

Water Resources

Introduction

The availability of water is one of the most critical factors in planning for the future growth of Coconino County. Balancing the needs of growth and the environment in the face of climate change promises to be complex and challenging in the years to come. To add to that challenge, the County's authority to assess and ensure long-term water supplies in the face of new development is constrained by overriding State law. In order to move towards a more water-secure future, the County should continue its efforts in the areas of long-range planning, cross-jurisdictional partnerships, water conservation and reuse, and state water law reform.

Water supplies are not only essential for human life, but also for healthy ecosystems. The goals and policies address the role of conservation in this drought-adapted environment. The residents of Coconino County and the NATURAL ENVIRONMENT need water to survive and thrive. The County envisions using creative approaches to ensure SUSTAINABLE WATER USE. This Chapter describes existing water resources and providers in the County and addresses demand for future water supplies. Policies encourage sustainable water use and a more efficient regulatory framework, one that works with all entities on a regional basis to effect better water management.

Water Sources

The ARIZONA DEPARTMENT OF WATER RESOURCES (ADWR) identifies four categories of water supplies currently available in Arizona: GROUNDWATER, SURFACE WATER, RECLAIMED WATER (treated wastewater), and the Colorado River. The primary source of water in Coconino County is groundwater, although some surface water is used. Reclaimed water is becoming an important source for non-drinking purposes. Colorado River water is classified separately due to the complex legal issues involving many states and jurisdictions. Currently, the only entities in the County that draw water directly from the Colorado River are the City of Page, some communities in the Navajo Nation, and the Navajo Generating Station.

Surface water reservoirs such as Upper Lake Mary near Flagstaff and Santa Fe Reservoir near Williams historically supplied a significant portion of the drinking water for these cities. However, drought conditions beginning in the 1990's have diminished and made these sources more unpredictable, making Flagstaff and Williams more reliant on groundwater sources. The City of Flagstaff, for example, now obtains about 70% of its water supply from wells in the surrounding area, including the Inner Basin of San Francisco Mountain¹. The City of Williams is currently in a water crisis and has recently drilled four deep wells (around 2,750 feet) in an attempt to supplement their surface water supplies. Small surface water impoundments are also important sources of water for livestock and wildlife across the County. However, precipitation

¹ Flagstaff Regional Plan 2030, City of Flagstaff. <http://www.flagstaff.az.gov>

is often insufficient to fill these tanks, so ranchers and wildlife managers often haul water from groundwater sources to support livestock and wildlife.

Most communities and water systems in the County are supplied exclusively by groundwater drawn from AQUIFERS. These regional aquifers contain water that varies in depth and age (up to several thousand years old). Groundwater aquifers are recharged when rain and snow PERCOLATE downward from the surface and flow along fractures in the bedrock, sometimes over great distances. For example, some SPRINGS that DISCHARGE along the Colorado and Verde Rivers originate 70 miles or more away. Because of this connectivity, groundwater pumping at one location can affect water levels in an entirely different geographical area or jurisdiction over time. Given the interconnected nature of groundwater systems, it is critical that water supply planning take place regionally and that it involve incorporated and unincorporated communities as well as State, Federal, and Tribal resource management agencies.

Groundwater resources in Coconino County occur in a series of layered aquifers within rock formations between 500 to 3,000 feet below the surface. The three primary aquifers that provide groundwater in the County are the N aquifer (Navajo Sandstone), the C aquifer (Coconino Sandstone), and the R-M aquifer. Of the three, the R-M aquifer is the deepest and the only one that underlies the entire county. The N aquifer has historically been a source of domestic, municipal, industrial, and livestock water use for both the Navajo Nation and Hopi Tribe and the Community of Fredonia. The C aquifer is the main source of municipal water for the larger communities and developments in southern Coconino County. The R-M aquifer, because it is so deeply buried, is only beginning to be developed for domestic and municipal supply at smaller communities such as Williams, Valle, Supai, and Tusayan.

