

Appendix R

Cambridge Water 2022 Drought Review

Overview

In 2022, hot weather and high water demand put unusual stress on the water resources of England. Cambridge Water keenly felt this impact and saw very high demands across the Cambridge region. This put pressure on our groundwater sources which supply all of the raw water to the Cambridge water supply area. Figure 1 below shows the exceptionally elevated demands that were seen in 2022 – values of 107.5 MI on 11 June and 113.7 MI on 18 July were consecutive record-breaking demand levels that have not been broken since at least 1995. The demanding summer was then followed by an unprecedented peak demand of 106.3 MI due to the winter freeze-thaw event.

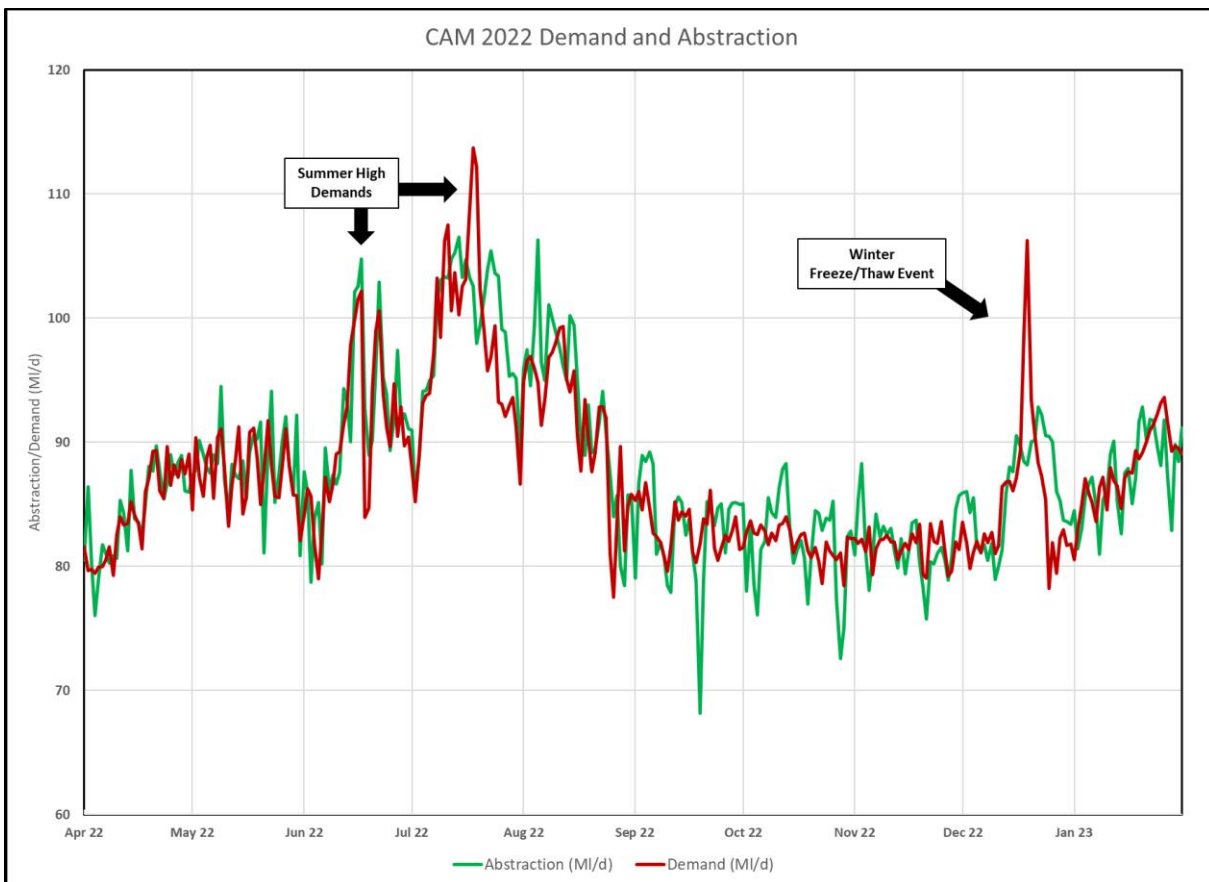


Figure 1: Total demand and abstraction for the Cambridge region from April 2022 to January 2023.

