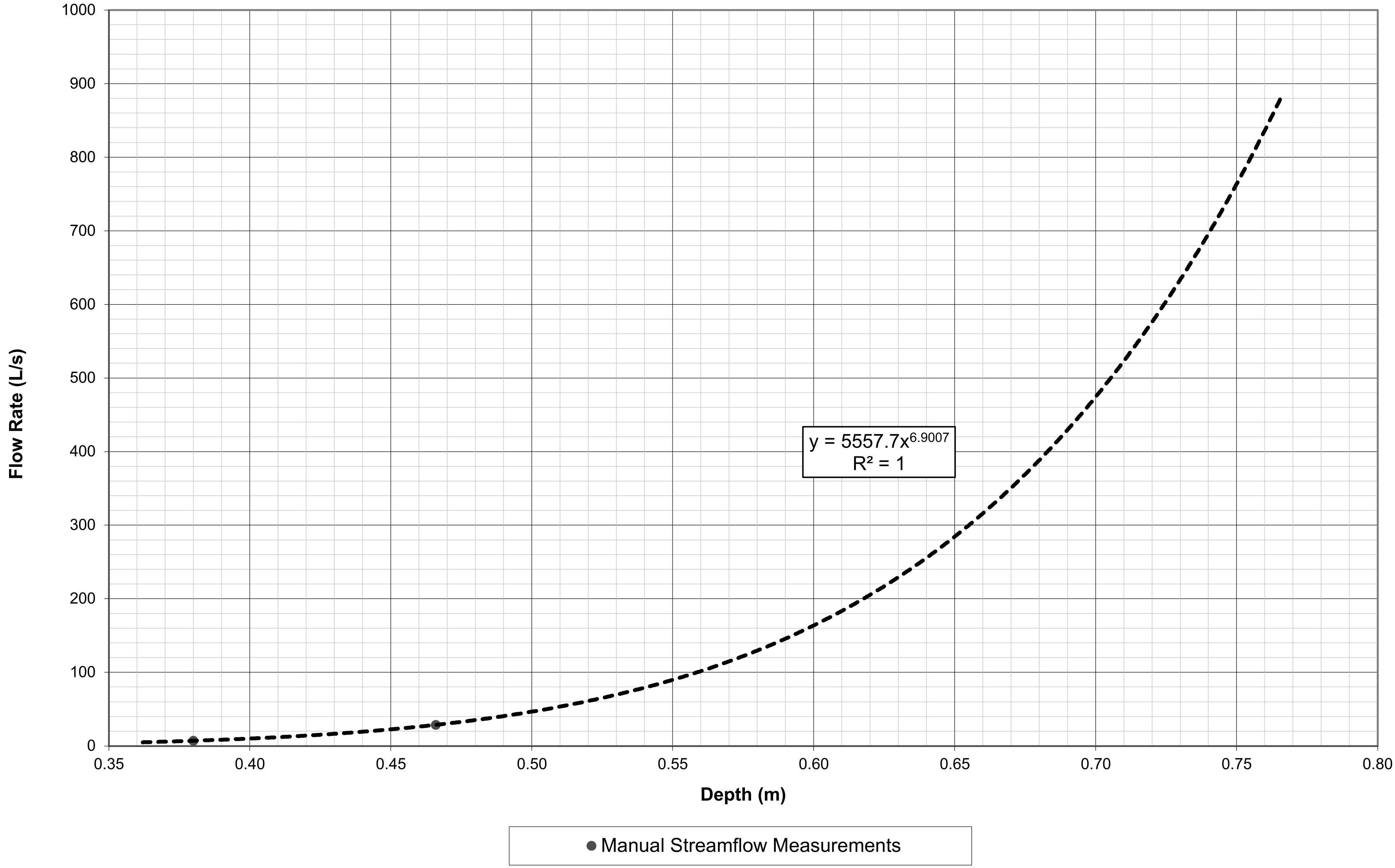
BURLINGTON QUARRY
MONITORING LOCATION SW22
STREAMFLOW RATING CURVE
Max Flow of 109 L/s based on theoretical capacity of culvert
$y = 73214x^{4.0386}$
$R^2 = 0.9489$
Flow Rate (L/s)
Depth (m)
0
5
10
15
20
25
30
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
Manual Streamflow Measurements

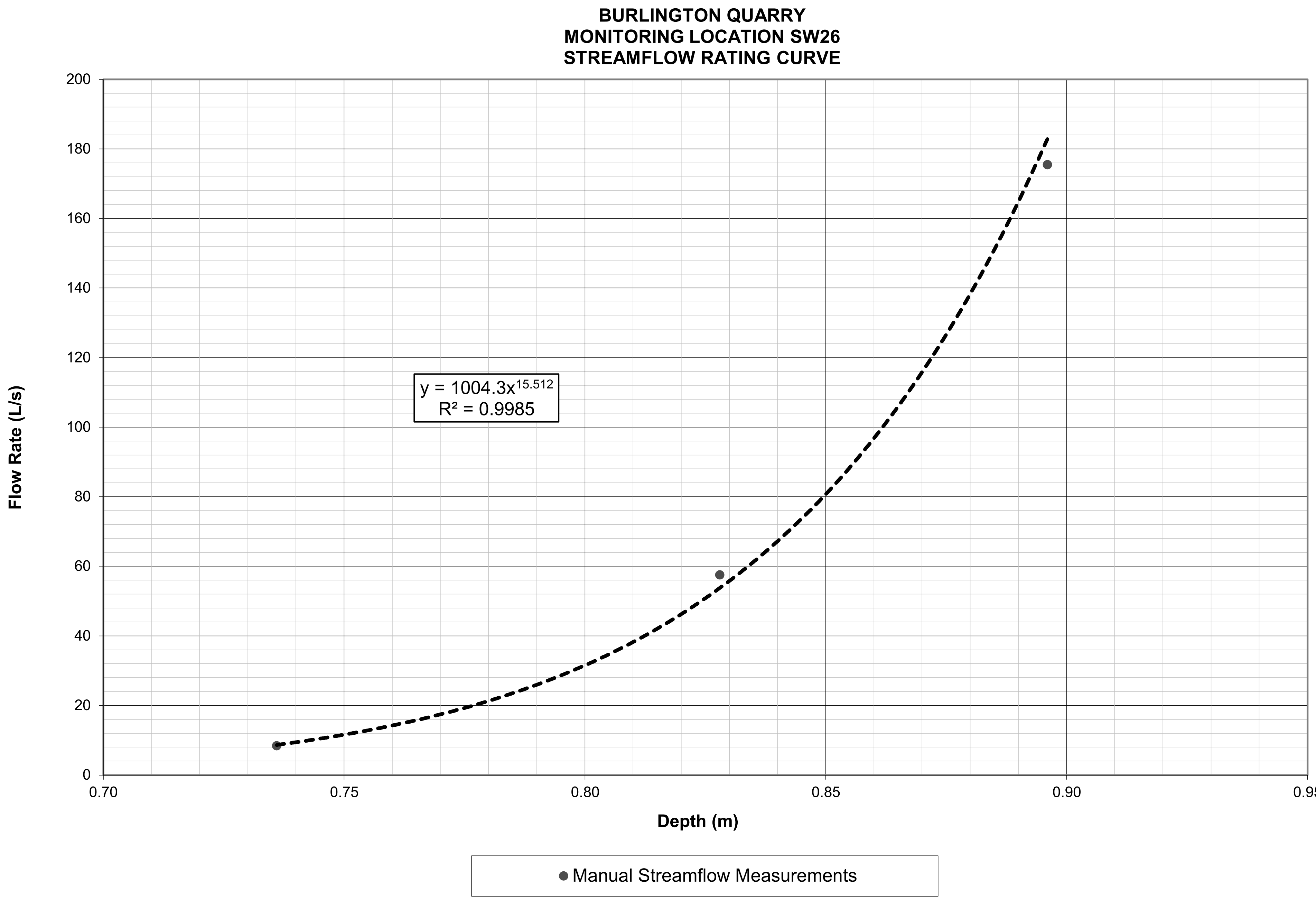


BURLINGTON QUARRY
MONITORING LOCATION SW23
STREAMFLOW RATING CURVE
200
180
160
140
120
100
80
60
40
20
0
Flow Rate (L/s)
$y = 0.6993e^{8.3245x}$
$R^2 = 0.9643$
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
Depth (m)
Manual Sreamflow Measurements

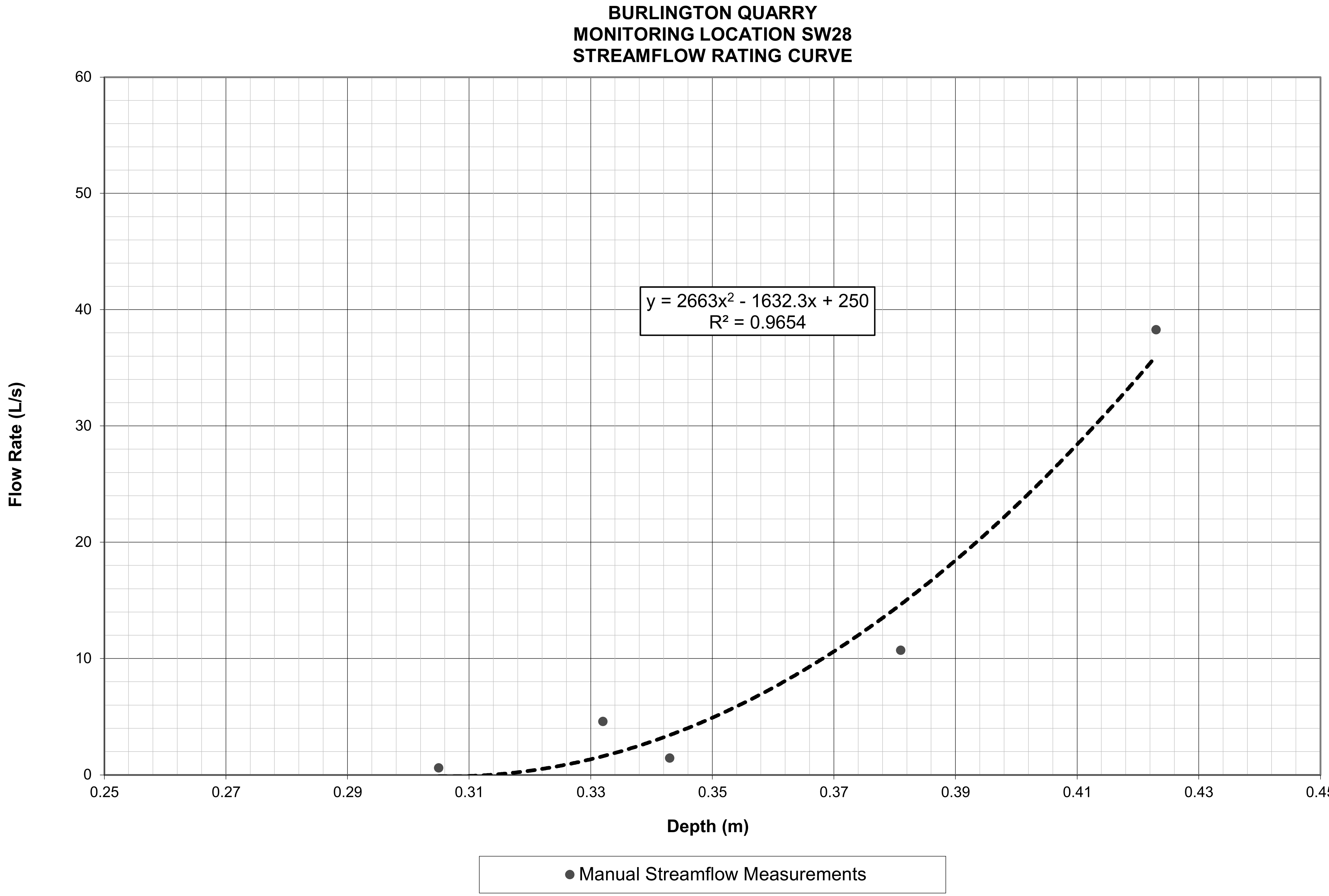

BURLINGTON QUARRY
MONITORING LOCATION SW24
STREAMFLOW RATING CURVE
y = 3653.6x² - 1153.3x + 92.103
R² = 0.9991
Flow Rate (L/s)
Depth (m)
0
50
100
150
200
250
300
350
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Manual Streamflow Measurements

BURLINGTON QUARRY
MONITORING LOCATION SW25
STREAMFLOW RATING CURVE

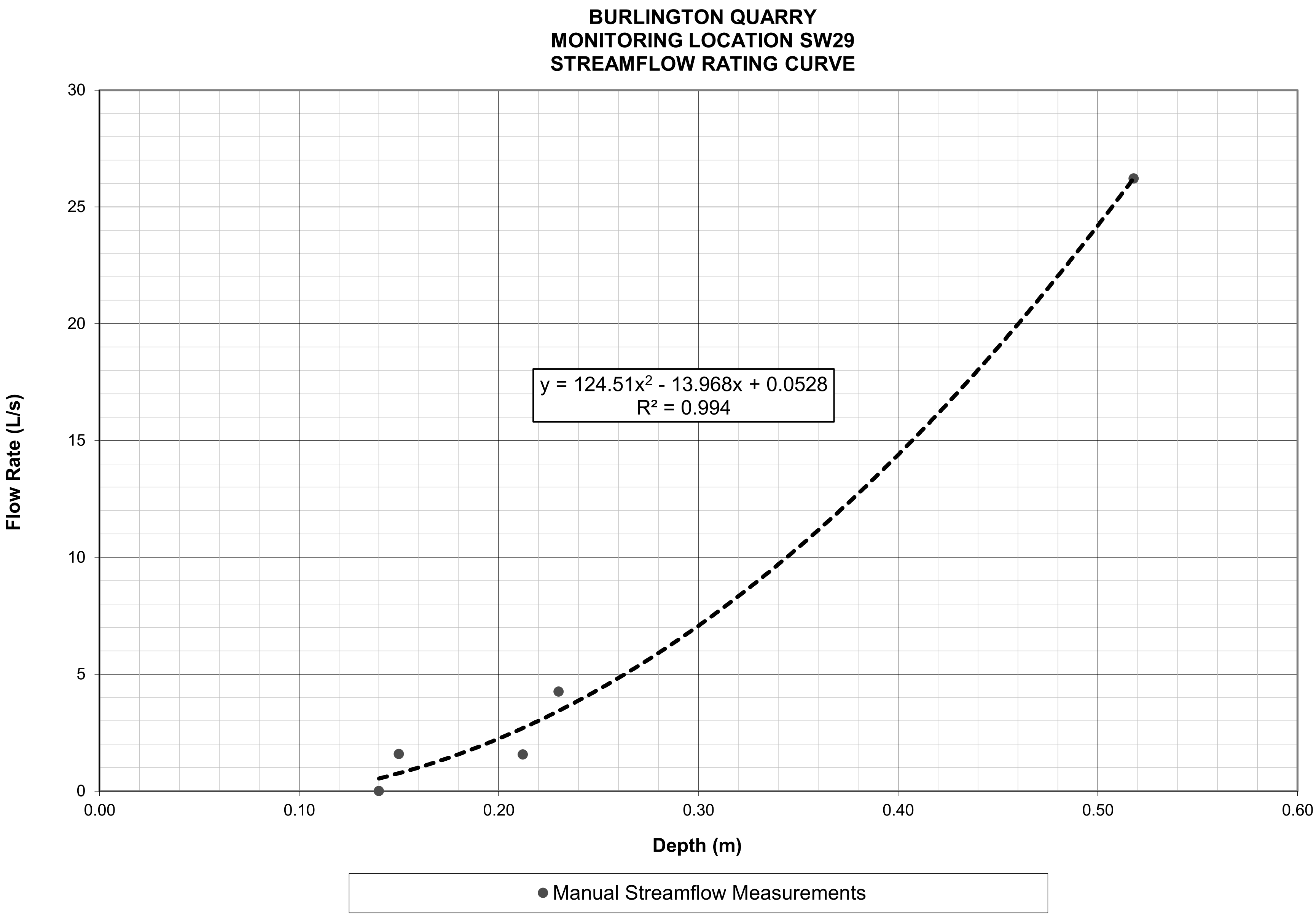


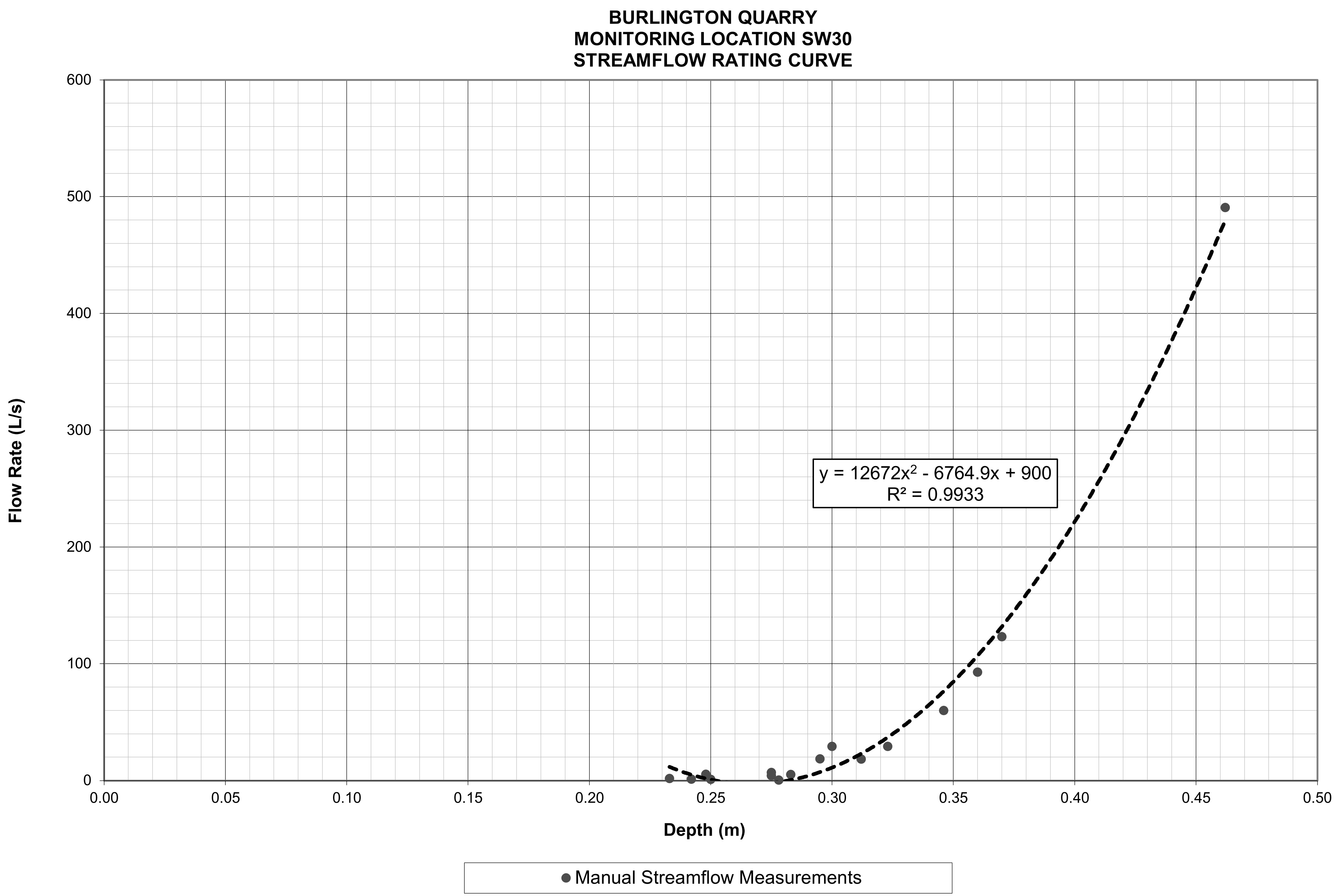


BURLINGTON QUARRY
MONITORING LOCATION SW26
STREAMFLOW RATING CURVE
y = 1004.3x^15.512
R² = 0.9985
Flow Rate (L/s)
0
20
40
60
80
100
120
140
160
180
200
0.70
0.75
0.80
0.85
0.90
0.95
Depth (m)
Manual Streamflow Measurements



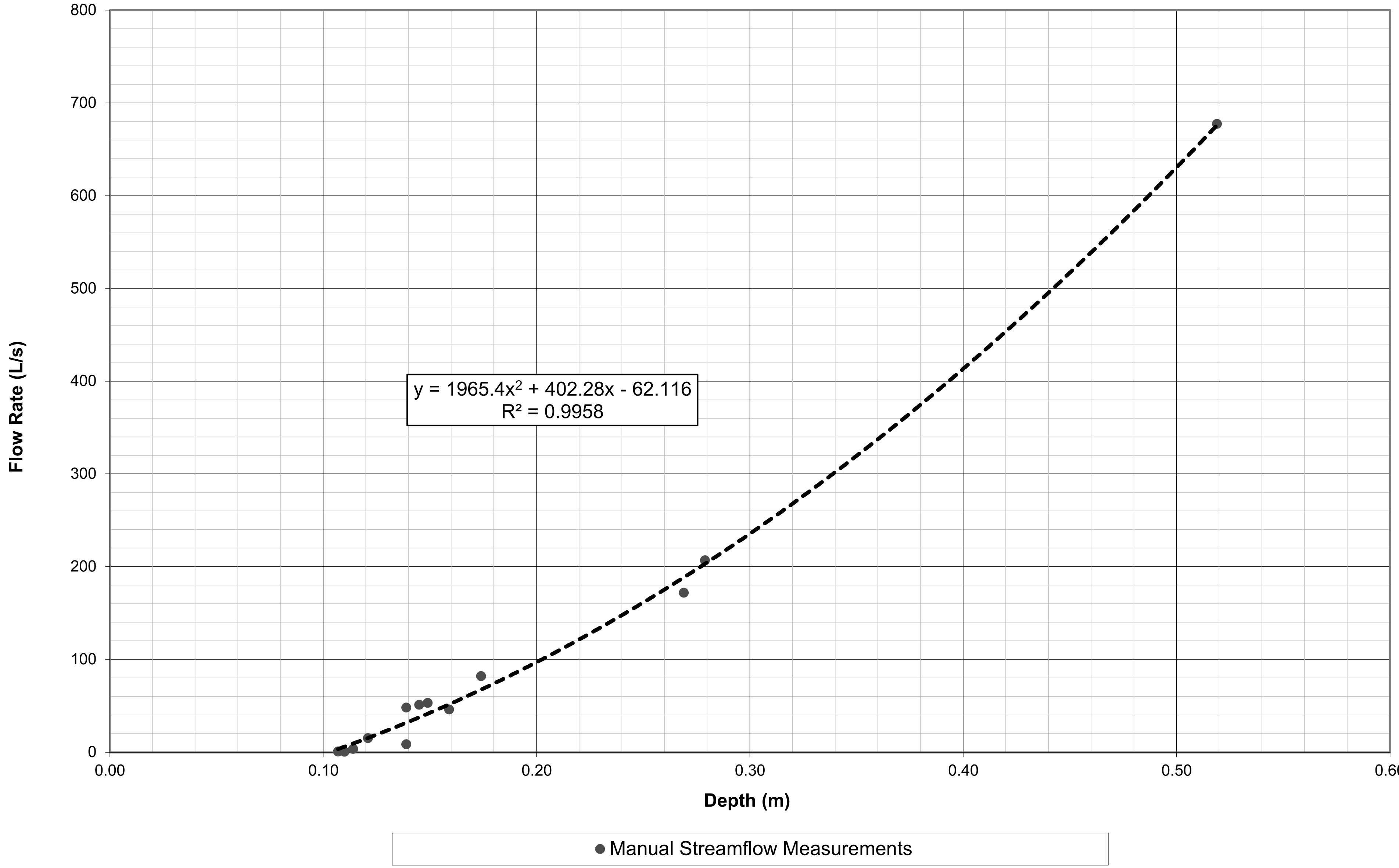
BURLINGTON QUARRY
MONITORING LOCATION SW28
STREAMFLOW RATING CURVE
y = 2663x² - 1632.3x + 250
R² = 0.9654
Flow Rate (L/s)
Depth (m)
0
10
20
30
40
50
60
0.25
0.27
0.29
0.31
0.33
0.35
0.37
0.39
0.41
0.43
0.45
Manual Streamflow Measurements


BURLINGTON QUARRY
MONITORING LOCATION SW29
STREAMFLOW RATING CURVE
y = 124.51x2 - 13.968x + 0.0528
R² = 0.994
Flow Rate (L/s)
Depth (m)
0
5
10
15
20
25
30
0.00
0.10
0.20
0.30
0.40
0.50
0.60
Manual Streamflow Measurements

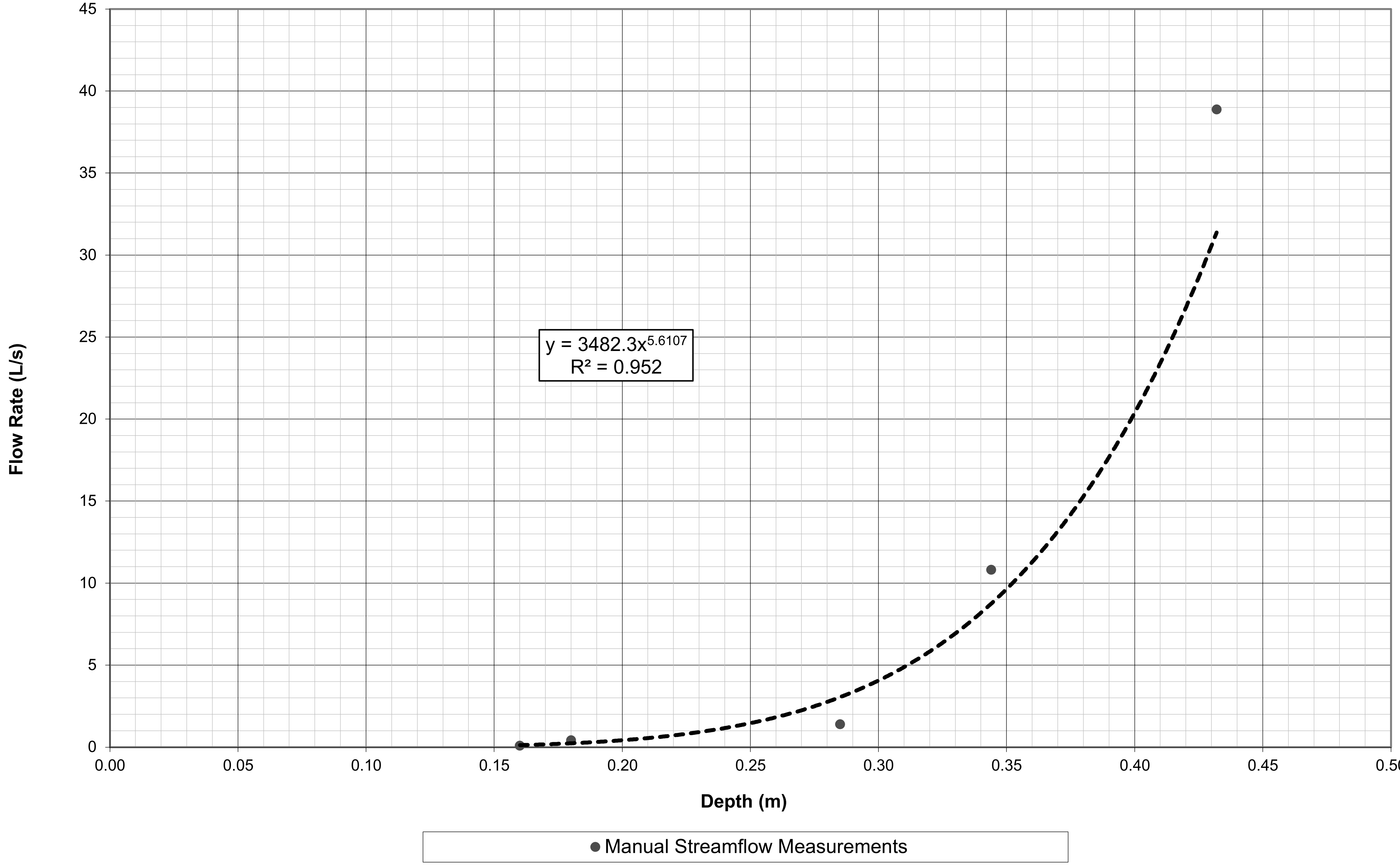


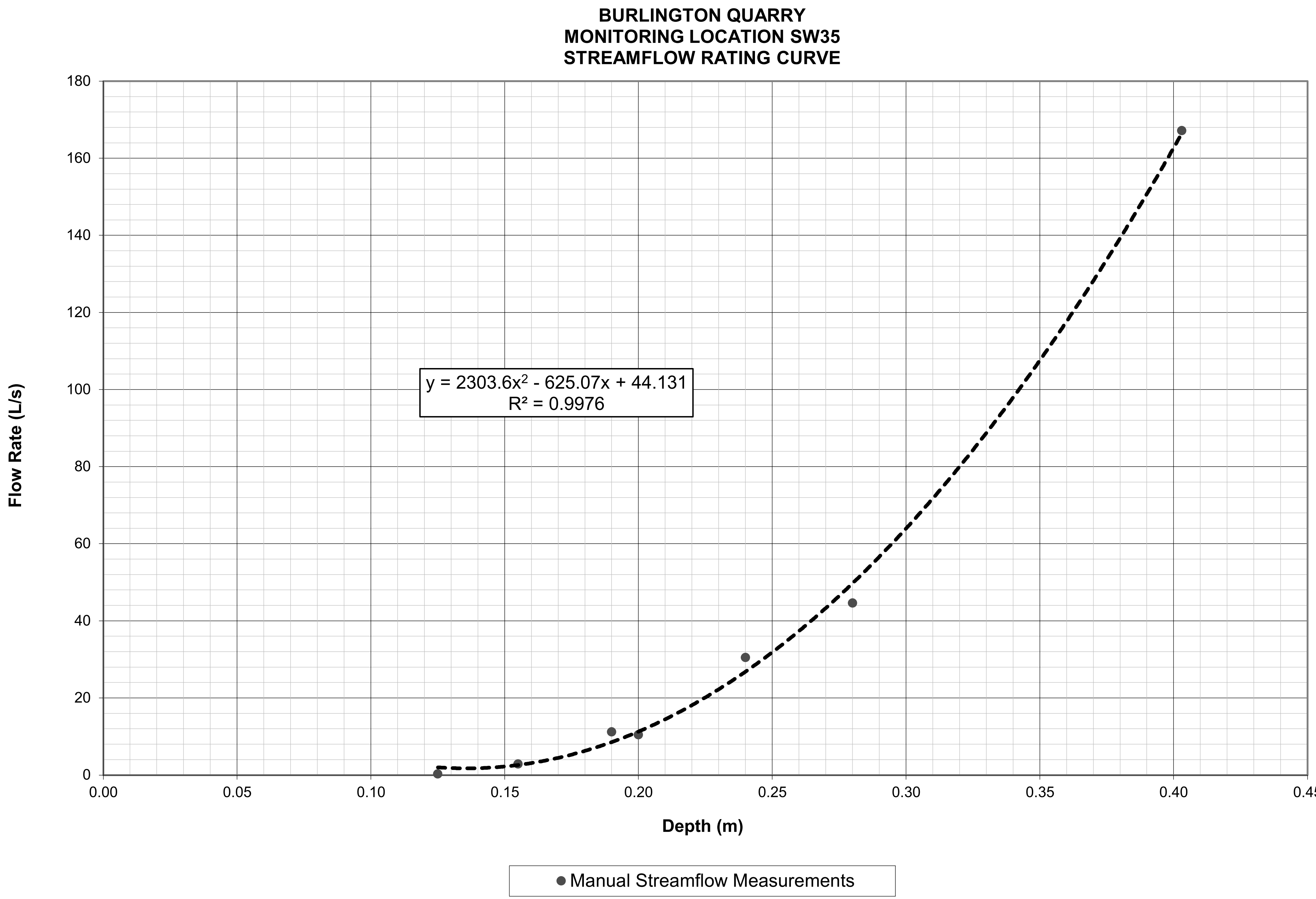
BURLINGTON QUARRY
MONITORING LOCATION SW30
STREAMFLOW RATING CURVE
Flow Rate (L/s)
0
100
200
300
400
500
600
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Depth (m)
y = 12672x² - 6764.9x + 900
R² = 0.9933
Manual Streamflow Measurements

BURLINGTON QUARRY
MONITORING LOCATION SW31
STREAMFLOW RATING CURVE



BURLINGTON QUARRY
MONITORING LOCATION SW34
STREAMFLOW RATING CURVE




BURLINGTON QUARRY
MONITORING LOCATION SW35
STREAMFLOW RATING CURVE
Flow Rate (L/s)
180
160
140
120
100
80
60
40
20
0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
Depth (m)
y = 2303.6x² - 625.07x + 44.131
R² = 0.9976
Manual Streamflow Measurements

VO Modelling Parameter Sources

1. SCS Curve Number

Typical CN values for various land use categories where taken from the MTO Design Charts (Table 1.09) and USDA (Urban Hydrology for Small Watersheds, Table 2.2a). The adopted values are summarized in the following table.

	Forest / Woodland	**Pasture / Lawns**	**Meadows**	**Cultivated**	**Gravel**	**Impervious**	**Wetland / Lakes / SWMF**
A	32	49	38	62	76	100	50
B	60	69	65	74	85	100	50
C	73	79	76	82	89	100	50
D	79	84	81	86	91	100	50

2. Initial Abstraction

Weighted averaged catchment Initial Abstraction values were estimated based on catchment land use areas. The following values were adopted for the various land use categories.

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

3. Land Use

A summary of the adopted land use area sources is provided overleaf.

4. Precipitation Data

Precipitation Intensity-Duration-Frequency information was taken from the MTO IDF look-up tool. These values have been further compared against the City of Burlington IDF data.