Through springs, these aquifers supply the perennial flow for all of the region's major rivers and creeks. For example, the R-M aquifer is the source of the spring flow in the Grand Canyon and maintains the perennial flow in several major tributaries including Bright Angel Creek and the Little Colorado River. The C aquifer feeds Oak Creek, Sycamore Creek, and East Clear Creek, and others. These creeks and their associated riparian areas are vital to supporting the region's wildlife and plant diversity, including 18 of the 27 federally endangered plants and animals that occur in the County. Eleven of those 18 species are fish, with very specific habitat needs. Localized drawdown of aquifers is already occurring in some areas with documented impacts on aquatic species (*awaiting citations from USFWS*). Continued overuse of aquifers could continue to jeopardize aquatic species. Increasing water demands and changing climate are the drivers that will continue to compromise the natural environment unless a comprehensive, sustainable water resources plan is formulated and implemented.

The use of reclaimed water has become an important resource in the conservation of groundwater in Coconino County. Page, Williams, Sedona and Flagstaff all use reclaimed water to irrigate golf courses, public parks and school grounds. In recent years, large subdivisions have begun using their reclaimed water to support similar uses. Reclaimed water use is discussed in more detail in the Water Conservation and Alternative Sources section below.

Water Quality

The quality of surface water in Coconino County's rivers, creeks, lakes and reservoirs is generally very good. Arizona Department of Water Resources (ADEQ) monitors surface water in a small network of fixed stations. Most of these waters meet drinking water standards that are based on *Clean Water Act* criteria published by the U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) and/or the State of Arizona's drinking water standards. The surface water used by Flagstaff and Williams typically only requires filtration, the standard water treatment process, to reduce dissolved sediment and chlorination to prevent bacterial contaminants.

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The quality of the County's groundwater varies from excellent to very poor depending on the aquifer and its location. Typically the quality of groundwater in the N aquifer is excellent wherever it is encountered. Groundwater quality in the C aquifer is generally excellent in the southern parts of Coconino County but degrades as the groundwater flows northward and salts are dissolved from the bedrock. To the north and east of Wupatki National Monument and Leupp, C aquifer water is generally not fit for human consumption but is still usable for livestock. The quality of groundwater in the R-M aquifer is not very well known. Excellent quality water has been developed from this aquifer in the Williams, Valle, and Tusayan areas as well as on the Havasupai Reservation. However, a few wells drilled in the Williams and Havasupai areas have encountered very poor quality water in the R-M aquifer.

Avoiding point and NONPOINT-SOURCE **POLLUTION** will help protect our aquatic ecosystems and our surface and groundwater quality. Point sources of pollution typically originate from industrial discharge of pollutants via atmospheric, solid, or liquid waste. This kind of pollution is regulated by the EPA and ADEQ. Nonpoint pollution can be a problem in areas of high development, recreational, or livestock use. The most common nonpoint source pollutants are sediment, animal waste, fertilizer, and motor oil that get washed into waterways during storm events.

The County's *Stormwater Ordinance* and *Floodplain Management Ordinance* are designed to minimize non-point pollution to our waterways and drinking water. The basic concept behind these ordinances is to slow down stormwater, allow it to infiltrate into the ground, and protect riparian and floodplains from pollution. LOW IMPACT DEVELOPMENT (LID) designs provide a set of tools such as swales, detention basins, and pervious pavement to retain stormwater on site. Resources such as the *City of Flagstaff's Low Impact Development Guidance Manual* provide practical guidance on these methods. Maintaining healthy vegetative cover throughout the watershed is another important step in reducing pollution. Intact riparian and floodplain ecosystems are very effective at filtering out pollutants, so steps should be taken to protect floodplains as well as provide vegetative buffers between nonpoint sources and waterways.

Concerns are often raised about the impact of septic systems on groundwater. As long as there is a sufficient thickness of soil under leach fields, typically at least a few feet, the potential for pathogens reaching groundwater is minimized. Nitrates are potentially of higher concern as heavy rains could leach nitrates into aquifers, particularly in areas containing loose cinders or faults. However, ADEQ monitors nitrate levels regionally and has not yet identified any areas within Coconino County that require nitrate mitigation. Recent studies nationally and locally have shown that EPA water-quality standards (A or A+ water) for reclaimed water discharge still

allow some organic and pharmaceutical compounds to pass into our waterways and can percolate to groundwater. These chemicals have documented effects on aquatic organisms². There potential impact on humans has yet to be thoroughly studied.

