



Temperature Standards

*When does protecting Aquatic Life
become extreme?*

WESTCAS ANNUAL CONFERENCE

June 26-28, 2013

Nancy Keller, Regulatory Compliance Specialist
City of Pueblo Water Reclamation Facility

Calculation Method

- *The temperature criteria were developed for warm, cold and cool temperature regimes based on review of the temperature toxicity data in the literature.*
 - *Where multiple studies were conducted for each species, the average upper optimum temperature was calculated before entering them into the Maximum Weekly Average Temperature (MWAT) equation. Species MWATs were ranked and the value was selected that protects 95 percent of the species.*
 - *The Daily Maximum (DM) was developed by calculating an average ultimate incipient lethal temperature for each species, ranking the species and selecting the value that protected 95 percent of the species.*



Two types of criteria were adopted

- *“DAILY MAXIMUM TEMPERATURE (DM)”*
 - *provides protection against lethal effects that elevated temperature can cause.*
 - *the highest two-hour average water temperature recorded during a given 24-hour period.*
 - *The DM of a water body shall not exceed the acute temperature criterion more than once in three years.*



Two types of criteria were adopted

- “*MAXIMUM WEEKLY AVERAGE TEMPERATURE (MWAT)*”
 - *moderate temperature fluctuations can be tolerated as long as the upper incipient lethal temperature is not exceeded for extended periods of time.*
 - *the largest mathematical mean of multiple, equally spaced temperatures over a seven-day consecutive period, with a minimum of three data points spaced equally through the day.*
 - *For lakes and reservoirs, the summertime MWAT is assumed to be equivalent to the maximum WAT from at least three profiles distributed throughout the growing season (generally Jul-Sep).*
 - *The MWAT of a water body shall not exceed the chronic temperature criterion more than once in three years.*



Special Considerations

- *The Commission determined that the temperature requirement should maintain a normal pattern of seasonal fluctuation. This is intended to preserve thermal cues for aquatic life cycles including spawning, egg incubation, and fry rearing.*
- *Winter season table value criteria were established.*

Exemptions

- *Air temperature excursion: when the daily maximum air temperature exceeds the 90th percentile value of the monthly maximum air temperatures calculated using at least 10 years of air temperature data.*
- *Low-flow excursion: when the daily stream flow falls below the acute critical low flow or monthly average stream flow falls below the chronic critical low flow*
- *Lakes and reservoirs: provided that an adequate refuge exists in water below the mixed layer. Adequate refuge depends on concurrent attainment of applicable dissolved oxygen standards*

<u>TEMPERATURE TIER</u>	<u>TIER CODE</u>	<u>SPECIES EXPECTED TO BE PRESENT</u>	<u>APPLICABLE MONTHS</u>	<u>TEMPERATURE STANDARD (°C)</u>	
				<u>MWAT</u>	<u>DM</u>
<u>Cold Stream Tier 1</u>	<u>CS-I</u>	<u>brook trout, cutthroat trout</u>	<u>June – Sept.</u>	<u>17.0</u>	<u>21.7</u>
			<u>Oct. – May</u>	<u>9.0</u>	<u>13.0</u>
<u>Cold Stream Tier 2</u>	<u>CS-II</u>	<u>Other cold-water species</u>	<u>April – Oct.</u>	<u>18.3</u>	<u>23.9</u>
			<u>Nov. – March</u>	<u>9.0</u>	<u>13.0</u>
<u>Cold Lakes</u>	<u>CL</u>	<u>brook trout, brown trout, cutthroat trout, lake trout, rainbow trout, Arctic grayling, sockeye salmon</u>	<u>April – Dec.</u>	<u>17.0</u>	<u>21.2</u>
			<u>Jan. – March</u>	<u>9.0</u>	<u>13.0</u>
<u>Cold Large Lakes (>100 acres surface area)</u>	<u>CLL</u>	<u>rainbow trout, brown trout, lake trout</u>	<u>April – Dec.</u>	<u>18.3</u>	<u>23.8</u>
			<u>Jan. – March</u>	<u>9.0</u>	<u>13.0</u>
<u>Warm Stream Tier 1</u>	<u>WS-I</u>	<u>common shiner, Johnny darter, orangethroat darter</u>	<u>March – Nov.</u>	<u>24.2</u>	<u>29.0</u>
			<u>Dec. – Feb.</u>	<u>12.1</u>	<u>14.5</u>
<u>Warm Stream Tier 2</u>	<u>WS-II</u>	<u>brook stickleback, central stoneroller, creek chub, longnose dace, Northern redbelly dace, finescale dace, razorback sucker, white sucker</u>	<u>March – Nov.</u>	<u>27.5</u>	<u>28.6</u>
			<u>Dec. – Feb.</u>	<u>13.8</u>	<u>14.3</u>
<u>Warm Stream Tier 3</u>	<u>WS-III</u>	<u>all other warm-water species</u>	<u>March – Nov.</u>	<u>28.7</u>	<u>31.8</u>
			<u>Dec. – Feb.</u>	<u>14.3</u>	<u>15.9</u>
<u>Warm Lakes</u>	<u>WL</u>	<u>black crappie, bluegill, common carp, gizzard shad, golden shiner, largemouth bass, Northern pike, pumpkinseed, sauger, smallmouth bass, spottail shiner, striped bass, tiger muskellunge, walleye, wiper, white bass, white crappie, yellow perch</u>	<u>April – Dec.</u>	<u>26.3</u>	<u>29.5</u>
			<u>Jan. – March</u>	<u>13.2</u>	<u>14.8</u>