Cambridge Water is supplied wholly by groundwater, largely from chalk stream aquifers. Unlike surface water, groundwater has a large lag time between changes in water level. During the summer, groundwater levels were normal until July when the elevated demands in June (as in Figure 1) started to reduce the typical levels of the aquifers. A lack of rainfall across the summer meant that there was minimal recharge to replenish the groundwater (Figure 2); from April to October 2022 each month’s rainfall was below the long-term average level. This not only reduced groundwater recharge but, in tandem with prolonged hot weather, increased demand, placing further pressure on our supply and aquifers. We can see how the effectiveness of the already low amount of rainfall (especially when compared to each month’s long term average level) becomes further reduced when effective precipitation is measured in Figure 2. Effective precipitation is the amount of rainfall that infiltrates into and percolates through the ground, which then supplies underground aquifers. This links to the soil moisture deficit (SMD) (Figure 3) which declined sharply throughout the spring in 2022 and continued to be unusually low until the autumn when more significant rainfall occurred. These figures show the severity of the 2022 drought and the prolonged impact that it had on our water resources.

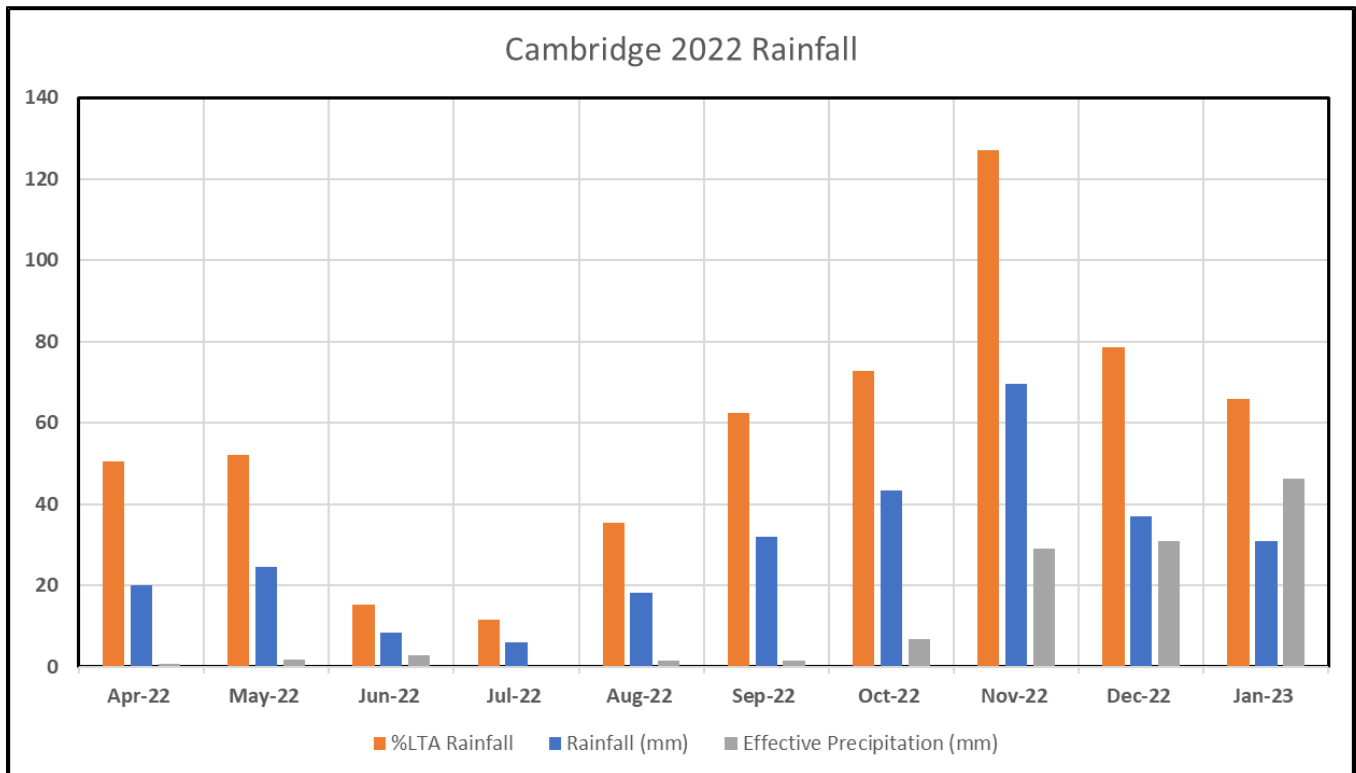


Figure 2: Long Term Average rainfall (%), rainfall (mm) and effective precipitation (mm) for the Cambridge region from April 2022 to January 2023.