In a few areas; most notably the Fort Valley, Bellemont, Pittman Valley, and Parks communities, groundwater is close to the surface in perched water-bearing zones. These shallow water tables are more susceptible to impacts from septic systems and other surface contamination and should be tested or treated periodically to ensure safety. Also, these perched water tables are closely tied to annual precipitation, and as a result, long-term supplies may be less secure.

Goal: Coordinate with State and local resource management agencies to ensure sustainable management practices that preserve and improve the quality of surface water and groundwater.

Policies:

1. Conserve and enhance riparian buffers, protect floodplains from development and require the capture of stormwater on site.
2. Protection of surface water and groundwater quality shall be a factor in the consideration for approval of all developments.
3. Development proposals that will affect drainage on adjacent properties, roads, or watercourses shall include a drainage plan addressing the impacts and mitigation measures affecting water quality and flooding.
4. To reduce stormwater runoff and improve water quality, the County encourages minimizing impervious surfaces and using Low Impact Development principles within commercial, industrial, public and semipublic use developments.
5. The County shall set an example of responsible water resource protection by locating its new buildings, roads, and other facilities in such a way as to protect surface water and groundwater quality and through the implementation of Low Impact Development principles.

Water Providers

Unlike many incorporated cities and towns that provide water to their residents, Coconino County is not a water provider. County residents obtain their water in a variety of ways, including Domestic Water Improvement Districts, owner cooperatives, community water systems, shared wells, individual wells, and hauled water. As of 2014, the County had six Domestic Water Improvement Districts: Forest Lakes, Kachina Village, Foxboro Ranch, Valle, Majestic View, and Badger Creek. Water Improvement Districts are formed by area residents to

² Wolff et al. 2015. Estrogenic environmental contaminants alter the RNA abundance profiles of genes involved in gonadal differentiation of the American bullfrog. Science of the Total Environment 521-522, pg.380-387.

raise money in order to manage or develop a system. They provide a mechanism for improving water security and quality for residents while helping the County and its partners assess and plan more comprehensively for the future. Doney Park Water is the only owner cooperative in the County. In that case, customers are members, and an elected Board of Directors and staff run the operation. In some areas, particularly subdivisions, individual lot owners have developed a private system of shared wells. Clear Creek Pines, Forest Highlands and Flagstaff Ranch are examples of a SUBDIVISION where owners have worked together to develop a well, storage, and line extensions for a limited number of homes. SPRINGS provide water in some areas, most notably Oak Creek Canyon, and parts of the Navajo and Hopi Reservations, the Havasupai Reservation and the Arizona Strip. Additional community-specific water suppliers are discussed in more detail in the Water Resources Appendix.

HAULING WATER is also a common practice among residents of unincorporated and remote areas. Typically, these residents access standpipes for bulk water sales by coin or card. Some residents haul their own water and others use commercial haulers. These bulk standpipes are provided by a variety of entities across the County; water districts, owner cooperatives, shared wells, private water systems, and municipalities. Residents who rely on hauled water may be the most vulnerable to future water shortfalls as they have no established water rights. **Additionally**, some municipalities that sell water have adopted policies that would restrict sales to external users under drought conditions.

Goal: Provide guidance to residents, water providers, and potential water districts to help them develop sustainable water supplies consistent with local and regional needs.

Policies:

6. The County shall provide guidance to communities in the formation of water districts.
7. The County shall work with other jurisdictions to secure sources of hauled water during times of drought.

Meeting Future Water Needs

Although Coconino County is not a water provider and cannot assure sustainable water yields to residents, water resources planning is clearly integral to long-term stability and growth. To further this purpose, Coconino County helped formulate the Coconino Plateau Water Advisory Council and Watershed Partnership in 2000 (CPWAC&WP). Today, the CPWAC&WP continues to function as an inter-agency group that is addressing the issues surrounding regional water security. A major accomplishment of the group has been the completion of the *North Central Arizona Water Supply Study* (NCAWSS) in 2006³. The area that was analyzed for the study encompasses most of Coconino County, including tribal lands. The objectives of the Study were to determine if there would be unmet demand for water in the future (into the year 2050) and to identify potential sources of additional water to meet those demands.

³ United States Department of Interior Bureau of Reclamation. 2006. North Central Arizona Water Supply Study.

