Water Shortage Contingency Plan

Mendocino City Community Services District

Mendocino, California

Based on a 2006 Report prepared by:
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Adopted _____, 2020

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Introduction

This Water Shortage Contingency Plan is intended to guide emergency water supply shortage planning and response implementation for the Mendocino City Community Services District (MCCSD). MCCSD is a Community Services District in accordance with Title 6, Division 3, of the California Government Code, Section 61000 *et seq.* MCCSD provides wastewater treatment, groundwater management, and street lighting to a small rural district of coastal Mendocino County, serving approximately 404 developed parcels with a total population of about 1,000. It is a local public agency as defined in California Water Code (CWC) 71720 and as provided under Section 10795. The MCCSD has power generally to perform all acts necessary to fully carry out the provisions of Division 3, Title 6, of the Government Code in accordance with Section 61060, including adopting ordinances.

The Contingency Plan includes information on the community, background information on the hydrogeology and water supply and demand, criteria for declaring a Water Shortage Emergency, and water shortage response procedures. It is to be used in conjunction with the proposed companion Water Shortage Contingency Plan Ordinance, which provides administrative procedures for declaring a Water Shortage, requirements for water conservation and water wastage prohibitions, and enforcement actions and penalties.

The Urban Water Management Planning Act (UWMPA) requires certain water suppliers to prepare and submit an Urban Water Management Plan (UWMP) in compliance with CWC Section 10610 *et. seq*. An "urban water supplier" means a supplier, either publicly or privately owned, that provides water for municipal purposes either directly or indirectly to more than 3,000 customers or supplies more than 3,000 acre-feet of water annually (CWC Section 10617). The MCCSD is not an "urban water supplier" per se, and is not subject to the UWMPA. Because the MCCSD has fewer than 3,000 connections (in this case, only 425 customers with individual wells), the MCCSD is not required to prepare a UWMP under CWC Section 10610 *et. seq*., nor the Water Shortage Contingency Plan element of a UWMP. However, this Contingency Plan has been prepared following UWMPA guidelines.

Also, since MCCSD is not a traditional water provider, in that it does not have reservoirs, storage tanks, or delivery pipelines, but rather is the responsible agency for groundwater management per CWC Sections 10700-10717, with the authority of a water provider, a number of modifications to the typical formatting of a Water Shortage Contingency Plan were required.

Background

The history of water shortage planning in the area of the Town of Mendocino is closely associated with the development and control over extraction of groundwater in response to historical and geographical limitations over water access and land development. Groundwater is a critical resource since there are no surface reservoirs and riparian rights are very limited. The Mendocino City Community Services District (MCCSD) manages the groundwater supply of the Town of Mendocino and surrounding area. Since 1987, the District has maintained authority for the management of groundwater resources within the District (California Water Code Section 10700 – 10717) and in 1990 they adopted an Ordinance for Groundwater Extraction Permits authorized by Assembly Bill (AB) 786. As part of this legislation they entered into an agreement with the County of Mendocino Public Health Department to regulate groundwater extraction within district boundaries and honor the groundwater extraction allotments issued by the County prior to MCCSD Groundwater Management Program authority.

The current groundwater withdrawal program limits groundwater extraction through terms of the Groundwater Extraction Permit (GWEP) Ordinance. This ordinance requires that an applicant obtain a Groundwater Extraction Permit for any new development, change in use for existing development, expansion of existing use, deepening or reconstruction of an existing well, and drilling a new well. Terms of the permit include completion of a hydrological study, the stipulation of a groundwater allotment for the proposed development based on the District's Water Use Standards, and District verification that the permittee has complied with the conditions of the preliminary Groundwater Extraction Permit prior to issuance of a final Groundwater Extraction Permit. Typically the terms and conditions of the permit require the installation of water conservation plumbing fixtures, such as low-flow showerheads and low-flush toilets, and limit exterior landscaping. Permit conditions also include limiting groundwater extraction to the permit allotment, installing a water meter at the wellhead, and sending in monthly meter readings of water use to the District office.

While the Groundwater Extraction Ordinance has been effective in protecting surrounding wells from groundwater level decline or potential interference of new wells on existing wells, cumulative impacts to the overall aquifer from multiple new water allocations are generally not considered in detail in individual hydrological studies. Faced with a limited supply, the District applied for and received a Department of Water Resources (DWR) grant to further evaluate and model the groundwater system for future water shortage planning and to establish better allocation standards and guidelines. The groundwater study funded by the DWR grant has enabled the development of the Water Shortage Contingency Plan presented here.

DWR Local Groundwater Assistance Grants and MCCSD Groundwater Management Planning

The District has applied for and received two Department of Water Resources (DWR) AB 303 Local Groundwater Assistance grants. A 2002 grant was used to develop a GIS-compatible three-dimensional computer model (MODFLOW) of MCCSD's Mendocino Headland's aquifer (Questa Engineering Corporation and ETIC, 2004). This model is being used to analyze District-wide impacts from groundwater extraction for new developments and is based on existing groundwater data from the 1985 DWR Groundwater Study of Mendocino (DWR, 1985), applicable data from the twenty-two hydrological studies conducted within the District over a ten year period, well logs, and from the existing database of monitoring wells that is used to monitor groundwater levels with the least possible influence from pumping. Some 22 new wells and pump tests were completed in 2003 and used to calibrate the model. Modeling was used to determine the perennial (safe) yield of the aquifer to insure that groundwater extraction was not depleting the Town's water supply, and to calculate the annual groundwater storage.

The 2004 grant project was aimed at better calibrating the groundwater model and updating the Groundwater Monitoring and Management Plans. A primary element is the Water Shortage Contingency Plan, presented here. This Plan is based on below-normal rainfall scenarios input into the updated Mendocino Groundwater Model, climate and well data, and from adaptation of previously developed plans for similar small coastal communities in California (Questa Engineering Corporation and Kennedy Jenks, 2006). The major goals of this Water Shortage Contingency Plan are to establish criteria for when to declare a water shortage through four (4) stages of alert and action, identify appropriate conservation measures and response actions for each water shortage alert stage, and assess water shortage financial impacts. This Water Shortage Contingency Plan, upon adoption by the MCCSD's Board of Directors, will become part of the overall groundwater management plan designed to protect the water resources in and around the Town of Mendocino.

Regional Overview

The Town of Mendocino is located on the Mendocino Headlands between Slaughterhouse Gulch and Big River, in the central part of Mendocino County. The broad headlands peninsula containing most of the Town is bounded on three sides by sea cliffs ranging in height from 40 to 100 feet. State Route 1 dissects the eastern portion of the unincorporated town. **Figure 1** shows the limits of the MCCSD service area. The MCCSD service area serves 404 developed parcels with a total population of about 1,000 that depend on over 420 privately owned wells to provide their potable water supply.

Figure 1. Mendocino City Community Services District Location Map.