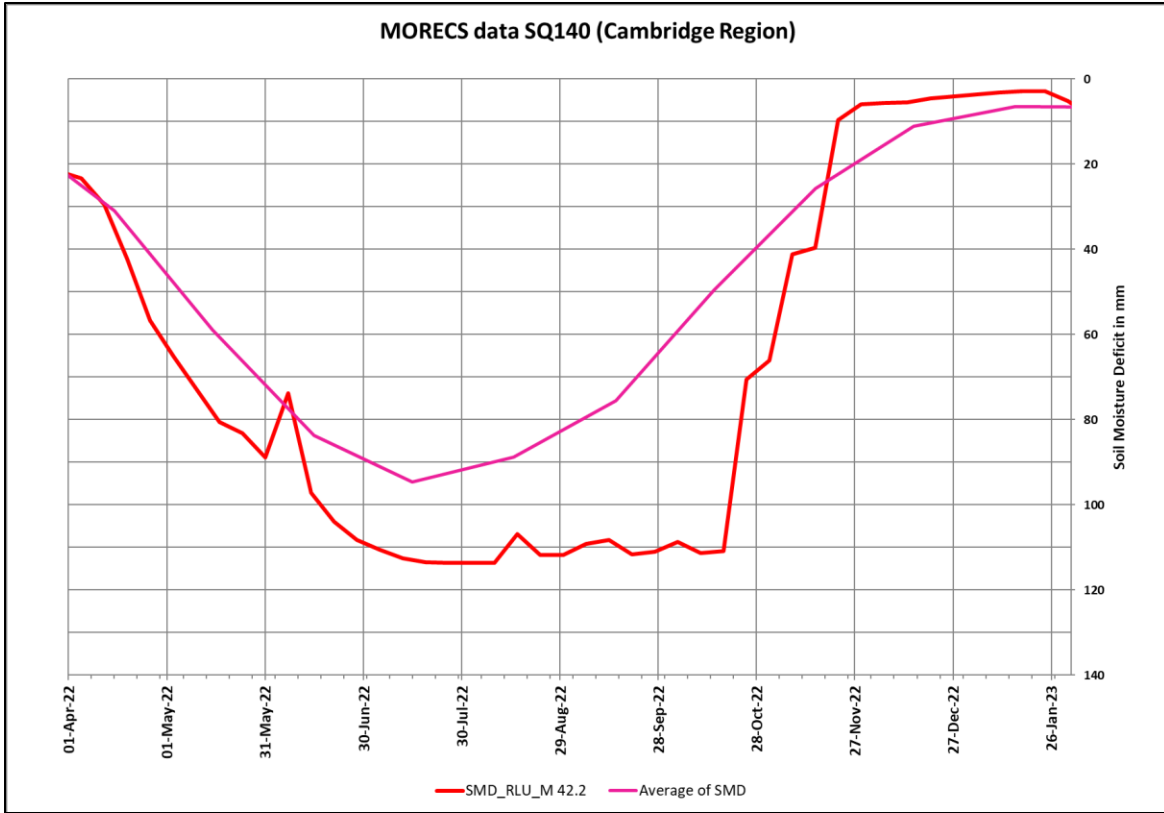


Figure 3: Soil Moisture Deficit (mm) and Long Term Average SMD (mm) for the Cambridge region from April 2022 to January 2023.

Groundwater levels began to recover in October and were significantly improved by December due to above-average winter rainfall (as the orange bars in Figure 2 show). However, the unprecedented abrupt rise in demand caused by the freeze-thaw event in mid-December impacted our strategic storage due to the intensity of the leakage that occurred: an extra 20 MI/d of water was suddenly required – an increase of over 25% of usual demand – placing unseasonal pressure on our water supply network.