The Study found that per capita water use varies widely according to ease of availability and cultural norms, ranging between 50 and 200 gallons per person per day. Overall, the NCAWSS projected a doubling in water demand by 2050. In many areas, especially in the rural parts of the County, this demand will undoubtedly be met by additional development of the C and R-M Aquifers. However there are potential problems with substantial additional development of these aquifers. The Study found that unsustainable withdrawals are possible in some areas which will negatively impact perennial waters such as rivers, creeks, springs, and seeps downstream from wells. This could lead to habitat degradation at these environmentally sensitive features. Such impacts have already been observed in the Winslow area where industrial use of water resources has resulted in the drying up of some wetlands along the Lower Colorado River (*awaiting citation from USGS*). In addition to environmental consequences, the drying of springs and rivers poses potential water rights problems with downstream users. Also, this consequence is unacceptable to many residents, including Native Americans, who hold some of these waters sacred.

In addition to further groundwater development, the Study (NCAWSS) identifies Colorado River water from Lake Powell (via pipeline) as the most likely source to meet future unmet water demands across the County and on tribal lands. This water could come from pending Indian water rights settlements and/or Colorado River entitlement reallocation in 2021. Non-tribal partners would have to lease or purchase water from tribal entities who may not be willing or able to sell. Also, the cost of building a pipeline to both tribal and non-tribal demand areas would be very expensive and it is currently unclear if the effort could be funded. Also, under this scenario, many rural residents of Coconino County would not benefit significantly from the pipeline as they would still be reliant on hauling water from standpipes to their residences.

The City of Flagstaff has taken steps to assure future water supplies for its growing population without drawing from the Colorado River. In a recent study⁴, the City determined that future demands within city limits will outpace surface water and groundwater recharge rates starting in the year 2036. In an effort to fill projected water demands, the City has purchased Red Gap Ranch east of Flagstaff and the associated water rights. Efforts to fund a pipeline that would bring that water to Flagstaff are just beginning.

Changing climate and natural drought cycles pose additional challenges to long-term water planning in Coconino County. Average annual temperatures in the American Southwest are consistently rising as a product of climate change. This has led to reduced annual snowpack, less natural occurring groundwater recharge, dryer soils, and more severe periods of drought⁵. Also, long-term climate records show that droughts spanning several decades are normal in the region and likely to occur in the future⁶. Future water resource projections and scenarios should err on

⁴ City of Flagstaff. Utilities Integrated Master Plan. 2013 *draft*.

⁵ EPA. 2015. <http://www.epa.gov/climatechange/impacts-adaptation/southwest.html>

⁶ McCabe, G.J., Palecki, M.A., and Betancourt, J.L., 2004, Pacific and Atlantic Ocean influences on multidecadal drought frequency in the United States: Proceedings of the National Academy of Sciences, v. 101, no.12, p. 4136–4141.

the side of caution by incorporating the influences of climate change and variability in water supply projections.

Coconino County needs a robust plan for its water future. The NCAWSS lays out a clear picture of what unmet demand will be. Now the County needs to begin a process that strives to ensure sustainable water supplies for its residents without compromising the ecological integrity of aquatic and riparian ecosystems. This process requires technical evaluations and political engagement. It should integrate our understanding of geohydrology with the physical location of unmet demand areas **as well as planned and designated growth areas**. This effort should be coordinated with municipalities, other water users, and water providers in order to create a regional water resource management plan. Such a plan should consider all the available science and potential actions in the areas of state and local water policy, water conservation and outreach, environmental water needs, water reuse, rainwater capture, as well as identifying potential additional sources from outside the region. **Some municipalities within the County have undertaken these types of detailed studies and those studies should also be taken into account.** The CPWAC&WP has already made advances in these areas and, at this time, is best positioned to lead such an effort.

Goal: Ensure a sustainable water supply for human communities while protecting natural systems.

Policies:

8. The County will actively participate in **developing a regional, cross-jurisdictional water resources** planning efforts (e.g. CPWAC&WP) that address how future human water demands will be met without compromising the ecological integrity of natural systems that rely on surface and ground water **and addresses conservation measures as well as reuse.**
9. Long-term water planning efforts supported by the County will incorporate climate science into projections of future water supply.
10. The County will promote the dissemination of information to current and future residents regarding the status of groundwater resources for domestic use.