5. Reservoir Storage-Discharge Characteristics

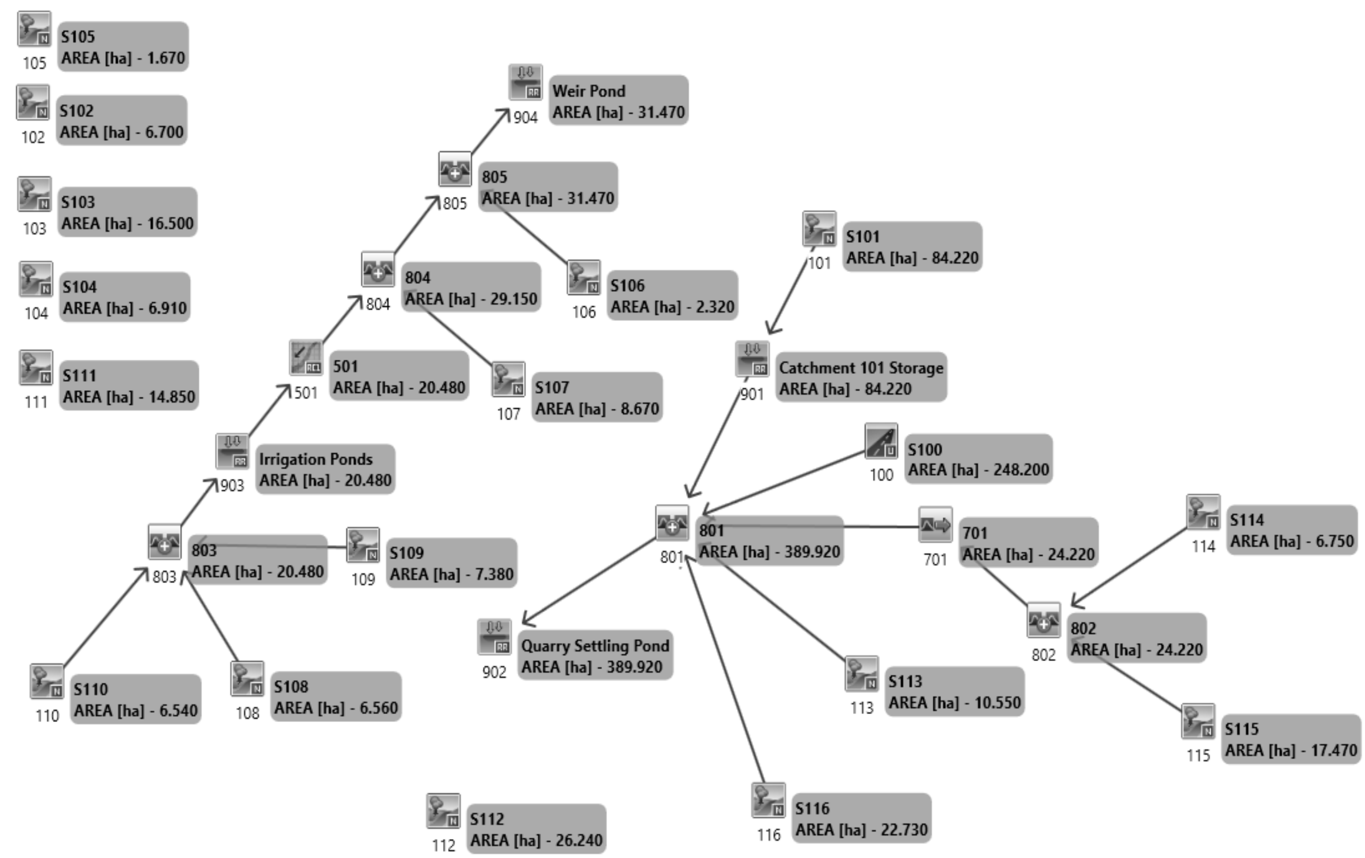
Reservoir storage-discharge characteristics are based on topographic survey information and known or proposed outlet configurations.

The ponds within the Burlington Quarry are not modelled.

CLASS_NAME	Description	Minimum Mapping Unit	Input Source	Possible Confusion	HYDROLOGY
Forest	Tree cover > 60%. Upland tree species > 75% canopy cover >2m in height.	0.25 ha	Perimeters visually extracted from high resolution ortho or satellite imagery. Attribute for forest type could not be derived spectrally from Landsat automated analysis due to size of feature.	Automated classification procedure is constrained to forest area polygons. Proportions of forest type cannot be determined due to size of feature. Forest may be confused with swamp and undifferentiated.	Forest or Woodland
Coniferous_Forest	Tree cover > 60%. Upland coniferous tree species > 75% canopy cover > 2m in height.	0.5 ha	Perimeters visually extracted from high resolution ortho or satellite imagery. Attribute derived spectrally from Landsat automated analysis.	Automated classification procedure is constrained to forest area polygons. Proportions of forest type may not be exact. Forest may be confused with swamp and undifferentiated.	Forest or Woodland
Mixed_Forest	Tree cover > 60%. Upland coniferous tree species > 25% and deciduous tree species > 25% of canopy cover > 2m in height.	0.5 ha			Forest or Woodland
Deciduous_Forest	Tree cover > 60%. Upland deciduous tree species > 75% canopy cover > 2m in height.	0.5 ha			Forest or Woodland
Treed_Swamp	Treed communities. Water table seasonally or permanently at, near, or above substrate surface/ Tree cover > 25%. Dominated by hydrophytic tree and shrub species.	0.5 ha	Combined from NRVIS evaluated wetlands database, modelled / interpreted OBM wetlands from DEM, soils, orthos, and satellite imagery.	Possible confusion with upland forest and undifferentiated. Results visually assessed from ortho imagery and adjusted where required.	Forest or Woodland
Marsh	Open and shrub communities. Water table seasonally or permanently at, near or above substrate surface – tree and shrub cover <=25%. Dominated by emergent hydrophytic macrophytes.	0.5 ha	Combined from NRVIS evaluated wetlands database, modelled / interpreted OBM wetlands from DEM, soils, orthos, and satellite imagery.		Wetland or Lakes or SWMFs
Wetland	LIO Delineated Wetland	The Wetland Consolidation project was carried out in the spring of 2011 to consolidate several wetland datasets into one comprehensive layer (Wetland). The MNRF district staff was consulted to identify the best available existing wetland data for their district. The resulting data were added to the Wetland layer where they did not overlap existing OWES evaluated wetland data. Sources for wetland data included Wetland Interim (OBM/NTS), Forest Resource Inventory (FRI), Southern Ontario Land Resource Inventory System (SOLRIS) and MNRF district data stored in the Significant Ecological Area layer.			Wetland or Lakes or SWMFs
Open_Water	Water depth > 2 meters. Lake trophic status. No macrophyte vegetation, trees or shrub cover.	0.5 ha	Derived from NRVIS hydrology database.	Results visually assessed from ortho imagery and adjusted where required.	Wetland or Lakes or SWMFs
Open Water - Ponds	Ponds layer from City of Burlington	Shape file downloaded from City of Burlington database.			Wetland or Lakes or SWMFs
Plantations–Tree_Cultivated	Tree cover > 60%, (trees > 2m height), linear organization, uniform tree type.	0.25 ha	Perimeters visually extracted from high resolution ortho or satellite imagery.	Forest type not differentiated. Mostly coniferous species. May be confused with upland forest. May include nurseries or Christmas tree plantations.	Cultivated
Hedge_Rows	Tree cover > 60%, (trees > 2m height), linear arrangement, minimum 10 meters width, maximum 30 meters width.	0.25 ha		Confusion may exist with trees under 2 meters in height.	Cultivated
Tilled	Agricultural fields managed as continuous annual row crops inferred from 3 observed sequential time periods over a 10 year time period. There can be as many as 2 time periods where fields are rotated with perennial crops. (e.g., hay, improved pasture)	0.5 ha	Derived from Landsat change detection analysis.	Automated classification procedure is constrained to rural areas. May include specialty crops and nurseries. Results visually assessed from ortho imagery and adjusted where required.	Cultivated
Transportation	Highways, roads	0.5 ha	Derived from the National Road Network - buffered to standard road allowance of 22 m.	National Road Network data deemed correct.	Impervious
Built-Up_Area-Pervious	Urban recreation areas (i.e. golf courses, playing fields)	0.25 ha	Perimeters visually extracted from high resolution ortho or satellite imagery.	Results visually assessed from ortho imagery and adjusted where required.	Pasture or Lawns
Built-Up_Area-Impervious	Residential, industrial, commercial and civic areas.	0.25 ha	Perimeters visually extracted from high resolution ortho or satellite imagery. Supplemented with Buildings shape file downloaded from City of Burlington database.		Impervious
Extraction-Aggregate	Pits, quarries	0.5 ha	Derived from NRVIS licensed pit/quarry data base. Active area derived spectrally from Landsat TM.	Automated classification procedure is constrained to licensed area. Results visually assessed from ortho imagery and adjusted where required.	Gravel
Undifferentiated	Includes some agricultural features not included in tilled (i.e. orchards, vineyards, perennial crops and idle land > 10 years - out of agricultural production) as well as urban brown fields, hydro and transportation right-of-ways, upland thicket and openings within forests.	0.5 ha	Areas not mapped by the previous classes.	May include tilled and wetlands.	Cultivated

TATHAM ENGINEERING

PROJECT	Burlington Quarry Extension Nelson Aggregrate Co.	FILE	113187
		DATE	2021-06-29
SUBJECT	Surface Water Assessment Existing Conditions	NAME	
		PAGE	OF

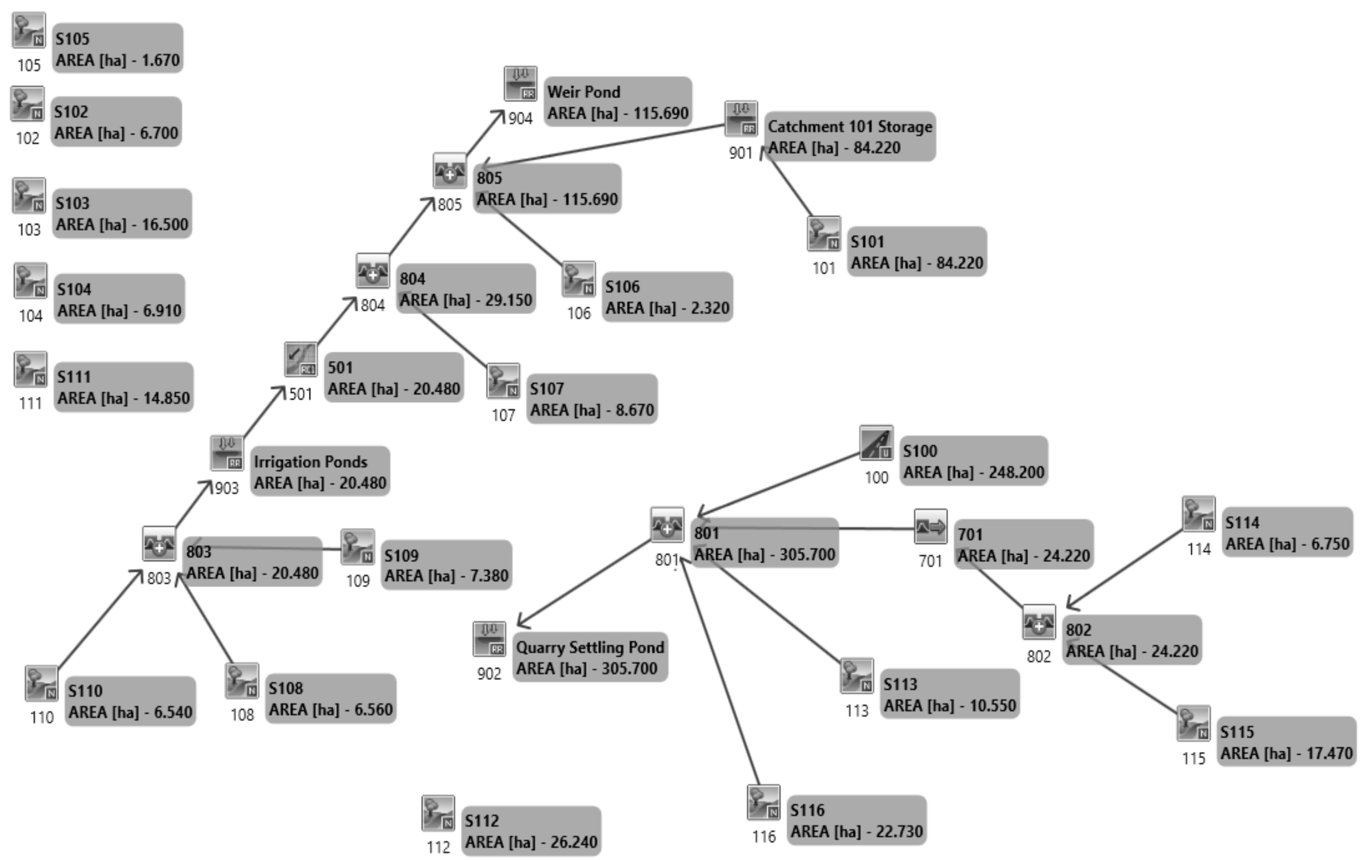


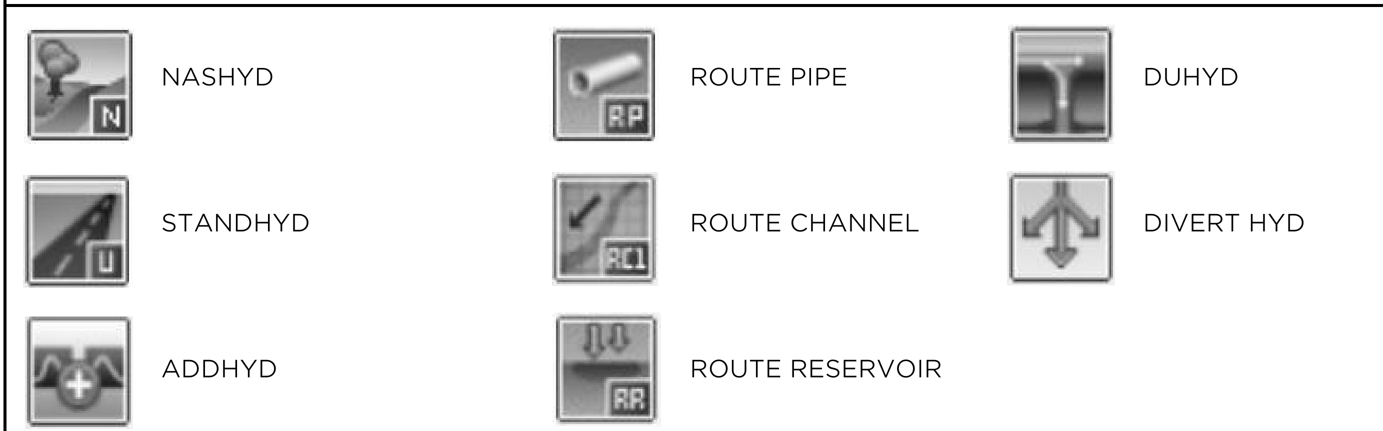
NASHYD
ROUTE PIPE
DUHYD
STANDHYD
ROUTE CHANNEL
DIVERT HYD
ADDHYD
ROUTE RESERVOIR

TATHAM ENGINEERING

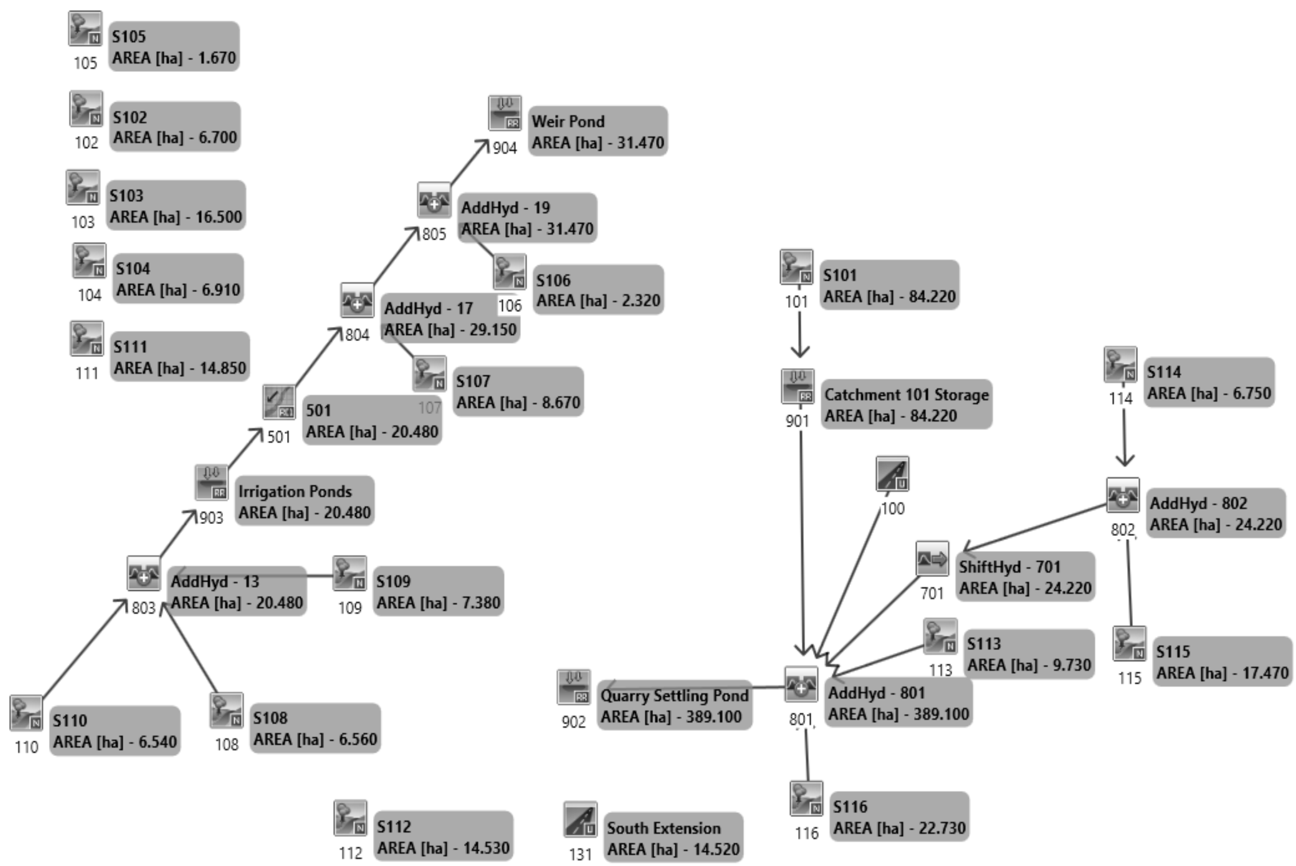
PROJECT	Burlington Quarry Extension Nelson Aggregrate Co.	FILE	113187
		DATE	2021-06-29
SUBJECT	Surface Water Assessment Existing Conditions	NAME	
		PAGE	OF

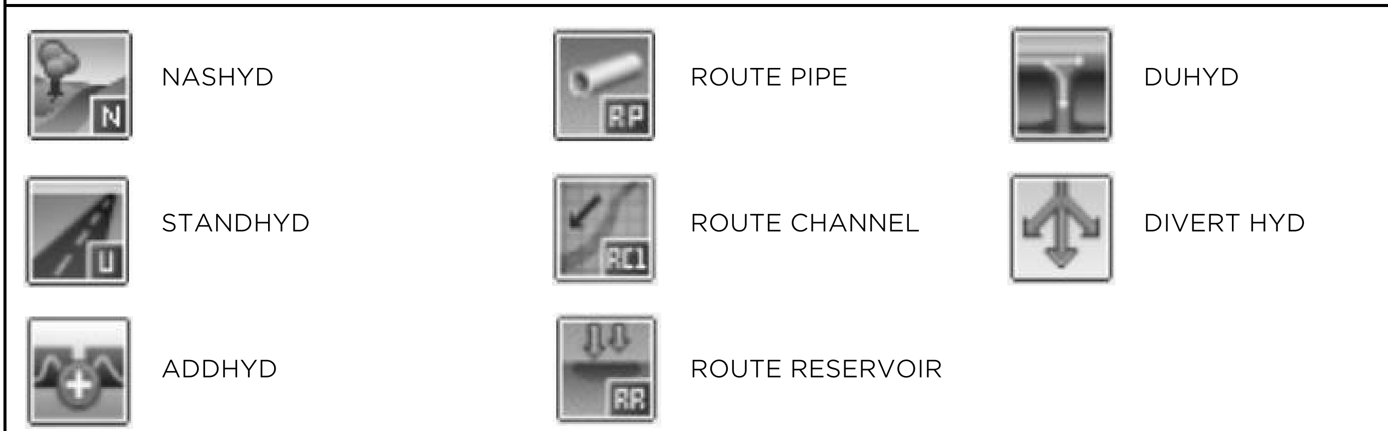
With Colling Road diversion





PROJECT	Burlington Quarry Extension	FILE	113187
	Nelson Aggregate Co.	DATE	2021-06-29
SUBJECT	Surface Water Assessment	NAME	
	Extraction Phase 1 & 2	PAGE	OF





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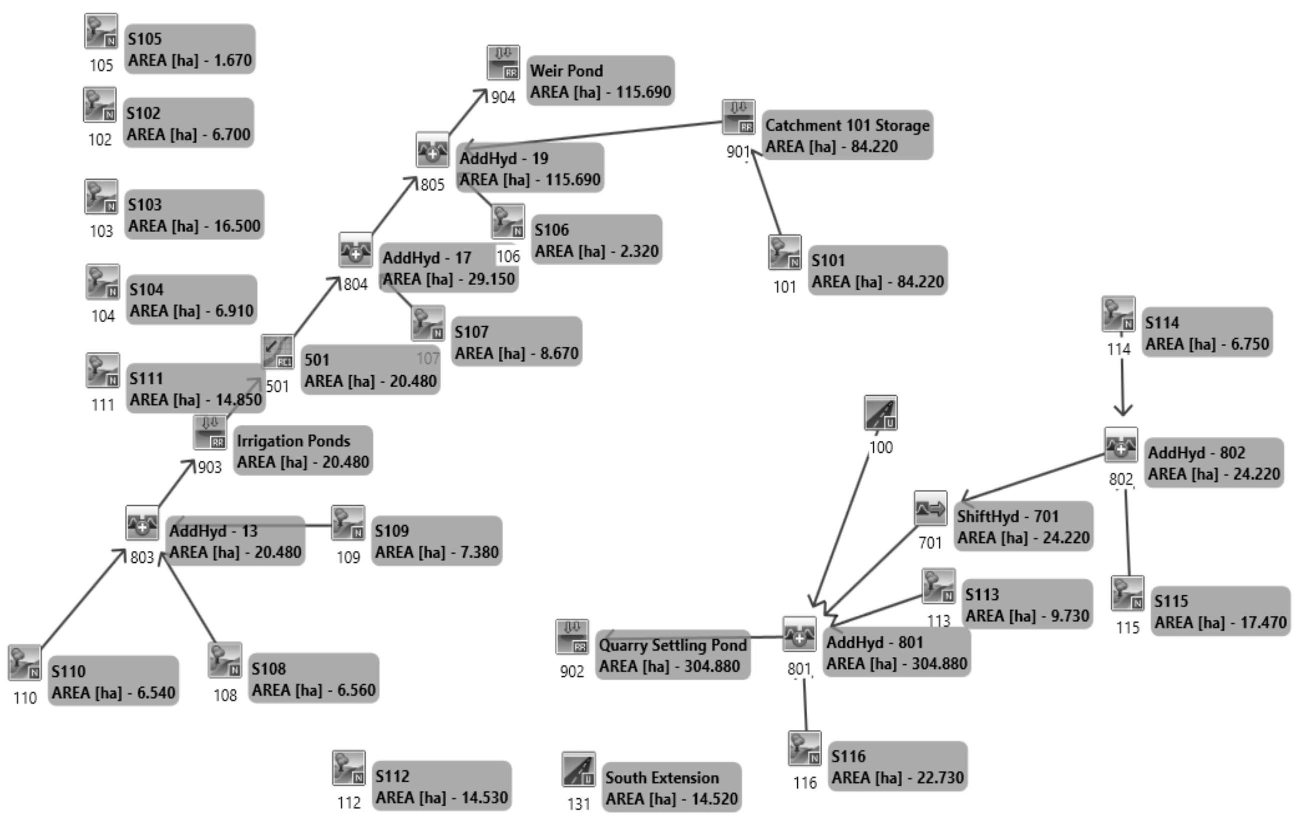
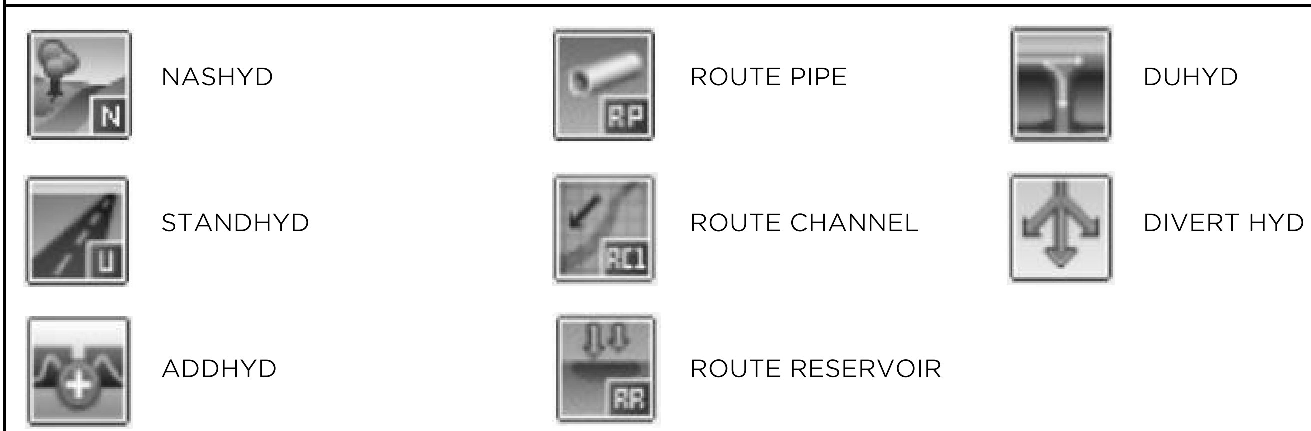
PROJECT	Burlington Quarry Extension Nelson Aggregrate Co.	FILE	113187
		DATE	2021-06-29
SUBJECT	Surface Water Assessment Extraction Phase 1 & 2	NAME	
		PAGE	OF

With Colling Road diversion





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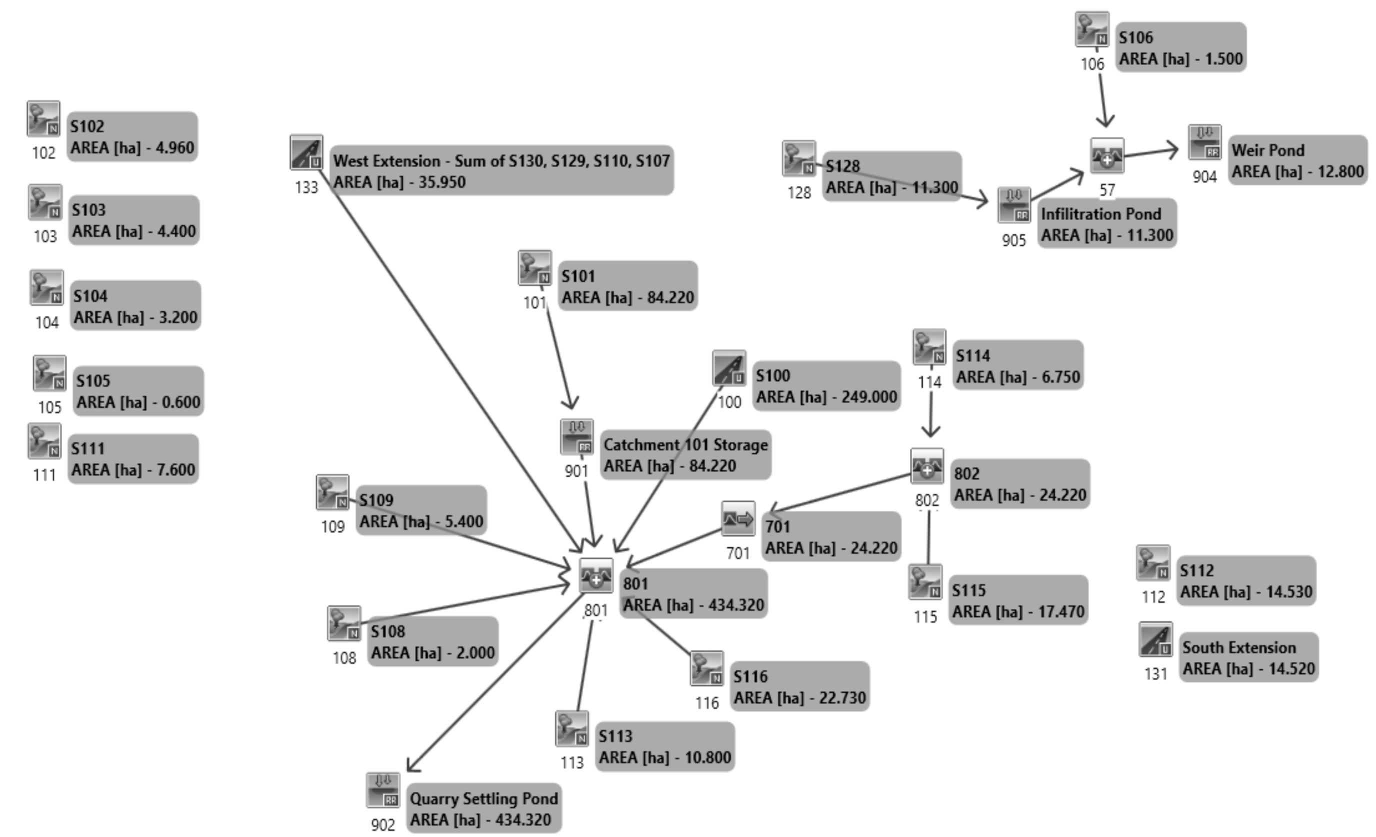
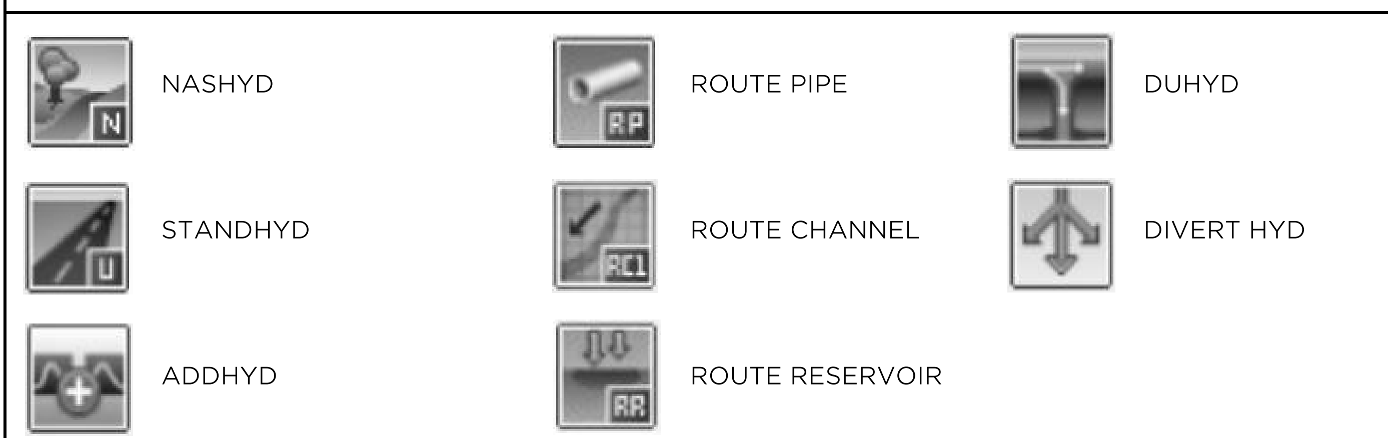
PROJECT	Burlington Quarry Extension Nelson Aggregrate Co.	FILE	113187
		DATE	2021-06-29
SUBJECT	Surface Water Assessment Extraction Phase 3-4-5-6	NAME	
		PAGE	OF