What Went Wrong!



Standards vs. Permitting

- *During the temperature hearing:*
 - *Division (Standard Unit) stated that it was “willing to consider changes to its reasonable potential guidance with respect to implementation of temperature standards as it develops the implementation guidance after the hearing” for low risk dischargers such as wastewater facilities. Commission (rule making body) explicitly directed that the Division include this exclusion in the reasonable potential guidance.*
- *After the temperature hearing:*
 - *Division (Permitting Unit) proposes to ignore the Commission’s directions. They now state that this approach “would likely be viewed as inconsistent with federal requirements.”*

State & Federal (40 C.F.R. § 122.4(d)(1)(i) and (iii)) Language

- *The relevant concept in these regulatory provisions is referred to as “Reasonable Potential”*
 - *Limitations must control all pollutants or pollutant parameters which the Division determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or measurably contribute to an excursion above any water quality standard, including narrative standards for water quality.*
 - *No legal exemption for a class of dischargers that have Reasonable Potential.*
 - *Consider site-specific standards or discharger specific variance,*



Cold Water Winter Seasons Dates Vary

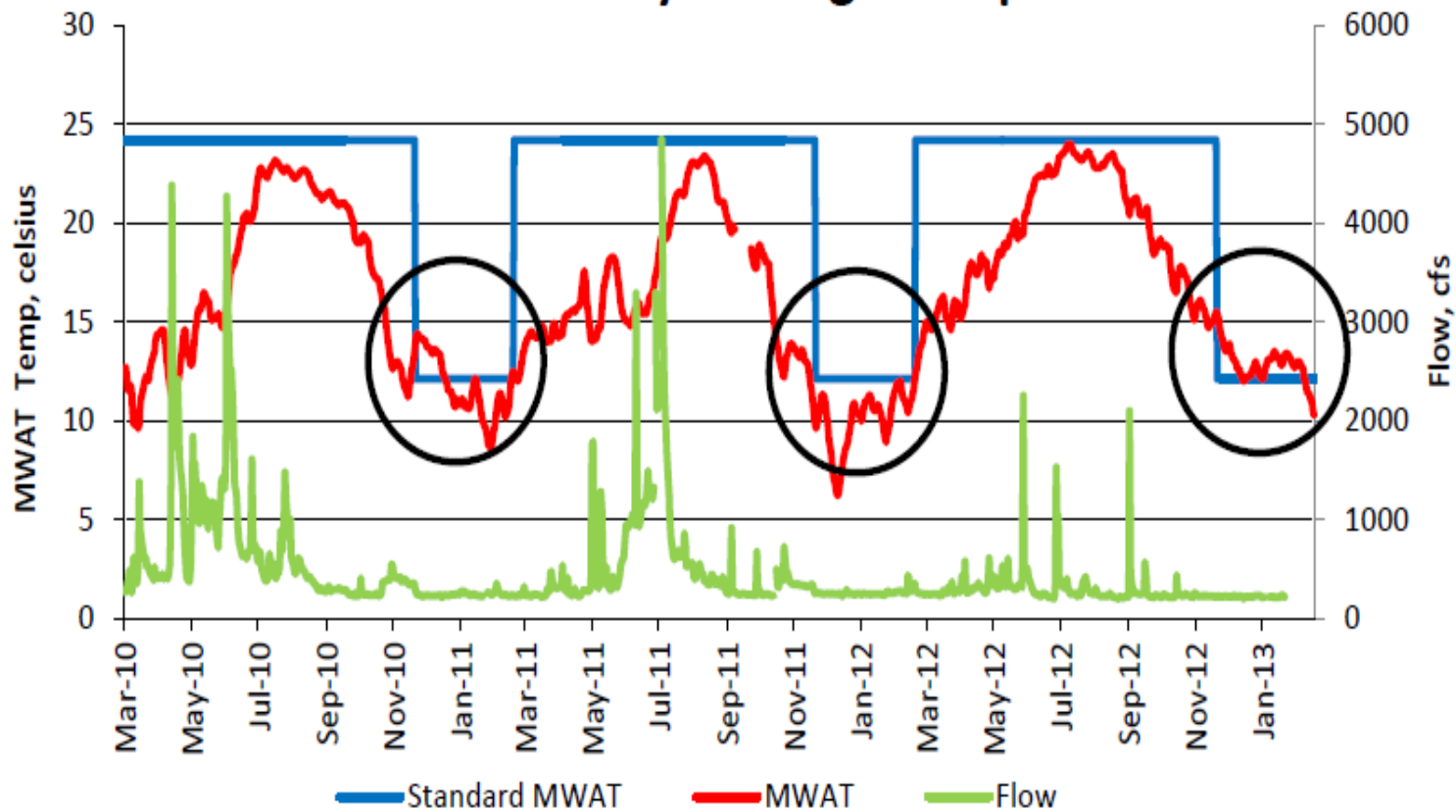
- *Winter shoulder-season excursion: For the purposes of assessment, ambient water temperatures in cold streams may exceed the winter criteria in Table 1 or applicable site-specific winter standard for 30-days before the winter/summer transition, and 30-days after the summer/winter transition.....*
 - *If it can be proven that it is not due to an anthropogenic cause*