Climate

The climate is maritime Mediterranean and is characterized by cool, foggy summers and cool, rainy winters. Windy conditions prevail much of the year with prevailing sea breezes from the west, while gale force winds are not uncommon during winter storms.

The nearest Western Region Climate Center is at Fort Bragg, located approximately 12 miles north of Mendocino. At Fort Bragg, the average rainfall from 1948 through 2003 was 41 inches, with an average maximum temperature in September of 66 degrees, and average minimum temperature of 40 degrees in January. These results are very similar to the climate data reported in the 1985 DWR report, which correlated the Fort Bragg and Point Arena weather stations. MCCSD also maintains a weather station, and information from the MCCSD station was used in the development and calibration of the numerical groundwater model.

The most variable aspect of climate is annual precipitation, which is sensitive to global climate phenomena such as "El Niño." These climate phenomena may help to explain the variability in annual rainfall, with extremes ranging from 16 inches to 71 inches. Rainfall is typically limited to the wet season from October to May, when the East Pacific High Pressure Cell has sufficiently weakened to allow the jet stream to cross the area and bring storms from the Gulf of Alaska and Central Pacific.

Geology

The Mendocino Headlands are underlain by rocks of the Franciscan Complex Coastal Belt (DWR, 1985). The Franciscan Complex rocks range from thinly interbedded greywacke sandstone and shale to more massive greywacke with discontinuous shale beds. The dense greywacke sandstones typically contain a clayey matrix. The Franciscan Complex has a very low primary porosity since rocks are typically well indurated and cemented, and/or contain a clayey matrix. However, rocks of the complex contain significant secondary porosity due to the presence of a pervasive system of rock fractures. This secondary porosity is thought to decrease with depth. Most of the wells produce water from zones of fractured rock, however there is no known or predictable pattern to the rock fracturing and no obvious structural control. Wells which produce water in the range of 15 to 20 gallons per minute (gpm) may be located less than 200 feet from wells which are only capable of producing water at 2 to 3 gpm.

Overlying the Franciscan Complex rocks are four terraces that represent former beach deposits. These marine terraces, named the Caspar Point, Jughandle Farm, Railroad, and Fern Creek terraces, form noticeable physiographic features atop the headlands. The terrace deposits consist of sand and gravel deposits that range up to 45 feet thick, but are mainly 10 to 20 feet thick. Typically the younger terrace deposits do not overlie older terraces, but rest directly atop the bedrock. Often a basal gravel layer occurs in the zone immediately above the bedrock. The upper elevation, or older terraces, which occur mainly east of Highway 1, have more highly weathered marine deposits than the younger terrace deposits and appear to have less porosity than the younger terrace deposits to the west of Highway 1.

The primary porosity of the sands is much greater than the secondary porosity (largely fracture porosity) of the bedrock and therefore the marine terrace deposits provide an important contribution to the overall groundwater storage for the Town of Mendocino.

Groundwater

Groundwater depth is very seasonal, with water table depth typically between 20 and 30 feet during the winter maximum, declining to at least 40 or 50 feet below ground surface during the late fall. Water levels and rates of decline and recharge are closely correlated to rainfall amounts and annual recharge volumes, and fluctuate both seasonally and depending on total rainfall received the previous winter recharge period.

Groundwater flows from the highland areas east of the Town of Mendocino towards the headland cliffs surrounding the town, where it is discharged through a large number of springs at the cliffs edge. Groundwater recharge is almost entirely dependent upon precipitation, and changes in groundwater levels through the year reflect the precipitation pattern. The lowest groundwater elevations are noted in the fall prior to the first substantial rainfall of the wet season. DWR (1985) noted that groundwater elevations appeared to start to rise after about 9 inches of precipitation. Groundwater levels continue to increase in response to each rainfall event throughout the main rainy season from January through April. Following the last large rainfall event in April or early May, the groundwater levels begin their summer decline.

Figure 2 presents a typical well hydrograph showing seasonal groundwater trends.

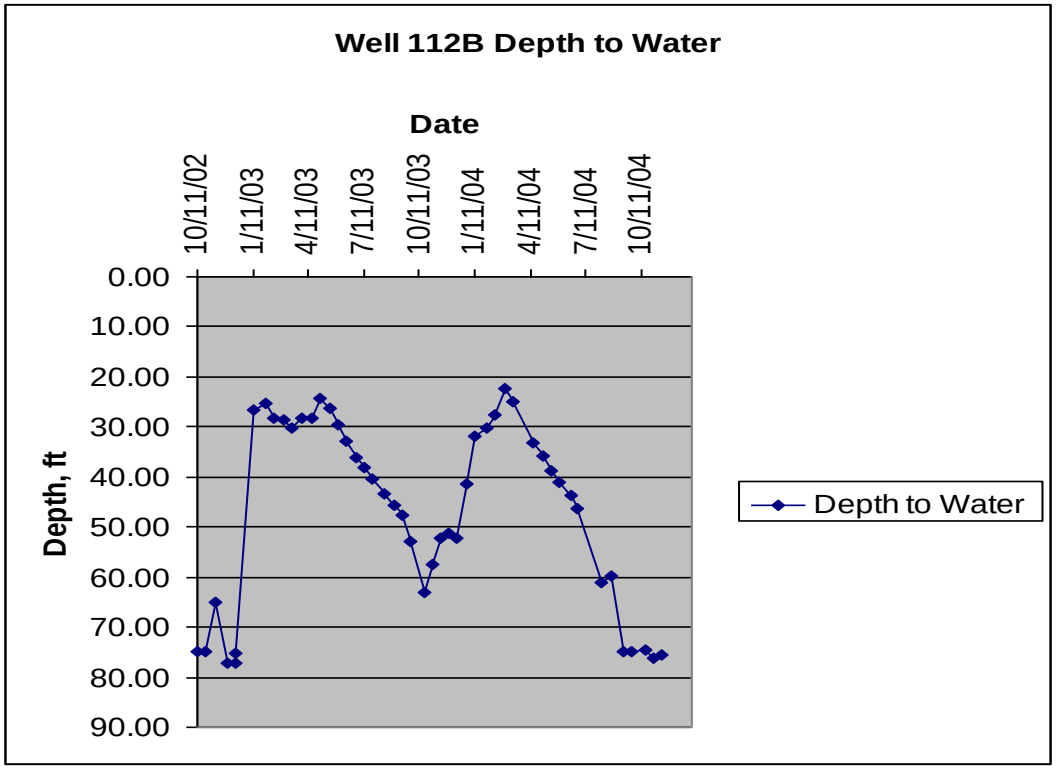

Figure 2: Typical Well Hydrograph

Water Use

Groundwater is the primary water supply for the Town of Mendocino. Individual wells are used to supply both commercial and domestic water usage. Well depths typically range between 40 to 200 feet, with most new wells in the range of 100 to 150 feet. A few older wells are as shallow as 20 to 25 feet. Shallower wells may be completed in marine terrace sands or gravels; however, most wells are composite and are completed in the underlying Franciscan bedrock. Flow rates to wells are quite variable, but typically range from less than 1 gpm to over 25 gpm. Wells that produce above 10 gpm are considered high-yield wells in this area, while typically high-yield wells in most areas produce over 100 gpm. Higher flow rates typically occur over short time intervals and during high water level periods during the winter months.