Water Conservation & Alternative Sources

Between 2000 and 2013, population grew by about 1% per year in Coconino County⁷. If growth continues at that rate, demands on our water supplies will continue to increase. The Bureau of Reclamation (BOR) *Report of Findings for the North Central Arizona Water Supply Study* (2006) projected an unmet demand for water of about 25,000 acre-feet (AF) by the year 2050 (25% more than the amount used today). Although developing additional water sources will be crucial, immediate, and cost-effective alternatives should also be utilized to meet these demands. An important component is to reduce consumption and conserve water through the use of low-

⁷ US Census. 2015. www.census.gov

flow plumbing devices, drought-tolerant LANDSCAPING, conservation-oriented rate structures, alternate day watering schedules for yards, and other approaches. Another is using water sources such as reclaimed water, GRAY WATER, rainwater and storm water for non-potable uses such as landscaping, agriculture, golf courses, and parks, along with some commercial/industrial purposes. The County also supports the development of technologies to use these sources for a broader range of needs, including potable uses.

Reclaimed Water

Reclaimed water from community wastewater systems is graded by water quality standards that determine if and how it can be used or returned to the environment (e.g A+, A, B, and C quality water). Using reclaimed water for landscaping and other purposes both conserves groundwater and saves the energy used to pump groundwater. The cities of Page, Williams, Sedona and Flagstaff all use their reclaimed water to irrigate golf courses, public parks, and school grounds. Flagstaff's reclaimed water is also used to make snow for skiing, and some is discharged into the Rio de Flag to support riparian habitat (per an agreement with the Arizona Game and Fish Department). The projected demand for reclaimed water in Flagstaff will exceed the available supply. Because of the expense of drilling and developing ground water from depths of over 3,000 feet below the surface, the City of Tusayan is retrofitting homes for the use of reclaimed water for non-potable domestic purposes.

At this time, most of the reclaimed water use in the County is within incorporated communities. However subdivisions that provide community wastewater treatment are also good candidates for developing the resource. For example, the Forest Highlands Water Company uses all its reclaimed water to irrigate its golf course and also holds an agreement with Kachina Village Improvement District to purchase its excess reclaimed water.

Gray Water

Gray water is all of the water uses in a residence, excluding human waste. Examples are bath water, dish water, and laundry water. Reusing gray water domestically is a simple way to reduce groundwater extraction. In 2001, the ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY (ADEQ) adopted regulations that allow residential users to reuse gray water which originates in their household. This program is now managed by Coconino County. Residents wishing to construct a gray water reuse system should work with the Coconino County Environmental Quality and Building Department to meet sanitation and aquifer protection requirements.

Rainwater Harvesting

Rainwater harvesting is capturing roof RUNOFF and storing it for domestic or landscaping use later. Using rainwater for non-potable uses is fairly straightforward, and at times, incentives for 1000 gallon or more tanks and other rainwater harvesting systems have been available. Rainwater capture for potable use is possible, but there are serious health risks if not properly managed. Standard construction materials typically do not conform to the specifications of the

American Water Works Association which assure the satisfactory quality water for human consumption. Also, there are sanitation risks associated with rainwater harvesting, including wildlife and vector contamination. Just as with domestic wells, residents should test their potable sources periodically to assure they meet ADEQ potable water standards. Grand Canyon National Park Airport is noteworthy because it harvests potable water via its rainwater collection system, which includes a 3-million-gallon tank to store untreated water.

Stormwater Capture

Stormwater capture means diverting runoff from precipitation events into places where the water can infiltrate into the ground. The practice has multiple benefits including reducing erosion, reducing conveyance infrastructure costs, recharging groundwater, and irrigating crops and landscaping. Stormwater capture can be implemented at residential or community scales. For example, the City of Flagstaff's Utilities Stormwater Section has developed unlined detention basins in areas prone to flooding. These basins (such as at the base of Mount Elden) reduce flood risk while allowing water to infiltrate into the ground and becoming a source of recharge to local groundwater.