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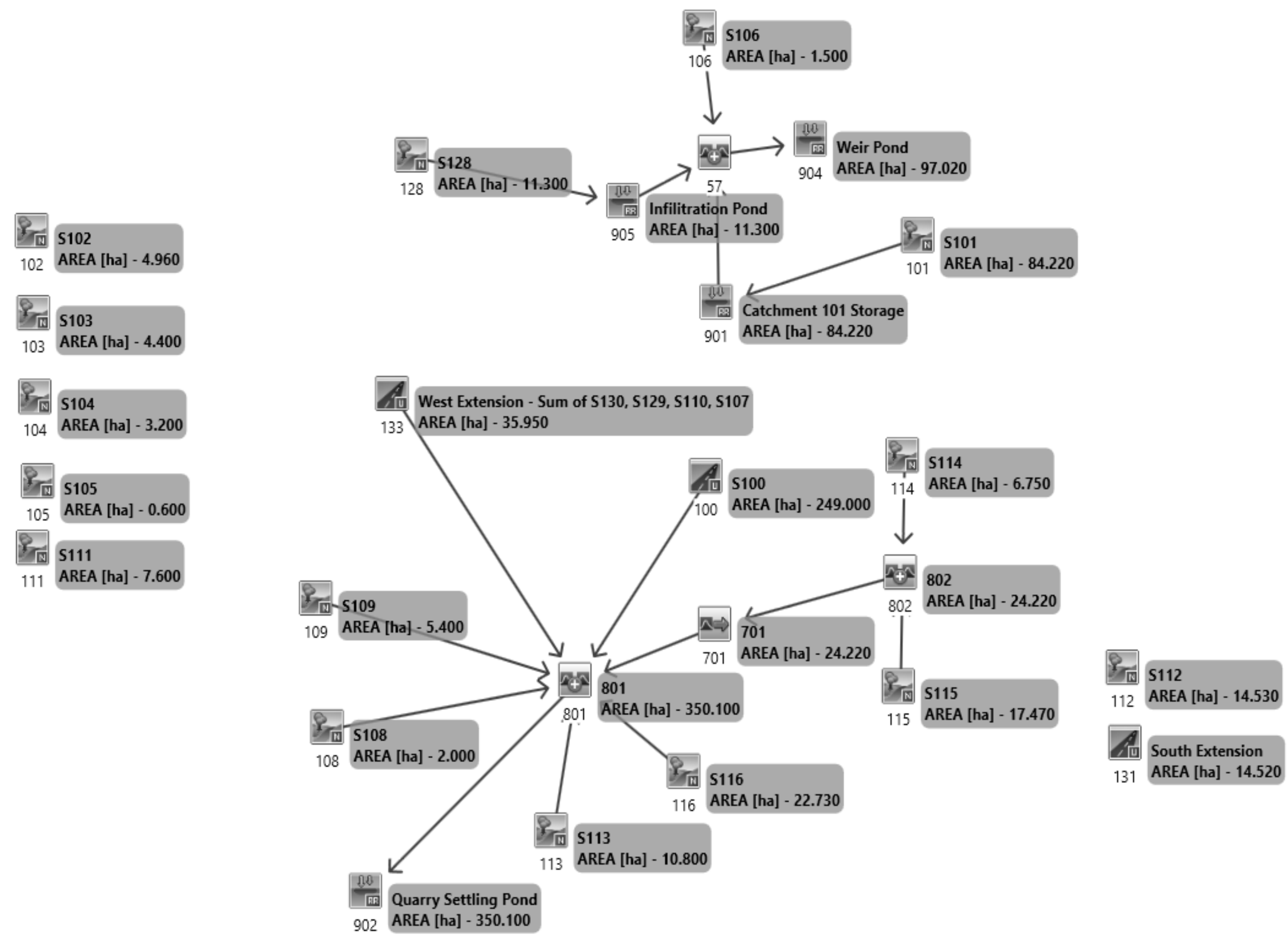
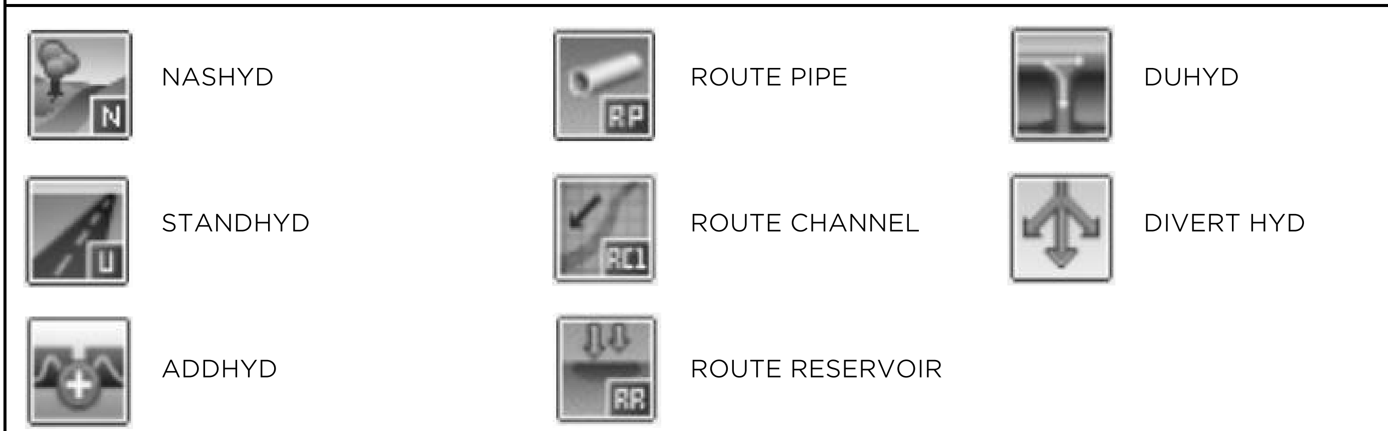
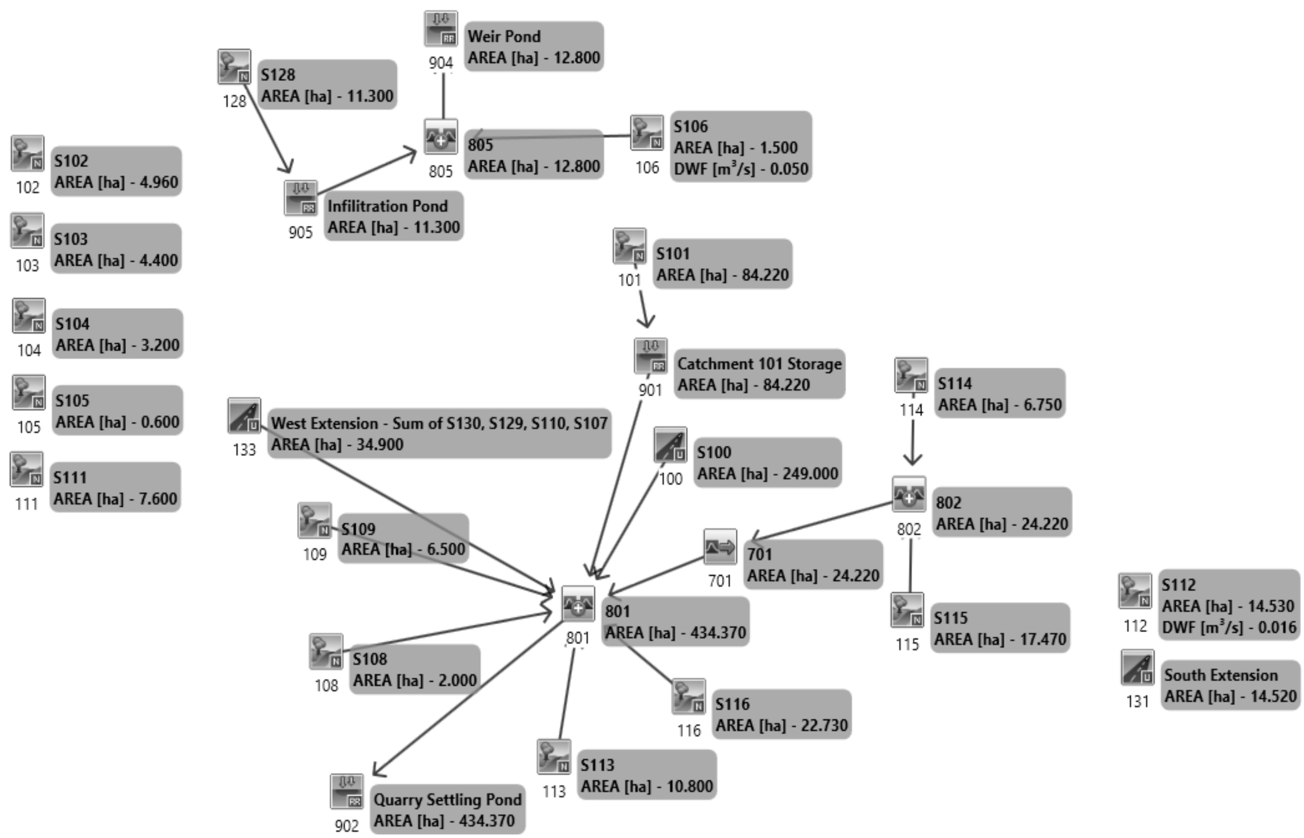
PROJECT	Burlington Quarry Extension	FILE	113187
	Nelson Aggregrate Co.	DATE	2021-06-29
SUBJECT	Surface Water Assessment	NAME	
	Extraction Phase 3-4-5-6	PAGE	OF

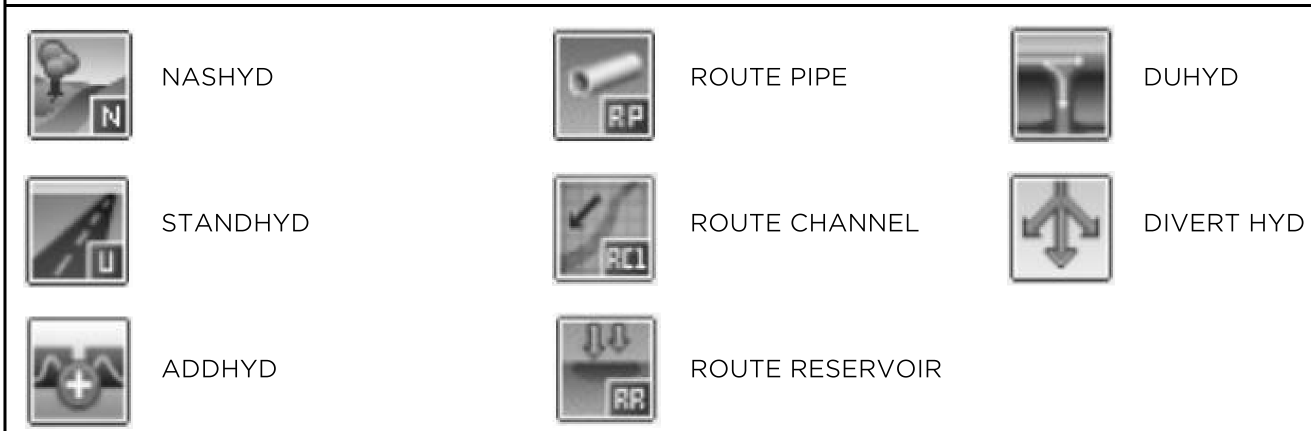
With Colling Road diversion





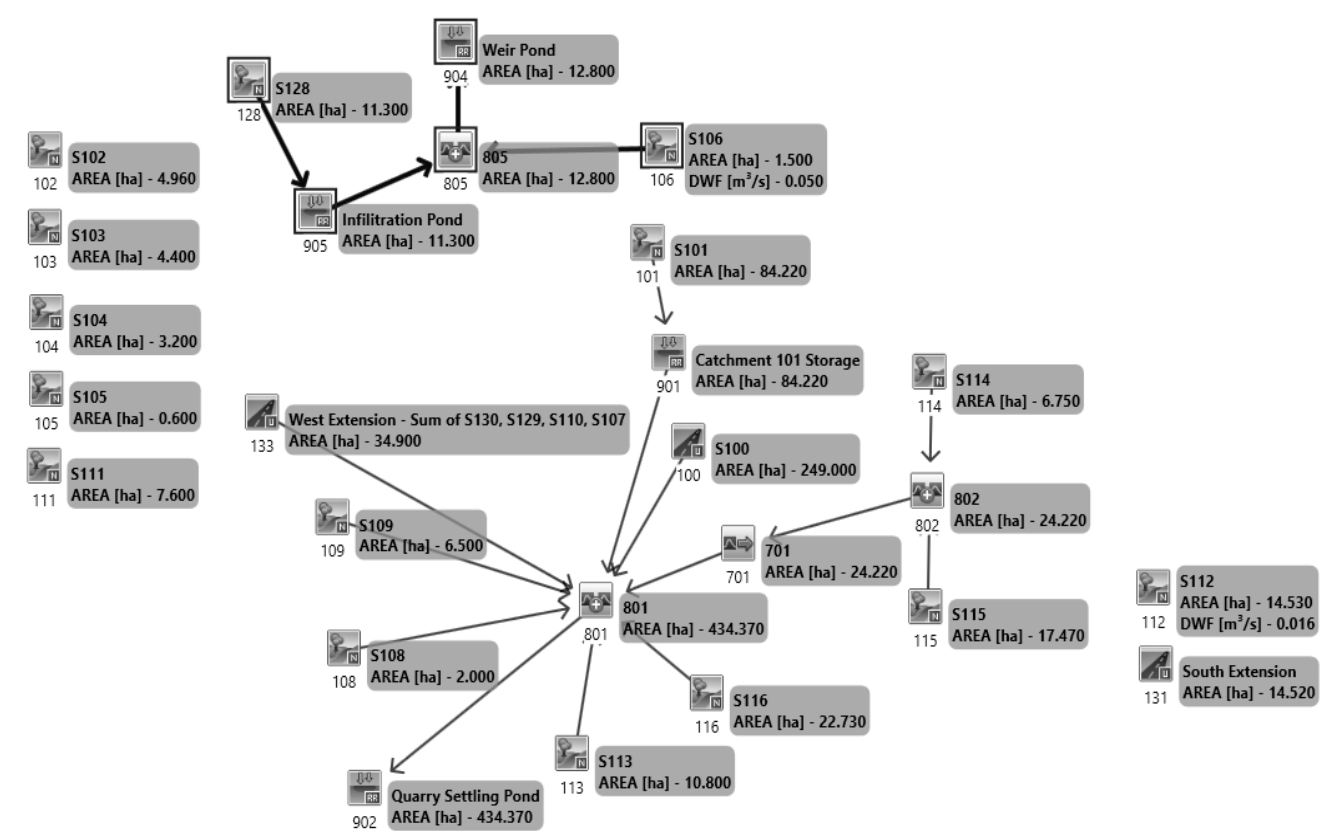
PROJECT	Burlington Quarry Extension Nelson Aggregrate Co.	FILE	113187
		DATE	2021-06-29
SUBJECT	Surface Water Assessment Rehabilitation	NAME	
		PAGE	OF

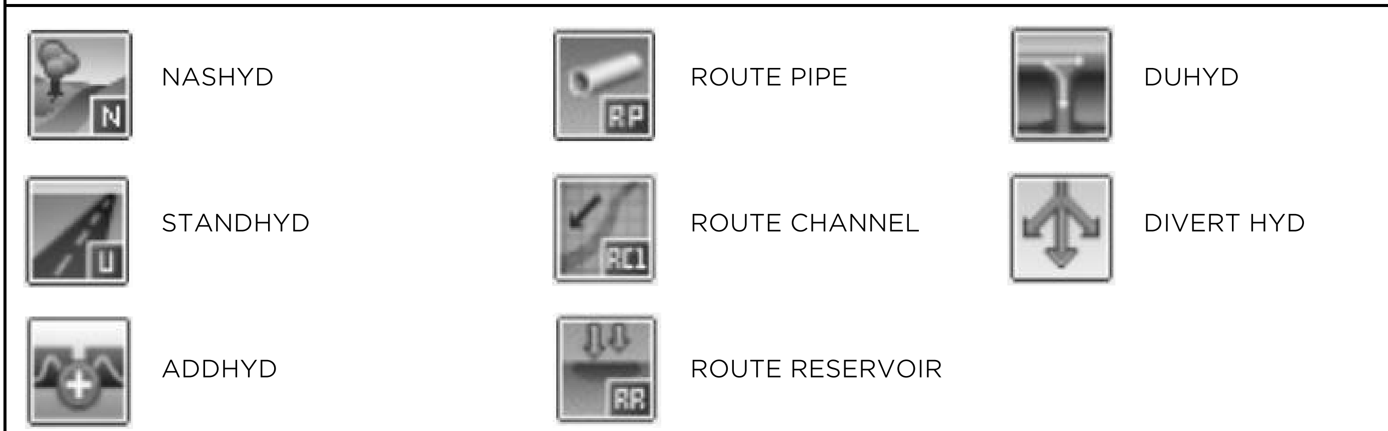




PROJECT	Burlington Quarry Extension	FILE	113187
	Nelson Aggregrate Co.	DATE	2021-06-29
SUBJECT	Surface Water Assessment	NAME	
	Rehabilitation	PAGE	OF

With Colling Road diversion





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TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 101 **Area** 84.22 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	41.56	0.49	3.72	0.09	60	0.00	0.00	69	0.00	0.00	65	31.10	0.75	74	4.28	0.10	100	2.47	0.06	50	0.00	0.00	85	74.00
C	3	42.66	0.51	3.34	0.08	73	0.00	0.00	79	0.00	0.00	76	23.61	0.55	82	3.01	0.07	100	12.70	0.30	50	0.00	0.00	89	73.04
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**84.22**	**1.00**	**7.05**	**0.08**		**0.00**	**0.00**		**0.00**	**0.00**		**54.71**	**0.65**		**7.29**	**0.09**		**15.17**	**0.18**		**0.00**	**0.00**		**73.51**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	1150	m
Catchment Slope	0.50%	
Catchment Area	84.22	ha

Time of Concentration (Minutes)	48.33
Time of Concentration (Hours)	0.81
Time to Peak (2/3 x Time of Concentration)	0.54

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	1150	m
Catchment Slope	0.50%	
Catchment Area	84.22	ha

Time of Concentration (Minutes)	97.33
Time of Concentration (Hours)	1.62
Time to Peak (2/3 x Time of Concentration)	1.08

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.72**	mm
Runoff Coefficient	**0.40**	
Time to Peak	**1.08**	hrs

Soil Series				
Land Use Type	B	C	0	0
	2	3	0	0
Forest/Woodland	0.25	0.35	0.00	0.00
Cultivated	0.35	0.55	0.00	0.00
Pasture/Lawn	0.28	0.40	0.00	0.00
Impervious	0.95	0.95	0.00	0.00
Wetland/Lake/SWMF	0.05	0.05	0.00	0.00
Meadows	0.27	0.38	0.00	0.00
Gravel	0.27	0.38	0.00	0.00
Soil Series Total	0.39	0.41	0.00	0.00

Project:	Project Sideways	Prepared By:	DAM
File No.:	113187	Reviewed By:	DRT
Revision No.:	1	Date:	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 102 **Area** 6.70 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.70	1.00	1.07	0.16	60	4.69	0.70	69	0.00	0.00	65	0.02	0.00	74	0.92	0.14	100	0.00	0.00	50	0.00	0.00	85	71.84
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.70**	**1.00**	**1.07**	**0.16**		**4.69**	**0.70**		**0.00**	**0.00**		**0.02**	**0.00**		**0.92**	**0.14**		**0.00**	**0.00**		**0.00**	**0.00**		**71.84**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	250	m
Catchment Slope	5.40%	
Catchment Area	6.70	ha

Time of Concentration (Minutes)	8.41
Time of Concentration (Hours)	0.14
Time to Peak (2/3 x Time of Concentration)	0.09

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	250	m
Catchment Slope	5.40%	
Catchment Area	6.70	ha

Time of Concentration (Minutes)	19.95
Time of Concentration (Hours)	0.33
Time to Peak (2/3 x Time of Concentration)	0.22

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.39**	mm
Runoff Coefficient	**0.42**	
Time to Peak	**0.09**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.30	0.00	0.00	0.00
Cultivated	0.45	0.00	0.00	0.00
Pasture/Lawn	0.35	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.33	0.00	0.00	0.00
Gravel	0.33	0.00	0.00	0.00
Soil Series Total	0.42	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 103 **Area** 16.50 ha

WEIGHTED CN VALUE																										
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	16.50	1.00	2.68	0.16	60	12.26	0.74	69	0.00	0.00	65	0.20	0.01	74	1.36	0.08	100	0.00	0.00	50	0.00	0.00	85	70.16
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**16.50**	**1.00**	**2.68**	**0.16**		**12.26**	**0.74**		**0.00**	**0.00**		**0.20**	**0.01**		**1.36**	**0.08**		**0.00**	**0.00**		**0.00**	**0.00**		**70.16**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	430	m
Catchment Slope	1.10%	
Catchment Area	16.50	ha

Time of Concentration (Minutes)	18.17
Time of Concentration (Hours)	0.30
Time to Peak (2/3 x Time of Concentration)	0.20

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	430	m
Catchment Slope	1.10%	
Catchment Area	16.50	ha

Time of Concentration (Minutes)	50.36
Time of Concentration (Hours)	0.84
Time to Peak (2/3 x Time of Concentration)	0.56

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.59**	mm
Runoff Coefficient	**0.33**	
Time to Peak	**0.56**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.33	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 104 **Area** 6.91 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.91	1.00	1.68	0.24	60	1.51	0.22	69	0.00	0.00	65	2.72	0.39	74	1.00	0.14	100	0.00	0.00	50	0.00	0.00	85	73.26
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.91**	**1.00**	**1.68**	**0.24**		**1.51**	**0.22**		**0.00**	**0.00**		**2.72**	**0.39**		**1.00**	**0.14**		**0.00**	**0.00**		**0.00**	**0.00**		**73.26**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	260	m
Catchment Slope	1.90%	
Catchment Area	6.91	ha

Time of Concentration (Minutes)	10.74
Time of Concentration (Hours)	0.18
Time to Peak (2/3 x Time of Concentration)	0.12

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	260	m
Catchment Slope	1.90%	
Catchment Area	6.91	ha

Time of Concentration (Minutes)	29.89
Time of Concentration (Hours)	0.50
Time to Peak (2/3 x Time of Concentration)	0.33

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.57**	mm
Runoff Coefficient	**0.40**	
Time to Peak	**0.33**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.40	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 105 **Area** 1.67 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	1.67	1.00	0.28	0.17	60	0.00	0.00	69	0.00	0.00	65	1.17	0.70	74	0.23	0.14	100	0.00	0.00	50	0.00	0.00	85	75.23
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**1.67**	**1.00**	**0.28**	**0.17**		**0.00**	**0.00**		**0.00**	**0.00**		**1.17**	**0.70**		**0.23**	**0.14**		**0.00**	**0.00**		**0.00**	**0.00**		**75.23**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	140	m
Catchment Slope	1.00%	
Catchment Area	1.67	ha

Time of Concentration (Minutes)	7.58
Time of Concentration (Hours)	0.13
Time to Peak (2/3 x Time of Concentration)	0.08

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	140	m
Catchment Slope	1.00%	
Catchment Area	1.67	ha

Time of Concentration (Minutes)	26.40
Time of Concentration (Hours)	0.44
Time to Peak (2/3 x Time of Concentration)	0.29

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.81**	mm
Runoff Coefficient	**0.42**	
Time to Peak	**0.08**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.42	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 106 **Area** 2.32 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	2.32	1.00	0.30	0.13	60	1.79	0.77	69	0.00	0.00	65	0.00	0.00	74	0.14	0.06	100	0.08	0.04	50	0.00	0.00	85	69.06
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**2.32**	**1.00**	**0.30**	**0.13**		**1.79**	**0.77**		**0.00**	**0.00**		**0.00**	**0.00**		**0.14**	**0.06**		**0.08**	**0.04**		**0.00**	**0.00**		**69.06**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	190	m
Catchment Slope	1.00%	
Catchment Area	2.32	ha

Time of Concentration (Minutes)	9.96
Time of Concentration (Hours)	0.17
Time to Peak (2/3 x Time of Concentration)	0.11

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	190	m
Catchment Slope	1.00%	
Catchment Area	2.32	ha

Time of Concentration (Minutes)	35.54
Time of Concentration (Hours)	0.59
Time to Peak (2/3 x Time of Concentration)	0.39

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.71**	mm
Runoff Coefficient	**0.31**	
Time to Peak	**0.39**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.31	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 107 **Area** 8.67 ha

WEIGHTED CN VALUE																							
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	8.67	1.00	0.49	0.06	60	8.15	0.94	69	0.00	0.00	65	0.00	0.00	74	0.03	0.00	100	0.00	0.00	50	0.00	0.00	85	68.58
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**8.67**	**1.00**	**0.49**	**0.06**		**8.15**	**0.94**		**0.00**	**0.00**		**0.00**	**0.00**		**0.03**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**68.58**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	280	m
Catchment Slope	1.30%	
Catchment Area	8.67	ha

Time of Concentration (Minutes)	12.20
Time of Concentration (Hours)	0.20
Time to Peak (2/3 x Time of Concentration)	0.14

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	280	m
Catchment Slope	1.30%	
Catchment Area	8.67	ha

Time of Concentration (Minutes)	41.01
Time of Concentration (Hours)	0.68
Time to Peak (2/3 x Time of Concentration)	0.46

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.28**	mm
Runoff Coefficient	**0.28**	
Time to Peak	**0.46**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.28	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 108 **Area** 6.56 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	6.56	1.00	1.95	0.30	60	3.48	0.53	69	0.00	0.00	65	0.00	0.00	74	0.01	0.00	100	1.12	0.17	50	0.00	0.00	85	63.12
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.56**	**1.00**	**1.95**	**0.30**		**3.48**	**0.53**		**0.00**	**0.00**		**0.00**	**0.00**		**0.01**	**0.00**		**1.12**	**0.17**		**0.00**	**0.00**		**63.12**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	0.70%	
Catchment Area	6.56	ha

Time of Concentration (Minutes)	15.22
Time of Concentration (Hours)	0.25
Time to Peak (2/3 x Time of Concentration)	0.17

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	0.70%	
Catchment Area	6.56	ha

Time of Concentration (Minutes)	55.10
Time of Concentration (Hours)	0.92
Time to Peak (2/3 x Time of Concentration)	0.61

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.68**	mm
Runoff Coefficient	**0.23**	
Time to Peak	**0.61**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.23	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 109 **Area** 7.38 ha

WEIGHTED CN VALUE																										
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	7.38	1.00	4.64	0.63	60	2.59	0.35	69	0.00	0.00	65	0.12	0.02	74	0.00	0.00	100	0.03	0.00	50	0.00	0.00	85	63.33
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**7.38**	**1.00**	**4.64**	**0.63**		**2.59**	**0.35**		**0.00**	**0.00**		**0.12**	**0.02**		**0.00**	**0.00**		**0.03**	**0.00**		**0.00**	**0.00**		**63.33**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	1.00%	
Catchment Area	7.38	ha

Time of Concentration (Minutes)	14.00
Time of Concentration (Hours)	0.23
Time to Peak (2/3 x Time of Concentration)	0.16

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	1.00%	
Catchment Area	7.38	ha

Time of Concentration (Minutes)	47.36
Time of Concentration (Hours)	0.79
Time to Peak (2/3 x Time of Concentration)	0.53

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.21**	mm
Runoff Coefficient	**0.26**	
Time to Peak	**0.53**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.26	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 110 **Area** 6.54 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.54	1.00	0.40	0.06	60	4.02	0.61	69	0.00	0.00	65	0.83	0.13	74	0.00	0.00	100	1.29	0.20	50	0.00	0.00	85	65.34
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.54**	**1.00**	**0.40**	**0.06**		**4.02**	**0.61**		**0.00**	**0.00**		**0.83**	**0.13**		**0.00**	**0.00**		**1.29**	**0.20**		**0.00**	**0.00**		**65.34**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	360	m
Catchment Slope	1.10%	
Catchment Area	6.54	ha

Time of Concentration (Minutes)	16.69
Time of Concentration (Hours)	0.28
Time to Peak (2/3 x Time of Concentration)	0.19

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	360	m
Catchment Slope	1.10%	
Catchment Area	6.54	ha

Time of Concentration (Minutes)	51.44
Time of Concentration (Hours)	0.86
Time to Peak (2/3 x Time of Concentration)	0.57

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.94**	mm
Runoff Coefficient	**0.24**	
Time to Peak	**0.57**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.24	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 111 **Area** 14.85 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	10.19	0.69	1.61	0.16	60	5.09	0.50	69	0.00	0.00	65	1.96	0.19	74	0.34	0.03	100	1.13	0.11	50	0.07	0.01	85	67.59
C	3	1.58	0.11	0.00	0.00	73	0.48	0.31	79	0.00	0.00	76	0.00	0.00	82	0.14	0.09	100	0.96	0.61	50	0.00	0.00	89	63.33
D	3	3.08	0.21	0.00	0.00	79	2.85	0.92	84	0.00	0.00	81	0.00	0.00	86	0.00	0.00	100	0.23	0.08	50	0.00	0.00	91	81.42
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**14.85**	**1.00**	**1.61**	**0.11**		**8.42**	**0.57**		**0.00**	**0.00**		**1.96**	**0.13**		**0.49**	**0.03**		**2.32**	**0.16**		**0.07**	**0.00**		**70.01**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	420	m
Catchment Slope	1.90%	
Catchment Area	14.85	ha

Time of Concentration (Minutes)	16.08
Time of Concentration (Hours)	0.27
Time to Peak (2/3 x Time of Concentration)	0.18

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	420	m
Catchment Slope	1.90%	
Catchment Area	14.85	ha

Time of Concentration (Minutes)	43.31
Time of Concentration (Hours)	0.72
Time to Peak (2/3 x Time of Concentration)	0.48

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.79**	mm
Runoff Coefficient	**0.30**	
Time to Peak	**0.48**	hrs

Soil Series				
Land Use Type	B	C	D	0
	2	3	3	0
Forest/Woodland	0.25	0.35	0.35	0.00
Cultivated	0.35	0.55	0.55	0.00
Pasture/Lawn	0.28	0.40	0.40	0.00
Impervious	0.95	0.95	0.95	0.00
Wetland/Lake/SWMF	0.05	0.05	0.05	0.00
Meadows	0.27	0.38	0.38	0.00
Gravel	0.27	0.38	0.38	0.00
Soil Series Total	0.29	0.24	0.37	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 112 **Area** 26.24 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	22.21	0.85	3.64	0.16	60	2.53	0.11	69	0.00	0.00	65	14.11	0.64	74	0.63	0.03	100	1.30	0.06	50	0.00	0.00	85	70.48
C	3	2.53	0.10	1.15	0.46	73	0.20	0.08	79	0.00	0.00	76	1.03	0.41	82	0.13	0.05	100	0.02	0.01	50	0.00	0.00	89	78.27
C	3	1.50	0.06	0.55	0.36	73	0.35	0.23	79	0.00	0.00	76	0.08	0.05	82	0.00	0.00	100	0.52	0.35	50	0.00	0.00	89	66.90
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**26.24**	**1.00**	**5.34**	**0.20**		**3.08**	**0.12**		**0.00**	**0.00**		**15.22**	**0.58**		**0.76**	**0.03**		**1.84**	**0.07**		**0.00**	**0.00**		**71.03**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	640	m
Catchment Slope	1.10%	
Catchment Area	26.24	ha

Time of Concentration (Minutes)	25.82
Time of Concentration (Hours)	0.43
Time to Peak (2/3 x Time of Concentration)	0.29

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	640	m
Catchment Slope	1.10%	
Catchment Area	26.24	ha

Time of Concentration (Minutes)	61.12
Time of Concentration (Hours)	1.02
Time to Peak (2/3 x Time of Concentration)	0.68

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.58**	mm
Runoff Coefficient	**0.34**	
Time to Peak	**0.68**	hrs

Soil Series				
Land Use Type	B	C	C	0
	2	3	3	0
Forest/Woodland	0.25	0.35	0.35	0.00
Cultivated	0.35	0.55	0.55	0.00
Pasture/Lawn	0.28	0.40	0.40	0.00
Impervious	0.95	0.95	0.95	0.00
Wetland/Lake/SWMF	0.05	0.05	0.05	0.00
Meadows	0.27	0.38	0.38	0.00
Gravel	0.27	0.38	0.38	0.00
Soil Series Total	0.33	0.46	0.27	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 113 **Area** 10.55 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	10.55	1.00	5.75	0.54	60	0.00	0.00	69	0.00	0.00	65	3.87	0.37	74	0.67	0.06	100	0.27	0.03	50	0.00	0.00	85	67.41
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**10.55**	**1.00**	**5.75**	**0.54**		**0.00**	**0.00**		**0.00**	**0.00**		**3.87**	**0.37**		**0.67**	**0.06**		**0.27**	**0.03**		**0.00**	**0.00**		**67.41**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	370	m
Catchment Slope	0.90%	
Catchment Area	10.55	ha

Time of Concentration (Minutes)	17.02
Time of Concentration (Hours)	0.28
Time to Peak (2/3 x Time of Concentration)	0.19

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	370	m
Catchment Slope	0.90%	
Catchment Area	10.55	ha

Time of Concentration (Minutes)	50.26
Time of Concentration (Hours)	0.84
Time to Peak (2/3 x Time of Concentration)	0.56

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.44**	mm
Runoff Coefficient	**0.33**	
Time to Peak	**0.56**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.33	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 114 **Area** 6.75 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.75	1.00	1.40	0.21	60	0.00	0.00	69	0.00	0.00	65	4.49	0.66	74	0.87	0.13	100	0.00	0.00	50	0.00	0.00	85	74.44
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.75**	**1.00**	**1.40**	**0.21**		**0.00**	**0.00**		**0.00**	**0.00**		**4.49**	**0.66**		**0.87**	**0.13**		**0.00**	**0.00**		**0.00**	**0.00**		**74.44**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	290	m
Catchment Slope	2.70%	
Catchment Area	6.75	ha

Time of Concentration (Minutes)	11.20
Time of Concentration (Hours)	0.19
Time to Peak (2/3 x Time of Concentration)	0.12

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	290	m
Catchment Slope	2.70%	
Catchment Area	6.75	ha

Time of Concentration (Minutes)	27.74
Time of Concentration (Hours)	0.46
Time to Peak (2/3 x Time of Concentration)	0.31

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.98**	mm
Runoff Coefficient	**0.41**	
Time to Peak	**0.12**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.41	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 115 **Area** 17.47 ha

WEIGHTED CN VALUE																								
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**		
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**
B	2	16.88	0.97	6.38	0.38	60	0.78	0.05	69	0.00	0.00	65	3.44	0.20	74	2.32	0.14	100	3.97	0.23	50	0.00	0.00	85
C	3	0.59	0.03	0.59	1.00	73	0.00	0.00	79	0.00	0.00	76	0.00	0.00	82	0.00	0.00	100	0.00	0.00	50	0.00	0.00	89
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A
	Totals	**17.47**	**1.00**	**6.97**	**0.40**		**0.78**	**0.04**		**0.00**	**0.00**		**3.44**	**0.20**		**2.32**	**0.13**		**3.97**	**0.23**		**0.00**	**0.00**	

Hydrologic Soil Group	**Average CN for Soil Type**
B	66.40
C	72.99
	0.00
	0.00
Totals	**66.63**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	490	m
Catchment Slope	2.00%	
Catchment Area	17.47	ha

Time of Concentration (Minutes)	18.27
Time of Concentration (Hours)	0.30
Time to Peak (2/3 x Time of Concentration)	0.20

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	490	m
Catchment Slope	2.00%	
Catchment Area	17.47	ha

Time of Concentration (Minutes)	44.68
Time of Concentration (Hours)	0.74
Time to Peak (2/3 x Time of Concentration)	0.50

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.58**	mm
Runoff Coefficient	**0.32**	
Time to Peak	**0.50**	hrs

Soil Series				
Land Use Type	B	C	0	0
	2	3	0	0
Forest/Woodland	0.25	0.35	0.00	0.00
Cultivated	0.35	0.55	0.00	0.00
Pasture/Lawn	0.28	0.40	0.00	0.00
Impervious	0.95	0.95	0.00	0.00
Wetland/Lake/SWMF	0.05	0.05	0.00	0.00
Meadows	0.27	0.38	0.00	0.00
Gravel	0.27	0.38	0.00	0.00
Soil Series Total	0.32	0.35	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 116 **Area** 22.73 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	22.73	1.00	5.76	0.25	60	0.00	0.00	69	0.00	0.00	65	10.35	0.46	74	1.91	0.08	100	4.70	0.21	50	0.00	0.00	85	67.67
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**22.73**	**1.00**	**5.76**	**0.25**		**0.00**	**0.00**		**0.00**	**0.00**		**10.35**	**0.46**		**1.91**	**0.08**		**4.70**	**0.21**		**0.00**	**0.00**		**67.67**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	520	m
Catchment Slope	0.40%	
Catchment Area	22.73	ha

Time of Concentration (Minutes)	26.05
Time of Concentration (Hours)	0.43
Time to Peak (2/3 x Time of Concentration)	0.29

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	520	m
Catchment Slope	0.40%	
Catchment Area	22.73	ha

Time of Concentration (Minutes)	79.17
Time of Concentration (Hours)	1.32
Time to Peak (2/3 x Time of Concentration)	0.88

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.38**	mm
Runoff Coefficient	**0.31**	
Time to Peak	**0.88**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.31	0.00	0.00	0.00

TATHAM ENGINEERING

AMC Conversion Calculation

Project Details

Burlington Quarry Expansion	113187

Prepared By

AMT	June 29, 2021

Municipality

CN* Calculation Requirement

No

Precipitation threshold to create AMCIII soil moisture conditions (mm): -

Initial Abstraction (Ia) (mm): -

Catchment ID	AMC II CN	AMC I CN	AMC III CN	AMC III CN*	AMC II CN*	AMC I CN*	AMCIII S	AMCIII Ia
101	73.51	54.32	87.15	-	-	-	37.47	5.62
102	71.84	52.30	86.03	-	-	-	41.23	5.39
103	70.16	50.33	84.89	-	-	-	45.21	5.59
104	73.26	54.01	86.98	-	-	-	38.02	5.70
105	75.23	56.48	88.26	-	-	-	33.78	5.07
106	69.06	49.07	84.13	-	-	-	47.92	5.71
107	68.58	48.53	83.79	-	-	-	49.13	5.28
108	63.12	42.70	79.84	-	-	-	64.13	6.41
109	63.33	42.91	80.00	-	-	-	63.51	6.35
110	65.34	45.00	81.48	-	-	-	57.75	6.94
111	70.01	50.15	84.79	-	-	-	45.57	6.79
112	71.03	51.34	85.49	-	-	-	43.13	6.47
113	67.41	47.23	82.97	-	-	-	52.15	7.82
114	74.44	55.48	87.75	-	-	-	35.45	5.32
115	66.63	46.38	82.41	-	-	-	54.22	8.13
116	67.67	47.52	83.15	-	-	-	51.47	7.72
100	85.00	70.37	93.96	-	-	-	16.32	3.26