Because of these low yields, most properties employ storage tanks and the community, through the MCCSD, has implemented significant water conservation measures. Even so, some wells run dry in the late fall months, especially in drier than normal years; water is trucked in to replenish storage tanks at several properties on a regular basis in the fall, and the practice is more widespread during periods of drought.

Water Supply and Demand

The usefulness of a Water Shortage Contingency Plan relies heavily on the accuracy of a water budget. A water budget compares available water supply with water demand over a series of years, including those with average, above-average, and below-average rainfall or drought conditions. The MCCSD water budget has been refined over the past several years with improved modeling of groundwater. This section presents information about how the MCCSD assesses supply and demand based on the pattern of precipitation and groundwater levels. This information and recent groundwater modeling results completed as part of the preparation of the Water Shortage Contingency Plan are used to determine when a shortfall should first be declared, and the severity or stage of that shortfall and subsequent continuing shortfalls.

Table 1 shows the total annual water demand from 2000 to 2005 in gallons per day and acre-feet per water year (July 1-June 31), and illustrates an almost inverse relationship between precipitation and demand.

Table 1: Mendocino Water Demand

Water Demand	2001-02	2002-03	2003-04	2004-05	2005-06
Rainfall (in)	34.85	49.39	36.54	43.09	53.48
gallons per day	272,466	244,566	248,019	207,387	195,691
acre-feet per year	305.22	273.96	277.83	232.32	219.21

The highest demand occurred during the driest year, while demand decreased significantly during a wetter than normal year. Yet demand did not increase significantly following the below-average rainfall year of 2003-2004 when 36.54 inches of rainfall were recorded, which is less than the average rainfall of 41 inches per year. This is likely due to the seasonal timing of rainfall and may also be related to generally improved water conservation, in part due to newly established groundwater allotments.

Figure 3 shows pumping demand versus annual rainfall.

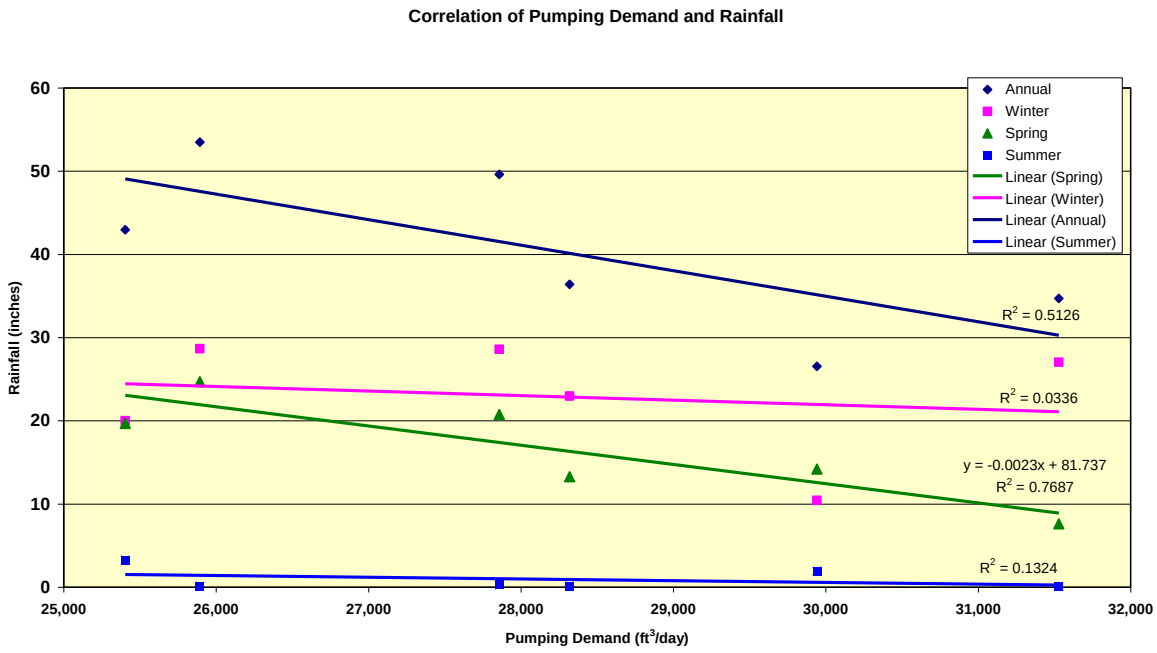

Figure 3: Correlation of Pumping Demand and Rainfall

Figure 3 shows daily demand increased from 25,403 cubic feet/day (190,014 gallons per day) to 31,529 cubic feet/day (235,836 gallons per day) when rainfall fell by 40 percent. This would not be sustainable during periods of water shortage. In the case of a water shortage, the demand would have to decrease with available supply, rather than increase. This is why a Water Shortage Contingency Plan is needed. The Plan must result in decreased water usage through increasingly more strenuous water conservation, so that available supply is not exceeded. Ideally, a 25-percent decline in rainfall (and groundwater recharge) should be matched by a 25-percent decline in water usage.

The chart also shows that the timing of precipitation is an important factor influencing demand. Pumping is more likely to increase with a dry (low-rainfall) spring than with a dry winter, indicating that most recognize the potential onset of drought from a dry winter and implement "voluntary" water conservation measures, but do not make the same association with a dry spring. This indicates the need for additional outreach and education on necessary water conservation and water use reduction, especially during and following dry springs.

In terms of the overall water supply, the annual demand of 200 to 300 acre-feet per year should be placed in context of the total water budget. According to the 2004 *Groundwater Modeling Study of the Mendocino Headlands, Mendocino, California* (Questa Engineering Corporation and ETIC, Inc.), human consumption (domestic well pumping) of water accounted for approximately 15 to 20 percent of estimated outflow between 1997 and 2003. Outflow varied between 974 acre-feet per year (AFY) in 2000/01 and 1,476 AFY in 1997/98. Inflow ranged from 886 AFY in 2000/2001 to 1,604 AFY in 1997/98.

Table 2: Water Balance for Select Years – Acre-Feet/Year

		Inflow			Outflow			
% normal	**Year**	**Precip.**	**GW Inflow**	**Total Inflow**	**Pumping Wells**	**Other Outflow***	**Total Outflow**	**Inflow-Outflow**
84	1984-1985	886	21	908	251	787	1,038	-120
82	2000-2001	863	23	886	251	723	974	-88
103	2001-2002	1,083	19	1,103	264	910	1,174	193
111	1999-2000	1,164	19	1,184	251	907	1,158	6

Average precipitation approximately 1,050 mm/yr.
* Primarily spring discharge over cliff bluffs.