Response

Cambridge Water identified the significance of the 2022 drought early into its development. We took multiple serious measures to prepare for and combat the drought as effectively as possible. Summer Action Plan (SAP) meetings were initiated in June due to a lack of spring rainfall and the lasting abstraction licence effects of the winter freeze-thaw event; the SAP is a planning structure used to increase the resilience of our supply network by instituting enhanced water resources and leakage monitoring as well as increasing response times to unplanned abstraction site outages. We also ensured that no new planned capital works projects were started so that no abstraction sites were taken out of supply, which would have limited our supply capacity. SAP meetings are held first weekly then twice daily at the highest level.

They are made up of a multi-disciplinary group that has representatives from the technical and operations sides of the company.

In addition, during the winter freeze-thaw event, we again recognised the severity of the threat to our water supply and consequently went into 'red' status in our Winter Action Plan (WAP). As with the SAP, we did not initiate any new capital works projects to maintain a stable supply of water throughout our abstraction sites. We also increased our water resources and leakage monitoring, modelling the changes in abstraction and how that would affect our abstraction licences for the remainder of the abstraction year. By using our RAG (Red-Amber-Green) system for our Action Plans we have been able to scale our responses to the different demand conditions.

Early 2023 has seen good winter rainfall and normal – if slightly high – demands, allowing us to reinstate our capital works projects and reduce the RAG status of our WAP.

Identified Improvements

As part of our response to the 2022 drought, we have examined both the supply and demand sides of the drought and the different factors that influenced them. We assembled a senior multi-disciplinary group with representatives from the direct technical teams that work in water supply and demand to undertake a full review, which also included the freeze-thaw event we experienced over the winter. We identified several key areas to address from the drought, with the communications, water resources and Environment Agency communication aspects highlighted as the most important parts to alter moving forward. These three areas were important components of how we responded to the drought, however there are several potential adjustments which could be made to improve the reporting of, and the responses to, the drought.

Communications

The greater distribution of information both around the business and to customers was seen as a limiting factor during the drought. This meant that our customers were not as aware of and engaged with the importance of the 2022 drought and were less aware of the changes that they could make to reduce their own water demand.

A key challenge that we identified was the length of time it took to prepare water saving and advice messages both leading up to and during the drought. Proactively developing communication packages ahead of droughts and high demand periods will allow Cambridge Water to circulate relevant advice effectively and quickly about the current pressures on water resources and water saving tips to reduce demand. These will be available as convenient 'on the shelf' packages that can be rolled out to customers across our region, whether through website content or via emails, text messages and letters. However, before deploying these messages, we will use our existing H2Online customer community to discuss the

effectiveness of our proposed communications, both in how relevant the messages are as well as the appropriateness of the delivery systems that we use (for example if using more physical methods of communications is preferred over social media methods). A customer-supported modular system such as this with pre-prepared comms will enable us to adapt the information that is provided throughout the different stages of a drought – creating more engaged and educated customers who understand the effects of and solutions to droughts.

In addition, we will look to connect more with our customers once a drought has ended. Similar to this report, we will address the recent drought and discuss what our responses were and what we will do in the future, along with any changes that will be made to our processes. Details about what our customers can do to improve their water efficiency shall be provided to educate them on how they can alter their water behaviour to reduce demand and save money on their bills. At the same time, we recognise that this is a two-way process and we will engage with our customers to understand their opinions on a drought and how it has affected them. These interactions allow us to develop our communications messages and make them more pertinent to our customers from all backgrounds to improve our business-as-usual (BAU) approach.



Maximising the breadth of our communications through different sources of information is a challenge that we are seeking to address. While this is in the same vein as our 'on the shelf' comms packages, we understand that the way we connect with our customers is not a static relationship and is important throughout the year, regardless of whether high demands and a drought are occurring or not. Cambridge Water will be exploring the capabilities of using DAB radio advertising, local media engagement, and newspaper articles and adverts to enhance the ways in which we spread our messages to our customers. We are also seeking to work with local parish councils and interest groups in our supply zone as they could help to disseminate information at a much larger local scale given their enhanced connection with our customers. All of these different channels of communication are intended to create an educated customer base that is well informed about our water plans and situation, as well as how they can help to reduce their own water demand throughout the year.

To augment the effectiveness of our customer communications we are looking to work with third parties to show and explain how droughts affect them. We intend to work with farmers in our region to show how the effects of lower levels of water and rainfall on their crops and animals alter their ability to produce vital goods and produce. Additionally, revealing the ecological damage that droughts and high demands have by working with the Environment Agency will demonstrate another facet of the damage that a lack of water can cause. We propose to create videos and podcasts that we share with our customers via our website and social media. These opportunities to collaborate with other significant water users will help our customers to visualise the real impacts of drought both on an economic and environmental scale, while also highlighting how relevant stressed water resources are to the local area.