AMC Conversion is determined using equations derived from MTO Design Chart 1.10

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 101 **Area** 84.22 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	41.56	0.49	3.72	0.09	60	0.00	0.00	69	0.00	0.00	65	31.10	0.75	74	4.28	0.10	100	2.47	0.06	50	0.00	0.00	85	74.00
C	3	42.66	0.51	3.34	0.08	73	0.00	0.00	79	0.00	0.00	76	23.61	0.55	82	3.01	0.07	100	12.70	0.30	50	0.00	0.00	89	73.04
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**84.22**	**1.00**	**7.05**	**0.08**		**0.00**	**0.00**		**0.00**	**0.00**		**54.71**	**0.65**		**7.29**	**0.09**		**15.17**	**0.18**		**0.00**	**0.00**		**73.51**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	1150	m
Catchment Slope	0.50%	
Catchment Area	84.22	ha

Time of Concentration (Minutes)	48.33
Time of Concentration (Hours)	0.81
Time to Peak (2/3 x Time of Concentration)	0.54

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	1150	m
Catchment Slope	0.50%	
Catchment Area	84.22	ha

Time of Concentration (Minutes)	97.33
Time of Concentration (Hours)	1.62
Time to Peak (2/3 x Time of Concentration)	1.08

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.72**	mm
Runoff Coefficient	**0.40**	
Time to Peak	**1.08**	hrs

Soil Series				
Land Use Type	B	C	0	0
	2	3	0	0
Forest/Woodland	0.25	0.35	0.00	0.00
Cultivated	0.35	0.55	0.00	0.00
Pasture/Lawn	0.28	0.40	0.00	0.00
Impervious	0.95	0.95	0.00	0.00
Wetland/Lake/SWMF	0.05	0.05	0.00	0.00
Meadows	0.27	0.38	0.00	0.00
Gravel	0.27	0.38	0.00	0.00
Soil Series Total	0.39	0.41	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 102 **Area** 6.70 ha

WEIGHTED CN VALUE																							
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel		Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.70	1.00	1.07	0.16	60	4.69	0.70	69	0.00	0.00	65	0.02	0.00	74	0.92	0.14	100	0.00	0.00	50	0.00	0.00	85	71.84
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.70**	**1.00**	**1.07**	**0.16**		**4.69**	**0.70**		**0.00**	**0.00**		**0.02**	**0.00**		**0.92**	**0.14**		**0.00**	**0.00**		**0.00**	**0.00**		**71.84**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	250	m
Catchment Slope	5.40%	
Catchment Area	6.70	ha

Time of Concentration (Minutes)	8.41
Time of Concentration (Hours)	0.14
Time to Peak (2/3 x Time of Concentration)	0.09

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	250	m
Catchment Slope	5.40%	
Catchment Area	6.70	ha

Time of Concentration (Minutes)	19.95
Time of Concentration (Hours)	0.33
Time to Peak (2/3 x Time of Concentration)	0.22

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.39**	mm
Runoff Coefficient	**0.42**	
Time to Peak	**0.09**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.30	0.00	0.00	0.00
Cultivated	0.45	0.00	0.00	0.00
Pasture/Lawn	0.35	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.33	0.00	0.00	0.00
Gravel	0.33	0.00	0.00	0.00
Soil Series Total	0.42	0.00	0.00	0.00

Project:	Project Sideways	Prepared By:	DAM
File No.:	113187	Reviewed By:	DRT
Revision No.:	1	Date:	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 103 **Area** 16.50 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	16.50	1.00	2.68	0.16	60	12.26	0.74	69	0.00	0.00	65	0.20	0.01	74	1.36	0.08	100	0.00	0.00	50	0.00	0.00	85	70.16
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**16.50**	**1.00**	**2.68**	**0.16**		**12.26**	**0.74**		**0.00**	**0.00**		**0.20**	**0.01**		**1.36**	**0.08**		**0.00**	**0.00**		**0.00**	**0.00**		**70.16**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	430	m
Catchment Slope	1.10%	
Catchment Area	16.50	ha

Time of Concentration (Minutes)	18.17
Time of Concentration (Hours)	0.30
Time to Peak (2/3 x Time of Concentration)	0.20

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	430	m
Catchment Slope	1.10%	
Catchment Area	16.50	ha

Time of Concentration (Minutes)	50.36
Time of Concentration (Hours)	0.84
Time to Peak (2/3 x Time of Concentration)	0.56

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.59**	mm
Runoff Coefficient	**0.33**	
Time to Peak	**0.56**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.33	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 104 **Area** 6.91 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	6.91	1.00	1.68	0.24	60	1.51	0.22	69	0.00	0.00	65	2.72	0.39	74	1.00	0.14	100	0.00	0.00	50	0.00	0.00	85	73.26
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.91**	**1.00**	**1.68**	**0.24**		**1.51**	**0.22**		**0.00**	**0.00**		**2.72**	**0.39**		**1.00**	**0.14**		**0.00**	**0.00**		**0.00**	**0.00**		**73.26**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	260	m
Catchment Slope	1.90%	
Catchment Area	6.91	ha

Time of Concentration (Minutes)	10.74
Time of Concentration (Hours)	0.18
Time to Peak (2/3 x Time of Concentration)	0.12

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	260	m
Catchment Slope	1.90%	
Catchment Area	6.91	ha

Time of Concentration (Minutes)	29.89
Time of Concentration (Hours)	0.50
Time to Peak (2/3 x Time of Concentration)	0.33

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.57**	mm
Runoff Coefficient	**0.40**	
Time to Peak	**0.33**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.40	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 105 **Area** 1.67 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	1.67	1.00	0.28	0.17	60	0.00	0.00	69	0.00	0.00	65	1.17	0.70	74	0.23	0.14	100	0.00	0.00	50	0.00	0.00	85	75.23
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**1.67**	**1.00**	**0.28**	**0.17**		**0.00**	**0.00**		**0.00**	**0.00**		**1.17**	**0.70**		**0.23**	**0.14**		**0.00**	**0.00**		**0.00**	**0.00**		**75.23**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	140	m
Catchment Slope	1.00%	
Catchment Area	1.67	ha

Time of Concentration (Minutes)	7.58
Time of Concentration (Hours)	0.13
Time to Peak (2/3 x Time of Concentration)	0.08

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	140	m
Catchment Slope	1.00%	
Catchment Area	1.67	ha

Time of Concentration (Minutes)	26.40
Time of Concentration (Hours)	0.44
Time to Peak (2/3 x Time of Concentration)	0.29

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.81**	mm
Runoff Coefficient	**0.42**	
Time to Peak	**0.08**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.42	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 106 **Area** 2.32 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	2.32	1.00	0.30	0.13	60	1.79	0.77	69	0.00	0.00	65	0.00	0.00	74	0.14	0.06	100	0.08	0.04	50	0.00	0.00	85	69.06
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**2.32**	**1.00**	**0.30**	**0.13**		**1.79**	**0.77**		**0.00**	**0.00**		**0.00**	**0.00**		**0.14**	**0.06**		**0.08**	**0.04**		**0.00**	**0.00**		**69.06**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	190	m
Catchment Slope	1.00%	
Catchment Area	2.32	ha

Time of Concentration (Minutes)	9.96
Time of Concentration (Hours)	0.17
Time to Peak (2/3 x Time of Concentration)	0.11

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	190	m
Catchment Slope	1.00%	
Catchment Area	2.32	ha

Time of Concentration (Minutes)	35.54
Time of Concentration (Hours)	0.59
Time to Peak (2/3 x Time of Concentration)	0.39

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.71**	mm
Runoff Coefficient	**0.31**	
Time to Peak	**0.39**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.31	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 107 **Area** 8.67 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	8.67	1.00	0.49	0.06	60	8.15	0.94	69	0.00	0.00	65	0.00	0.00	74	0.03	0.00	100	0.00	0.00	50	0.00	0.00	85	68.58
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**8.67**	**1.00**	**0.49**	**0.06**		**8.15**	**0.94**		**0.00**	**0.00**		**0.00**	**0.00**		**0.03**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**68.58**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	280	m
Catchment Slope	1.30%	
Catchment Area	8.67	ha

Time of Concentration (Minutes)	12.20
Time of Concentration (Hours)	0.20
Time to Peak (2/3 x Time of Concentration)	0.14

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	280	m
Catchment Slope	1.30%	
Catchment Area	8.67	ha

Time of Concentration (Minutes)	41.01
Time of Concentration (Hours)	0.68
Time to Peak (2/3 x Time of Concentration)	0.46

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.28**	mm
Runoff Coefficient	**0.28**	
Time to Peak	**0.46**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.28	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 108 **Area** 6.56 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.56	1.00	1.95	0.30	60	3.48	0.53	69	0.00	0.00	65	0.00	0.00	74	0.01	0.00	100	1.12	0.17	50	0.00	0.00	85	63.12
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.56**	**1.00**	**1.95**	**0.30**		**3.48**	**0.53**		**0.00**	**0.00**		**0.00**	**0.00**		**0.01**	**0.00**		**1.12**	**0.17**		**0.00**	**0.00**		**63.12**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	0.70%	
Catchment Area	6.56	ha

Time of Concentration (Minutes)	15.22
Time of Concentration (Hours)	0.25
Time to Peak (2/3 x Time of Concentration)	0.17

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	0.70%	
Catchment Area	6.56	ha

Time of Concentration (Minutes)	55.10
Time of Concentration (Hours)	0.92
Time to Peak (2/3 x Time of Concentration)	0.61

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.68**	mm
Runoff Coefficient	**0.23**	
Time to Peak	**0.61**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.23	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 109 **Area** 7.38 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	7.38	1.00	4.64	0.63	60	2.59	0.35	69	0.00	0.00	65	0.12	0.02	74	0.00	0.00	100	0.03	0.00	50	0.00	0.00	85	63.33
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**7.38**	**1.00**	**4.64**	**0.63**		**2.59**	**0.35**		**0.00**	**0.00**		**0.12**	**0.02**		**0.00**	**0.00**		**0.03**	**0.00**		**0.00**	**0.00**		**63.33**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	1.00%	
Catchment Area	7.38	ha

Time of Concentration (Minutes)	14.00
Time of Concentration (Hours)	0.23
Time to Peak (2/3 x Time of Concentration)	0.16

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	1.00%	
Catchment Area	7.38	ha

Time of Concentration (Minutes)	47.36
Time of Concentration (Hours)	0.79
Time to Peak (2/3 x Time of Concentration)	0.53

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.21**	mm
Runoff Coefficient	**0.26**	
Time to Peak	**0.53**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.26	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 110 **Area** 6.54 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	6.54	1.00	0.40	0.06	60	4.02	0.61	69	0.00	0.00	65	0.83	0.13	74	0.00	0.00	100	1.29	0.20	50	0.00	0.00	85	65.34
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.54**	**1.00**	**0.40**	**0.06**		**4.02**	**0.61**		**0.00**	**0.00**		**0.83**	**0.13**		**0.00**	**0.00**		**1.29**	**0.20**		**0.00**	**0.00**		**65.34**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	360	m
Catchment Slope	1.10%	
Catchment Area	6.54	ha

Time of Concentration (Minutes)	16.69
Time of Concentration (Hours)	0.28
Time to Peak (2/3 x Time of Concentration)	0.19

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	360	m
Catchment Slope	1.10%	
Catchment Area	6.54	ha

Time of Concentration (Minutes)	51.44
Time of Concentration (Hours)	0.86
Time to Peak (2/3 x Time of Concentration)	0.57

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.94**	mm
Runoff Coefficient	**0.24**	
Time to Peak	**0.57**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.24	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 111 **Area** 14.85 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	10.19	0.69	1.61	0.16	60	5.09	0.50	69	0.00	0.00	65	1.96	0.19	74	0.34	0.03	100	1.13	0.11	50	0.07	0.01	85	67.59
C	3	1.58	0.11	0.00	0.00	73	0.48	0.31	79	0.00	0.00	76	0.00	0.00	82	0.14	0.09	100	0.96	0.61	50	0.00	0.00	89	63.33
D	3	3.08	0.21	0.00	0.00	79	2.85	0.92	84	0.00	0.00	81	0.00	0.00	86	0.00	0.00	100	0.23	0.08	50	0.00	0.00	91	81.42
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**14.85**	**1.00**	**1.61**	**0.11**		**8.42**	**0.57**		**0.00**	**0.00**		**1.96**	**0.13**		**0.49**	**0.03**		**2.32**	**0.16**		**0.07**	**0.00**		**70.01**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	420	m
Catchment Slope	1.90%	
Catchment Area	14.85	ha

Time of Concentration (Minutes)	16.08
Time of Concentration (Hours)	0.27
Time to Peak (2/3 x Time of Concentration)	0.18

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	420	m
Catchment Slope	1.90%	
Catchment Area	14.85	ha

Time of Concentration (Minutes)	43.31
Time of Concentration (Hours)	0.72
Time to Peak (2/3 x Time of Concentration)	0.48

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.79**	mm
Runoff Coefficient	**0.30**	
Time to Peak	**0.48**	hrs

Soil Series				
Land Use Type	B	C	D	0
	2	3	3	0
Forest/Woodland	0.25	0.35	0.35	0.00
Cultivated	0.35	0.55	0.55	0.00
Pasture/Lawn	0.28	0.40	0.40	0.00
Impervious	0.95	0.95	0.95	0.00
Wetland/Lake/SWMF	0.05	0.05	0.05	0.00
Meadows	0.27	0.38	0.38	0.00
Gravel	0.27	0.38	0.38	0.00
Soil Series Total	0.29	0.24	0.37	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 112 **Area** 14.53 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	10.49	0.72	1.41	0.13	60	2.66	0.25	69	0.00	0.00	65	4.48	0.43	74	0.57	0.05	100	1.36	0.13	50	0.00	0.00	85	69.15
C	3	2.46	0.17	1.21	0.49	73	0.21	0.08	79	0.00	0.00	76	0.89	0.36	82	0.13	0.05	100	0.02	0.01	50	0.00	0.00	89	77.99
C	3	1.58	0.11	0.58	0.36	73	0.37	0.23	79	0.00	0.00	76	0.09	0.05	82	0.00	0.00	100	0.55	0.35	50	0.00	0.00	89	66.90
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**14.53**	**1.00**	**3.20**	**0.22**		**3.24**	**0.22**		**0.00**	**0.00**		**5.46**	**0.38**		**0.70**	**0.05**		**1.94**	**0.13**		**0.00**	**0.00**		**70.40**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	640	m
Catchment Slope	1.10%	
Catchment Area	14.53	ha

Time of Concentration (Minutes)	27.39
Time of Concentration (Hours)	0.46
Time to Peak (2/3 x Time of Concentration)	0.30

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	640	m
Catchment Slope	1.10%	
Catchment Area	14.53	ha

Time of Concentration (Minutes)	61.38
Time of Concentration (Hours)	1.02
Time to Peak (2/3 x Time of Concentration)	0.68

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.64**	mm
Runoff Coefficient	**0.33**	
Time to Peak	**0.68**	hrs

Soil Series				
Land Use Type	B	C	C	0
	2	3	3	0
Forest/Woodland	0.25	0.35	0.35	0.00
Cultivated	0.35	0.55	0.55	0.00
Pasture/Lawn	0.28	0.40	0.40	0.00
Impervious	0.95	0.95	0.95	0.00
Wetland/Lake/SWMF	0.05	0.05	0.05	0.00
Meadows	0.27	0.38	0.38	0.00
Gravel	0.27	0.38	0.38	0.00
Soil Series Total	0.31	0.46	0.27	0.00

TATHAM ENGINEERING			
Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 113 **Area** 9.73 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	9.73	1.00	5.69	0.58	60	0.00	0.00	69	0.00	0.00	65	3.12	0.32	74	0.65	0.07	100	0.27	0.03	50	0.00	0.00	85	66.91
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**9.73**	**1.00**	**5.69**	**0.58**		**0.00**	**0.00**		**0.00**	**0.00**		**3.12**	**0.32**		**0.65**	**0.07**		**0.27**	**0.03**		**0.00**	**0.00**		**66.91**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	370	m
Catchment Slope	0.90%	
Catchment Area	9.73	ha

Time of Concentration (Minutes)	17.16
Time of Concentration (Hours)	0.29
Time to Peak (2/3 x Time of Concentration)	0.19

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	370	m
Catchment Slope	0.90%	
Catchment Area	9.73	ha

Time of Concentration (Minutes)	50.40
Time of Concentration (Hours)	0.84
Time to Peak (2/3 x Time of Concentration)	0.56

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.55**	mm
Runoff Coefficient	**0.32**	
Time to Peak	**0.56**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.32	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 114 **Area** 6.75 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.75	1.00	1.40	0.21	60	0.00	0.00	69	0.00	0.00	65	4.49	0.66	74	0.87	0.13	100	0.00	0.00	50	0.00	0.00	85	74.44
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.75**	**1.00**	**1.40**	**0.21**		**0.00**	**0.00**		**0.00**	**0.00**		**4.49**	**0.66**		**0.87**	**0.13**		**0.00**	**0.00**		**0.00**	**0.00**		**74.44**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	290	m
Catchment Slope	2.70%	
Catchment Area	6.75	ha

Time of Concentration (Minutes)	11.20
Time of Concentration (Hours)	0.19
Time to Peak (2/3 x Time of Concentration)	0.12

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	290	m
Catchment Slope	2.70%	
Catchment Area	6.75	ha

Time of Concentration (Minutes)	27.74
Time of Concentration (Hours)	0.46
Time to Peak (2/3 x Time of Concentration)	0.31

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.98**	mm
Runoff Coefficient	**0.41**	
Time to Peak	**0.12**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.41	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 115 **Area** 17.47 ha

WEIGHTED CN VALUE																										
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	16.88	0.97	6.38	0.38	60	0.78	0.05	69	0.00	0.00	65	3.44	0.20	74	2.32	0.14	100	3.97	0.23	50	0.00	0.00	85	66.40
C	3	0.59	0.03	0.59	1.00	73	0.00	0.00	79	0.00	0.00	76	0.00	0.00	82	0.00	0.00	100	0.00	0.00	50	0.00	0.00	89	72.99
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**17.47**	**1.00**	**6.97**	**0.40**		**0.78**	**0.04**		**0.00**	**0.00**		**3.44**	**0.20**		**2.32**	**0.13**		**3.97**	**0.23**		**0.00**	**0.00**		**66.63**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	490	m
Catchment Slope	2.00%	
Catchment Area	17.47	ha

Time of Concentration (Minutes)	18.27
Time of Concentration (Hours)	0.30
Time to Peak (2/3 x Time of Concentration)	0.20

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	490	m
Catchment Slope	2.00%	
Catchment Area	17.47	ha

Time of Concentration (Minutes)	44.68
Time of Concentration (Hours)	0.74
Time to Peak (2/3 x Time of Concentration)	0.50

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.58**	mm
Runoff Coefficient	**0.32**	
Time to Peak	**0.50**	hrs

Soil Series				
Land Use Type	B	C	0	0
	2	3	0	0
Forest/Woodland	0.25	0.35	0.00	0.00
Cultivated	0.35	0.55	0.00	0.00
Pasture/Lawn	0.28	0.40	0.00	0.00
Impervious	0.95	0.95	0.00	0.00
Wetland/Lake/SWMF	0.05	0.05	0.00	0.00
Meadows	0.27	0.38	0.00	0.00
Gravel	0.27	0.38	0.00	0.00
Soil Series Total	0.32	0.35	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 116 **Area** 22.73 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	22.73	1.00	5.76	0.25	60	0.00	0.00	69	0.00	0.00	65	10.35	0.46	74	1.91	0.08	100	4.70	0.21	50	0.00	0.00	85	67.67
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**22.73**	**1.00**	**5.76**	**0.25**		**0.00**	**0.00**		**0.00**	**0.00**		**10.35**	**0.46**		**1.91**	**0.08**		**4.70**	**0.21**		**0.00**	**0.00**		**67.67**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	520	m
Catchment Slope	0.40%	
Catchment Area	22.73	ha

Time of Concentration (Minutes)	26.05
Time of Concentration (Hours)	0.43
Time to Peak (2/3 x Time of Concentration)	0.29

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	520	m
Catchment Slope	0.40%	
Catchment Area	22.73	ha

Time of Concentration (Minutes)	79.17
Time of Concentration (Hours)	1.32
Time to Peak (2/3 x Time of Concentration)	0.88

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.38**	mm
Runoff Coefficient	**0.31**	
Time to Peak	**0.88**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.31	0.00	0.00	0.00

TATHAM ENGINEERING

AMC Conversion Calculation

Project Details

Burlington Quarry Expansion	113187

Prepared By

Insert name	June 29, 2021

Municipality

CN* Calculation Requirement

No

Precipitation threshold to create AMCIII soil moisture conditions (mm): -

Initial Abstraction (Ia) (mm): -

Catchment ID	AMC II CN	AMC I CN	AMC III CN	AMC III CN*	AMC II CN*	AMC I CN*	AMCIII S	AMCIII Ia
101	73.51	54.32	87.15	-	-	-	37.47	5.62
102	71.84	52.30	86.03	-	-	-	41.23	5.39
103	70.16	50.33	84.89	-	-	-	45.21	5.59
104	73.26	54.01	86.98	-	-	-	38.02	5.70
105	75.23	56.48	88.26	-	-	-	33.78	5.07
106	69.06	49.07	84.13	-	-	-	47.92	5.71
107	68.58	48.53	83.79	-	-	-	49.13	5.28
108	63.12	42.70	79.84	-	-	-	64.13	6.41
109	63.33	42.91	80.00	-	-	-	63.51	6.35
110	65.34	45.00	81.48	-	-	-	57.75	6.94
111	70.01	50.15	84.79	-	-	-	45.57	6.79
112	70.40	50.60	85.06	-	-	-	44.63	6.69
113	66.91	46.69	82.61	-	-	-	53.47	8.02
114	74.44	55.48	87.75	-	-	-	35.45	5.32
115	66.63	46.38	82.41	-	-	-	54.22	8.13
116	67.67	47.52	83.15	-	-	-	51.47	7.72
100	85.00	70.37	93.96	-	-	-	16.32	3.26
131	85.00	70.37	93.96	-	-	-	16.32	3.26

AMC Conversion is determined using equations derived from MTO Design Chart 1.10

Project:	Project Sideways
File No.:	113187
Revision No.:	1
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations
Prepared By:	DAM
Reviewed By:	DRT
Date:	21-May-19

EXISTING CONDITIONS

Catchment 101 **Area** 84.22 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	41.56	0.49	3.72	0.09	60	0.00	0.00	69	0.00	0.00	65	31.10	0.75	74	4.28	0.10	100	2.47	0.06	50	0.00	0.00	85	74.00
C	3	42.66	0.51	3.34	0.08	73	0.00	0.00	79	0.00	0.00	76	23.61	0.55	82	3.01	0.07	100	12.70	0.30	50	0.00	0.00	89	73.04
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**84.22**	**1.00**	**7.05**	**0.08**		**0.00**	**0.00**		**0.00**	**0.00**		**54.71**	**0.65**		**7.29**	**0.09**		**15.17**	**0.18**		**0.00**	**0.00**		**73.51**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	1150	m
Catchment Slope	0.50%	
Catchment Area	84.22	ha

Time of Concentration (Minutes)	48.33
Time of Concentration (Hours)	0.81
Time to Peak (2/3 x Time of Concentration)	0.54

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	1150	m
Catchment Slope	0.50%	
Catchment Area	84.22	ha

Time of Concentration (Minutes)	97.33
Time of Concentration (Hours)	1.62
Time to Peak (2/3 x Time of Concentration)	1.08

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.72**	mm
Runoff Coefficient	**0.40**	
Time to Peak	**1.08**	hrs

Soil Series				
Land Use Type	B	C	0	0
	2	3	0	0
Forest/Woodland	0.25	0.35	0.00	0.00
Cultivated	0.35	0.55	0.00	0.00
Pasture/Lawn	0.28	0.40	0.00	0.00
Impervious	0.95	0.95	0.00	0.00
Wetland/Lake/SWMF	0.05	0.05	0.00	0.00
Meadows	0.27	0.38	0.00	0.00
Gravel	0.27	0.38	0.00	0.00
Soil Series Total	0.39	0.41	0.00	0.00

Project: Project Sideways	**Prepared By:** DAM
File No.: 113187	**Reviewed By:** DRT
Revision No.: 1	**Date:** 21-May-19
Description: Curve Number, Initial Abstraction & Time to Peak Calculations	

EXISTING CONDITIONS

Catchment 102 **Area** 4.96 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	4.96	1.00	0.85	0.17	60	3.16	0.64	69	0.00	0.00	65	0.02	0.00	74	0.92	0.19	100	0.00	0.00	50	0.00	0.00	85	73.22
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**4.96**	**1.00**	**0.85**	**0.17**		**3.16**	**0.64**		**0.00**	**0.00**		**0.02**	**0.00**		**0.92**	**0.19**		**0.00**	**0.00**		**0.00**	**0.00**		**73.22**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	250	m
Catchment Slope	5.40%	
Catchment Area	4.96	ha

Time of Concentration (Minutes)	8.67
Time of Concentration (Hours)	0.14
Time to Peak (2/3 x Time of Concentration)	0.10

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	250	m
Catchment Slope	5.40%	
Catchment Area	4.96	ha

Time of Concentration (Minutes)	19.11
Time of Concentration (Hours)	0.32
Time to Peak (2/3 x Time of Concentration)	0.21

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.31**	mm
Runoff Coefficient	**0.45**	
Time to Peak	**0.10**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.30	0.00	0.00	0.00
Cultivated	0.45	0.00	0.00	0.00
Pasture/Lawn	0.35	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.33	0.00	0.00	0.00
Gravel	0.33	0.00	0.00	0.00
Soil Series Total	0.45	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 103 **Area** 4.40 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	4.40	1.00	1.10	0.25	60	3.02	0.69	69	0.00	0.00	65	0.09	0.02	74	0.19	0.04	100	0.00	0.00	50	0.00	0.00	85	68.17
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**4.40**	**1.00**	**1.10**	**0.25**		**3.02**	**0.69**		**0.00**	**0.00**		**0.09**	**0.02**		**0.19**	**0.04**		**0.00**	**0.00**		**0.00**	**0.00**		**68.17**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	430	m
Catchment Slope	1.10%	
Catchment Area	4.40	ha

Time of Concentration (Minutes)	20.74
Time of Concentration (Hours)	0.35
Time to Peak (2/3 x Time of Concentration)	0.23

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	430	m
Catchment Slope	1.10%	
Catchment Area	4.40	ha

Time of Concentration (Minutes)	52.23
Time of Concentration (Hours)	0.87
Time to Peak (2/3 x Time of Concentration)	0.58

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.16**	mm
Runoff Coefficient	**0.30**	
Time to Peak	**0.58**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.30	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 104 **Area** 3.20 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	3.20	1.00	0.83	0.26	60	0.55	0.17	69	0.00	0.00	65	1.34	0.42	74	0.49	0.15	100	0.00	0.00	50	0.00	0.00	85	73.52
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**3.20**	**1.00**	**0.83**	**0.26**		**0.55**	**0.17**		**0.00**	**0.00**		**1.34**	**0.42**		**0.49**	**0.15**		**0.00**	**0.00**		**0.00**	**0.00**		**73.52**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	260	m
Catchment Slope	1.90%	
Catchment Area	3.20	ha

Time of Concentration (Minutes)	11.60
Time of Concentration (Hours)	0.19
Time to Peak (2/3 x Time of Concentration)	0.13

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	260	m
Catchment Slope	1.90%	
Catchment Area	3.20	ha

Time of Concentration (Minutes)	29.59
Time of Concentration (Hours)	0.49
Time to Peak (2/3 x Time of Concentration)	0.33

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.67**	mm
Runoff Coefficient	**0.40**	
Time to Peak	**0.13**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.40	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 105 **Area** 0.61 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	0.61	1.00	0.10	0.17	60	0.00	0.00	69	0.00	0.00	65	0.43	0.70	74	0.08	0.14	100	0.00	0.00	50	0.00	0.00	85	75.23
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**0.61**	**1.00**	**0.10**	**0.17**		**0.00**	**0.00**		**0.00**	**0.00**		**0.43**	**0.70**		**0.08**	**0.14**		**0.00**	**0.00**		**0.00**	**0.00**		**75.23**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	140	m
Catchment Slope	1.00%	
Catchment Area	0.61	ha

Time of Concentration (Minutes)	8.38
Time of Concentration (Hours)	0.14
Time to Peak (2/3 x Time of Concentration)	0.09

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	140	m
Catchment Slope	1.00%	
Catchment Area	0.61	ha

Time of Concentration (Minutes)	26.40
Time of Concentration (Hours)	0.44
Time to Peak (2/3 x Time of Concentration)	0.29

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.81**	mm
Runoff Coefficient	**0.42**	
Time to Peak	**0.09**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.42	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 106 **Area** 1.46 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	1.46	1.00	0.38	0.26	60	0.88	0.60	69	0.00	0.00	65	0.00	0.00	74	0.12	0.08	100	0.08	0.06	50	0.00	0.00	85	68.14
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**1.46**	**1.00**	**0.38**	**0.26**		**0.88**	**0.60**		**0.00**	**0.00**		**0.00**	**0.00**		**0.12**	**0.08**		**0.08**	**0.06**		**0.00**	**0.00**		**68.14**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	190	m
Catchment Slope	1.00%	
Catchment Area	1.46	ha

Time of Concentration (Minutes)	10.43
Time of Concentration (Hours)	0.17
Time to Peak (2/3 x Time of Concentration)	0.12

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	190	m
Catchment Slope	1.00%	
Catchment Area	1.46	ha

Time of Concentration (Minutes)	35.31
Time of Concentration (Hours)	0.59
Time to Peak (2/3 x Time of Concentration)	0.39

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.45**	mm
Runoff Coefficient	**0.31**	
Time to Peak	**0.39**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.31	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 108 **Area** 2.00 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	2.00	1.00	1.12	0.56	60	0.88	0.44	69	0.00	0.00	65	0.00	0.00	74	0.00	0.00	100	0.00	0.00	50	0.00	0.00	85	64.04
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**2.00**	**1.00**	**1.12**	**0.56**		**0.88**	**0.44**		**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**64.04**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	120	m
Catchment Slope	0.70%	
Catchment Area	2.00	ha

Time of Concentration (Minutes)	6.85
Time of Concentration (Hours)	0.11
Time to Peak (2/3 x Time of Concentration)	0.08

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	120	m
Catchment Slope	0.70%	
Catchment Area	2.00	ha

Time of Concentration (Minutes)	33.58
Time of Concentration (Hours)	0.56
Time to Peak (2/3 x Time of Concentration)	0.37

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.80**	mm
Runoff Coefficient	**0.26**	
Time to Peak	**0.37**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.26	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 109 **Area** 5.37 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	5.37	1.00	3.82	0.71	60	1.40	0.26	69	0.00	0.00	65	0.11	0.02	74	0.00	0.00	100	0.03	0.01	50	0.00	0.00	85	62.58
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**5.37**	**1.00**	**3.82**	**0.71**		**1.40**	**0.26**		**0.00**	**0.00**		**0.11**	**0.02**		**0.00**	**0.00**		**0.03**	**0.01**		**0.00**	**0.00**		**62.58**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	1.00%	
Catchment Area	5.37	ha

Time of Concentration (Minutes)	14.45
Time of Concentration (Hours)	0.24
Time to Peak (2/3 x Time of Concentration)	0.16

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	1.00%	
Catchment Area	5.37	ha

Time of Concentration (Minutes)	47.50
Time of Concentration (Hours)	0.79
Time to Peak (2/3 x Time of Concentration)	0.53

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.65**	mm
Runoff Coefficient	**0.26**	
Time to Peak	**0.53**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.26	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 111 **Area** 7.60 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	5.49	0.72	1.01	0.18	60	1.24	0.22	69	0.00	0.00	65	1.75	0.32	74	0.31	0.06	100	1.13	0.21	50	0.06	0.01	85	66.96
C	3	1.30	0.17	0.00	0.00	73	0.22	0.17	79	0.00	0.00	76	0.00	0.00	82	0.13	0.10	100	0.96	0.73	50	0.00	0.00	89	59.76
D	3	0.80	0.11	0.00	0.00	79	0.57	0.71	84	0.00	0.00	81	0.00	0.00	86	0.00	0.00	100	0.23	0.29	50	0.00	0.00	91	74.11
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**7.60**	**1.00**	**1.01**	**0.13**		**2.02**	**0.27**		**0.00**	**0.00**		**1.75**	**0.23**		**0.44**	**0.06**		**2.32**	**0.31**		**0.06**	**0.01**		**66.48**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	420	m
Catchment Slope	1.90%	
Catchment Area	7.60	ha

Time of Concentration (Minutes)	17.19
Time of Concentration (Hours)	0.29
Time to Peak (2/3 x Time of Concentration)	0.19

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	420	m
Catchment Slope	1.90%	
Catchment Area	7.60	ha

Time of Concentration (Minutes)	44.72
Time of Concentration (Hours)	0.75
Time to Peak (2/3 x Time of Concentration)	0.50

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.07**	mm
Runoff Coefficient	**0.27**	
Time to Peak	**0.50**	hrs

Soil Series				
Land Use Type	B	C	D	0
	2	3	3	0
Forest/Woodland	0.25	0.35	0.35	0.00
Cultivated	0.35	0.55	0.55	0.00
Pasture/Lawn	0.28	0.40	0.40	0.00
Impervious	0.95	0.95	0.95	0.00
Wetland/Lake/SWMF	0.05	0.05	0.05	0.00
Meadows	0.27	0.38	0.38	0.00
Gravel	0.27	0.38	0.38	0.00
Soil Series Total	0.29	0.20	0.30	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 112 **Area** 14.53 ha

WEIGHTED CN VALUE																								
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	10.49	0.72	1.41	0.13	60	2.66	0.25	69	0.00	0.00	65	4.48	0.43	74	0.57	0.05	100	1.36	0.13	50	0.00	0.00	85	69.15
C	3	2.46	0.17	1.21	0.49	73	0.21	0.08	79	0.00	0.00	76	0.89	0.36	82	0.13	0.05	100	0.02	0.01	50	0.00	0.00	89	77.99
C	3	1.58	0.11	0.58	0.36	73	0.37	0.23	79	0.00	0.00	76	0.09	0.05	82	0.00	0.00	100	0.55	0.35	50	0.00	0.00	89	66.90
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**14.53**	**1.00**	**3.20**	**0.22**		**3.24**	**0.22**		**0.00**	**0.00**		**5.46**	**0.38**		**0.70**	**0.05**		**1.94**	**0.13**		**0.00**	**0.00**		**70.40**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	640	m
Catchment Slope	1.10%	
Catchment Area	14.53	ha

Time of Concentration (Minutes)	27.39
Time of Concentration (Hours)	0.46
Time to Peak (2/3 x Time of Concentration)	0.30

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	640	m
Catchment Slope	1.10%	
Catchment Area	14.53	ha

Time of Concentration (Minutes)	61.38
Time of Concentration (Hours)	1.02
Time to Peak (2/3 x Time of Concentration)	0.68

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.64**	mm
Runoff Coefficient	**0.33**	
Time to Peak	**0.68**	hrs