Education & Outreach

The County can continue to promote water conservation and alternative water sources in a variety of ways. Educating the public, developers, and County staff is important. The County is already helping incorporate conservation elements into development projects, and encourages the use of reclaimed water, gray water, and rainwater systems. Currently, the County offers free consultation and resources for implementing water conservation in new and existing development through its Sustainable Building Program, and the 2001 *Landscape Ordinance*. The *Landscape Ordinance* is based on Xeriscape principles that requires new, nonresidential development to use native and/or drought-tolerant plants, based on geographic location. Another way the County works to promote water awareness and conservation is through regional partnerships and programs like the Coconino Plateau Water Advisory Council's Public Outreach Program. New technologies are constantly emerging that can help us reduce our consumption of this precious resource.

Goal: Promote water conservation practices that include new technologies and methods to reuse water.

Policies:

11. The County encourages and supports water conservation measures by both water providers and consumers.
12. Water conservation should be a consideration in approval of all major developments and high-efficiency, low-net volume water use encouraged.

13. The County encourages decreased water use and promotes the use of such conservation tools as water saving plumbing fixtures and environmentally sound water harvesting systems in all new development and retrofits.
14. The County shall strongly encourage reuse of reclaimed water and rainwater harvesting to reduce the use of potable water.
15. The use of reclaimed water and gray water will be encouraged wherever possible as permitted by State law.
16. The County supports education and programs that inform residents about water scarcity and encourage water conservation.
17. Continually evaluate regulations to ensure they allow for and facilitate best practices related to water conservation.
18. The County shall set an example in new and existing County facilities by implementing best practices for water conservation techniques.
19. The County encourages individual homeowners and businesses to reduce water use, provide for detention of rainwater, and control erosion.
20. In conjunction with considerations for dust control, drainage, and maintenance, the County supports alternative paving methods that mitigate the impacts of surface water runoff and conserve water by promoting aquifer recharge.

Regulatory Framework

The Arizona Department of Water Resources (ADWR) administers Arizona's groundwater code and surface water rights laws. Most of the surface water in the County (and indeed the state) has already been allocated through existing appropriation claims (or is undergoing an adjudication process). The scientifically recognized connections between groundwater and surface water are not explicitly recognized in state water law. As a result, groundwater withdrawals are generally not as constrained as surface water. Under current state law, any landowner can drill a water well on his or her property as long as it pumps less than 35 gallons per minute and is outside of an Active Management Area (AMA). **As of 2015**, no part of Coconino County is within an AMA. As a result, other than its transportation, groundwater use is not regulated within the County. This presents serious challenges to sustainable water use because the cumulative impact of multiple wells pumping from the same aquifer and the potential impacts of groundwater overdraft on surface flows is not considered in the permitting of new developments or the appropriation of new wells. In the last decade, Coconino County has considered several policy options that would increase water use oversight, but so far has not taken any action.

In 2007, the Arizona State Legislature passed Senate Bill 1575 which gave local jurisdictions (Counties and Cities) the ability to require new developments to comply with state water adequacy rules. In 2008, the County investigated the possibility of opting into this Mandatory

Adequate Water Supply Program. The Program would require new subdivisions (more than six parcels) to demonstrate a 100-year water supply before being approved by ADWR and the County. Enrolling in the Mandatory Adequate Water Supply Program would move the County towards more sustainable water use by assuring long-term water security for property owners while allowing ADWR to more closely track water use and ensure sustainable supplies into the future. One potential drawback to requiring developers to prove water adequacy is that it could motivate some to circumvent the subdivision process, resulting in more lot splits. In order to enroll in the program, the County would have to request a waiver from the state that would allow groundwater below 1,200 feet to qualify as adequate water supply (a similar waiver was granted to the City of Flagstaff in 2009).

Alternatively, the County could investigate the possibility of creating an AMA for one or more of its groundwater basins. The advantage of this approach would be that groundwater use within AMAs is tightly controlled by the ADWR and proposed developments are required to demonstrate an 'assured' water supply (a more stringent standard).

Goal: To pursue and implement long-term water management policies that ensure sustainable water supplies for future generations and the natural environment.

Policies:

21. In coordination with the appropriate agencies, the County supports actively reforming Arizona water law to recognize surface and ground water connectivity and require the cumulative assessment of water use in relation to availability when considering new development projects and the ability to take actions to create more local/regional authority for ground-water management.
22. The County will actively participate in and pursue programs and activities that address regional water resources conservation and management.
23. The legal availability of water should be a primary consideration for all development applications filed in conjunction with a rezoning for higher density.

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