In 2006, the District estimated there were 427 residential well users, in addition to 254 guest units in hotels, bed and breakfasts, and motels that rely on well water. Residential well water users are typically single-family homes. Commercial users include restaurants, retail and service shops, and bars. Approximately 43 percent of the District's monthly meter readings are from residential property owners, 30 percent from commercial businesses, and 20 percent from commercial lodging providers, such as hotels and bed and breakfast establishments. The remaining 7 percent of the readings are from schools and for various miscellaneous uses.

Overall domestic water use is less significant than seepage from cliffs and surface water runoff and comparable to the annual loss to the water supply from evaporation and transpiration. The aquifer has negligible year-to-year carryover storage and annual outflow nearly always balances with inflow. For this reason the MCCSD groundwater supply is extremely sensitive to annual variation in rainfall.

Whatever rainfall infiltrates into the soil and shallow groundwater and is not used essentially seeps out the cliffs or is evaporated from the upper soil layers and shallow groundwater table. Should rainfall that is not infiltrated be able to be stored in a reservoir, there could be as much as a two- to three-year backup supply. However, because of physical conditions making diversion and storage extremely difficult to engineer within the Mendocino headlands, this is not the case, and since annual demand is close to the estimated perennial yield of 259 AFY (rather than a small percent), the available groundwater supply must be carefully allocated during times of drought to avoid extreme water shortages. The importance of water shortage contingency planning can be seen in **Figure 4**, which shows the variability in annual precipitation in the area.

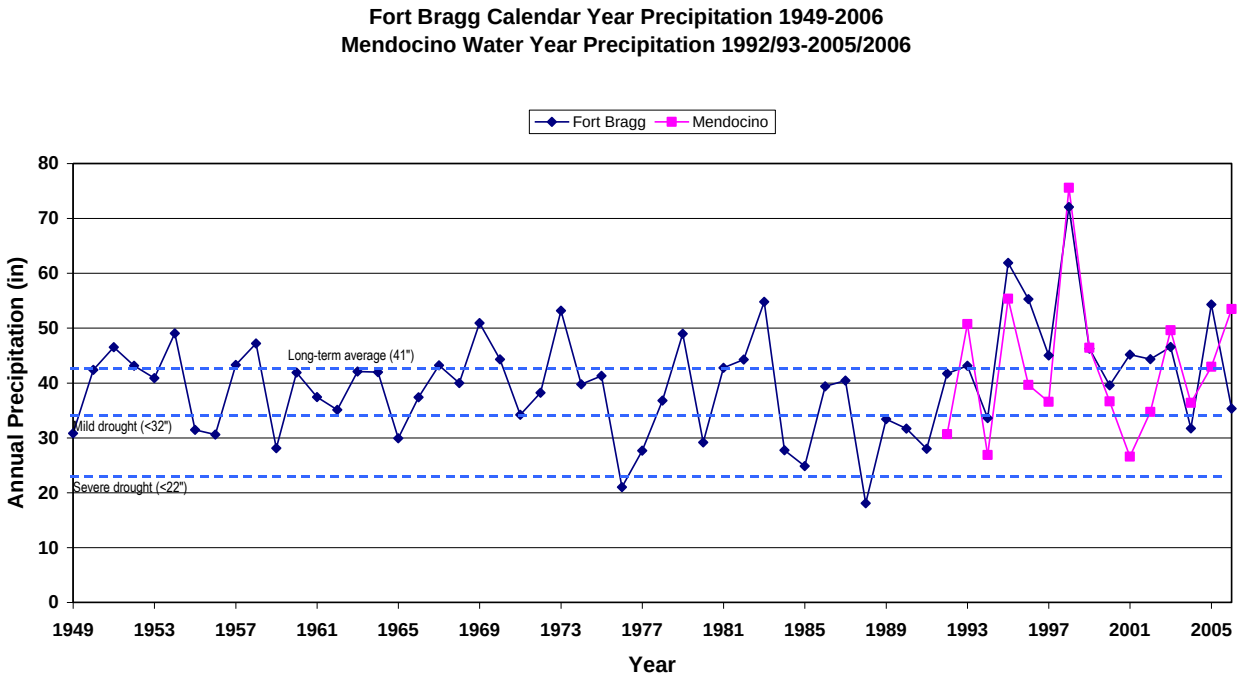

Figure 4: Historical Precipitation

Considering that normal rainfall is approximately 41 inches per year, there have been minor water shortages (less than 32 inches of rainfall) at least once every five years and major water shortages (less than 22 inches of rainfall) every 10 to 30 years , with the most significant in water years 1975/76 through 1977/78 and 1988/89. The last major water shortage in the Town of Mendocino area was in water year 2012-2014. In response to past water shortages, the MCCSD and town residents have enacted their own largely voluntary water conservation measures, such as use of paper plates in restaurants, wise domestic use of potable water, and severely limiting landscape irrigation and other outdoor water usage. Although some customers supplement their well water with imported (trucked in) water even during periods of normal rainfall, this practice increases during times of drought. While emergency measures were informally issued, no formal water shortage emergency has ever been declared in Mendocino. **Figure 4** shows that, if available, a Water Shortage Contingency Plan could have been instituted several times in the 58 years prior to 2006, and based on past history, is very likely to be required again in the not-too-distant future.

In terms of future water demand, it should be noted that the MCCSD area is largely "built-out," with no significant increase in water demand expected over the next 10 to 20 years.

Stages of Action and Water Shortage Condition Criteria

A water shortage emergency should be declared when a lack of groundwater supply appears imminent, such as after an unusually dry winter, or following a period of consecutive dry seasons. For the MCCSD, groundwater supply is generally adequate during the wet season from December through April, even during minor drought years. The critical period, when supplies are most likely to be short, is typically from May through November. In order to determine the severity of the potential shortfall, the District must compare the total expected water supply against the expected demand. Due to the limited available storage volume of the Mendocino Groundwater Aquifer, lack of inter-annual (carryover groundwater) storage with no reservoirs, and no existing water rights to neighboring rivers or groundwater basins, the MCCSD area really is on a water shortage watch every year. This means the carryover surplus from an unusually wet year will be quickly erased by a succeeding dry year, often evident as early as February 1st. For this reason, the severity of the water shortage versus demand must be analyzed each month and since the supply is strongly seasonal, this analysis and determination of water shortage stage must be completed well before the middle of the rainy season, in early February. In order to be most effective, water conservation measures should always be in effect and water shortage response, including mandatory water conservation, should be enacted as soon as supply versus demand can be reliably forecast from measurement of precipitation and groundwater levels.