Soil Series				
Land Use Type	B	C	C	0
	2	3	3	0
Forest/Woodland	0.25	0.35	0.35	0.00
Cultivated	0.35	0.55	0.55	0.00
Pasture/Lawn	0.28	0.40	0.40	0.00
Impervious	0.95	0.95	0.95	0.00
Wetland/Lake/SWMF	0.05	0.05	0.05	0.00
Meadows	0.27	0.38	0.38	0.00
Gravel	0.27	0.38	0.38	0.00
Soil Series Total	0.31	0.46	0.27	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 113 **Area** 9.73 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	9.73	1.00	5.69	0.58	60	0.00	0.00	69	0.00	0.00	65	3.12	0.32	74	0.65	0.07	100	0.27	0.03	50	0.00	0.00	85	66.91
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**9.73**	**1.00**	**5.69**	**0.58**		**0.00**	**0.00**		**0.00**	**0.00**		**3.12**	**0.32**		**0.65**	**0.07**		**0.27**	**0.03**		**0.00**	**0.00**		**66.91**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	370	m
Catchment Slope	0.90%	
Catchment Area	9.73	ha

Time of Concentration (Minutes)	17.16
Time of Concentration (Hours)	0.29
Time to Peak (2/3 x Time of Concentration)	0.19

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	370	m
Catchment Slope	0.90%	
Catchment Area	9.73	ha

Time of Concentration (Minutes)	50.40
Time of Concentration (Hours)	0.84
Time to Peak (2/3 x Time of Concentration)	0.56

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.55**	mm
Runoff Coefficient	**0.32**	
Time to Peak	**0.56**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.32	0.00	0.00	0.00

Project: Project Sideways | **Prepared By:** DAM
File No.: 113187 | **Reviewed By:** DRT
Revision No.: 1 | **Date:** 21-May-19
Description: Curve Number, Initial Abstraction & Time to Peak Calculations

EXISTING CONDITIONS

Catchment 114 **Area** 6.75 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.75	1.00	1.40	0.21	60	0.00	0.00	69	0.00	0.00	65	4.49	0.66	74	0.87	0.13	100	0.00	0.00	50	0.00	0.00	85	74.44
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.75**	**1.00**	**1.40**	**0.21**		**0.00**	**0.00**		**0.00**	**0.00**		**4.49**	**0.66**		**0.87**	**0.13**		**0.00**	**0.00**		**0.00**	**0.00**		**74.44**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	290	m
Catchment Slope	2.70%	
Catchment Area	6.75	ha

Time of Concentration (Minutes)	11.20
Time of Concentration (Hours)	0.19
Time to Peak (2/3 x Time of Concentration)	0.12

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	290	m
Catchment Slope	2.70%	
Catchment Area	6.75	ha

Time of Concentration (Minutes)	27.74
Time of Concentration (Hours)	0.46
Time to Peak (2/3 x Time of Concentration)	0.31

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.98**	mm
Runoff Coefficient	**0.41**	
Time to Peak	**0.12**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.41	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 115 **Area** 17.47 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	16.88	0.97	6.38	0.38	60	0.78	0.05	69	0.00	0.00	65	3.44	0.20	74	2.32	0.14	100	3.97	0.23	50	0.00	0.00	85	66.40
C	3	0.59	0.03	0.59	1.00	73	0.00	0.00	79	0.00	0.00	76	0.00	0.00	82	0.00	0.00	100	0.00	0.00	50	0.00	0.00	89	72.99
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**17.47**	**1.00**	**6.97**	**0.40**		**0.78**	**0.04**		**0.00**	**0.00**		**3.44**	**0.20**		**2.32**	**0.13**		**3.97**	**0.23**		**0.00**	**0.00**		**66.63**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	490	m
Catchment Slope	2.00%	
Catchment Area	17.47	ha

Time of Concentration (Minutes)	18.27
Time of Concentration (Hours)	0.30
Time to Peak (2/3 x Time of Concentration)	0.20

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	490	m
Catchment Slope	2.00%	
Catchment Area	17.47	ha

Time of Concentration (Minutes)	44.68
Time of Concentration (Hours)	0.74
Time to Peak (2/3 x Time of Concentration)	0.50

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.58**	mm
Runoff Coefficient	**0.32**	
Time to Peak	**0.50**	hrs

Soil Series				
Land Use Type	B	C	0	0
	2	3	0	0
Forest/Woodland	0.25	0.35	0.00	0.00
Cultivated	0.35	0.55	0.00	0.00
Pasture/Lawn	0.28	0.40	0.00	0.00
Impervious	0.95	0.95	0.00	0.00
Wetland/Lake/SWMF	0.05	0.05	0.00	0.00
Meadows	0.27	0.38	0.00	0.00
Gravel	0.27	0.38	0.00	0.00
Soil Series Total	0.32	0.35	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 116 **Area** 22.73 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	22.73	1.00	5.76	0.25	60	0.00	0.00	69	0.00	0.00	65	10.35	0.46	74	1.91	0.08	100	4.70	0.21	50	0.00	0.00	85	67.67
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**22.73**	**1.00**	**5.76**	**0.25**		**0.00**	**0.00**		**0.00**	**0.00**		**10.35**	**0.46**		**1.91**	**0.08**		**4.70**	**0.21**		**0.00**	**0.00**		**67.67**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	520	m
Catchment Slope	0.40%	
Catchment Area	22.73	ha

Time of Concentration (Minutes)	26.05
Time of Concentration (Hours)	0.43
Time to Peak (2/3 x Time of Concentration)	0.29

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	520	m
Catchment Slope	0.40%	
Catchment Area	22.73	ha

Time of Concentration (Minutes)	79.17
Time of Concentration (Hours)	1.32
Time to Peak (2/3 x Time of Concentration)	0.88

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.38**	mm
Runoff Coefficient	**0.31**	
Time to Peak	**0.88**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.31	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 128 **Area** 11.29 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	11.29	1.00	0.00	0.00	60	4.52	0.40	69	0.00	0.00	65	0.00	0.00	74	0.00	0.00	100	6.77	0.60	50	0.00	0.00	85	57.60
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**11.29**	**1.00**	**0.00**	**0.00**		**4.52**	**0.40**		**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**2.32**	**0.21**		**0.00**	**0.00**		**57.60**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	272.00	m
Minimum Catchment Elevation	270.00	m
Catchment length	1100	m
Catchment Slope	0.18%	
Catchment Area	11.29	ha

Time of Concentration (Minutes)	69.19
Time of Concentration (Hours)	1.15
Time to Peak (2/3 x Time of Concentration)	0.77

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	272.00	m
Minimum Catchment Elevation	270.00	m
Catchment length	1100	m
Catchment Slope	0.18%	
Catchment Area	11.29	ha

Time of Concentration (Minutes)	181.80
Time of Concentration (Hours)	3.03
Time to Peak (2/3 x Time of Concentration)	2.02

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**4.46**	mm
Runoff Coefficient	**0.14**	
Time to Peak	**2.02**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.14	0.00	0.00	0.00

TATHAM ENGINEERING

AMC Conversion Calculation

Project Details

Burlington Quarry Expansion	113187

Prepared By

Insert name	June 29, 2021

Municipality

CN* Calculation Requirement

No

Precipitation threshold to create AMCIII soil moisture conditions (mm): -

Initial Abstraction (Ia) (mm): -

Catchment ID	AMC II CN	AMC I CN	AMC III CN	AMC III CN*	AMC II CN*	AMC I CN*	AMCIII S	AMCIII Ia
101	73.51	54.32	87.15	-	-	-	37.47	5.62
102	73.22	53.96	86.95	-	-	-	38.11	5.31
103	68.17	48.07	83.50	-	-	-	50.18	6.16
104	73.52	54.33	87.15	-	-	-	37.45	5.62
105	75.23	56.48	88.26	-	-	-	33.78	5.07
106	68.14	48.04	83.48	-	-	-	50.25	6.45
108	64.04	43.64	80.52	-	-	-	61.44	7.80
109	62.58	42.15	79.44	-	-	-	65.75	6.58
111	66.48	46.22	82.30	-	-	-	54.62	8.07
112	70.40	50.60	85.06	-	-	-	44.63	6.69
113	66.91	46.69	82.61	-	-	-	53.47	8.02
114	74.44	55.48	87.75	-	-	-	35.45	5.32
115	66.63	46.38	82.41	-	-	-	54.22	8.13
116	67.67	47.52	83.15	-	-	-	51.47	7.72
128	57.60	37.30	75.61	-	-	-	81.95	4.46
100	85.00	70.37	93.96	-	-	-	16.32	3.26
South	85.00	70.37	93.96	-	-	-	16.32	3.26
West	85.00	70.37	93.96	-	-	-	16.32	3.26

AMC Conversion is determined using equations derived from MTO Design Chart 1.10

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 101 **Area** 84.22 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	41.56	0.49	3.72	0.09	60	0.00	0.00	69	0.00	0.00	65	31.10	0.75	74	4.28	0.10	100	2.47	0.06	50	0.00	0.00	85	74.00
C	3	42.66	0.51	3.34	0.08	73	0.00	0.00	79	0.00	0.00	76	23.61	0.55	82	3.01	0.07	100	12.70	0.30	50	0.00	0.00	89	73.04
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**84.22**	**1.00**	**7.05**	**0.08**		**0.00**	**0.00**		**0.00**	**0.00**		**54.71**	**0.65**		**7.29**	**0.09**		**15.17**	**0.18**		**0.00**	**0.00**		**73.51**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	1150	m
Catchment Slope	0.50%	
Catchment Area	84.22	ha

Time of Concentration (Minutes)	48.33
Time of Concentration (Hours)	0.81
Time to Peak (2/3 x Time of Concentration)	0.54

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	1150	m
Catchment Slope	0.50%	
Catchment Area	84.22	ha

Time of Concentration (Minutes)	97.33
Time of Concentration (Hours)	1.62
Time to Peak (2/3 x Time of Concentration)	1.08

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.72**	mm
Runoff Coefficient	**0.40**	
Time to Peak	**1.08**	hrs

Soil Series				
Land Use Type	B	C	0	0
	2	3	0	0
Forest/Woodland	0.25	0.35	0.00	0.00
Cultivated	0.35	0.55	0.00	0.00
Pasture/Lawn	0.28	0.40	0.00	0.00
Impervious	0.95	0.95	0.00	0.00
Wetland/Lake/SWMF	0.05	0.05	0.00	0.00
Meadows	0.27	0.38	0.00	0.00
Gravel	0.27	0.38	0.00	0.00
Soil Series Total	0.39	0.41	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 102 **Area** 4.96 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	4.96	1.00	0.85	0.17	60	3.16	0.64	69	0.00	0.00	65	0.02	0.00	74	0.92	0.19	100	0.00	0.00	50	0.00	0.00	85	73.22
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**4.96**	**1.00**	**0.85**	**0.17**		**3.16**	**0.64**		**0.00**	**0.00**		**0.02**	**0.00**		**0.92**	**0.19**		**0.00**	**0.00**		**0.00**	**0.00**		**73.22**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	250	m
Catchment Slope	5.40%	
Catchment Area	4.96	ha

Time of Concentration (Minutes)	8.67
Time of Concentration (Hours)	0.14
Time to Peak (2/3 x Time of Concentration)	0.10

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	250	m
Catchment Slope	5.40%	
Catchment Area	4.96	ha

Time of Concentration (Minutes)	19.11
Time of Concentration (Hours)	0.32
Time to Peak (2/3 x Time of Concentration)	0.21

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**5.31**	mm
Runoff Coefficient	**0.45**	
Time to Peak	**0.10**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.30	0.00	0.00	0.00
Cultivated	0.45	0.00	0.00	0.00
Pasture/Lawn	0.35	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.33	0.00	0.00	0.00
Gravel	0.33	0.00	0.00	0.00
Soil Series Total	0.45	0.00	0.00	0.00

Project:	Project Sideways
File No.:	113187
Revision No.:	1
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations
Prepared By:	DAM
Reviewed By:	DRT
Date:	21-May-19

EXISTING CONDITIONS

Catchment 103 **Area** 4.40 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	4.40	1.00	1.10	0.25	60	3.02	0.69	69	0.00	0.00	65	0.09	0.02	74	0.19	0.04	100	0.00	0.00	50	0.00	0.00	85	68.17
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**4.40**	**1.00**	**1.10**	**0.25**		**3.02**	**0.69**		**0.00**	**0.00**		**0.09**	**0.02**		**0.19**	**0.04**		**0.00**	**0.00**		**0.00**	**0.00**		**68.17**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	430	m
Catchment Slope	1.10%	
Catchment Area	4.40	ha

Time of Concentration (Minutes)	20.74
Time of Concentration (Hours)	0.35
Time to Peak (2/3 x Time of Concentration)	0.23

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	430	m
Catchment Slope	1.10%	
Catchment Area	4.40	ha

Time of Concentration (Minutes)	52.23
Time of Concentration (Hours)	0.87
Time to Peak (2/3 x Time of Concentration)	0.58

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.16**	mm
Runoff Coefficient	**0.30**	
Time to Peak	**0.58**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.30	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 104 **Area** 3.20 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	3.20	1.00	0.83	0.26	60	0.55	0.17	69	0.00	0.00	65	1.34	0.42	74	0.49	0.15	100	0.00	0.00	50	0.00	0.00	85	73.52
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**3.20**	**1.00**	**0.83**	**0.26**		**0.55**	**0.17**		**0.00**	**0.00**		**1.34**	**0.42**		**0.49**	**0.15**		**0.00**	**0.00**		**0.00**	**0.00**		**73.52**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	260	m
Catchment Slope	1.90%	
Catchment Area	3.20	ha

Time of Concentration (Minutes)	11.60
Time of Concentration (Hours)	0.19
Time to Peak (2/3 x Time of Concentration)	0.13

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	260	m
Catchment Slope	1.90%	
Catchment Area	3.20	ha

Time of Concentration (Minutes)	29.59
Time of Concentration (Hours)	0.49
Time to Peak (2/3 x Time of Concentration)	0.33

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.67**	mm
Runoff Coefficient	**0.40**	
Time to Peak	**0.13**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.40	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 105 **Area** 0.61 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	0.61	1.00	0.10	0.17	60	0.00	0.00	69	0.00	0.00	65	0.43	0.70	74	0.08	0.14	100	0.00	0.00	50	0.00	0.00	85	75.23
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**0.61**	**1.00**	**0.10**	**0.17**		**0.00**	**0.00**		**0.00**	**0.00**		**0.43**	**0.70**		**0.08**	**0.14**		**0.00**	**0.00**		**0.00**	**0.00**		**75.23**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	140	m
Catchment Slope	1.00%	
Catchment Area	0.61	ha

Time of Concentration (Minutes)	8.38
Time of Concentration (Hours)	0.14
Time to Peak (2/3 x Time of Concentration)	0.09

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	140	m
Catchment Slope	1.00%	
Catchment Area	0.61	ha

Time of Concentration (Minutes)	26.40
Time of Concentration (Hours)	0.44
Time to Peak (2/3 x Time of Concentration)	0.29

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.81**	mm
Runoff Coefficient	**0.42**	
Time to Peak	**0.09**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.42	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 106 **Area** 1.46 ha

WEIGHTED CN VALUE																										
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	1.46	1.00	0.38	0.26	60	0.88	0.60	69	0.00	0.00	65	0.00	0.00	74	0.12	0.08	100	0.08	0.06	50	0.00	0.00	85	68.14
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**1.46**	**1.00**	**0.38**	**0.26**		**0.88**	**0.60**		**0.00**	**0.00**		**0.00**	**0.00**		**0.12**	**0.08**		**0.08**	**0.06**		**0.00**	**0.00**		**68.14**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	190	m
Catchment Slope	1.00%	
Catchment Area	1.46	ha

Time of Concentration (Minutes)	10.43
Time of Concentration (Hours)	0.17
Time to Peak (2/3 x Time of Concentration)	0.12

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	190	m
Catchment Slope	1.00%	
Catchment Area	1.46	ha

Time of Concentration (Minutes)	35.31
Time of Concentration (Hours)	0.59
Time to Peak (2/3 x Time of Concentration)	0.39

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.45**	mm
Runoff Coefficient	**0.31**	
Time to Peak	**0.39**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.31	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 108 **Area** 2.00 ha

WEIGHTED CN VALUE																										
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	2.00	1.00	1.12	0.56	60	0.88	0.44	69	0.00	0.00	65	0.00	0.00	74	0.00	0.00	100	0.00	0.00	50	0.00	0.00	85	64.04
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**2.00**	**1.00**	**1.12**	**0.56**		**0.88**	**0.44**		**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**64.04**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	120	m
Catchment Slope	0.70%	
Catchment Area	2.00	ha

Time of Concentration (Minutes)	6.85
Time of Concentration (Hours)	0.11
Time to Peak (2/3 x Time of Concentration)	0.08

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	120	m
Catchment Slope	0.70%	
Catchment Area	2.00	ha

Time of Concentration (Minutes)	33.58
Time of Concentration (Hours)	0.56
Time to Peak (2/3 x Time of Concentration)	0.37

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.80**	mm
Runoff Coefficient	**0.26**	
Time to Peak	**0.37**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.26	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 109 **Area** 6.47 ha

WEIGHTED CN VALUE																										
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.47	1.00	4.61	0.71	60	1.69	0.26	69	0.00	0.00	65	0.14	0.02	74	0.00	0.00	100	0.03	0.01	50	0.00	0.00	85	62.53
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.47**	**1.00**	**4.61**	**0.71**		**1.69**	**0.26**		**0.00**	**0.00**		**0.14**	**0.02**		**0.00**	**0.00**		**0.03**	**0.01**		**0.00**	**0.00**		**62.53**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	1.00%	
Catchment Area	6.47	ha

Time of Concentration (Minutes)	14.19
Time of Concentration (Hours)	0.24
Time to Peak (2/3 x Time of Concentration)	0.16

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	300	m
Catchment Slope	1.00%	
Catchment Area	6.47	ha

Time of Concentration (Minutes)	47.51
Time of Concentration (Hours)	0.79
Time to Peak (2/3 x Time of Concentration)	0.53

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.63**	mm
Runoff Coefficient	**0.26**	
Time to Peak	**0.53**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.26	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 111 **Area** 7.60 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	5.49	0.72	1.01	0.18	60	1.24	0.22	69	0.00	0.00	65	1.75	0.32	74	0.31	0.06	100	1.13	0.21	50	0.06	0.01	85	66.96
C	3	1.30	0.17	0.00	0.00	73	0.22	0.17	79	0.00	0.00	76	0.00	0.00	82	0.13	0.10	100	0.96	0.73	50	0.00	0.00	89	59.76
D	3	0.80	0.11	0.00	0.00	79	0.57	0.71	84	0.00	0.00	81	0.00	0.00	86	0.00	0.00	100	0.23	0.29	50	0.00	0.00	91	74.11
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**7.60**	**1.00**	**1.01**	**0.13**		**2.02**	**0.27**		**0.00**	**0.00**		**1.75**	**0.23**		**0.44**	**0.06**		**2.32**	**0.31**		**0.06**	**0.01**		**66.48**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	420	m
Catchment Slope	1.90%	
Catchment Area	7.60	ha

Time of Concentration (Minutes)	17.19
Time of Concentration (Hours)	0.29
Time to Peak (2/3 x Time of Concentration)	0.19

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	420	m
Catchment Slope	1.90%	
Catchment Area	7.60	ha

Time of Concentration (Minutes)	44.72
Time of Concentration (Hours)	0.75
Time to Peak (2/3 x Time of Concentration)	0.50

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.07**	mm
Runoff Coefficient	**0.27**	
Time to Peak	**0.50**	hrs

Soil Series				
Land Use Type	B	C	D	0
	2	3	3	0
Forest/Woodland	0.25	0.35	0.35	0.00
Cultivated	0.35	0.55	0.55	0.00
Pasture/Lawn	0.28	0.40	0.40	0.00
Impervious	0.95	0.95	0.95	0.00
Wetland/Lake/SWMF	0.05	0.05	0.05	0.00
Meadows	0.27	0.38	0.38	0.00
Gravel	0.27	0.38	0.38	0.00
Soil Series Total	0.29	0.20	0.30	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 112 **Area** 14.53 ha

WEIGHTED CN VALUE																										
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	10.49	0.72	1.41	0.13	60	2.66	0.25	69	0.00	0.00	65	4.48	0.43	74	0.57	0.05	100	1.36	0.13	50	0.00	0.00	85	69.15
C	3	2.46	0.17	1.21	0.49	73	0.21	0.08	79	0.00	0.00	76	0.89	0.36	82	0.13	0.05	100	0.02	0.01	50	0.00	0.00	89	77.99
C	3	1.58	0.11	0.58	0.36	73	0.37	0.23	79	0.00	0.00	76	0.09	0.05	82	0.00	0.00	100	0.55	0.35	50	0.00	0.00	89	66.90
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**14.53**	**1.00**	**3.20**	**0.22**		**3.24**	**0.22**		**0.00**	**0.00**		**5.46**	**0.38**		**0.70**	**0.05**		**1.94**	**0.13**		**0.00**	**0.00**		**70.40**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	640	m
Catchment Slope	1.10%	
Catchment Area	14.53	ha

Time of Concentration (Minutes)	27.39
Time of Concentration (Hours)	0.46
Time to Peak (2/3 x Time of Concentration)	0.30

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	640	m
Catchment Slope	1.10%	
Catchment Area	14.53	ha

Time of Concentration (Minutes)	61.38
Time of Concentration (Hours)	1.02
Time to Peak (2/3 x Time of Concentration)	0.68

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**7.64**	mm
Runoff Coefficient	**0.33**	
Time to Peak	**0.68**	hrs

Soil Series				
Land Use Type	B	C	C	0
	2	3	3	0
Forest/Woodland	0.25	0.35	0.35	0.00
Cultivated	0.35	0.55	0.55	0.00
Pasture/Lawn	0.28	0.40	0.40	0.00
Impervious	0.95	0.95	0.95	0.00
Wetland/Lake/SWMF	0.05	0.05	0.05	0.00
Meadows	0.27	0.38	0.38	0.00
Gravel	0.27	0.38	0.38	0.00
Soil Series Total	0.31	0.46	0.27	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 113 **Area** 9.73 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	**Runoff Coefficient Type**	**Catchment Soil Characteristics**		**Forest / Woodland**			**Pasture / Lawns**			**Meadows**			**Cultivated**			**Impervious**			**Wetland / Lakes / SWMF**			**Gravel**			**Average CN for Soil Type**
		Area	**Percent**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	**Area**	**Percent**	**CN**	
B	2	9.73	1.00	5.69	0.58	60	0.00	0.00	69	0.00	0.00	65	3.12	0.32	74	0.65	0.07	100	0.27	0.03	50	0.00	0.00	85	66.91
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**9.73**	**1.00**	**5.69**	**0.58**		**0.00**	**0.00**		**0.00**	**0.00**		**3.12**	**0.32**		**0.65**	**0.07**		**0.27**	**0.03**		**0.00**	**0.00**		**66.91**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	370	m
Catchment Slope	0.90%	
Catchment Area	9.73	ha

Time of Concentration (Minutes)	17.16
Time of Concentration (Hours)	0.29
Time to Peak (2/3 x Time of Concentration)	0.19

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	370	m
Catchment Slope	0.90%	
Catchment Area	9.73	ha

Time of Concentration (Minutes)	50.40
Time of Concentration (Hours)	0.84
Time to Peak (2/3 x Time of Concentration)	0.56

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.55**	mm
Runoff Coefficient	**0.32**	
Time to Peak	**0.56**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.32	0.00	0.00	0.00

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 114 **Area** 6.75 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	6.75	1.00	1.40	0.21	60	0.00	0.00	69	0.00	0.00	65	4.49	0.66	74	0.87	0.13	100	0.00	0.00	50	0.00	0.00	85	74.44
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**6.75**	**1.00**	**1.40**	**0.21**		**0.00**	**0.00**		**0.00**	**0.00**		**4.49**	**0.66**		**0.87**	**0.13**		**0.00**	**0.00**		**0.00**	**0.00**		**74.44**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	290	m
Catchment Slope	2.70%	
Catchment Area	6.75	ha

Time of Concentration (Minutes)	11.20
Time of Concentration (Hours)	0.19
Time to Peak (2/3 x Time of Concentration)	0.12

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	290	m
Catchment Slope	2.70%	
Catchment Area	6.75	ha

Time of Concentration (Minutes)	27.74
Time of Concentration (Hours)	0.46
Time to Peak (2/3 x Time of Concentration)	0.31

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**6.98**	mm
Runoff Coefficient	**0.41**	
Time to Peak	**0.12**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.41	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 115 **Area** 17.47 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	16.88	0.97	6.38	0.38	60	0.78	0.05	69	0.00	0.00	65	3.44	0.20	74	2.32	0.14	100	3.97	0.23	50	0.00	0.00	85	66.40
C	3	0.59	0.03	0.59	1.00	73	0.00	0.00	79	0.00	0.00	76	0.00	0.00	82	0.00	0.00	100	0.00	0.00	50	0.00	0.00	89	72.99
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**17.47**	**1.00**	**6.97**	**0.40**		**0.78**	**0.04**		**0.00**	**0.00**		**3.44**	**0.20**		**2.32**	**0.13**		**3.97**	**0.23**		**0.00**	**0.00**		**66.63**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4, Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	490	m
Catchment Slope	2.00%	
Catchment Area	17.47	ha

Time of Concentration (Minutes)	18.27
Time of Concentration (Hours)	0.30
Time to Peak (2/3 x Time of Concentration)	0.20

For Runoff Coefficients less than 0.4, Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	490	m
Catchment Slope	2.00%	
Catchment Area	17.47	ha

Time of Concentration (Minutes)	44.68
Time of Concentration (Hours)	0.74
Time to Peak (2/3 x Time of Concentration)	0.50

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.58**	mm
Runoff Coefficient	**0.32**	
Time to Peak	**0.50**	hrs

Soil Series				
Land Use Type	B	C	0	0
	2	3	0	0
Forest/Woodland	0.25	0.35	0.00	0.00
Cultivated	0.35	0.55	0.00	0.00
Pasture/Lawn	0.28	0.40	0.00	0.00
Impervious	0.95	0.95	0.00	0.00
Wetland/Lake/SWMF	0.05	0.05	0.00	0.00
Meadows	0.27	0.38	0.00	0.00
Gravel	0.27	0.38	0.00	0.00
Soil Series Total	0.32	0.35	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 116 **Area** 22.73 ha

WEIGHTED CN VALUE

Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	22.73	1.00	5.76	0.25	60	0.00	0.00	69	0.00	0.00	65	10.35	0.46	74	1.91	0.08	100	4.70	0.21	50	0.00	0.00	85	67.67
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**22.73**	**1.00**	**5.76**	**0.25**		**0.00**	**0.00**		**0.00**	**0.00**		**10.35**	**0.46**		**1.91**	**0.08**		**4.70**	**0.21**		**0.00**	**0.00**		**67.67**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	520	m
Catchment Slope	0.40%	
Catchment Area	22.73	ha

Time of Concentration (Minutes)	26.05
Time of Concentration (Hours)	0.43
Time to Peak (2/3 x Time of Concentration)	0.29

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	-	m
Minimum Catchment Elevation	-	m
Catchment length	520	m
Catchment Slope	0.40%	
Catchment Area	22.73	ha

Time of Concentration (Minutes)	79.17
Time of Concentration (Hours)	1.32
Time to Peak (2/3 x Time of Concentration)	0.88

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**8.38**	mm
Runoff Coefficient	**0.31**	
Time to Peak	**0.88**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.31	0.00	0.00	0.00

TATHAM ENGINEERING

Project:	Project Sideways	**Prepared By:**	DAM
File No.:	113187	**Reviewed By:**	DRT
Revision No.:	1	**Date:**	21-May-19
Description:	Curve Number, Initial Abstraction & Time to Peak Calculations		

EXISTING CONDITIONS

Catchment 128 **Area** 11.29 ha

WEIGHTED CN VALUE																									
Hydrologic Soil Group	Runoff Coefficient Type	Catchment Soil Characteristics		Forest / Woodland			Pasture / Lawns			Meadows			Cultivated			Impervious			Wetland / Lakes / SWMF			Gravel			Average CN for Soil Type
		Area	Percent	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	Area	Percent	CN	
B	2	11.29	1.00	0.00	0.00	60	4.52	0.40	69	0.00	0.00	65	0.00	0.00	74	0.00	0.00	100	6.77	0.60	50	0.00	0.00	85	57.60
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	3	0.00		0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00		#N/A	0.00
	Totals	**11.29**	**1.00**	**0.00**	**0.00**		**4.52**	**0.40**		**0.00**	**0.00**		**0.00**	**0.00**		**0.00**	**0.00**		**2.32**	**0.21**		**0.00**	**0.00**		**57.60**

Time of Concentration Calculations

For Runoff Coefficients greater than 0.4,
Bransby-Williams Formula

Maximum Catchment Elevation	272.00	m
Minimum Catchment Elevation	270.00	m
Catchment length	1100	m
Catchment Slope	0.18%	
Catchment Area	11.29	ha

Time of Concentration (Minutes)	69.19
Time of Concentration (Hours)	1.15
Time to Peak (2/3 x Time of Concentration)	0.77

For Runoff Coefficients less than 0.4,
Airport Method

Maximum Catchment Elevation	272.00	m
Minimum Catchment Elevation	270.00	m
Catchment length	1100	m
Catchment Slope	0.18%	
Catchment Area	11.29	ha

Time of Concentration (Minutes)	181.80
Time of Concentration (Hours)	3.03
Time to Peak (2/3 x Time of Concentration)	2.02

Initial Abstraction	
Wetlands	12
Woods	10
Meadows	8
Cultivated	7
Lawns	5
Impervious	2
Gravel	3

Initial Abstraction	**4.46**	mm
Runoff Coefficient	**0.14**	
Time to Peak	**2.02**	hrs

Soil Series				
Land Use Type	B	0	0	0
	2	0	0	0
Forest/Woodland	0.25	0.00	0.00	0.00
Cultivated	0.35	0.00	0.00	0.00
Pasture/Lawn	0.28	0.00	0.00	0.00
Impervious	0.95	0.00	0.00	0.00
Wetland/Lake/SWMF	0.05	0.00	0.00	0.00
Meadows	0.27	0.00	0.00	0.00
Gravel	0.27	0.00	0.00	0.00
Soil Series Total	0.14	0.00	0.00	0.00

TATHAM ENGINEERING

AMC Conversion Calculation

Project Details

Burlington Quarry Expansion	113187

Prepared By

Insert name	June 29, 2021

Municipality

CN* Calculation Requirement

No

Precipitation threshold to create AMCIII soil moisture conditions (mm): -

Initial Abstraction (Ia) (mm): -

Catchment ID	AMC II CN	AMC I CN	AMC III CN	AMC III CN*	AMC II CN*	AMC I CN*	AMCIII S	AMCIII Ia
101	73.51	54.32	87.15	-	-	-	37.47	5.62
102	73.22	53.96	86.95	-	-	-	38.11	5.31
103	68.17	48.07	83.50	-	-	-	50.18	6.16
104	73.52	54.33	87.15	-	-	-	37.45	5.62
105	75.23	56.48	88.26	-	-	-	33.78	5.07
106	68.45	48.38	83.70	-	-	-	49.46	6.33
108	64.04	43.64	80.52	-	-	-	61.44	7.80
109	62.53	42.10	79.40	-	-	-	65.90	6.59
111	66.32	46.05	82.19	-	-	-	55.06	8.12
112	70.40	50.60	85.06	-	-	-	44.63	6.69
113	66.91	46.69	82.61	-	-	-	53.47	8.02
114	74.44	55.48	87.75	-	-	-	35.45	5.32
115	66.63	46.38	82.41	-	-	-	54.22	8.13
116	67.67	47.52	83.15	-	-	-	51.47	7.72
128	57.60	37.30	75.61	-	-	-	81.95	4.46
100	85.00	70.37	93.96	-	-	-	16.32	3.26
South	85.00	70.37	93.96	-	-	-	16.32	3.26
West	85.00	70.37	93.96	-	-	-	16.32	3.26

AMC Conversion is determined using equations derived from MTO Design Chart 1.10

NASHYD

Catchment	Existing Conditions				Phase 1/2				Phase 3/4/5/6				Rehabilitation			
	Area	CN	IA	TP	Area	CN	IA	TP	Area	CN	IA	TP	Area	CN	IA	TP
101	84.2	73.51	7.72	1.08	84.2	73.51	7.72	1.08	84.2	73.51	7.72	1.08	84.2	73.51	7.72	1.08
102	6.7	71.84	5.39	0.09	6.7	71.84	5.39	0.09	5.0	73.22	5.31	0.1	5.0	73.22	5.31	0.1
103	16.5	70.16	5.59	0.56	16.5	70.16	5.59	0.56	4.4	68.17	6.16	0.58	4.4	68.17	6.16	0.58
104	6.9	73.26	6.57	0.33	6.9	73.26	6.57	0.33	3.2	73.52	6.67	0.33	3.2	73.52	6.67	0.33
105	1.7	75.23	6.81	0.08	1.7	75.23	6.81	0.08	0.6	75.23	6.81	0.1	0.6	75.23	6.81	0.1
106	2.3	69.06	5.71	0.39	2.3	69.06	5.71	0.39	1.5	68.14	6.45	0.39	1.5	68.14	6.45	0.39
107	8.7	68.58	5.28	0.46	8.7	68.58	5.28	0.46								
108	6.6	63.12	7.68	0.61	6.6	63.12	7.68	0.61	2.0	64.04	7.8	0.37	2.0	64.04	7.8	0.37
109	7.4	63.33	8.21	0.53	7.4	63.33	8.21	0.53	5.4	62.58	8.65	0.53	6.5	62.53	8.63	0.53
110	6.5	65.34	6.94	0.57	6.5	65.34	6.94	0.57								
111	14.9	70.01	6.79	0.48	14.9	70.01	6.79	0.48	7.6	66.48	8.07	0.5	7.6	66.48	8.07	0.5
112	26.2	71.03	7.58	0.68	14.5	70.4	7.63	0.68	14.5	70.4	7.63	0.68	14.5	70.4	7.63	0.68
113	10.5	67.41	8.44	0.56	9.7	66.91	8.55	0.56	9.7	66.91	8.55	0.56	9.7	66.91	8.55	0.56
114	6.8	74.44	6.98	0.12	6.8	74.44	6.98	0.12	6.8	74.44	6.98	0.12	6.8	74.44	6.98	0.12
115	17.5	66.63	8.58	0.5	17.5	66.63	8.58	0.5	17.5	66.63	8.58	0.5	17.5	66.63	8.58	0.5
116	22.7	67.67	8.38	0.88	22.7	67.67	8.38	0.88	22.7	67.67	8.38	0.88	22.7	67.67	8.38	0.88
128									11.3	57.6	4.46	0.77	11.3	57.6	4.46	0.77