Overall, we understand that a greater level of communications with our customers is required to alleviate the stress that high water demand causes. We will improve the relevance and spread of our comms and create a variety of pre-prepared information ahead of periods of high demand. Alongside working with third parties who are also affected by high water use, we shall increase the awareness of our customers and their education about the causes, effects and responses to drought in order to reduce the demand on our water supply and to help them save money on their bills.

Water Resources

We have created a new process to strategically plan our water resources as we identified that there was no such structure in place, which would be beneficial when planning abstraction in a dry year. In addition, we intend to create a conservation meetings framework in Cambridge to better monitor and maintain groundwater levels, similar to the framework used in South Staffs Water to keep Blithfield reservoir in a healthy position. We also found that there was a lack of overall appreciation of the water supply and demand situation both internally and externally, through our employees and our customers. We propose to explore these further to realise their full effectiveness in alleviating pressure on our supply to improve resilience.

The Cambridge Deployable Output Planner has been created by the Water Resources team to provide a guide for abstraction across the year to more efficiently utilise and protect our abstraction licences. It is intended to predict the general utilisation of each abstraction site based on historical usage, such as typical summer peaks or expected lower groundwater and river levels. This new system will provide a rough outline of the abstraction picture across the year, showing the remaining abstraction licence volumes not already allocated. We can then utilise this spare volume to cover days when medium- and long-term outages occur or when summer and potential freeze-thaw peak demands place more strain on our supply system. The abstraction volumes are roughly planned out across the year but are then forecast on a fortnightly basis – the Water Resources and Production teams discuss any proposed abstraction changes and if they are feasible to implement. The refined forecast is then communicated to the relevant personnel who work closely on Cambridge's supply so any changes can be made. Implementing a new strategic planning system has allowed for a long-term approach to be used alongside the normal short- and medium-term planning that is already in place, creating a comprehensive forecasting framework best placed to efficiently use our abstraction licences.

In a similar vein to South Staffs Water, we intend to institute conservation meetings to preserve groundwater levels in Cambridge during times of greater stress. Borrowing from the Blithfield reservoir conservation meetings – which seek to preserve the reservoir's level in high demand periods so it can be consistently abstracted from – we will create a system that involves multiple groups from our technical water supply teams. This group will consider all the different aspects of water supply, such as abstraction licences, short- and long-term demand, and potential outages, to create an effective plan to preserve groundwater. The meetings will be triggered when we hit the first level of our drought plan. Conservation meetings will likely start as weekly sessions but, dependent on the water resources situation and peak demands, we will increase the frequency of these meetings to stay ahead of any new developments and plan accordingly.

In partnership with improving our strategic water resources, we have examined the role that communicating our water supply situation plays in the narrative of a drought. The current groundwater level is published monthly on the Cambridge Water website alongside a view of our water resources situation. However, we have recognised that this does not go into enough detail about how this compares to historical levels nor the immediate impact that this could have on our levels of service and therefore our customers. We will consequently produce a more rigorous and complete picture of our water resources situation which will be colour-coded against historical average rates. This will be added more prominently to our website and will be tied-in with water-saving methods that our customers can follow to help reduce demand and their bills. In addition, we will also spread more information internally to our colleagues who work in areas of the business that are not directly aware of the water resources situation; for instance, the monthly water resources situation shall be sent round to all employees so that those not directly involved with water supply are cognisant of the strategic situation. These two methods of information dispersal will educate both our colleagues and customers, improving their engagement with our water supply and demand, and raising the general awareness of our water resources situation not just in a drought but throughout the year.



Within the technical water supply side of Cambridge Water, there are frequent meetings to discuss the current water supply and demand situation and to devise solutions to improve our water resources. We have SAP meetings leading up to and during the summer and high demand periods, and separate drought plan meetings to respond to an identified drought. However, these two meeting sessions often include the same members and discuss similar topics. We will therefore combine the two meetings into the SAP to ensure that there is clarity and cohesiveness of plans and strategies. A stronger Communications and Water Resources presence in the SAP meetings will provide better representation for these areas. However, we are looking to keep the conservation meetings separate as they focus on the longer-term management of water resources, rather than the immediate future as the SAP and drought meetings do. Efficiently addressing the short- and long-term will enable the technical teams to both feed into, and be aware of, the challenges and thoughts of the other water supply and demand areas of the business, further increasing the internal awareness of our water situation.