The basic information needed for determining the severity of a pending water shortage or drought for the MCCSD area is from measurement of cumulative rainfall. Precipitation falling directly on the Headlands is the primary source of groundwater recharge, and water levels in the area are strongly influenced by rainfall. During the winter and spring months, the variation of groundwater levels between potential water shortage conditions is within the range of potential natural variation. This is because groundwater recharge and water level recovery lags by several months after incident rainfall. Therefore, groundwater level is a poor predictor of potential upcoming water shortage conditions, especially during the winter. Only during the onset of the dry season (late April to early May) is measurement of groundwater levels an adequate indicator of water supply.

Groundwater modeling shows groundwater levels in the summer months are most sensitive to the preceding wet season starting October 1st, as well as late winter and spring starting from February 1st of the previous year.

Four stages of water shortage are recognized:

1. Mild Drought (alert)
2. Moderate Drought (warning)
3. Severe Drought (emergency)
4. Historic Drought (crisis)

The four stages of water shortage, with criteria for declaration of a water shortage based on cumulative rainfall, are presented in **Table 3**.

Table 3: Water Shortage Stage Criteria (Previous Year with Normal Rainfall)*

Water Shortage Stage	Severity	Rainfall	Expected Recurrence	Evaluation Date/ Cumulative Rainfall Total		
				Jan. 31	March 31	May 31
1 Alert	mild	75% to 82.5% of normal	±5 years	14-19”	29-32” and <7” since Feb 1	32-35” and <12” since Feb 1
					26-29” and 7-18” since Feb 1	29-32” and 10-20” since Feb 1
					22-26” and >18” since Feb 1	24-29” and >20” since Feb 1
2 Warning	moderate	60% to 75% of normal	±8 years	10-14”	26-29” and <7” since Feb 1	29-32” and <10” since Feb 1
					22-26” and 7-18” since February 1	24-29” and 10-20” since February 1
					16-22” and >18” since Feb 1	20-24” and >20” since Feb 1
3 Emergency	severe	50% to 60% of normal	±15 years	8-10”	22-26” and <7” since Feb 1	24-29” and <10” since Feb 1
					16-22” and 7-18” since Feb 1	20-24” and 10-20” since Feb 1
4 Crisis	historic	less than 50% of normal	±50 years	<8”	16-22” and <7” since Feb 1	20-24” and <10” since Feb 1
					<16”	<20

**Rainfall measured from October 1.*

The criteria presented in **Table 3** should be used each year to determine water shortage onset stage and modified appropriately if there is a pre-existing water shortage (drought from the previous year or earlier), according to the following criteria:

- If there is a pre-existing **Stage 1 Water Shortage,** follow the Water Shortage Condition Criteria without modification.
- If there is a pre-existing **Stage 2 or 3 Water Shortage,** modify the Water Shortage Condition Criteria recommendation for the appropriate date to the next most severe water shortage condition.

To stay on track the MCCSD must evaluate conditions on a regular schedule. Such a schedule must enact a Water Shortage Contingency Response Plan as soon as a shortage is forecast.

Table 4: Calendar for Declaring Water Shortage & Determining Water Shortage Response Plan

Target Date	Action
October - December	Monitor rainfall amounts
Late January	Prepare written status report on water supply conditions; report to Board
Early February	Present initial estimate of water supply availability for year ahead to Board
Early March	Present revised estimate of water supply availability for year ahead
Mid to late March	MCCSD determines target water budget and need for mandatory response.
April through May	Monitor select wells. MCCSD formally declares Water Shortage Emergency, implements provisions of emergency ordinance, if applicable
End of May	Mandatory water shortage regulations become effective for shortage stage

If water shortage is not declared by the end of May, no further evaluation is required until the following January 31. However, if a water shortage condition is defined prior to May 31, there should be additional evaluation dates on August 31, November 30, and December 31 to evaluate whether the water shortage condition should be continued, increased in stage, or terminated. Depth to groundwater and rainfall criteria shall determine if: (1) initial voluntary water conservation or other mitigation measures were sufficient to ease the water shortage restrictions, (2) conditions have worsened and more stringent water shortage restrictions and mandatory water conservation measures are necessary, or (3) conditions have remained unchanged.

August 31 Evaluation Date

Typically, no significant rainfall occurs during the period from May 31 to August 31; therefore, depth-to-groundwater levels are considered as the primary tool for groundwater supply evaluation for the end of summer. Depth-to-groundwater levels are defined for five indicator wells that will be used as the primary basis for declaration of a potential water supply shortage during the summer months, based on model results and historic data. Because a range of conditions may occur based on this analysis, the average condition should be considered as the indicator of the water shortage condition, in which a majority of wells (e.g., three out of five) fall within the depth-to-water criteria for a particular stage (different wells may sometimes indicate different stages).

Table 5: Indicator Well Groundwater Levels to Trigger Water Shortage

	No Water Shortage	Stage 1	Stage 2	Stage 3	Stage 4
Well 139					
August	<18’	18’-22’	22’-26’	26’-34’	>34’
November or December	<15’	15’-19’	19’-23’	23’-29’	>29’
Well 25					
August	<38’	38’-40’	40’-44’	44’-50’	>50’
November or December	<35’	35’-37’	37’-41’	41’-47’	>47’
Well 134A					
August	<17’	17’-19’	19’-23’	23’-30’	>30’
November or December	<14’	14’-16’	16’-20’	20’-27’	>27’
Well 134B					
August	<17’	17’-19’	19’-23’	23’-30’	>30’
November or December	<13’	13’-15’	15’-19’	19’-25’	>25’
Well 136					
August	<14’	14’-16’	16’-20’	20’-24’	>24’
November or December	<14’	14’-16’	16’-20’	20’-24’	>24’

November 30 and December 31 Evaluation Dates

Modeling results indicate that unless rainfall is well below average in the fall, groundwater levels can be restored to near-normal conditions, even when the previous year is drier than normal and there is a lack of significant carryover storage in the aquifer. This of course depends on the severity of the pre-existing water shortage condition. The criteria are based on the December 31 conditions. November 30 is considered an interim date, so that if high rainfall occurs in November, water shortage conditions can be modified prior to December 31.

For the November 30 and December 31 evaluations, the decision-making data will consist of both rainfall and depth to groundwater. If rainfall and depth to groundwater evaluations do not agree, then the more conservative (severe) of the conditions will be used. The rainfall conditions are defined as cumulative rainfall since October 1 in relation to the pre-existing water shortage condition. **Table 6** shows the decision matrix, should there be a continuing water shortage.