Reional Storm Summary

Catchment	Existing Conditions					Phase 1/2					Phase 3/4/5/6					Rehabilitation				
	Area	AMCII		AMCIII		Area	AMCII		AMCIII		Area	AMCII		AMCIII		Area	AMCII		AMCIII	
		CN	IA	CN	IA		CN	IA	CN	IA		CN	IA	CN	IA		CN	IA	CN	IA
100	248.2	85.0	1.50	94.0	1.50	248.2	85.0	1.50	94.0	1.50	249.0	85.0	1.50	94.0	1.50	249.0	85.0	1.50	85.0	1.50
101	84.2	73.5	7.72	87.1	5.62	84.2	73.5	7.72	87.1	5.62	84.2	73.5	7.72	87.1	5.62	84.2	73.5	7.72	87.1	5.62
102	6.7	71.8	5.39	86.0	5.39	6.7	71.8	5.39	86.0	5.39	5.0	73.2	5.31	87.0	5.31	5.0	73.2	5.31	87.0	5.31
103	16.5	70.2	5.59	84.9	5.59	16.5	70.2	5.59	84.9	5.59	4.4	68.2	6.16	83.5	6.16	4.4	68.2	6.16	83.5	6.16
104	6.9	73.3	6.57	87.0	5.70	6.9	73.3	6.57	87.0	5.70	3.2	73.5	6.67	87.2	5.62	3.2	73.5	6.67	87.2	5.62
105	1.7	75.2	6.81	88.3	5.07	1.7	75.2	6.81	88.3	5.07	0.6	75.2	6.81	88.3	5.07	0.6	75.2	6.81	88.3	5.07
106	2.3	69.1	5.71	84.1	5.71	2.3	69.1	5.71	84.1	5.71	1.5	68.1	6.45	83.5	6.45	1.5	68.1	6.33	83.7	6.33
107	8.7	68.6	5.28	83.8	5.28	8.7	68.6	5.28	83.8	5.28										
108	6.6	63.1	7.68	79.8	6.41	6.6	63.1	7.68	79.8	6.41	2.0	64.0	7.80	80.5	7.80	2.0	64.0	7.80	80.5	7.80
109	7.4	63.3	8.21	80.0	6.35	7.4	63.3	8.21	80.0	6.35	5.4	62.6	8.65	79.4	6.58	6.5	62.5	8.63	79.4	6.59
110	6.5	65.3	6.94	81.5	6.94	6.5	65.3	6.94	81.5	6.94										
111	14.9	70.0	6.79	84.8	6.79	14.9	70.0	6.79	84.8	6.79	7.6	66.5	8.07	82.3	8.07	7.6	66.5	8.12	82.2	8.12
112	26.2	71.0	7.58	85.5	6.47	14.5	70.4	7.63	85.1	6.69	14.5	70.4	7.63	85.1	6.69	14.5	70.4	7.63	85.1	6.69
113	10.5	67.4	8.44	83.0	7.82	9.7	66.9	8.55	82.6	8.02	9.7	66.9	8.55	82.6	8.02	9.7	66.9	8.55	82.6	8.02
114	6.8	74.4	6.98	87.8	5.32	6.8	74.4	6.98	87.8	5.32	6.8	74.4	6.98	87.8	5.32	6.8	74.4	6.98	87.8	5.32
115	17.5	66.6	8.58	82.4	8.13	17.5	66.6	8.58	82.4	8.13	17.5	66.6	8.58	82.4	8.13	17.5	66.6	8.58	82.4	8.13
116	22.7	67.7	8.38	83.2	7.72	22.7	67.7	8.38	83.2	7.72	22.7	67.7	8.38	83.2	7.72	22.7	67.7	8.38	83.2	7.72
128											11.5	57.6	4.46	75.6	4.46	11.5	57.6	4.46	75.6	4.46
131						14.5	85.0	1.50	94.0	1.50	14.5	85.0	1.50	94.0	1.50	14.5	85.0	1.50	94.0	1.50
133											36.0	85.0	1.50	94.0	1.50	34.9	85.0	1.50	94.0	1.50

Burlington Quarry
VO6 Model Parameters

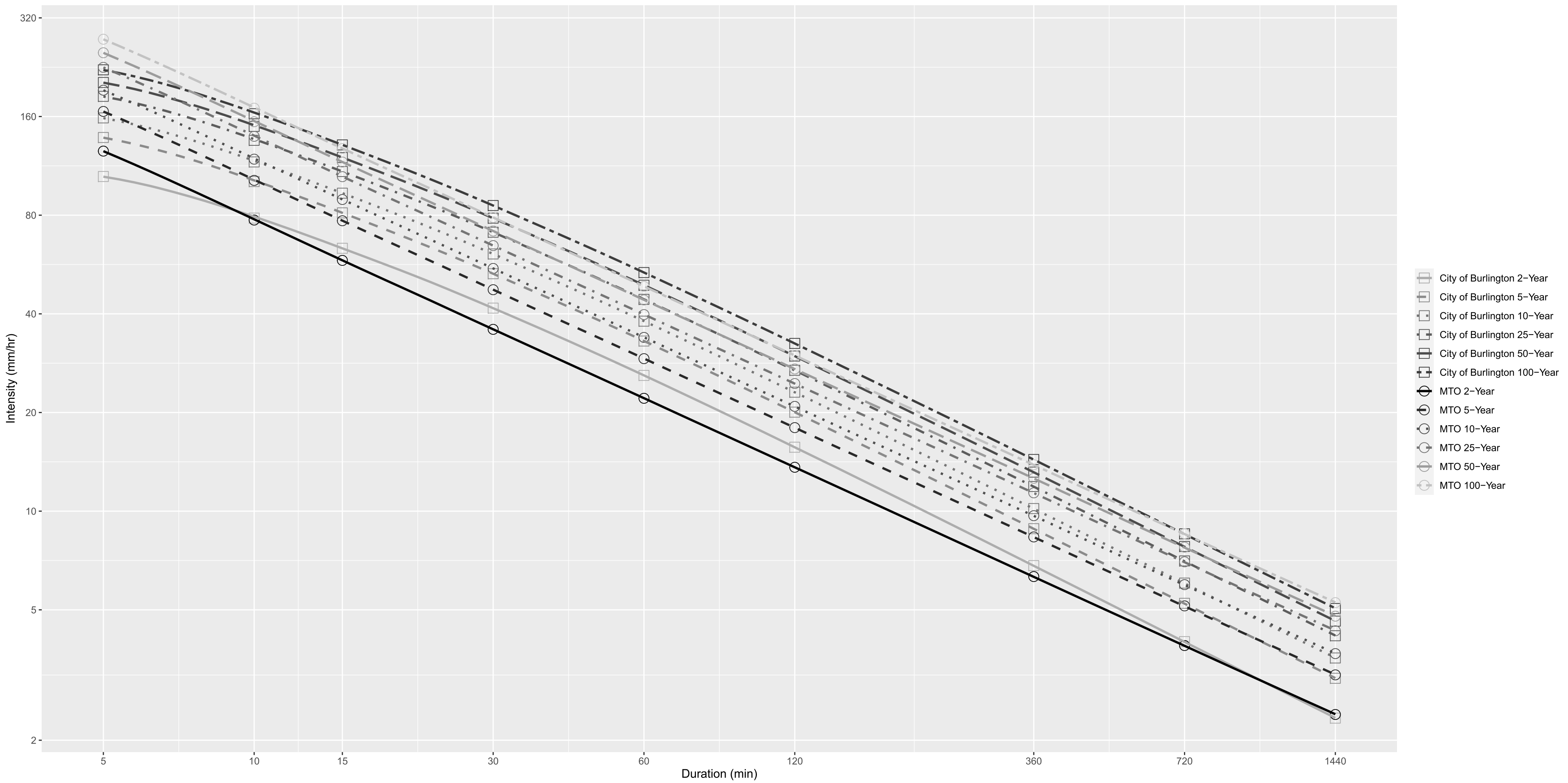
STANDHYD

Catchment	Existing Conditions						
	Area	% Impervious	% Directly Connected	CN	IA	Flow Length (m)	
						Imperious	Pervious
100	248.2	66%	50%	85.0	1.5	40	1286

Catchment	Phase 1/2						
	Area	% Impervious	% Directly Connected	CN	IA	Flow Length (m)	
						Imperious	Pervious
100	248.2	66%	50%	85.0	1.5	40	1286
131	14.5	99%	99%	85	1.5	40	311

Catchment	Phase 3/4/5/6						
	Area	% Impervious	% Directly Connected	CN	IA	Flow Length (m)	
						Imperious	Pervious
100	249	66%	50%	85.0	1.5	40	1288
131	14.5	99%	99%	85	1.5	40	311
133	36	99%	99%	85	1.5	40	490

Catchment	Rehabilitiation						
	Area	% Impervious	% Directly Connected	CN	IA	Flow Length (m)	
						Imperious	Pervious
100	249	66%	50%	85.0	1.5	40	1288
131	14.5	99%	99%	85	1.5	40	311
133	34.9	99%	99%	85	1.5	40	482



320
160
80
40
20
10
5
2
Intensity (mm/hr)
5
10
15
30
60
120
360
720
1440
Duration (min)
City of Burlington 2-Year
City of Burlington 5-Year
City of Burlington 10-Year
City of Burlington 25-Year
City of Burlington 50-Year
City of Burlington 100-Year
MTO 2-Year
MTO 5-Year
MTO 10-Year
MTO 25-Year
MTO 50-Year
MTO 100-Year

Burlington Quarry
IDF Comparision

City of Burlington IDF Data			
	A	B	C
2-Year	681.52	6	0.78
5-Year	802.04	5	0.764
10-Year	918.28	5	0.763
25-Year	1065.95	5	0.762
50-Year	1172.34	5	0.761
100-Year	1281.34	5	0.761

i = A / (t + B)^C

MTO IDF Lookup Tool		
	A	B
2-Year	22.1	-0.699
5-Year	29.2	-0.699
10-Year	33.9	-0.699
25-Year	39.8	-0.699
50-Year	44.1	-0.699
100-Year	48.5	-0.699

Coordinate: 43.404167, -79.887500
*i = A * t ^ B*

Intensity (mm/hr)										
Return Period	5 min		10 min		15 min		30 min		60 min	
	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO
2-Year	105.00	125.53	78.39	77.33	63.41	58.24	41.64	35.88	25.96	22.10
	20%		-1%		-8%		-14%		-15%	
5-Year	138.10	165.86	101.31	102.17	81.32	76.95	53.03	47.40	33.05	29.20
	20%		1%		-5%		-11%		-12%	
10-Year	158.48	192.55	116.31	118.61	93.39	89.34	60.93	55.03	37.99	33.90
	21%		2%		-4%		-10%		-11%	
25-Year	184.39	226.06	135.38	139.25	108.73	104.89	70.98	64.61	44.29	39.80
	23%		3%		-4%		-9%		-10%	
50-Year	203.26	250.49	149.30	154.30	119.94	116.22	78.35	71.59	48.91	44.10
	23%		3%		-3%		-9%		-10%	
100-Year	222.16	275.48	163.18	169.70	131.09	127.81	85.63	78.73	53.46	48.50
	24%		4%		-3%		-8%		-9%	

Return Period	2 hours		6 hours		12 hours		24 hours	
	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO
2-Year	15.67	13.61	6.82	6.32	4.00	3.89	2.34	2.40
	-13%		-7%		-3%		3%	
5-Year	20.05	17.99	8.84	8.35	5.23	5.14	3.09	3.17
	-10%		-6%		-2%		2%	
10-Year	23.07	20.88	10.18	9.69	6.03	5.97	3.56	3.68
	-9%		-5%		-1%		3%	
25-Year	26.91	24.52	11.89	11.38	7.05	7.01	4.17	4.32
	-9%		-4%		-1%		4%	
50-Year	29.74	27.17	13.16	12.60	7.80	7.76	4.62	4.78
	-9%		-4%		-1%		4%	
100-Year	32.50	29.88	14.38	13.86	8.53	8.54	5.05	5.26
	-8%		-4%		0%		4%	

Rainfall Depth (mm)										
Return Period	5 min		10 min		15 min		30 min		60 min	
	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO
5-Year	11.51	13.82	16.89	17.03	20.33	19.24	26.52	23.70	33.05	29.20
	20%		1%		-5%		-11%		-12%	
2-Year	8.75	10.46	13.07	12.89	15.85	14.56	20.82	17.94	25.96	22.10
	20%		-1%		-8%		-14%		-15%	
10-Year	13.21	16.05	19.39	19.77	23.35	22.33	30.47	27.52	37.99	33.90
	21%		2%		-4%		-10%		-11%	
25-Year	15.37	18.84	22.56	23.21	27.18	26.22	35.49	32.31	44.29	39.80
	23%		3%		-4%		-9%		-10%	
50-Year	16.94	20.87	24.88	25.72	29.99	29.05	39.17	35.80	48.91	44.10
	23%		3%		-3%		-9%		-10%	
100-Year	18.51	22.96	27.20	28.28	32.77	31.95	42.82	39.37	53.46	48.50
	24%		4%		-3%		-8%		-9%	

Return Period	2 hours		6 hours		12 hours		24 hours	
	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO	City of Burlington	MTO
2-Year	31.35	27.23	40.94	37.90	47.99	46.69	56.07	57.52
	-13%		-7%		-3%		3%	
5-Year	40.10	35.97	53.06	50.07	62.82	61.69	74.18	76.00
	-10%		-6%		-2%		2%	
10-Year	46.14	41.76	61.11	58.13	72.40	71.62	85.55	88.24
	-9%		-5%		-1%		3%	
25-Year	53.82	49.03	71.35	68.25	84.59	84.08	100.03	103.59
	-9%		-4%		-1%		4%	
50-Year	59.48	54.33	78.94	75.62	93.65	93.17	110.82	114.78
	-9%		-4%		-1%		4%	
100-Year	65.00	59.75	86.28	83.17	102.36	102.46	121.12	126.24
	-8%		-4%		0%		4%	

Ontario IDF CURVE LOOKUP

Active coordinate

43° 24' 15" N, 79° 53' 15" W (43.404167,-79.887500)

Retrieved: Tue, 29 Jun 2021 12:51:50 GMT

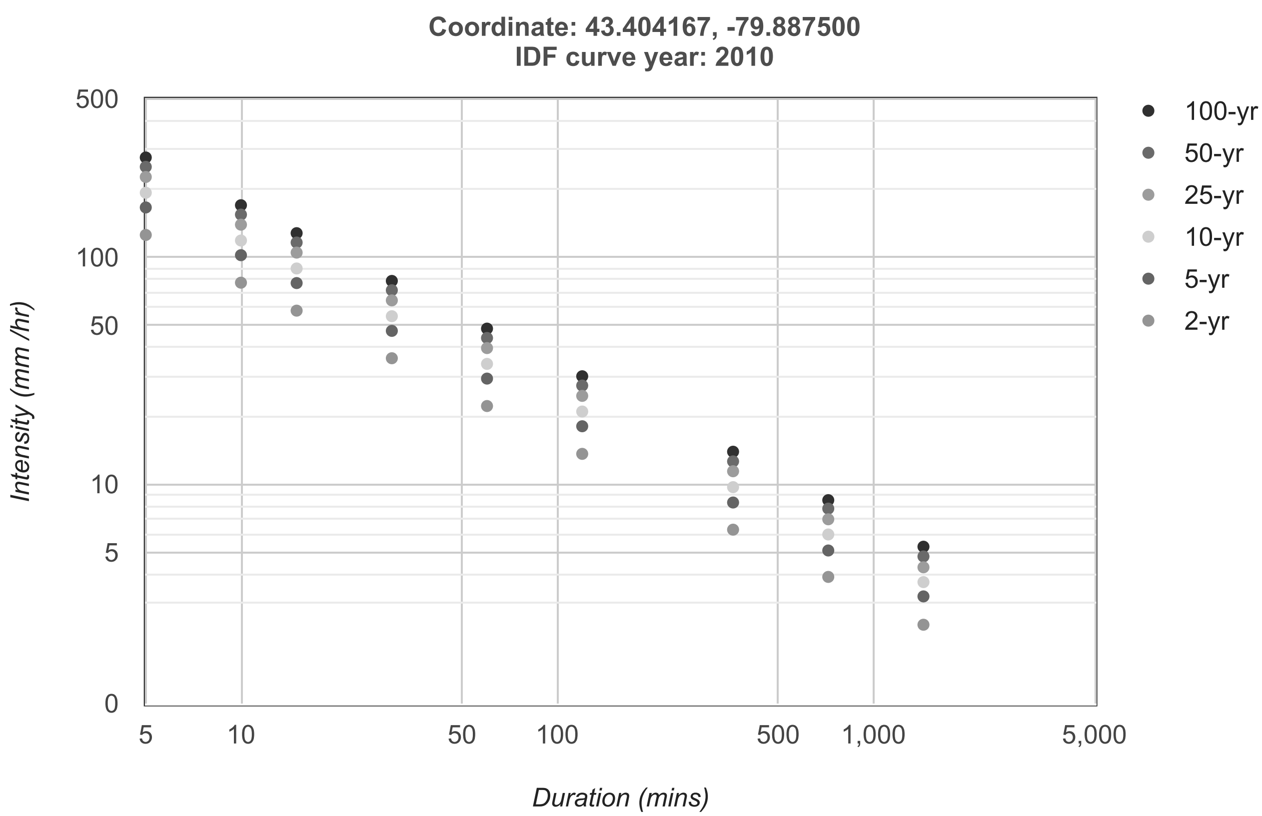
Location summary

These are the locations in the selection.

IDF Curve: 43° 24' 15" N, 79° 53' 15" W (43.404167,-79.887500)

Results

An IDF curve was found.



Coefficient summary

IDF Curve: 43° 24' 15" N, 79° 53' 15" W (43.404167,-79.887500)

Retrieved: Tue, 29 Jun 2021 12:51:50 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	22.1	29.2	33.9	39.8	44.1	48.5
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	125.5	77.3	58.2	35.9	22.1	13.6	6.3	3.9	2.4
5-yr	165.9	102.2	77.0	47.4	29.2	18.0	8.3	5.1	3.2
10-yr	192.6	118.6	89.3	55.0	33.9	20.9	9.7	6.0	3.7
25-yr	226.1	139.3	104.9	64.6	39.8	24.5	11.4	7.0	4.3
50-yr	250.5	154.3	116.2	71.6	44.1	27.2	12.6	7.8	4.8
100-yr	275.5	169.7	127.8	78.7	48.5	29.9	13.9	8.5	5.3

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	10.5	12.9	14.6	17.9	22.1	27.2	37.9	46.7	57.5
5-yr	13.8	17.0	19.2	23.7	29.2	36.0	50.1	61.7	76.0
10-yr	16.0	19.8	22.3	27.5	33.9	41.8	58.1	71.6	88.2
25-yr	18.8	23.2	26.2	32.3	39.8	49.0	68.3	84.1	103.6
50-yr	20.9	25.7	29.1	35.8	44.1	54.3	75.6	93.2	114.8
100-yr	23.0	28.3	32.0	39.4	48.5	59.8	83.2	102.5	126.2

Terms of Use

BURLINGTON QUARRY
CLIMATE DATA SUMMARY
EarthFX Climate Data

	TOTAL PRECIPIATION (mm)																						
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Average**
January	33.4	23.3	19.3	22.8	1.5	8.3	37.7	80.1	39.6	39.9	0.4	15.7	7.8	45.4	69.1	24.2	26.1	31.0	77.4	52.3	16.4		32.0
February	34.3	16.0	61.0	28.1	23.1	8.9	36.4	54.7	0.0	28.4	45.9	0.2	11.7	16.8	15.9	18.4	0.2	47.8	55.7	50.7	30.0		27.8
March	2.9	21.1	14.5	44.2	32.1	69.5	7.5	58.9	27.5	23.5	62.2	76.9	75.7	25.9	12.8	9.3	12.3	97.4	60.9	29.2	49.2		38.7
April	56.3	76.8	47.0	89.2	39.3	73.6	89.3	70.0	56.3	45.2	136.2	51.2	118.4	41.0	114.9	98.3	72.2	44.7	124.8	113.2	97.7		78.8
May	57.4	140.1	97.2	90.5	129.4	109.3	29.9	81.6	49.6	72.9	64.4	78.6	153.0	30.8	78.4	71.4	64.1	49.5	142.9	61.9	113.9		84.1
June	64.0	178.0	69.6	60.8	59.6	72.4	51.0	48.5	31.2	109.0	81.8	158.1	57.8	78.3	89.3	70.8	149.5	39.5	92.7	83.1	96.1		82.9
July	67.3	82.5	36.3	82.2	79.9	106.8	111.5	145.0	38.7	160.1	120.5	90.0	33.2	76.5	97.8	120.1	30.9	57.6	77.6	61.0	83.4		83.8
August	56.2	60.2	62.4	24.8	53.6	44.8	91.5	51.9	36.8	138.6	140.6	29.1	90.0	61.0	63.7	51.9	69.3	87.4	75.3	114.5	73.4		70.3
September	99.0	82.9	59.1	89.0	115.7	31.1	102.3	114.6	38.3	109.6	33.8	93.5	102.1	101.2	76.4	104.6	72.0	73.6	25.5	63.2	47.5		77.9
October	73.9	28.2	122.0	52.8	70.5	49.7	67.9	89.8	55.1	43.2	86.5	82.2	126.1	155.4	116.2	59.1	83.5	54.3	77.6	78.5			78.6
November	79.2	54.9	82.4	56.0	119.6	86.9	100.4	86.3	68.3	71.7	37.9	85.4	101.5	12.1	37.5	37.6	37.1	57.4	74.9	76.0			68.2
December	36.7	14.6	40.9	20.1	51.6	54.9	19.5	73.2	48.2	36.5	60.1	18.6	61.7	56.0	38.7	22.8	43.2	27.4	11.1	52.3			39.4
Total	**660.6**	**778.5**	**711.5**	**660.5**	**775.7**	**716.2**	**744.9**	**954.6**	**489.4**	**878.8**	**870.5**	**779.4**	**939.1**	**700.5**	**810.7**	**688.6**	**660.5**	**667.7**	**896.4**	**836.1**			**762.6**

BURLINGTON QUARRY
CLIMATE DATA SUMMARY
Hamilton RBG Weather Station Climate Data

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Average**
January			25.8	53.5	21.5	46.8	70.3	79.1	71.8	2.1	40.1	25.0	26.9	58.6	95.0		51.5	38.0	69.4	54.4	56.3		49.2
February			59.6	27.7	61.0	26.7	59.9	84.1	19.6	75.2	62.3	22.1	44.3	24.3	81.1	56.3	36.0	81.5	71.7	56.4			52.8
March			28.3	95.7	56.8	74.5	27.7	55.2	68.0	205.3	74.1	115.2	106.5	31.6	24.5	21.2	21.5	145.5	87.3	43.2	60.8		70.7
April			43.8	80.2	83.5	84.0	113.7	60.5	62.5	58.2	127.7	49.3	108.5	45.5	110.9		85.5		154.9		90.0		84.9
May			93.2	69.8	104.3	99.7	15.8	66.6	56.0	64.4	39.5	76.5	129.0	17.7	82.2	76.1		38.3		57.0			67.9
June			65.2	44.0	47.4	74.2	44.0	48.8	30.1	85.6	75.4	165.5	78.9	71.4	76.6	70.0	123.1	31.6	111.2	86.3		33.5	71.7
July			33.8	47.4	99.4	74.2	113.4	178.6	62.6	140.6	125.1	118.9	11.5			121.4	41.2	30.6	71.0	51.7			82.6
August			41.6	14.4	23.8	18.2	96.2	45.4	2.5	109.4	123.1	38.5	46.8	47.5		23.6			53.4	49.8		103.4	52.4
September			46.8	65.3	106.3	29.1	80.2	133.6	1.2	70.9	24.3	110.3	73.3	85.8	76.3	88.6		60.6	34.7	63.1		48.3	66.6
October			107.4	42.4	66.3	43.4	87.3	131.6		36.9	68.7	84.2	129.0	126.0		49.8		36.9	82.5			82.1	78.3
November			63.7	52.4		87.7	111.0	76.6	2.1	72.5	27.1	84.2	86.5	10.8	38.2	47.7						71.8	59.5
December			48.6	22.0	55.3	88.3	37.0	93.8	0.6	92.4	78.3	25.2	68.9	71.4	85.2		56.9	73.0		60.3		69.7	60.4
Total			**657.8**	**614.8**	**725.6**	**746.8**	**856.5**	**1053.9**	**377.0**	**1013.5**	**865.7**	**914.9**	**910.1**	**590.6**	**670.0**	**554.7**	**415.7**	**536.0**	**736.1**	**522.2**	**207.1**	**408.8**	**796.9**

Climate Normals 1981-2010 Station Data

Metadata including Station Name, Province, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID

STATION_NAME	PROVINCE	LATITUDE	LONGITUDE	ELEVATION	CLIMATE_ID	WMO_ID	TC_ID
HAMILTON RBG	ON	43°17'00.000" N	79°53'00.000" W	102.1 m	6153300		

Legend

A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation)

B = At least 25 years

C = At least 20 years

D = At least 15 years

1981 to 2010 Canadian Climate Normals station data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Temperature														
Daily Average (°C)	-4.7	-3.9	0.5	7.1	13.3	18.9	22	20.9	16.3	10	4.1	-1.4	8.6	D
Standard Deviation	2.7	2.2	1.8	1.4	1.8	1.4	1.3	1.4	1	1.3	1.4	2.7	0.8	D
Daily Maximum (°C)	-0.9	0.1	4.8	11.7	18.6	24.3	27.3	25.9	21.1	14.6	7.7	2	13.1	D
Daily Minimum (°C)	-8.5	-7.9	-3.8	2.4	7.9	13.4	16.7	15.8	11.4	5.4	0.4	-4.7	4	D
Extreme Maximum (°C)	14.5	16.7	25	31	35	36.5	38.8	37.8	37.8	32.2	26.1	21.2		
Date (yyyy/dd)	1996/18	1954/28	1977/30	1990/25	1962/18	1988/25	1988/07	1955/01	1953/02	1951/05	1950/01	1982/03		
Extreme Minimum (°C)	-28.3	-26.2	-21.7	-12.2	-2	2.2	7.2	3.6	-0.7	-6.1	-14.4	-25.7		
Date (yyyy/dd)	1976/23	1979/18	1967/18	1972/07	1978/01	1964/05	1968/30	1982/28	1989/27	1965/29	1958/30	1980/25		
Precipitation														
Rainfall (mm)	27.4	26.4	43.3	70.1	85.5	72.7	82.7	89.7	80.9	71.6	83.2	46.8	780	D
Snowfall (cm)	32.4	31.1	18.3	2.8	0	0	0	0	0	0	7.5	26	118.1	D
Precipitation (mm)	56.8	57.2	63.7	73.3	85.5	72.7	82.7	89.7	80.9	71.6	91.3	71.9	897.1	D
Extreme Daily Rainfall (mm)	42	46.8	44.7	43.7	80.8	57.2	57.4	93.8	78.7	106.8	69.6	40		
Date (yyyy/dd)	1993/04	1990/22	1972/01	1959/28	1953/25	1968/25	1964/13	1982/24	1976/17	1995/05	1962/10	1979/24		
Extreme Daily Snowfall (cm)	38.4	25.4	18.5	26.3	1	0	0	0	0	15	25.4	24		
Date (yyyy/dd)	1965/23	1965/25	1968/12	1979/08	1963/01	1950/01	1950/01	1950/01	1950/01	1962/26	1950/24	1977/05		
Extreme Daily Precipitation (mm)	42	46.8	44.7	43.7	80.8	57.2	57.4	93.8	78.7	106.8	69.6	40.4		
Date (yyyy/dd)	1993/04	1990/22	1972/01	1959/28	1953/25	1968/25	1964/13	1982/24	1976/17	1995/05	1962/10	1990/03		
Extreme Snow Depth (cm)	51	45	51	28	0	0	0	0	0	15	20	28		
Date (yyyy/dd)	1994/09	1993/23	1993/06	1987/01	1962/01	1962/01	1961/01	1961/01	1961/01	1962/26	1986/21	1973/21		
Days with Maximum Temperature														
<= 0 °C	16.4	13.7	7	0.41	0	0	0	0	0	0	1.3	9.8	48.6	D
> 0 °C	14.6	14.6	24	29.6	31	30	31	31	30	31	28.7	21.2	316.6	D
> 10 °C	0.82	0.88	5.5	16.5	30.1	30	31	31	29.9	25.4	8.5	1.8	211.4	D
> 20 °C	0	0	0.69	2.7	10.9	24.3	30.1	29.1	17	4.7	0.38	0.06	119.8	D
> 30 °C	0	0	0	0.24	1.1	3.6	7.6	5.1	0.82	0	0	0	18.5	D
> 35 °C	0	0	0	0	0	0.24	0.81	0.13	0	0	0	0	1.2	D
Days with Minimum Temperature														
> 0 °C	2.5	3.3	7.9	20.9	30.8	30	31	31	29.8	27.8	15.2	6.1	236.3	D
<= 2 °C	30.4	27.2	27.3	13.9	2.2	0	0	0	0.41	7.7	20.9	28.9	158.9	D
<= 0 °C	28.5	24.9	23.1	9.1	0.24	0	0	0	0.18	3.2	14.8	24.9	129	D
< -2 °C	25.3	21.6	17.9	3.6	0	0	0	0	0	0.88	8.2	19.1	96.5	D
< -10 °C	12.2	10.2	4.4	0	0	0	0	0	0	0	0.06	5.8	32.6	D
< -20 °C	1.8	0.5	0	0	0	0	0	0	0	0	0	0.19	2.5	D
< - 30 °C	0	0	0	0	0	0	0	0	0	0	0	0	0	D
Days with Rainfall														
>= 0.2 mm	5.7	5	8.8	12.6	12.2	10.5	10.7	11.1	12.3	11.8	12.8	7.6	120.9	D
>= 5 mm	1.8	1.4	3.1	4.7	5.7	4.8	4.8	4.4	4.7	4.6	5.1	3.1	48.1	D
>= 10 mm	0.94	0.56	1.3	2.4	2.9	2.4	2.8	2.8	2.7	2.4	2.6	1.4	25.2	D
>= 25 mm	0.12	0.25	0.13	0.29	0.47	0.53	0.76	0.88	0.47	0.24	0.44	0.13	4.7	D
Days With Snowfall														
>= 0.2 cm	10.5	8.6	4.9	1.2	0	0	0	0	0	0	2.6	8.4	36.2	D
>= 5 cm	1.9	1.8	1.6	0.18	0	0	0	0	0	0	0.38	1.9	7.8	D
>= 10 cm	0.76	0.88	0.5	0.06	0	0	0	0	0	0	0.19	0.5	2.9	D
>= 25 cm	0.12	0.06	0	0	0	0	0	0	0	0	0	0	0.18	D
Days with Precipitation														
>= 0.2 mm	14.7	12.1	12.3	13.5	12.2	10.5	10.7	11.1	12.3	11.8	14.3	13.8	149.1	D

Climate Normals 1981-2010 Station Data

Metadata including Station Name, Province, Latitude, Longitude, Elevation, Climate ID, WMO ID, TC ID

STATION_NAME	PROVINCE	LATITUDE	LONGITUDE	ELEVATION	CLIMATE_ID	WMO_ID	TC_ID
HAMILTON RBG	ON	43°17'00.000" N	79°53'00.000" W	102.1 m	6153300		

Legend
A = WMO "3 and 5 rule" (i.e. no more than 3 consecutive and no more than 5 total missing for either temperature or precipitation)
B = At least 25 years
C = At least 20 years
D = At least 15 years

1981 to 2010 Canadian Climate Normals station data

>= 5 mm	3.3	3.3	4.4	4.9	5.7	4.8	4.8	4.4	4.7	4.6	5.6	4.6	55.1	D
>= 10 mm	1.7	1.6	1.9	2.5	2.9	2.4	2.8	2.8	2.7	2.4	3	2.2	28.9	D
>= 25 mm	0.18	0.38	0.19	0.29	0.47	0.53	0.76	0.88	0.47	0.24	0.5	0.25	5.1	D
Wind														
Maximum Hourly Speed (km/h)	61	51	55	56	47	47	42	37	37	51	55	51	61	
Date (yyyy/dd)	1974/27	1967/16	1970/26	1963/04	1964/24	1972/23	1964/13	1963/04	1963/12	1965/31	1965/27	1971/15	1974/27	
Direction of Maximum Hourly Speed	SW	SW	SW	W	S	NW	N	W	SW	SW	SW	SW	SW	
Degree Days														
Above 24 °C	0	0	0	0	1	4.5	18.4	9.8	1.6	0	0	0	35.3	D
Above 18 °C	0	0	0	1.6	16.2	59.4	129.4	102.2	29.5	2.2	0	0	340.4	D
Above 15 °C	0	0	0.5	4	37.4	124.1	218.5	187.1	71.3	9.5	0.4	0	652.9	D
Above 10 °C	0.1	0.1	3.5	23.1	115.6	265.9	373.3	341	190.9	53.5	7.7	0.3	1374.9	D
Above 5 °C	1.7	2.3	17.8	89	256	415.8	528.3	496	338.1	160.5	40.7	6.3	2352.4	D
Above 0 °C	18.1	22.5	74.4	214.7	410.9	565.8	683.3	651	488.1	311.1	132.3	42.8	3615.1	D
Below 0 °C	163.5	132.3	58.8	3.2	0	0	0	0	0	0	10.5	85.5	453.8	D
Below 5 °C	302	253.3	157.2	27.4	0.1	0	0	0	0	4.4	68.8	204	1017.4	D
Below 10 °C	455.5	392.4	297.9	111.5	14.7	0.1	0	0	2.8	52.5	185.8	353	1866.1	D
Below 15 °C	610.4	533.6	449.9	242.5	91.5	8.4	0.2	1.1	33.2	163.4	328.5	507.7	2970.3	D
Below 18 °C	703.4	618.3	542.4	330	163.3	33.6	4.1	9.1	81.4	249.1	418.2	600.7	3753.6	D
Evaporation														
Lake Evaporation (mm)				2.3	3.4	4.2	4.2	3.3	1.8	0.7	-0.1			
Bright Sunshine														
Extreme Daily	9	10.7	11.8	13.6	14.7	15	15.1	14.2	12.8	10.8	9.6	9		
Date (yyyy/dd)	1962/18	1986/27	1995/24	1976/28	1977/30	1977/10	1980/06	1986/13	1991/02	1994/06	1981/03	1994/25		

1981 to 2010 Canadian Climate Normals station data (Frost-Free)

	Frost-Free:	Code					
Average Date of Last Spring Frost	21-Apr	D					
Average Date of First Fall Frost	16-Oct	D					
Average Length of Frost-Free Period	177 Days	D					
Probability of last temperature in spring c	10%	25%	33%	50%	66%	75%	90%
Date	15-May	8-May	3-May	27-Apr	22-Apr	20-Apr	14-Apr
Probability of first temperature in fall of (	10%	25%	33%	50%	66%	75%	90%
Date	30-Sep	7-Oct	11-Oct	17-Oct	19-Oct	22-Oct	31-Oct
Probability of frost-free period equal to o	10%	25%	33%	50%	66%	75%	90%
Days	147	160	162	169	176	182	186

Table 21a: Existing Condition Hydrologic Model Results Summary – MTO IDF Curves

DESIGN STORM	PEAK FLOW (m^3/s)			
	West Arm	Weir Pond	Burlington Quarry	Wetland 13201
25 mm	0.09	0.09	9.57	0.05
1:2-Year	0.46	0.30	22.09	0.32
1:5-Year	0.78	0.47	34.00	0.54
1:10-Year	1.01	0.60	41.11	0.71
1:25-Year	1.32	0.77	50.25	0.94
1:50-Year	1.58	0.91	57.19	1.11
1:100-Year	1.83	1.05	64.07	1.30
Regional	2.97	1.56	39.63	1.82

Notes: 1) Table summarizes results of SCS Type II 24-hour design storms

2) West Arm flow includes 16 L/s flow contribution from the Burlington Quarry Sump 0200

3) Weir Pond flow includes 50 L/s flow contributions from the Burlington Quarry Sump 0100

Table 21b: Existing Condition Hydrologic Model Results Summary – City of Burlington IDF Curves

DESIGN STORM	PEAK FLOW (m^3/s)			
	West Arm	Weir Pond	Burlington Quarry	Wetland 13201
1:2-Year	0.43 *(-6%)*	0.29 *(-4%)*	21.37 *(-3%)*	0.30 *(-6%)*
1:5-Year	0.74 *(-6%)*	0.45 *(-4%)*	32.82 *(-3%)*	0.52 *(-4%)*
1:10-Year	0.95 *(-6%)*	0.57 *(-5%)*	39.38 *(-4%)*	0.67 *(-6%)*
1:25-Year	1.24 *(-6%)*	0.73 *(-6%)*	47.95 *(-5%)*	0.88 *(-7%)*
1:50-Year	1.47 *(-7%)*	0.85 *(-6%)*	54.46 *(-5%)*	1.04 *(-6%)*
1:100-Year	1.70 *(-7%)*	0.98 *(-7%)*	60.76 *(-5%)*	1.21 *(-7%)*

Notes: 1) (-6%) – indicates percent change from VO model results using MTO IDF Curve rainfall data
2) Table summarizes results of SCS Type II 24-hour design storms
3) West Arm flow includes 16 L/s flow contribution from the Burlington Quarry Sump 0200
4) Weir Pond flow includes 50 L/s flow contributions from the Burlington Quarry Sump 0100

Table 28: Proposed Condition (Operations) Outlet Water Balance Results Summary

YEAR	TOTAL PRECIPITATION (mm)	RUNOFF VOLUME (mm)									
		West Arm		East Arm		Weir Pond		Burlington Quarry		Wetland 13201	
		PR.	*EX.*	PR.	*EX.*	PR.	*EX.*	PR.	*EX.*	PR.	*EX.*
2009	1016	92	*168*	108	*113*	786	*117*	575	*473*	111	*205*
2010	847	16	*38*	23	*26*	243	*31*	413	*326*	23	*41*
2011	1088	98	*173*	112	*117*	964	*111*	649	*544*	123	*222*
2012	780	10	*20*	8	*11*	215	*12*	364	*271*	20	*35*
2013	969	57	*100*	58	*62*	566	*52*	529	*410*	75	*138*
2014	838	34	*64*	32	*34*	428	*45*	451	*355*	56	*95*
2015	756	18	*39*	21	*25*	175	*33*	383	*270*	21	*41*
2016	819	26	*47*	21	*22*	354	*23*	400	*310*	37	*68*
2017	996	72	*127*	78	*83*	711	*70*	528	*433*	89	*167*
2018	970	49	*99*	58	*64*	582	*56*	534	*432*	63	*120*

Notes: 1) Results for Proposed Condition (Operations) include proposed Colling Road diversion.
2) Quarry discharge not included in above noted volumes.
3) Runoff volumes are calculated from simulated total annual volume draining to the point of interest. Reported runoff volumes are normalised by existing drainage area at the point of interest.