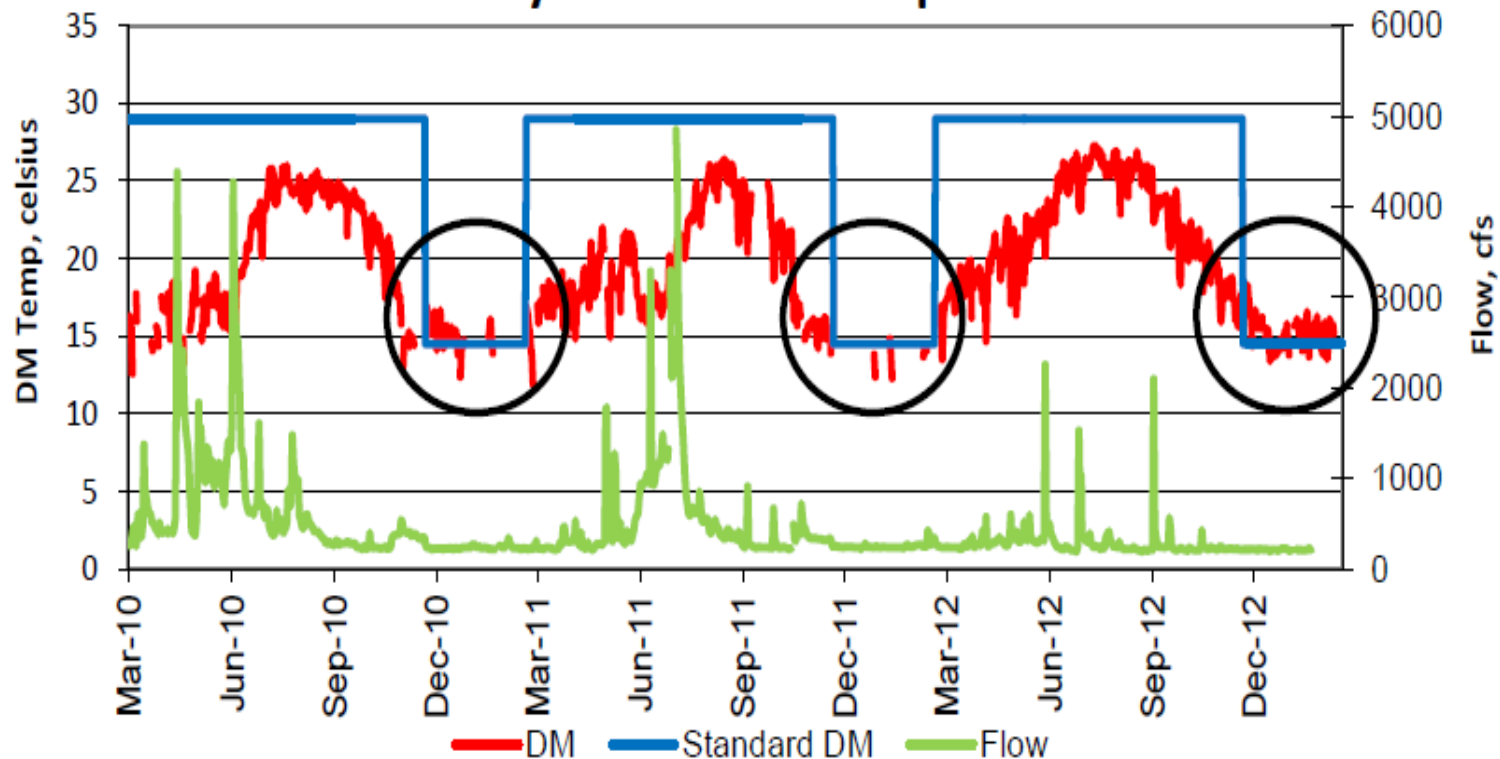
Warm Water Issues

- *As temperature standards are adopted Basin by Basin, the dischargers to warm water segments are collecting data. Numerous issues are becoming apparent.*
 - *Shoulder season*
 - *At the time of transition between summer and winter season, water temperature does not naturally change as rapidly as the standards indicate.*
 - *Discharge from wastewater facilities change even slower*