Table 6: Water Shortage Stage Criteria for Continuing Water Shortage

Pre-existing Water Shortage Stage	November 30, December 31	Action
1	>12” since Oct 1	No Water shortage
	<12” since Oct 1	Continue Stage 1
2	>16” since Oct 1	No Water shortage
	12-16” since Oct 1	Change to Stage 1
	<12” since Oct 1	Continue Stage 2
3	>22” since Oct 1	No Water shortage
	16-22” since Oct 1	Change to Stage 1
	12-16” since Oct 1	Change to Stage 2
	<12”	Continue Stage 3
4	>22” since Oct 1	Change to Stage 1
	16-22” since Oct 1	Change to Stage 2
	12-16” since Oct 1	Change to Stage 3
	<12”	Continue Stage 4

Estimate of Minimum Supply

The minimum available groundwater supply (defined as that available to water supply wells) has been estimated from long-term water budget data compiled for the 2004 Groundwater Modeling Study (Questa and ETIC, 2004) and from the 2006 Mendocino Drought Contingency Modeling Scenarios (Questa and Kennedy-Jenks, 2006). **Table 2** presented earlier, shows a general water balance completed for the Mendocino Headlands Aquifer. The 2004 report determined a safe yield for the aquifer of 259 AFY.

Climate records indicate that a minimum supply was probably reached near the end of 1977 after two water shortage years, and near the end of 1989 after an extremely dry fall. In these instances the available groundwater supply likely dropped to 40 percent of the average. Forty percent of the perennial yield of 259 AFY is 104 AFY. This yield is assumed to be a reasonable estimate of minimum supply. As discussed subsequently, a 40-percent water demand reduction is recommended during severe, or historic Stage 4, droughts.

Catastrophic Supply Interruption Plan

In addition to drought-caused water shortages, there are a number of scenarios that could affect the available water supply. This includes floods, earthquakes, fires, and spills of hazardous materials.

There is no significant threat to disruption of water storage facilities or transmission lines from earthquakes, floods, or fires within the MCCSD service area, since nearly all water is extracted by private wells rather than transmitted through District-owned pipelines. A more significant potential catastrophic occurrence is the threat of contamination from a hazardous materials spill or leaking underground storage tank that could spread fairly rapidly, given the permeability and limited extent of the aquifer. The potential threat of a spreading plume of contaminated groundwater is exacerbated by the high density of active wells.

Records of leaking underground fuel tanks (LUFTs) are compiled in a database that can be accessed through the State Water Resources Control Board Website (geotracker.swrcb.ca.gov). The database includes three sites in Mendocino: 1) a fuel tank at the Mendocino Headlands Park at 725 Main Street, 2) the Presbyterian Church at 44831 Main Street, and 3) the Chevron Station at 44901 Main Street. The Park tank is reported for a leak of gasoline discovered in 1998, for which no further action has been instigated, although the case is still considered open. The Presbyterian Church is reported for a leak of diesel fuel oil first discovered in 1993. Following excavation of contaminated soil and replacement with clean fill, the case was officially closed in 2004. The only active site is the Chevron Station at 44901 Main Street. Records indicate gasoline leakage from buried fuel tanks and ongoing site assessment since 1988, when the case file was opened. A network of monitoring wells is currently located around the buried tanks that supply the station. According to the quarterly monitoring report dated July 1, 2006, there was significant groundwater contamination from gasoline, and benzene, toluene, ethylene and xylene (BTEX). This contamination was concentrated in Monitoring Well 2, located between the Pump Island and Church Street. Sampling and testing results indicated total petroleum hydrocarbons occurring as gasoline as high as 70,000 micrograms per liter on July 23, 2001 have typically been declining to as low as 5,900 micrograms per liter in 2006.

Groundwater monitoring and vigilance in containing and remediating any contaminant spills is especially important considering the high density of water wells in the community. A spill from one of several underground fuel tanks would pose a major threat to the available water supply and negatively impact the water balance. It is therefore considered critical that remediation efforts and actions following detection or suspicion of groundwater contamination be carefully coordinated between the MCCSD, the North Coast Regional Water Quality Control Board, the County of Mendocino, and the responsible party.

Various possible catastrophes and MCCSD response actions are summarized in **Table 7**.

Table 7: Preparation Actions for a Catastrophe

Possible Catastrophe	Summary of Actions
Regional Power Outage	Individual wells and electric pumps not operable. MCCSD to contact utility (PG&E) for repair service. MCCSD has standby generator for its use and 6,000-gallon storage tank available to customers.
Earthquake/Flood Damage	MCCSD makes customer visits and initiates repairs to wastewater treatment plant. Temporary distribution of trucked water by private vendors for prolonged outages, or use of private generators and bottled water. Responsibility of individual customer to check wells and pump/pressure tanks and repair where broken.
Locally Contaminated Aquifer and Spreading Plume	Switch to alternate source for drinking water (i.e., bottled water, trucked-in water). MCCSD to test District monitoring wells to see if supply may still be suitable to use for non-potable uses such as showers, toilets, and outdoor uses. MCCSD to coordinate with responsible party, Mendocino County Environmental Health, California Department of Health Services, and North Coast Regional Water Quality Control Board re: aquifer testing, investigation, and cleanup. MCCSD to provide emergency supply from 6000-gallon storage tank.

Water Demand Reduction Methods, Prohibitions, and Penalties

General

This Contingency Plan's voluntary and mandatory water conservation and water demand reduction methods, including various prohibitions and penalties based on the proposed water wastage prohibition and water conservation ordinance, are summarized in **Table 8**. In general, uniform District-wide rationing is not feasible since District residents and businesses use groundwater pumped from private wells; therefore, water can only be shut off with well closure by court order for blatant violations. In addition, the MCCSD has established water allotments to equitably allocate the groundwater resource to all developed parcels. Allotments are based on the size and type of parcel development to ensure that each developed parcel has a proportionate share of the groundwater supply. As **Table 8** shows, when a Stage 3 Water Shortage Emergency is declared, customers with allotments would have their allotment reduced 20 percent, with a 40-percent reduction during a Stage 4 Water Shortage Emergency. Following the water shortage emergency, allotments will be increased to the normal amounts calculated from the District's Water Use Standards.

Most water use restrictions, mandatory water conservation measures, and prohibitions with penalties addressed in the proposed Ordinance are focused on a reduction in landscape watering and prohibition of outdoor washing for non-sanitary needs, with fines for reported repeat violators. Unauthorized use of water would include watering of landscaping in a manner that allows excess water to run to waste, uncorrected plumbing leaks, outdoor washing of hard surfaces without the use of a positive shut-off nozzle, etc. Any hosing of exterior surfaces would be prohibited during a Stage 3 or Stage 4 Water Shortage Emergency.