Table 30a: Proposed Condition (Operations) Hydrologic Model Results Summary (w Colling Road Diversion)

DESIGN STORM	PEAK FLOW (m^3/s)							
	West Arm		Weir Pond		Burlington Quarry		Wetland 13201	
	Proposed	*Existing*	Proposed	*Existing*	Proposed	*Existing*	Proposed	*Existing*
25 mm	0.05	*0.09*	0.06	*0.09*	11.61	*9.57*	0.02	*0.05*
1:2-Year	0.25	*0.46*	0.10	*0.30*	27.10	*22.09*	0.13	*0.32*
1:5-Year	0.43	*0.78*	0.16	*0.47*	40.53	*34.00*	0.23	*0.54*
1:10-Year	0.55	*1.01*	0.20	*0.60*	48.82	*41.11*	0.31	*0.71*
1:25-Year	0.73	*1.32*	0.25	*0.77*	59.50	*50.25*	0.41	*0.94*
1:50-Year	0.86	*1.58*	0.29	*0.91*	67.63	*57.19*	0.50	*1.11*
1:100-Year	1.00	*1.83*	0.34	*1.05*	75.69	*64.07*	0.58	*1.30*
Regional	1.65	*2.97*	0.96	*1.56*	45.31	*39.63*	0.90	*1.82*

Notes: 1) Table summarizes results of SCS Type II 24-hour design storms

2) West Arm flow includes 16 L/s flow contribution from the Burlington Quarry Sump 0200

3) Weir Pond flow include 50 L/s flow contribution from the Burlington Quarry Sump 0100

Table 30b: Proposed Condition (Operations) Hydrologic Model Results Summary (w/o Colling Road Diversion)

DESIGN STORM	PEAK FLOW (m^3/s)							
	West Arm		Weir Pond		Burlington Quarry		Wetland 13201	
	Proposed	*Existing*	Proposed	*Existing*	Proposed	*Existing*	Proposed	*Existing*
25 mm	0.05	*0.09*	0.06	*0.09*	11.61	*9.57*	0.02	*0.05*
1:2-Year	0.25	*0.46*	0.09	*0.30*	27.10	*22.09*	0.13	*0.32*
1:5-Year	0.43	*0.78*	0.11	*0.47*	40.53	*34.00*	0.23	*0.54*
1:10-Year	0.55	*1.01*	0.13	*0.60*	48.82	*41.11*	0.31	*0.71*
1:25-Year	0.73	*1.32*	0.16	*0.77*	59.50	*50.25*	0.41	*0.94*
1:50-Year	0.86	*1.58*	0.18	*0.91*	67.63	*57.19*	0.50	*1.11*
1:100-Year	1.00	*1.83*	0.20	*1.05*	75.69	*64.07*	0.58	*1.30*
Regional	1.65	*2.97*	0.33	*1.56*	45.50	*39.63*	0.90	*1.82*

Notes: 1) Table summarizes results of SCS Type II 24-hour design storms

2) West Arm flow includes 16 L/s flow contribution from the Burlington Quarry Sump 0200

3) Weir Pond flow include 50 L/s flow contribution from the Burlington Quarry Sump 0100

Table 36: Proposed Condition (Rehabilitation) Outlet Water Balance Results Summary

YEAR	TOTAL PRECIPITATION (mm)	RUNOFF VOLUME (mm)									
		West Arm		East Arm		Weir Pond		Burlington Quarry		Wetland 13201	
		PR.	*EX.*	PR.	*EX.*	PR.	*EX.*	PR.	*EX.*	PR.	*EX.*
2009	1016	92	*168*	108	*113*	786	*117*	575	*473*	111	*205*
2010	847	16	*38*	23	*26*	243	*31*	413	*326*	23	*41*
2011	1088	98	*173*	112	*117*	964	*111*	649	*544*	123	*222*
2012	780	10	*20*	8	*11*	215	*12*	364	*271*	20	*35*
2013	969	57	*100*	58	*62*	566	*52*	529	*410*	75	*138*
2014	838	34	*64*	32	*34*	428	*45*	451	*355*	56	*95*
2015	756	18	*39*	21	*25*	175	*33*	383	*270*	21	*41*
2016	819	26	*47*	21	*22*	354	*23*	400	*310*	37	*68*
2017	996	72	*127*	78	*83*	711	*70*	528	*433*	89	*167*
2018	970	49	*99*	58	*64*	582	*56*	534	*432*	63	*120*

Notes: 1) Results for Proposed Condition (Operations) include proposed Colling Road diversion.

2) Quarry discharge not included in above noted volumes.

3) Runoff volumes are calculated from simulated total annual volume draining to the point of interest. Reported runoff volumes are normalised by existing drainage area at the point of interest.

Table 37a: Proposed Condition (Rehabilitation) Hydrologic Model Results Summary (w Colling Road Diversion)

DESIGN STORM	PEAK FLOW (m^3/s)							
	West Arm		Weir Pond		Burlington Quarry		Wetland 13201	
	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing
25 mm	0.05	*0.09*	0.06	*0.09*	11.53	*9.57*	0.02	*0.05*
1:2-Year	0.25	*0.46*	0.10	*0.30*	26.96	*22.09*	0.13	*0.32*
1:5-Year	0.43	*0.78*	0.16	*0.47*	40.31	*34.00*	0.23	*0.54*
1:10-Year	0.55	*1.01*	0.20	*0.60*	48.56	*41.11*	0.31	*0.71*
1:25-Year	0.73	*1.32*	0.25	*0.77*	59.20	*50.25*	0.41	*0.94*
1:50-Year	0.86	*1.58*	0.29	*0.91*	67.29	*57.19*	0.50	*1.11*
1:100-Year	1.00	*1.83*	0.34	*1.05*	75.32	*64.07*	0.58	*1.30*
Regional	1.65	*2.97*	0.96	*1.56*	45.16	*39.63*	0.90	*1.82*

Notes: 1) Table summarizes results of SCS Type II 24-hour design storms

2) West Arm flow includes 16 L/s flow contribution from the Burlington Quarry Sump 0200

3) Weir Pond flow include 50 L/s flow contribution from the Burlington Quarry Sump 0100

Table 37b: Proposed Condition (Rehabilitation) Hydrologic Model Results Summary (w/o Colling Road Diversion)

DESIGN STORM	PEAK FLOW (m^3/s)							
	West Arm		Weir Pond		Burlington Quarry		Wetland 13201	
	Proposed	*Existing*	Proposed	*Existing*	Proposed	*Existing*	Proposed	*Existing*
25 mm	0.05	*0.09*	0.06	*0.09*	11.53	*9.57*	0.02	*0.05*
1:2-Year	0.25	*0.46*	0.09	*0.30*	26.96	*22.09*	0.13	*0.32*
1:5-Year	0.43	*0.78*	0.11	*0.47*	40.31	*34.00*	0.23	*0.54*
1:10-Year	0.55	*1.01*	0.13	*0.60*	48.56	*41.11*	0.31	*0.71*
1:25-Year	0.73	*1.32*	0.16	*0.77*	59.20	*50.25*	0.41	*0.94*
1:50-Year	0.86	*1.58*	0.18	*0.91*	67.29	*57.19*	0.50	*1.11*
1:100-Year	1.00	*1.83*	0.20	*1.05*	75.32	*64.07*	0.58	*1.30*
Regional	1.65	*2.97*	0.32	*1.56*	45.47	*39.63*	0.90	*1.82*

Notes: 1) Table summarizes results of SCS Type II 24-hour design storms
2) West Arm flow includes 16 L/s flow contribution from the Burlington Quarry Sump 0200
3) Weir Pond flow include 50 L/s flow contribution from the Burlington Quarry Sump 0100

Project: Project Sideways	Date: 29-Jul-19
File No.: 113187	Designed: DAM
Subject: Hydraulic Conductivity	Checked: DRT

INFILTRATION RATE GIVEN HYDRAULIC CONDUCTIVITY

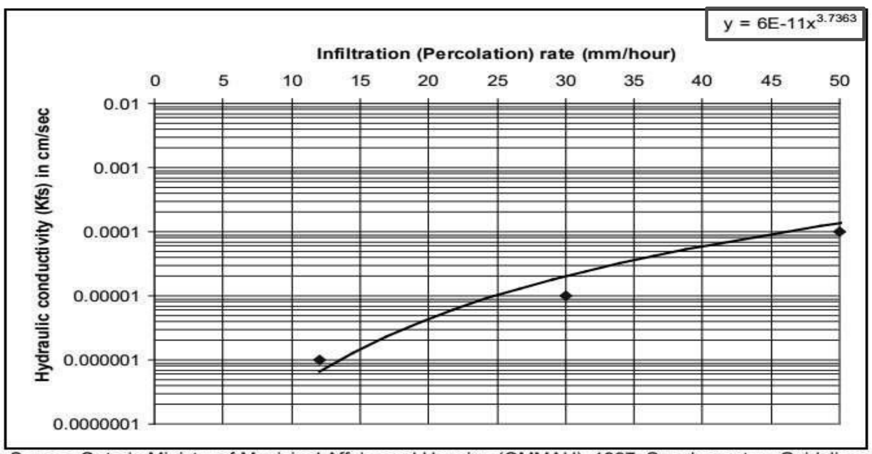
Reference: TRCA, CVC Low Impact Development Stormwater Management Planning and Design Guide (2011) - Appendix C

Table C1: Approximate relationships between hydraulic conductivity, percolation time and infiltration rate

Hydraulic Conductivity, K_{fs} (centimetres/second)	Percolation Time, T (minutes/centimetre)	Infiltration Rate, 1/T (millimetres/hour)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

Figure C1: Approximate relationship between infiltration rate and hydraulic conductivity



Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

Hydraulic Conductivity (mm/s) = *6E-11x* $^{3.7363}$ *where x = infiltration rate (mm/hr)*

Soil Type	Range	Infiltration rate (mm/hr)	Hydraulic Conductivity (cm/s)	Hydraulic Conductivity (mm/d)
D	Minimum	1	0.00000000060	0.00005184000
	Maximum	5	0.00000024531	0.02119466810
C	Minimum	5	0.00000024531	0.02119466810
	Maximum	10	0.00000326927	0.28246522792
B	Minimum	10	0.00000326927	0.28246522792
	Maximum	20	0.00004357021	3.76446588419
A	Minimum	20	0.00004357021	3.76446588419
	Maximum	30	0.00019820719	17.12510081578

TATHAM ENGINEERING

Project: Project Sideways	Date: 29-Jul-19
File No.: 113187	Designed: DAM
Subject: Hydraulic Conductivity of Catchments	Checked: DRT

Hydrologic Soil Group	Average Hydraulic Conductivity (mm/d)	Average Field Capacity (%)
A	10.44478335	17.5
B	2.023465556	26
C	0.151829948	34
D	0.010623254	40

	Fractional Composition					
Catchment Name	HSG A	HSG B	HSG C	HSG D	Hydraulic Conductivity (mm/d)	Field Capacity (%)
100	0.00	0.71	0.29	0.00	1.48069123	28.3
101	0.00	0.57	0.43	0.00	1.218662245	29.4
102	0.00	1.00	0.00	0.00	2.023465556	26.0
103	0.00	1.00	0.00	0.00	2.023465556	26.0
104	0.00	1.00	0.00	0.00	2.023465556	26.0
105	0.00	1.00	0.00	0.00	2.023465556	26.0
106	0.00	1.00	0.00	0.00	2.023465556	26.0
107	0.00	1.00	0.00	0.00	2.023465556	26.0
108	0.00	1.00	0.00	0.00	2.023465556	26.0
109	0.00	1.00	0.00	0.00	2.023465556	26.0
110	0.00	1.00	0.00	0.00	2.023465556	26.0
111	0.00	0.72	0.05	0.23	1.466930046	29.6
112	0.00	0.86	0.10	0.04	1.755788303	27.4
113	0.00	1.00	0.00	0.00	2.023465556	26.0
114	0.00	1.00	0.00	0.00	2.023465556	26.0
115	0.00	0.96	0.04	0.00	1.948600132	26.3
116	0.00	1.00	0.00	0.00	2.023465556	26.0
117	0.00	1.00	0.00	0.00	2.023465556	26.0
118	0.00	1.00	0.00	0.00	2.023465556	26.0
119	0.00	1.00	0.00	0.00	2.023465556	26.0
120	0.00	1.00	0.00	0.00	2.023465556	26.0
121	0.00	1.00	0.00	0.00	2.023465556	26.0
122	0.00	1.00	0.00	0.00	2.023465556	26.0
123	0.00	1.00	0.00	0.00	2.023465556	26.0
124	0.00	1.00	0.00	0.00	2.023465556	26.0
125	0.00	1.00	0.00	0.00	2.023465556	26.0
126	0.00	1.00	0.00	0.00	2.023465556	26.0
127	0.00	0.86	0.14	0.00	1.761436571	27.1

BURLINGTON QUARRY
WETLAND WATER BALANCE
EXISTING CONDITION HYDROLOGIC PARAMETER SUMMARY

Catchment	Total Area (ha)	Wetland Area (ha)	Tp (hrs)	Catchment Parameters (Excluding Wetlands)					
				CN (AMC II)	CN (AMC I)	CN (AMC III)	S (AMC II)	S (AMC I)	S (AMC III)
100	248.20	52.75	1.40	89.44	78.40	95.10	29.99	69.98	13.09
101	84.22	15.17	1.08	78.68	62.90	90.46	68.83	149.85	26.80
102	6.70	0.00	0.09	71.84	53.93	86.63	99.56	216.98	39.22
103	16.50	0.00	0.56	70.16	51.83	85.58	108.03	236.02	42.80
104	6.91	0.00	0.33	73.26	55.73	87.48	92.71	201.73	36.36
105	1.67	0.00	0.08	75.23	58.29	88.61	83.63	181.77	32.65
106	2.32	0.08	0.39	69.79	51.38	85.34	109.95	240.37	43.62
107	8.67	0.00	0.46	68.58	49.90	84.56	116.37	255.00	46.38
108	6.56	1.12	0.61	65.81	46.60	82.68	131.96	291.05	53.20
109	7.38	0.03	0.53	63.39	43.81	80.95	146.69	325.75	59.78
110	6.54	1.29	0.57	69.10	50.53	84.90	113.58	248.64	45.18
111	14.85	2.32	0.48	73.71	56.31	87.74	90.59	197.05	35.49
112	26.24	1.84	0.68	72.61	54.91	87.09	95.81	208.62	37.65
113	10.55	0.27	0.56	67.86	49.03	84.08	120.30	264.02	48.09
114	6.75	0.00	0.12	74.44	57.26	88.16	87.21	189.62	34.11
115	17.47	3.97	0.50	71.51	53.52	86.42	101.20	220.63	39.90
116	22.73	4.70	0.88	72.28	54.49	86.89	97.41	212.17	38.32
117	1.55	0.28	0.31	65.96	46.78	82.79	131.08	289.00	52.82
118	1.48	0.28	0.30	68.11	49.33	84.25	118.93	260.86	47.49
119	3.07	0.71	0.34	70.35	52.07	85.70	107.05	233.81	42.38
120	1.56	1.05	0.29	73.98	56.66	87.90	89.34	194.28	34.97
121	0.46	0.16	0.27	74.00	56.69	87.91	89.24	194.08	34.94
122	8.15	0.55	0.52	61.09	41.24	79.22	161.78	361.90	66.61
123	17.21	1.98	0.79	74.49	57.32	88.19	86.99	189.11	34.01
124	22.04	6.53	0.77	70.19	51.87	85.60	107.87	235.67	42.73
125	0.86	0.05	0.15	73.57	56.13	87.66	91.25	198.50	35.76
126	9.19	1.00	0.47	68.72	50.07	84.65	115.62	253.28	46.06
127	4.07	0.00	0.35	73.36	55.86	87.54	92.24	200.68	36.17

Note: Wetland area storage and infiltration considered separately in water balance.

BURLINGTON QUARRY
WETLAND WATER BALANCE
PHASES 1 & 2 HYDROLOGIC PARAMETER SUMMARY

Catchment	Total Area (ha)	Wetland Area (ha)	Tp (hrs)	Catchment Parameters (Excluding Wetlands)					
				CN (AMC II)	CN (AMC I)	CN (AMC III)	S (AMC II)	S (AMC I)	S (AMC III)
100	248.20	52.75	1.40	89.44	78.40	95.10	29.99	69.98	13.09
101	84.22	15.17	1.08	78.68	62.90	90.46	68.83	149.85	26.80
102	6.70	0.00	0.09	71.84	53.93	86.63	99.56	216.98	39.22
103	16.50	0.00	0.56	70.16	51.83	85.58	108.03	236.02	42.80
104	6.91	0.00	0.33	73.26	55.73	87.48	92.71	201.73	36.36
105	1.67	0.00	0.08	75.23	58.29	88.61	83.63	181.77	32.65
106	2.32	0.08	0.39	69.79	51.38	85.34	109.95	240.37	43.62
107	8.67	0.00	0.46	68.58	49.90	84.56	116.37	255.00	46.38
108	6.56	1.12	0.61	65.81	46.60	82.68	131.96	291.05	53.20
109	7.38	0.03	0.53	63.39	43.81	80.95	146.69	325.75	59.78
110	6.54	1.29	0.57	69.10	50.53	84.90	113.58	248.64	45.18
111	14.85	2.32	0.48	73.71	56.31	87.74	90.59	197.05	35.49
112	14.05	1.84	0.68	73.53	56.08	87.64	91.44	198.92	35.84
112B**	1.05	0.00	0.29	68.81	50.18	84.71	115.13	252.17	45.85
113	9.73	0.27	0.56	67.39	48.47	83.77	122.91	270.04	49.23
114	6.75	0.00	0.12	74.44	57.26	88.16	87.21	189.62	34.11
115	17.47	3.97	0.50	71.51	53.52	86.42	101.20	220.63	39.90
116	22.73	4.70	0.88	72.28	54.49	86.89	97.41	212.17	38.32
117	1.55	0.28	0.31	65.96	46.78	82.79	131.08	289.00	52.82
118	1.48	0.28	0.30	68.11	49.33	84.25	118.93	260.86	47.49
119	3.07	0.71	0.34	70.35	52.07	85.70	107.05	233.81	42.38
120	1.56	1.05	0.29	73.98	56.66	87.90	89.34	194.28	34.97
121	0.46	0.16	0.27	74.00	56.69	87.91	89.24	194.08	34.94
122	8.15	0.55	0.52	61.09	41.24	79.22	161.78	361.90	66.61
123	17.21	1.98	0.79	74.49	57.32	88.19	86.99	189.11	34.01
124	22.04	6.53	0.77	70.19	51.87	85.60	107.87	235.67	42.73
125	0.86	0.05	0.15	73.57	56.13	87.66	91.25	198.50	35.76
126	9.19	1.00	0.47	68.72	50.07	84.65	115.62	253.28	46.06
127	1.24	0.00	0.31	74.98	57.96	88.47	84.76	184.23	33.11
Extraction	14.55								

**112B corresponds to Subcatchment S132 in Drainage Plan

Note: Wetland area storage and infiltration considered separately in water balance.

BURLINGTON QUARRY
WETLAND WATER BALANCE
PHASES 3, 4, 5 & 6 SCENARIO HYDROLOGIC PARAMETER SUMMARY

Catchment	Total Area (ha)	Wetland Area (ha)	Tp (hrs)	Catchment Parameters (Excluding Wetlands)					
				CN (AMC II)	CN (AMC I)	CN (AMC III)	S (AMC II)	S (AMC I)	S (AMC III)
100	249.00	52.75	1.40	89.44	78.40	95.10	29.99	69.98	13.09
101	84.22	15.17	1.08	78.68	62.90	90.46	68.83	149.85	26.80
102	4.96	0.00	0.10	73.22	55.68	87.45	92.90	202.15	36.44
103	4.07	0.00	0.58	70.16	51.83	85.58	108.03	236.02	42.80
104	1.75	0.00	0.33	73.26	55.73	87.48	92.71	201.73	36.36
105	0.40	0.00	0.08	75.23	58.29	88.61	83.63	181.77	32.65
106	2.03	0.08	0.39	69.25	50.72	85.00	112.79	246.82	44.84
108	2.00	0.00	64.04	64.04	44.55	81.42	142.63	316.11	57.95
109	5.26	0.03	0.37	62.66	42.99	80.41	151.36	336.88	61.88
110	0.93	0.08	0.52	73.67	56.26	87.72	90.78	197.47	35.57
111	7.44	2.32	0.50	73.75	56.36	87.76	90.41	196.64	35.41
112	14.05	1.84	0.68	73.53	56.08	87.64	91.44	198.92	35.84
112B	1.05	0.00	0.29	68.81	50.18	84.71	115.13	252.17	45.85
113	9.73	0.27	0.56	67.39	48.47	83.77	122.91	270.04	49.23
114	6.75	0.00	0.12	74.45	57.27	88.17	87.17	189.52	34.09
115	17.47	3.97	0.50	71.51	53.52	86.42	101.20	220.63	39.90
116	22.73	4.70	0.88	72.28	54.49	86.89	97.41	212.17	38.32
117	1.55	0.28	0.31	65.96	46.78	82.79	131.08	289.00	52.82
118	1.48	0.28	0.30	68.11	49.33	84.25	118.93	260.86	47.49
119	3.07	0.71	0.34	70.35	52.07	85.70	107.05	233.81	42.38
120	1.56	1.05	0.29	73.98	56.66	87.90	89.34	194.28	34.97
121	0.46	0.16	0.27	74.00	56.69	87.91	89.24	194.08	34.94
122	8.15	0.55	0.52	61.09	41.24	79.22	161.78	361.90	66.61
123	17.21	1.98	0.79	74.49	57.32	88.19	86.99	189.11	34.01
124	22.04	6.53	0.77	70.19	51.87	85.60	107.87	235.67	42.73
125	0.86	0.05	0.15	73.57	56.13	87.66	91.25	198.50	35.76
126	9.19	1.00	0.47	68.72	50.07	84.65	115.62	253.28	46.06
127	1.24	0.00	0.31	74.98	57.96	88.47	84.76	184.23	33.11
128	11.29	6.77	2.02	69.00	50.41	84.83	114.12	249.85	45.41
Extraction	50.87								

**112B corresponds to Subcatchment S132 in Drainage Plan

Note: Wetland area storage and infiltration considered separately in water balance.

BURLINGTON QUARRY
WETLAND WATER BALANCE
REHABILITATION SCENARIO HYDROLOGIC PARAMETER SUMMARY

Catchment	Total Area (ha)	Wetland Area (ha)	Tp (hrs)	Catchment Parameters (Excluding Wetlands)					
				CN (AMC II)	CN (AMC I)	CN (AMC III)	S (AMC II)	S (AMC I)	S (AMC III)
100	249.00	52.75	1.40	89.44	78.40	95.10	29.99	69.98	13.09
101	84.22	15.17	1.08	78.68	62.90	90.46	68.83	149.85	26.80
102	4.96	0.00	0.10	73.22	55.68	87.45	92.90	202.15	36.44
103	4.07	0.00	0.58	70.16	51.83	85.58	108.03	236.02	42.80
104	1.75	0.00	0.33	73.26	55.73	87.48	92.71	201.73	36.36
105	0.40	0.00	0.08	75.23	58.29	88.61	83.63	181.77	32.65
106	2.03	0.08	0.39	69.25	50.72	85.00	112.79	246.82	44.84
108	2.00	0.00	64.04	64.04	44.55	81.42	142.63	316.11	57.95
109	6.47	0.03	0.53	62.66	42.99	80.41	151.36	336.88	61.88
110	0.93	0.08	0.52	73.67	56.26	87.72	90.78	197.47	35.57
111	7.64	2.32	0.50	73.75	56.36	87.76	90.41	196.64	35.41
112	14.05	1.84	0.68	73.53	56.08	87.64	91.44	198.92	35.84
112B	1.05	0.00	0.29	68.81	50.18	84.71	115.13	252.17	45.85
113	9.73	0.27	0.56	67.39	48.47	83.77	122.91	270.04	49.23
114	6.75	0.00	0.12	74.45	57.27	88.17	87.17	189.52	34.09
115	17.47	3.97	0.50	71.51	53.52	86.42	101.20	220.63	39.90
116	22.73	4.70	0.88	72.28	54.49	86.89	97.41	212.17	38.32
117	1.55	0.28	0.31	65.96	46.78	82.79	131.08	289.00	52.82
118	1.48	0.28	0.30	68.11	49.33	84.25	118.93	260.86	47.49
119	3.07	0.71	0.34	70.35	52.07	85.70	107.05	233.81	42.38
120	1.56	1.05	0.29	73.98	56.66	87.90	89.34	194.28	34.97
121	0.46	0.16	0.27	74.00	56.69	87.91	89.24	194.08	34.94
122	8.15	0.55	0.52	61.09	41.24	79.22	161.78	361.90	66.61
123	17.21	1.98	0.79	74.49	57.32	88.19	86.99	189.11	34.01
124	22.04	6.53	0.77	70.19	51.87	85.60	107.87	235.67	42.73
125	0.86	0.05	0.15	73.57	56.13	87.66	91.25	198.50	35.76
126	9.19	1.00	0.47	68.72	50.07	84.65	115.62	253.28	46.06
127	1.24	0.00	0.31	74.98	57.96	88.47	84.76	184.23	33.11
128	11.29	6.77	2.02	69.00	50.41	84.83	114.12	249.85	45.41
Extraction	49.77								

**112B corresponds to Subcatchment S132 in Drainage Plan

Note: Wetland area storage and infiltration considered separately in water balance.

BURLINGTON QUARRY
DAILY WATER BALANCE
EXISTING CONDITIONS WETLAND STORAGE SUMMARY
JULY 13, 2021

Catchment	Land Use Layers	Bathymetric Survey		Daily Water Balance			
	Wetland Area (m^2)	Wetland Area (m^2)	Surface Storage (m^3)	Wetland Area (m^2)	Total (Soil + Surface)Storage (m^3)	Surface Storage (m^3)	Stage-Storage-Discharge Characterisitics (above surface storage)
100	N/A	N/A	N/A	N/A	N/A	N/A	N/A
101	151,686	-	-	151,686	6,067	-	Established through Calibration (SW15)
102	N/A	N/A	N/A	N/A	N/A	N/A	N/A
103	N/A	N/A	N/A	N/A	N/A	N/A	N/A
104	N/A	N/A	N/A	N/A	N/A	N/A	N/A
105	N/A	N/A	N/A	N/A	N/A	N/A	N/A
106	846	-	-	846	203	-	SSD Not Assigned - runoff exceeding surface storage capacity drains from wetland in less than water balance time step (24 hours)
107	N/A	N/A	N/A	N/A	N/A	N/A	N/A
108	11,171	-	-	11,171	3,251	-	SSD Not Assigned - runoff exceeding surface storage capacity drains from wetland in less than water balance time step (24 hours)
109	334	-	-	334	109	-	
110	12,869	-	-	12,869	3,200	-	
111	23,189	-	-	23,189	4,570	-	
112	18,417	-	-	18,417	3,842	-	Established through Calibration (SW6)
113	2,670	-	-	2,670	705	-	SSD Not Assigned - runoff exceeding surface storage capacity drains from wetland in less than water balance time step (24 hours)
114	N/A	N/A	N/A	N/A	N/A	N/A	N/A
115	39,663	-	-	39,663	8,751	-	SSD Not Assigned - runoff exceeding surface storage capacity drains from wetland in less than water balance time step (24 hours)
116	47,030	-	-	47,030	9,978	-	
117	2,808	2,194	321	2,194	955	321	
118	2,841	763	12	763	237	38	
119	7,104	1,669	329	1,669	719	329	
120	10,451	2,823	-	2,823	548	0	
121	1,598	790	-	790	153	0	
122	5,489	2,054	10	2,054	754	10	Established through Calibration (SW12)
123	19,808	940	-	940	178	0	Established through Calibration (SW9)
124	65,297	15,621	-	15,621	3,994	312	SSD Not Assigned - runoff exceeding surface storage capacity drains from wetland in less than water balance time step (24 hours)
125	527	-	-	527	105	0	
126	10,017	1,451	-	1,451	411	44	
127	N/A	N/A	N/A	N/A	N/A	N/A	N/A

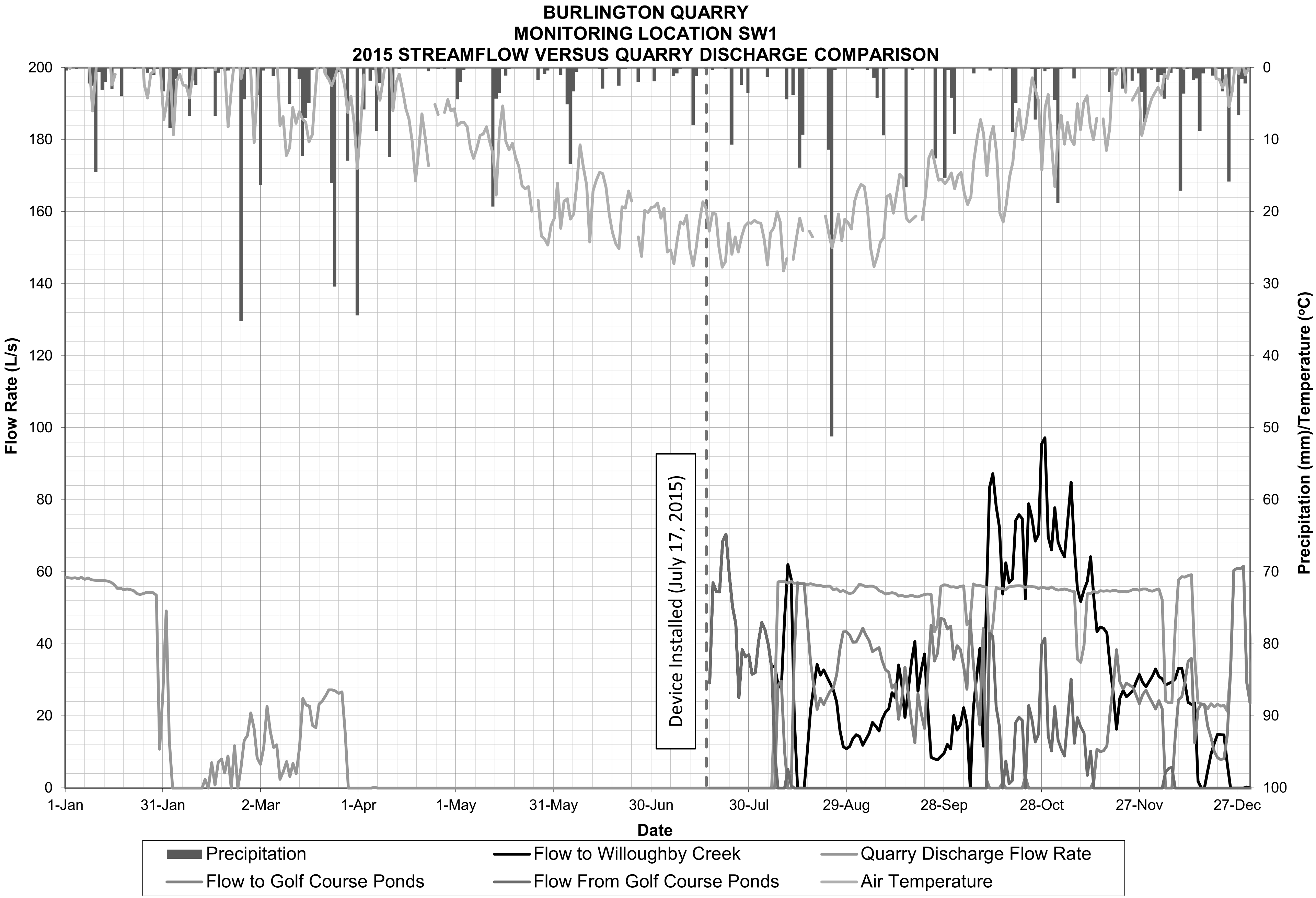
Note: Surveyed wetland volume does account for soil storage, vegetation or varying (undulating) grade between survey points.