The combination of creating new strategic water resources planning and management options alongside the greater spread of information about our water supply situation will lead to enhanced water resources management. We believe that developing these modifications to our strategic water resources processes as well as enhancing the level of information that we provide about them will become part of our BAU, helping our supply and demand both in and out of drought.

Communicating with the Environment Agency

In the previous two sections we have recognised a need to communicate more effectively with our customers and colleagues through our Communications and Water Resources. However, we also appreciate that communicating with one of our main regulators, the Environment Agency, is crucial to ensuring that our plans are sensible and supported. Just as we are doing with our customers, we are sharing our water resources situation with the EA regularly. In 2022 we only did this as the water situation worsened and the drought increased. Instead, this year we intend to send weekly situation reports to the EA to explain our strategic position as well as any forecast changes that could affect our water supply and demand. We will also send increased levels of information as necessary should there be threats to our supply (e.g. if there are large unplanned site outages) and if we forecast high demands. This will improve the transparency of our water resources position with the EA and will ensure that both parties are coordinated in their responses to any high demands and drought.

Further to this, as with our SAP and drought plan meetings, we have had several duplicated meetings between Cambridge Water and the EA. This has hampered efficiency as information was often being repeated on different meetings with similar people. We are now working together with the Agency to reduce these duplicated meetings and improve their relevance. For example, the aforementioned weekly situation reports will be sent to a wider group of EA staff so that more related teams are apprised of our water resources position; the EA have also committed to combining some meetings to avoid duplication so that relevant information and queries are not mired by repetition. These two simple changes will consequently improve the relationship between Cambridge Water and the Environment Agency by improving the level of communication about water resources. The closer alignment of both groups will therefore allow for communications to customers to be more effective and pertinent as we can address any potential threats to the water environment and to customers' levels of service, whether in or out of a period of drought.

Conclusion

Throughout our examination of the unusually high-demand 2022 drought, we have looked to understand both the positive actions that we took as well as the areas that could be developed further to improve our strategies and processes. We quickly decided to implement Summer Action Plan meetings when the first signs of drought began as part of our normal response process. We carefully managed our water supply through actions such as pausing our capital works schemes and implementing increased water resources and leakage monitoring. We also stepped up our unplanned outage response levels as the drought progressed, increasing our resilience throughout our water supply network. These actions were communicated to the Environment Agency weekly and we informed our customers each month about our water resources situation.

As part of our technical review, we found that there were improvements to be made in our communications, water resources, and Environment Agency communications areas as detailed below:

- We are targeting a greater level of customer engagement through quicker, pre-prepared communications around hot weather and high demands via a greater variety of message delivery methods.
- We will also work with third parties, such as farmers and the EA, to explain the direct economic

and environmental impacts that a drought has, and the actions that customers can take to reduce their own water demand and bills.

- We have created and begun implementing a strategic abstraction planner for Cambridge. This considers abstraction over the entire year and sets out a general plan for abstraction for each site, accounting for expected summer peak demands and potential freeze-thaw events. A more detailed level of forecasting on a fortnightly basis has allowed for the short- and long-term water resources situation to be maintained and preserved for the future.
- We are instituting a conservation meeting scheme based on our drought triggers to preserve the health of our groundwater in potential drought periods. Following the success of the Blithfield conservation meetings at South Staffs Water in sustainably managing the Blithfield reservoir level over drought periods, these meetings will address the long-term use of our groundwater to ensure that it stays healthy if a drought does occur.
- We will also improve how we illustrate our water resources situation, both internally to our colleagues and externally to our customers, to ensure that everyone in the Cambridge area is educated and engaged in water.
- We highlighted how we could improve our conversations with the EA, both in the water resources situation updates that we provide and in the water supply and drought meetings that we frequently have with them. Changing these two processes will enhance the awareness of our current water supply with the EA and align both groups' positions on the current water resources situation and outlook.

These options will all work together to reduce water demand, by creating an educated customer base, and improve supply resilience, by focusing on strategic water resources planning throughout an abstraction year.