Table 8: MCCSD Water Shortage Contingency Plan

Water Shortage Stage/ Condition	Customer Responsibilities	Water District Activities	Penalties
1. Conservation Alert: Mild shortage. (22.5-25% below normal rainfall) Frequent condition after March 1 due to lack of inter-annual (carryover) storage.	➢ Voluntary water conservation ➢ Prohibition of water waste (hose washing driveways, parking area, walkways or other paved surface, except as is required for sanitary purposes) ➢ Display of conservation information by hotels and restaurants	➢ Ongoing public information campaign, media outreach ➢ Request voluntary water conservation with 10% use reduction	➢ Warning letter on need for water conservation ➢ Possible penalties on blatant water wastage after first warning
2. Mandatory Restrictions: Moderate Shortage (25-40% below normal rainfall)	➢ Designated irrigation times ➢ No vehicle washing except with a hand-held bucket or hose equipped with a positive shutoff nozzle ➢ Prohibition on refilling of decorative fountains or ponds unless such water is part of a recycling system. ➢ No refilling of hot tubs or swimming pools. ➢ Drinking water served at restaurants only upon request	➢ Request voluntary 15% reduction ➢ Intensify media outreach and information campaign	➢ Warnings ➢ Educational letter from MCCSD representative ➢ Water wastage penalties (e.g., fine for any person that causes or allows the water to run off landscape areas into adjoining streets, sidewalks, or other paved areas due to incorrectly directed or maintained sprinklers or excessive watering and hard surface washing)
3. Limited Rationing: Serious Shortage (40-50% below normal rainfall)	➢ 20% reduction in water usage by all GWEP holders. ➢ Request 20% reduction in water usage by all developed property owners. ➢ Irrigation audit for landscape maintenance. ➢ Recommend use of paper plates at restaurants to avoid dishwashing.	➢ Require a 20% allotment reduction ➢ Intensify public relations ➢ Temporary moratorium on new groundwater extraction permits for new development, expansion of existing use, and changes of use, which require a hydrological study. ➢ Prohibitions on aquifer pump tests.	➢ Warnings ➢ Surcharge or penalty for repeat offenders
4. Full Rationing: Severe Shortage (>50% below normal rainfall)	➢ Rationing for all developed property owners with GWEPs ➢ 40% reduction in water usage by all property owners with GWEPs ➢ Mandatory GWEP for all developed parcel owners	➢ 40% allotment reduction by all developed parcel owners ➢ Intensify all Stage 3 actions ➢ MCCSD coordinates outside water delivery to meet demand, provided by private vendors. ➢ MCCSD requires all developed property owners to obtain a GWEP.	➢ Warnings ➢ Rigorous enforcement with penalties and surcharges ➢ Possible revocation of GWEP for serious repeat violators

Note: Each increasingly severe water shortage stage includes the requirements, activities, and penalties of the less severe stages. In Stage 4, suppliers (vendors with water trucks) who anticipate they can handle the demand can supply water shortage water privately.

The MCCSD has access to a well owned by the State Park and a 6,000-gallon tank located down-gradient of the downtown area aquifer that could also supply emergency drinking water for a limited period.

At Stage 4 the intention of the plan is to restrict water demand to vital functions, such as human consumption, sanitation, and fire protection. This should equate to a minimum supply of 50 gallons per person per day or approximately 50,000 gallons per day, about one-quarter of the average daily demand calculated for the Town of Mendocino with above average rainfall.

Demand Reduction

Water Wastage Prohibition

The companion Ordinance prohibits the following water wastage practices:

- Indiscriminate running of extracted groundwater that is wasteful and without reasonable purpose.
- Allowing extracted groundwater to spill into streets, curbs, or gutters.
- Using extracted groundwater in any manner that results in runoff beyond the immediate area and intended purpose of use.
- Watering using extracted groundwater to establish new lawns and other high water demand (non-Xeric) landscaping

Water Conservation

The companion Ordinance limits the watering of existing established landscaping to manual garden hose watering or use of a drip irrigation system between the hours of 7:00 PM and 10:00 AM. However, since extensive outdoor landscaping is not common in this community, the Water Conservation portion of the companion Ordinance focuses on the following:

- **Washing of Vehicles**. The washing of personal and commercial motor vehicles, including boats and other equipment, is permitted only by means of a "bucket and sponge," and a hose with a shutoff nozzle.
- **Cleaning of Exterior Surfaces**. The hosing down of porches, sidewalks, driveways, and other hard surfaces is prohibited, except as needed for health and safety reasons.
- **Cleaning of Structures**. Using a hose to clean the exterior of buildings is prohibited, except as is necessary to avoid creation of a public nuisance.

- **Pools and Spas**. Emptying and refilling a swimming pool, hot tub, or spa except to prevent or repair structural damage or to comply with public health regulations, are prohibited. All pools, hot tubs, and spas are to be covered to prevent evaporative losses when not in use.
- **Fountains**. Use of decorative fountains is discouraged. Using water to operate a fountain is prohibited unless such water is recirculated.
- **Visitor-Serving Facilities**. Owners and managers of hotels, motels, bars, restaurants, and other visitor-serving facilities are to display placards or decals promoting public awareness of the need for water conservation and/or advising the public that waste of water is prohibited.
- **Restaurants**. Restaurants in the District are only to serve water to restaurant customers upon request.
- **Construction**. No potable water obtained from the MCCSD groundwater supply may be used for soil compaction or dust control during construction activities. All water hoses used in connection with construction activities are to be equipped with an automatic shutoff nozzle.

Water conservation would be voluntary during a declared Stage 1 Water Shortage and become mandatory in Stages 2 through 4.

Recycled Water

MCCSD currently provides recycled water to Mendocino High School for irrigation of its athletic field. There are no other large turf grass areas or large blocks of landscaping with high water demand where it would be feasible to bring in recycled water for landscape irrigation.

Indoor Water Conservation and Plumbing Retrofit Program

MCCSD does not have direct building permit approval authority over plan submittals for new buildings or substantial remodeling projects, or retrofit of existing structures where a remodeling building permit has submitted, which would enable it to require use of water-conserving indoor plumbing fixtures. Since the Town of Mendocino is an unincorporated area, Mendocino County has planning/building approval authority in this area. Mendocino County has an existing Water Conservation Ordinance requiring the use of low-flush toilets for all new building and remodeling projects. All projects that also require a groundwater extraction permit issued by MCCSD are referred to the District by the County. Use of water-conserving indoor plumbing fixtures (i.e., low-flush toilets, low-flow showerheads, water-conserving water softeners, commercial dishwashers, etc.) is made a condition of approval for both the County building permit and the groundwater extraction permit.

Since the MCCSD does not have planning/building approval authority, it currently does not administer a water-conserving fixture retrofit rebate program.

Public Education and Outreach

The Town of Mendocino and surrounding area is very unique from a water supply and water conservation planning perspective. All of the residents and business owners in the community are aware of the limited water supply available to them from their individual wells, and virtually all (by necessity) have a strong water conservation understanding and ethic. Nearly all are also very aware of the need to "ramp up" water conservation efforts late in the summer and fall, even during normal rainfall years, and to achieve even higher water conservation practices during times of drought.

Accordingly, the MCCSD public education and outreach program regarding water conservation will focus on the following:

1) Informing the public and MCCSD customers when a Water Shortage has been declared by the District Board and providing additional water conservation tips.

2) Informing tourists and visitors to the community of the ongoing, perennial water supply situation and any declared Water Shortage Emergencies, as well as the need for them to help conserve water.

4) Performing water conservation "audits" at the request of residential and business customers to help identify additional water conservation strategies.

5) Providing brief water conservation seminars to community groups and local schools.