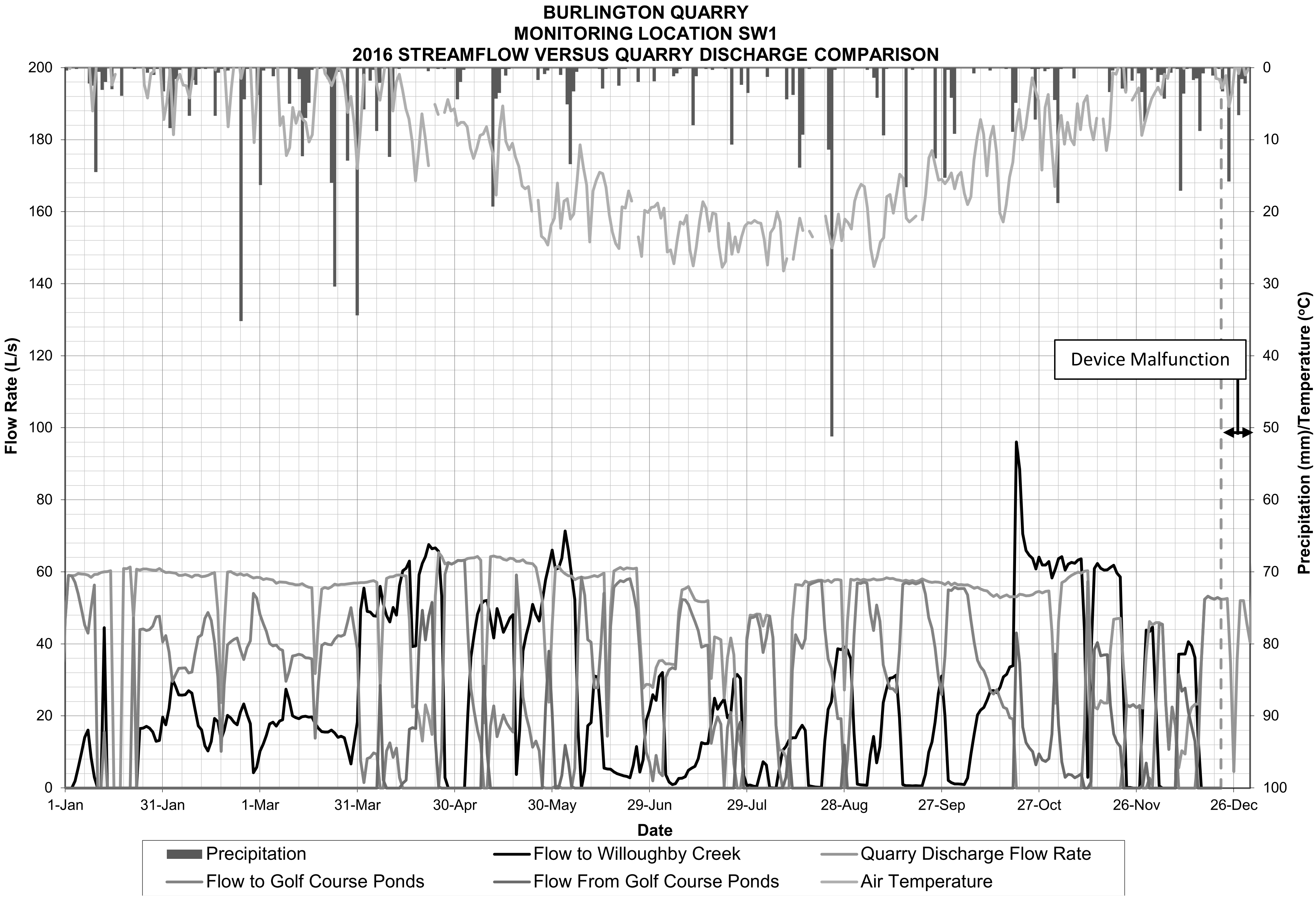
BURLINGTON QUARRY
DAILY WATER BALANCE
WETLAND STAGE-STORAGE-DISCHARGE CHARACTERISTICS
JULY 13, 2021

Catchment	Depth Above Wetland Storage (mm)	Discharge (mm/day)	Volume (m^3)	Discharge (m^3/day)
101 151,686 m^2 Wetland Area	100	30.0	15,169	4,551
	80	20.0	12,135	3,034
	65	16.0	9,860	2,427
	50	12.0	7,584	1,820
	40	9.0	6,067	1,365
	30	7.0	4,551	1,062
	25	5.0	3,792	758
	20	4.0	3,034	607
	15	3.0	2,275	455
	10	2.0	1,517	303
	5	1.0	758	152
	2	0.5	303	76
	0	0.1	0	15
112 18,417 m^2 Wetland Area	400	200.0	7,367	3,683
	250	100.0	4,604	1,842
	150	50.0	2,763	921
	100	40.0	1,842	737
	75	30.0	1,381	553
	50	20.0	921	368
	40	16.0	737	295
	30	12.0	553	221
	20	8.0	368	147
	10	4.0	184	74
	5	2.0	92	37
	2	1.0	37	18
	0	0.5	0	9
122 2,054 m^2 Wetland Area	365	194.7	750	400
	316	146.1	650	300
	273	97.4	560	200
	49	34.1	100	70
	15	9.7	30	20
	10	2.9	20	6
	5	1.0	10	2
	2	0.5	4	1
	0	0.2	0	1
123 940 m^2 Wetland Area	4000	2000	3,758	1,879
	2000	1000	1,879	940
	1000	500	940	470
	600	300	564	282
	300	150	282	141
	200	100	188	94
	150	75	141	70
	100	50	94	47
	50	25	47	23
	20	10	19	9
	10	5	9	5
	5	2	5	2
	0	1	0	1

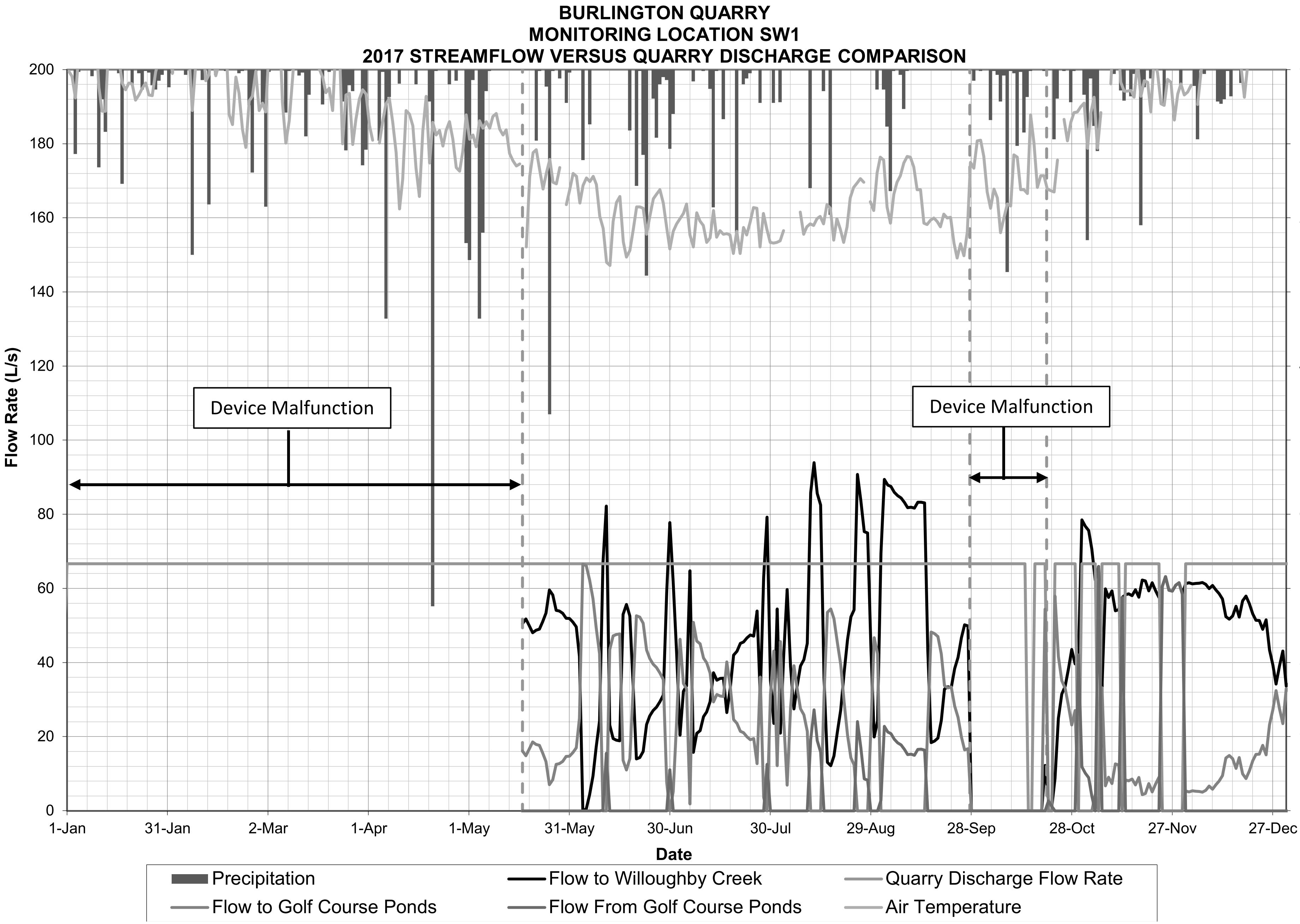
BURLINGTON QUARRY
DAILY WATER BALANCE
CALIBRATION CORRECTION FACTORS
JULY 13, 2021

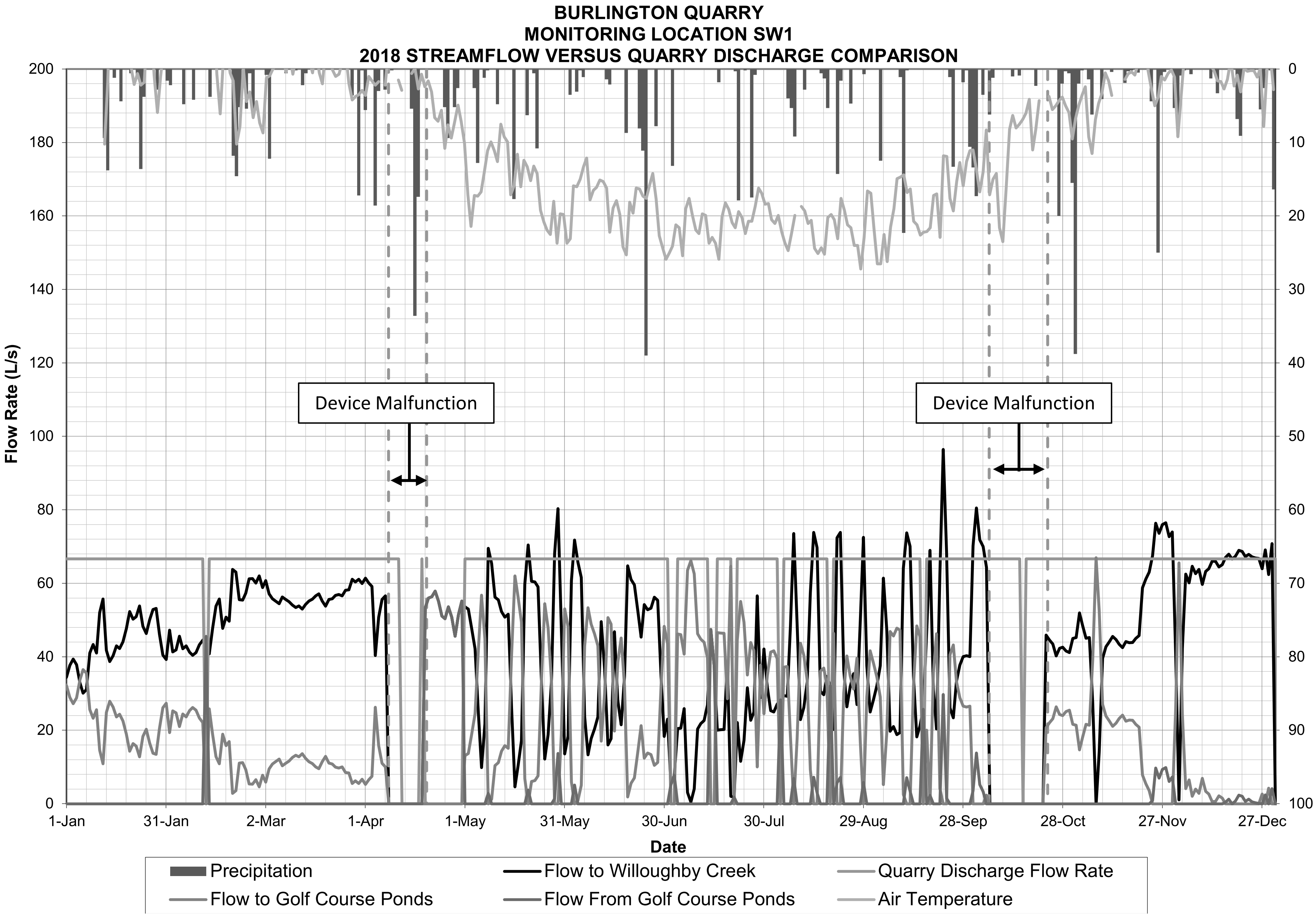
Calibration Location	Water Balance Catchment	Water BalanceStorage Correction Factor	Water Balance Overflow Correction Factor
SW11	124	Multiply wetland surface storage depth by 2 to align with monitored depth.	Divide depth above wetland surface storage by 1500 to align with monitored depth.
SW12	122	Subtract 0.04 m from wetland surface storage depth to align with monitored depth.	Subtract 0.04 m from depth above wetland surface storage to align with monitored depth.
SW13	118	Multiply wetland surface storage depth by 1.85 to align with monitored depth.	Divide depth above wetland surface storage by 2000 to align with monitored depth.
SW16	126	Multiply wetland surface storage depth by 2.22 to align with monitored depth.	Divide depth above wetland surface storage by 2000 to align with monitored depth.


BURLINGTON QUARRY
MONITORING LOCATION SW1
2015 STREAMFLOW VERSUS QUARRY DISCHARGE COMPARISON
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Installed (July 17, 2015)
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
0
20
40
60
80
100
120
140
160
180
200
10
30
50
70
90
Precipitation
Flow to Willoughby Creek
Quarry Discharge Flow Rate
Flow to Golf Course Ponds
Flow From Golf Course Ponds
Air Temperature

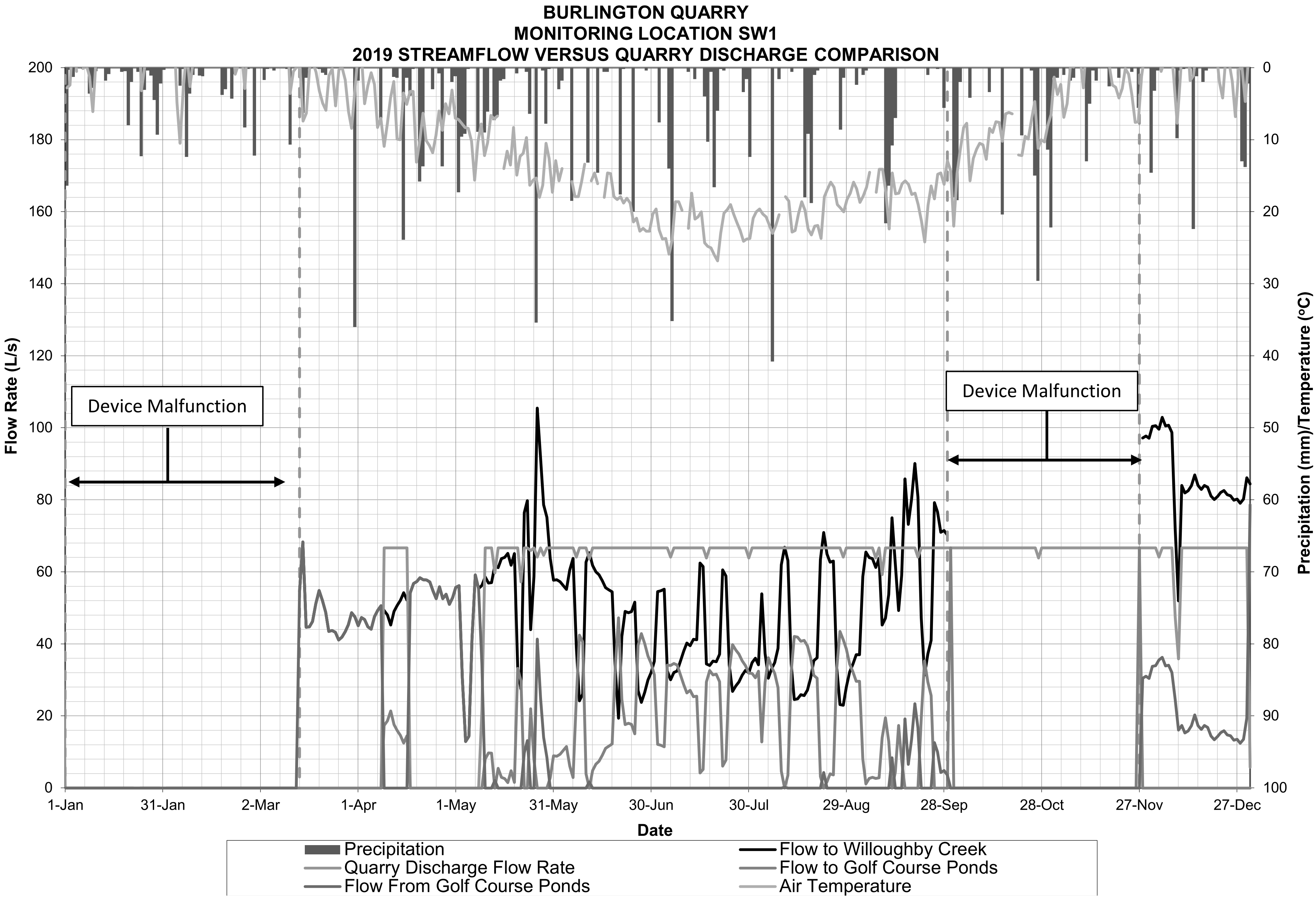


BURLINGTON QUARRY
MONITORING LOCATION SW1
2016 STREAMFLOW VERSUS QUARRY DISCHARGE COMPARISON
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Device Malfunction
Date
1-Jan
31-Jan
1-Mar
31-Mar
30-Apr
30-May
29-Jun
29-Jul
28-Aug
27-Sep
27-Oct
26-Nov
26-Dec
Precipitation
Flow to Willoughby Creek
Quarry Discharge Flow Rate
Flow to Golf Course Ponds
Flow From Golf Course Ponds
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW1
2017 STREAMFLOW VERSUS QUARRY DISCHARGE COMPARISON
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
200
180
160
140
120
100
80
60
40
20
0
10
30
50
70
90
Device Malfunction
Device Malfunction
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Precipitation
Flow to Willoughby Creek
Quarry Discharge Flow Rate
Flow to Golf Course Ponds
Flow From Golf Course Ponds
Air Temperature



BURLINGTON QUARRY
MONITORING LOCATION SW1
2018 STREAMFLOW VERSUS QUARRY DISCHARGE COMPARISON
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
200
180
160
140
120
100
80
60
40
20
0
10
30
50
70
90
Device Malfunction
Device Malfunction
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Date
Precipitation
Flow to Willoughby Creek
Quarry Discharge Flow Rate
Flow to Golf Course Ponds
Flow From Golf Course Ponds
Air Temperature


BURLINGTON QUARRY
MONITORING LOCATION SW1
2019 STREAMFLOW VERSUS QUARRY DISCHARGE COMPARISON
Flow Rate (L/s)
Precipitation (mm)/Temperature (°C)
Date
Device Malfunction
Device Malfunction
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
100
1-Jan
31-Jan
2-Mar
1-Apr
1-May
31-May
30-Jun
30-Jul
29-Aug
28-Sep
28-Oct
27-Nov
27-Dec
Precipitation
Quarry Discharge Flow Rate
Flow From Golf Course Ponds
Flow to Willoughby Creek
Flow to Golf Course Ponds
Air Temperature

BURLINGTON QUARRY
SW1 / QUARRY DISCHARGE COMPARISON
2015 Volume Summary (Litres)

Month	Leaving Weir Pond	Quarry Discharge	To Golf Course	From Golf Course
January				
February				
March				
April				
May				
June				
July				
August	78,502,375	118,352,312	66,957,497	21,750,761
September	57,482,153	139,817,873	87,532,363	0
October	152,555,484	145,577,222	30,142,860	31,764,322
November	123,470,597	137,312,016	34,896,271	15,800,855
December	45,020,922	105,443,768	67,125,540	1,345,894
Total	**457,031,531**	**646,503,191**	**286,654,531**	**70,661,831**

BURLINGTON QUARRY
SW1 / QUARRY DISCHARGE COMPARISON
2016 Volume Summary (Litres)

Month	Leaving Weir Pond	Quarry Discharge	To Golf Course	From Golf Course
January	20,560,096	142,985,697	127,782,401	0
February	52,767,802	143,274,992	95,368,332	0
March	50,357,384	148,810,679	103,810,095	0
April	127,868,952	124,985,946	30,554,936	28,234,453
May	114,404,754	154,896,590	56,710,524	10,861,888
June	60,378,668	138,033,084	84,822,102	1,931,331
July	41,267,593	107,261,876	74,292,986	2,941,903
August	42,849,453	122,943,691	87,693,262	2,242,224
September	34,442,300	149,268,120	120,010,926	0
October	107,231,258	144,990,970	58,945,796	15,829,284
November	120,110,693	102,352,056	17,337,247	29,858,837
December	30,704,206	94,372,462	79,460,106	10,435,049
Total	**679,257,878**	**1,139,104,795**	**609,827,884**	**102,334,968**

BURLINGTON QUARRY
SW1 / QUARRY DISCHARGE COMPARISON
2017 Volume Summary (Litres)

Month	Leaving Weir Pond	Quarry Discharge	To Golf Course	From Golf Course
January				
February				
March				
April				
May	71,310,996	178,560,000	112,605,804	0
June	88,951,653	172,800,000	91,365,864	2,286,689
July	109,010,284	178,560,000	75,987,048	1,080,532
August	133,097,214	178,560,000	62,936,274	12,116,688
September	141,302,933	172,800,000	57,006,242	20,300,616
October	35,699,606	149,760,000	124,389,688	4,972,494
November	161,104,970	120,960,000	14,202,416	49,089,386
December	147,720,875	178,560,000	36,195,925	0
Total	**888,198,530**	**1,330,560,000**	**574,689,261**	**89,846,405**

BURLINGTON QUARRY
SW1 / QUARRY DISCHARGE COMPARISON
2018 Volume Summary (Litres)

Month	Leaving Weir Pond	Quarry Discharge	To Golf Course	From Golf Course
January				
February				
March	156,774,397	178,560,000	27,142,403	0
April	91,043,525	69,120,000	36,202,112	52,883,117
May	120,246,686	178,560,000	65,633,719	1,963,605
June	111,999,370	172,800,000	66,429,946	430,922
July	64,060,152	149,760,000	99,698,552	8,641,904
August	113,725,015	167,040,000	66,970,954	8,299,169
September	111,355,833	167,040,000	66,835,059	5,942,645
October				
November	135,050,650	172,800,000	47,251,830	4,279,051
December	147,776,531	178,560,000	37,032,615	892,346
Total	**895,257,762**	**1,255,680,000**	**486,054,786**	**83,332,758**

BURLINGTON QUARRY
SW1 / QUARRY DISCHARGE COMPARISON
2019 Volume Summary (Litres)

Month	Leaving Weir Pond	Quarry Discharge	To Golf Course	From Golf Course
January	5,356,800	-5,356,800	0	0
February	4,838,400	-4,838,400	0	0
March	76,769,095	-76,769,095	0	71,412,295
April	139,071,367	-92,991,367	11,443,123	99,210,329
May	159,060,410	-32,335,329	13,829,825	40,808,354
June	126,458,745	45,861,255	51,233,220	136,797
July	111,299,362	66,560,638	71,917,438	0
August	113,791,111	64,548,889	70,283,021	377,331
September	154,202,158	17,497,842	33,166,185	10,451,832
October	5,356,800	0	178,320,000	0
November	26,131,115	146,668,885	157,080,610	5,227,725
December	233,517,403	-64,757,403	0	59,400,603
Total	**1,068,888,471**	**151,053,409**	**587,273,421**	**215,612,971**

BURLINGTON QUARRY
TEMPORARY SETTLING POND
SETTLING POND DESIGN CALCULATIONS

Spherical Particle Terminal Settling Velocity (Stokes Law) - $v_p \approx g(sg_p - sg_w)d_p^2/18v$

where:

v_p = terminal particle settling velocity (cm/s)
g = gravitational acceleration (cm/s^2) = 981
sg_p = specific gravity of particle = 2.65
sg_w = specific gravity of water = 1
d_p = particle diameter (cm)
v = kinematic viscosity of water (cm^2/s) = 0.01003

Note: Stokes Law applies to spherical particles. A correction factor of 0.5 has been applied to the particle settling velocity to account for non spherical particles.

Critical Settling Velocity - v_c = Q/A

where:

v_c = critical settling velocity (cm/s)
Q = design flow rate (cm^3/s)
A = surface area of settling pond (cm^2)

Removal Efficiency - $X_r = v_p/v_c$

where:

X_r = removal efficiency (%)
v_p = particle settling velocity (cm/s)
v_c = critical settling velocity (cm/s)

Proposed Settling Pond Charateristics - Cell 1

Design Flow Rate	3,000	l/min
	0.05	m^3/s
length	40	m
Width	25	m
Depth	1	m
Surface Area	1000	m^2
Storage	1000	m^3

Particle Diameter (cm)	Particle Diameter (Microns)	Particle Settling Velocity (cm/s)	Critical Settling Velocity (cm/s)	Removal Efficiency (%)	Detention Time (hrs)
0.0001	1	0.0000448	0.005	0.9%	619.65
0.0005	5	0.0011207	0.005	22.4%	24.79
0.001	10	0.0044828	0.005	89.7%	6.20
0.005	50	0.1120700	0.005	100.0%	0.25
0.01	100	0.4482802	0.005	100.0%	0.06
0.05	500	11.21	0.005	100.0%	0.00
0.1	1000	44.83	0.005	100.0%	0.00
0.5	5000	1121	0.005	100.0%	0.00
1	10000	4483	0.005	100.0%	0.00
5	50000	112070	0.005	100.0%	0.00
10	100000	448280	0.005	100.0%	0.00

BURLINGTON QUARRY
TEMPORARY SETTLING POND
SETTLING POND DESIGN CALCULATIONS

Proposed Settling Pond Charateristics - Cell 2

Design Flow Rate	3,000	l/min
	0.05	m^3/s
length	40	m
Width	15	m
Depth	1	m
Surface Area	600	m^2
Storage	600	m^3

Particle Diameter (cm)	Particle Diameter (Microns)	Particle Settling Velocity (cm/s)	Critical Settling Velocity (cm/s)	Removal Efficiency (%)	Detention Time (hrs)
0.0001	1	0.0000448	0.008333333	0.5%	619.65
0.0005	5	0.0011207	0.008333333	13.4%	24.79
0.001	10	0.0044828	0.008333333	53.8%	6.20
0.005	50	0.1120700	0.008333333	100.0%	0.25
0.01	100	0.4482802	0.008333333	100.0%	0.06
0.05	500	11.21	0.008333333	100.0%	0.00
0.1	1000	44.83	0.008333333	100.0%	0.00
0.5	5000	1121	0.008333333	100.0%	0.00
1	10000	4483	0.008333333	100.0%	0.00
5	50000	112070	0.008333333	100.0%	0.00
10	100000	448280	0.008333333	100.0%	0.00

Proposed Settling Pond Charateristics - Cell 3

Design Flow Rate	3,000	l/min
	0.05	m^3/s
length	40	m
Width	5	m
Depth	1	m
Surface Area	200	m^2
Storage	200	m^3

Particle Diameter (cm)	Particle Diameter (Microns)	Particle Settling Velocity (cm/s)	Critical Settling Velocity (cm/s)	Removal Efficiency (%)	Detention Time (hrs)
0.0001	1	0.0000448	0.025	0.2%	619.65
0.0005	5	0.0011207	0.025	4.5%	24.79
0.001	10	0.0044828	0.025	17.9%	6.20
0.005	50	0.1120700	0.025	100.0%	0.25
0.01	100	0.4482802	0.025	100.0%	0.06
0.05	500	11.21	0.025	100.0%	0.00
0.1	1000	44.83	0.025	100.0%	0.00
0.5	5000	1121	0.025	100.0%	0.00
1	10000	4483	0.025	100.0%	0.00
5	50000	112070	0.025	100.0%	0.00
10	100000	448280	0.025	100.0%	0.00

Settling Pond Performance Summary

BURLINGTON QUARRY
TEMPORARY SETTLING POND
SETTLING POND DESIGN CALCULATIONS

Particle Diameter (cm)	Particle Diameter (Microns)	Removal Efficiency - Cell 1 (%)	Removal Efficiency - Cell 2 (%)	Removal Efficiency - Cell 3 (%)	Removal Efficiency - Total (%)	Percentage of Particles Untreated (%)
0.0001	1	0.9%	0.5%	0.2%	1.6%	0.0%
0.0005	5	22.4%	10.4%	3.0%	35.9%	3.2%
0.001	10	89.7%	5.6%	0.9%	96.1%	15.5%
0.005	50	100.0%	100.0%	100.0%	100.0%	0.0%
0.01	100	100.0%	100.0%	100.0%	100.0%	0.0%
0.05	500	100.0%	100.0%	100.0%	100.0%	0.0%
0.1	1000	100.0%	100.0%	100.0%	100.0%	0.0%
0.5	5000	100.0%	100.0%	100.0%	100.0%	0.0%
1	10000	100.0%	100.0%	100.0%	100.0%	0.0%
5	50000	100.0%	100.0%	100.0%	100.0%	0.0%
10	100000	100.0%	100.0%	100.0%	100.0%	0.0%
					81.3%	**18.7%**

Ontario

MINISTRY OF NATURAL RESOURCES AND FORESTRY

Ontario Flow Assessment Tools

Notes:

Legend

- Assessment Parcel
- Secondary Watershed
- Tertiary Watershed
- Quaternary Watershed
- Great Lakes - St. Lawrence Basin
- Hudson - James Bay Basin
- Nelson River Basin
- Diversions
- Waterbody Outlet
- Conservation Authority Dam
- Provincial Dam
- Federal Dam
- OPG Dam
- Other Dam
- HYDAT Gauge
- HYDAT Gauge (RHBN)
- Virtual Flow Segment

Land Cover Compilation

- Other
- Cloud/Shadow
- Clear Open Water
- Turbid Water
- Shoreline
- Mudflats
- Marsh
- Swamp
- Fen
- Bog
- Heath
- Sparse Treed
- Treed Upland
- Deciduous Treed
- Mixed Treed
- Coniferous Treed
- Plantations - Treed Cultivated
- Hedge Rows
- Disturbance
- Open Cliff and Talus
- Alvar
- Sand Barren and Dune
- Open Tallgrass Prairie
- Tallgrass Savannah
- Tallgrass Woodland
- Sand/Gravel/Mine Tailings/Extraction
- Bedrock
- Community/Infrastructure
- Agriculture and Undifferentiated Rural Land Use

0.0 0 km 0.02 0.0

Scale: 1 : 820

Projection: Web Mercator

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TATHAM ENGINEERING

PROJECT	Burlington Quarry	FILE	113187
		DATE	June 21, 2021
SUBJECT	Colling Road Ditch Capacity Calcuations	NAME	John Gore
		PAGE	1 OF 2

Manning's Equation

Irregular Channel, Full Flow

Manning's n	0.035	
Slope	0.008	m/m
Area	4.295	m^2
Perimeter	6.906	m
Hydraulic Radius	0.6219	m
Flow	**7.9027**	**cms**

$$Q = \frac{1}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2}$$

Location	Station (m)	Depth (m)	Flow Area (m^2)	Perimeter (m)
0	0.00	0.000		
1	1.21	0.500	0.303	1.309
2	2.82	1.000	1.208	1.686
3	4.22	1.000	1.4	1.400
4	5.86	0.500	1.230	1.715
5	6.48	0.000	0.155	0.796
TOTAL			4.295	6.906

MINISTRY OF NATURAL RESOURCES AND FORESTRY

Ontario Flow Assessment Tools

Notes:

Legend

- Assessment Parcel
- Secondary Watershed
- Tertiary Watershed
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- Great Lakes - St. Lawrence Basin
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- Diversions
- Waterbody Outlet
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- Other
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- Marsh
- Swamp
- Fen
- Bog
- Heath
- Sparse Treed
- Treed Upland
- Deciduous Treed
- Mixed Treed
- Coniferous Treed
- Plantations - Treed Cultivated
- Hedge Rows
- Disturbance
- Open Cliff and Talus
- Alvar
- Sand Barren and Dune
- Open Tallgrass Prairie
- Tallgrass Savannah
- Tallgrass Woodland
- Sand/Gravel/Mine Tailings/Extraction
- Bedrock
- Community/Infrastructure
- Agriculture and Undifferentiated Rural Land Use

0.0 0 km 0.02 0.0

Scale: 1 : 820

Projection: Web Mercator

TATHAM ENGINEERING

PROJECT	Burlington Quarry	FILE	113187
		DATE	June 21, 2021
SUBJECT	Sideroad 2 Ditch Capacity Calcuations	NAME	John Gore
		PAGE	1 OF 2

Manning's Equation

Irregular Channel, Full Flow

Manning's n	0.035	
Slope	0.015	m/m
Area	0.267	m^2
Perimeter	2.154	m
Hydraulic Radius	0.1241	m
Flow	**0.2326**	**cms**

$$Q = \frac{1}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2}$$

Location	Station (m)	Depth (m)	Flow Area (m^2)	Perimeter (m)
0	0.00	0.000		
1	0.40	0.000	0.000	0.400
2	0.70	0.240	0.036	0.384
3	0.90	0.250	0.049	0.200
4	1.10	0.210	0.046	0.204
5	1.30	0.180	0.039	0.202
6	1.70	0.140	0.064	0.402
7	2.05	0.050	0.033	0.361
TOTAL			0.267	2.154

TATHAM ENGINEERING

PROJECT	Burlington Quarry	FILE	113187
		DATE	June 21, 2021
SUBJECT	Sideroad 2 Ditch Capacity Calcuations	NAME	John Gore
		PAGE	2 OF 2

Manning's Equation

Irregular Channel, Full Flow

Manning's n	0.035	
Slope	0.015	m/m
Area	0.344	m^2
Perimeter	2.115	m
Hydraulic Radius	0.1626	m
Flow	**0.3586**	**cms**

$$Q = \frac{1}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2}$$

Location	Station (m)	Depth (m)	Flow Area (m^2)	Perimeter (m)
0	0.00	0.000		
1	0.40	0.110	0.022	0.415
2	0.80	0.200	0.062	0.410
3	1.20	0.280	0.096	0.408
4	1.60	0.270	0.110	0.400
5	2.00	0.000	0.054	0.483
TOTAL			0.344	2.115