Public education and outreach during declared Water Shortage Emergencies will be achieved by the following mechanisms:

- Newspaper articles
- Information on MCCSD Website (water conservation links)
- Billing inserts
- Tent cards on water conservation in hotels and restaurants.

Penalties

The Ordinance provides for enforcement mechanisms and a penalty structure, which includes written warnings by MCCSD staff for first offenses, with penalties and surcharges on customer bills for subsequent violations.

Analysis of Fiscal/Economic Impacts During Drought

Drought Impact on MCCSD

A drought or water shortage emergency can potentially have significant adverse financial impacts on most Water Districts or water providers, as typically user fees and other revenues for

metered water services decrease as water usage drops due to water conservation, while services and district costs related to public outreach, including media advertising, water conservation education, and staff time for assessments, audits, and code enforcement for water wastage and poor water conservation practices increase sharply.

Due to MCCSD's unique structure, it is not thought that a drought, and the subsequent declaration of a drought emergency, will have a serious effect on District financing, or the ability of MCCSD to provide additional services during a drought. That is because MCCSD's groundwater management budget is limited to approximately $140,000 per year. Most of the District's groundwater management planning has been supported by grants. Revenues to support MCCSD groundwater management responsibilities are based on an equivalent single-family dwelling (ESD) rate structure, and is calculated from the User Category Index as set forth in the Monthly Sewer Service Charges Ordinance. This charge is computed for each individual developed parcel use within the District, whether or not the parcel is connected to the sewer system. Although water usage, and consequently wastewater flows, will likely drop during times of drought, the charge fee collected for groundwater management services provided by the District is relatively stable.

District costs will rise during the declaration of a Water Shortage, especially Stages 3 and 4, principally as staff costs needed for conducting public outreach and education, and in staff time to track water usage, issue citations, and calculate estimates of water savings needed for allocation reductions.

It is currently thought that MCCSD staff can handle the duties associated with the proposed Water Shortage Contingency Plan Ordinance and the Contingency Plan adoption as part of their current workload during a normal year, or during a Stage 1 declared Water Shortage. Part of the reason for this is the strong water conservation ethic already established in the Town of Mendocino area. All residents and businesses are keenly aware of the limited supply of water in the area and nearly all implement self-imposed water conservation measures that reflect this knowledge. Those who import potable water from time to time also realize the high costs associated with outside water purchase and the prudence of water conservation.

The MCCSD maintains a very minimal reserve fund that could potentially be drawn upon to partially support increased groundwater management and water conservation program requirements during declared Water Shortage Emergencies. It would also be necessary for the District to increase the charge fee on the monthly sewer bill to fund the increased groundwater management and water conservation activities. This would require public noticing of the proposed charge fee increase and approval by the Board of Directors.

Drought Impact on the Local Economy

Although the Town of Mendocino's economy is dependent on local and area-wide tourism, and although the Town is located along the coast with water-dependent recreational activities, drought and water shortages are not thought to adversely affect this sector of the local economy. For one thing, winter climate along the north coast tends to be much improved during drought years compared to years of normal and above-average rainfall, and if anything there would likely

be a small upsurge in tourism associated with longer periods of favorable weather conditions. In addition, the tourism industry is not dependent on streams or reservoirs subject to water level fluctuations during times of drought.

It is highly unlikely that any commercial business would have to cut back or curtail activities during even a severe or historic water shortage. Restaurants would only offer water to customers upon request, and could provide bottled water. Hotels could send laundry service outside of the area to be cleaned. Many commercial businesses currently import water via private-vendor water trucks during the late summer and fall months and would continue to do so, with water importation perhaps beginning earlier for these customers, as would a number of additional customers who do not now typically import water, except during droughts.

During a prolonged Stage 4 water shortage occur, a significant amount of water importation would be needed. Meeting the absolute minimum demand of 25 gallons per person each day for basic sanitation would require approximately 25,000 gallons be trucked in, equivalent to about 8.5 water trucks holding 3,000 gallons each. Each water truck would cost about $300, with a total daily cost of about $2,500. Assuming, per the Drought Scenario Model, most wells are dry by July 1 and not replenished until December 1 (five months), this corresponds to about 150 days of water importation, or an impact of approximately $375,000 on the local economy. Therefore, the cost of importation during a severe water shortage is expected to be significant. As a result, even though local revenue loss to the local economy during a severe drought is unlikely, there could be a significant increase in cost of living and in doing business locally.

Considering that development of a municipal water supply, storage, and transmission system would likely cost several million dollars, there are no readily identifiable alternative supply sources. The Town will likely continue to rely on strict water conservation and trucked-in water during the inevitable severe to historic drought that typically occurs every 15 to 50 years.

Use Monitoring Procedure

In order to assess the effectiveness of this Water Shortage Contingency Plan, the MCCSD should continue to monitor customer water use (as reported on meter readings and through mail-in surveys), groundwater wells in the monitoring network, and wastewater treatment plant flow as indicators of groundwater extraction. Some water use mechanisms are presented in **Table 9**.

Table 9: Water Use Monitoring Mechanisms

Mechanisms for determining actual reductions	Type and quality of data expected
Continue monitoring of treatment plant flow.	Good record of daily bulk consumption, but little detail.
Customer Survey	Identification of water use patterns, fair quality

Contingency Plan Implementation Recommendations

Prior to the adoption of the Water Shortage Contingency Plan (WSCP), the District will hold a public hearing after publication of notice pursuant to Section 6066 of the Government Code on the proposed WSCP groundwater management program. The District shall adopt a Resolution of Intention to implement the WSCP program at that hearing. A copy of the WSCP will be published in a newspaper of general circulation following the adoption of the Resolution of Intention. The Board of Directors will hold a second hearing to consider protests by eligible registered voters residing within the boundaries of the District to the implementation of the WSCP program. If there is not a majority protest represented by more than 50% of eligible registered voters of the District, the Board may adopt the WSCP by resolution within 35 days. The resolution adopting the WSCP will be considered for adoption by the Board of Directors at a scheduled and noticed public meeting.

Summary

The Water Shortage Contingency Plan presented here is intended to provide technical support, including program implantation, for the companion Water Shortage Contingency Plan Ordinance to curtail demand to meet available supply. Since supply is primarily limited to a shallow, limited, and seasonally replenished groundwater aquifer, the WSCP should be successful for mild to moderate water shortages, while a severe water shortage (two or more years of drought) is likely to have severe impacts that cannot be fully mitigated by water demand reduction management. The only alternatives will be to further reduce demand through innovative use of recycled water and conservation or to develop another supply. Such a supply would likely involve sharing of water rights that are now reserved for other uses, such as those of the Big River. Other options, such as a desalinization plant, are infeasible for a small town until such time that the technology is sufficiently improved to reduce costs. Nevertheless, the WSCP is considered to be effective except in the most severe cases and should improve advance planning for water shortages.

References

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