 - *Winter standard not based on science*
 - *Could not be based on spawning studies for warm water fish, they do not spawn during winter months.*
 - *Based on same difference as shown to be protective in cold streams, 1/2 of summer limit*

South Platte at 88th Ave Maximum Weekly Average Temperature



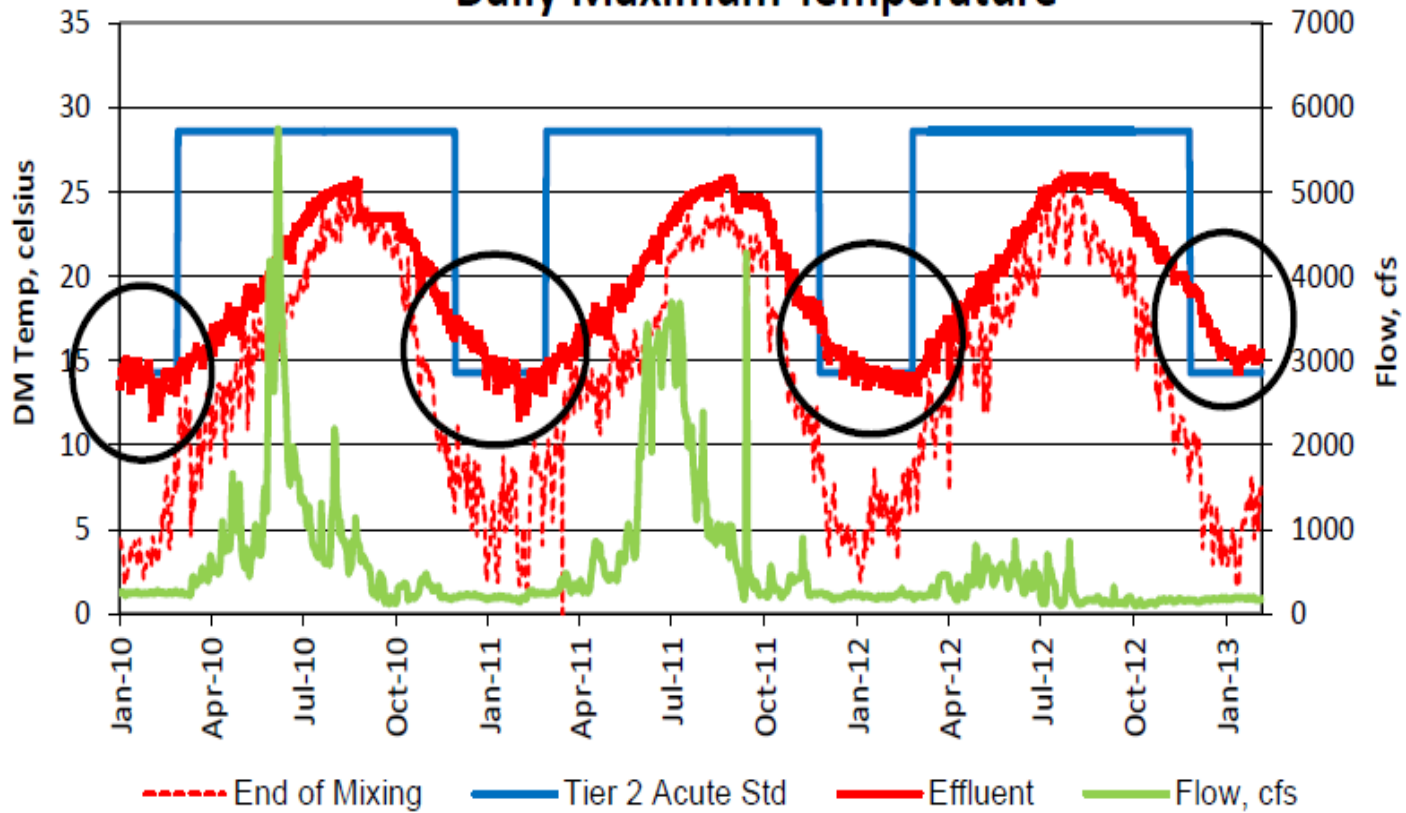
South Platte at 88th Ave Daily Maximum Temperature



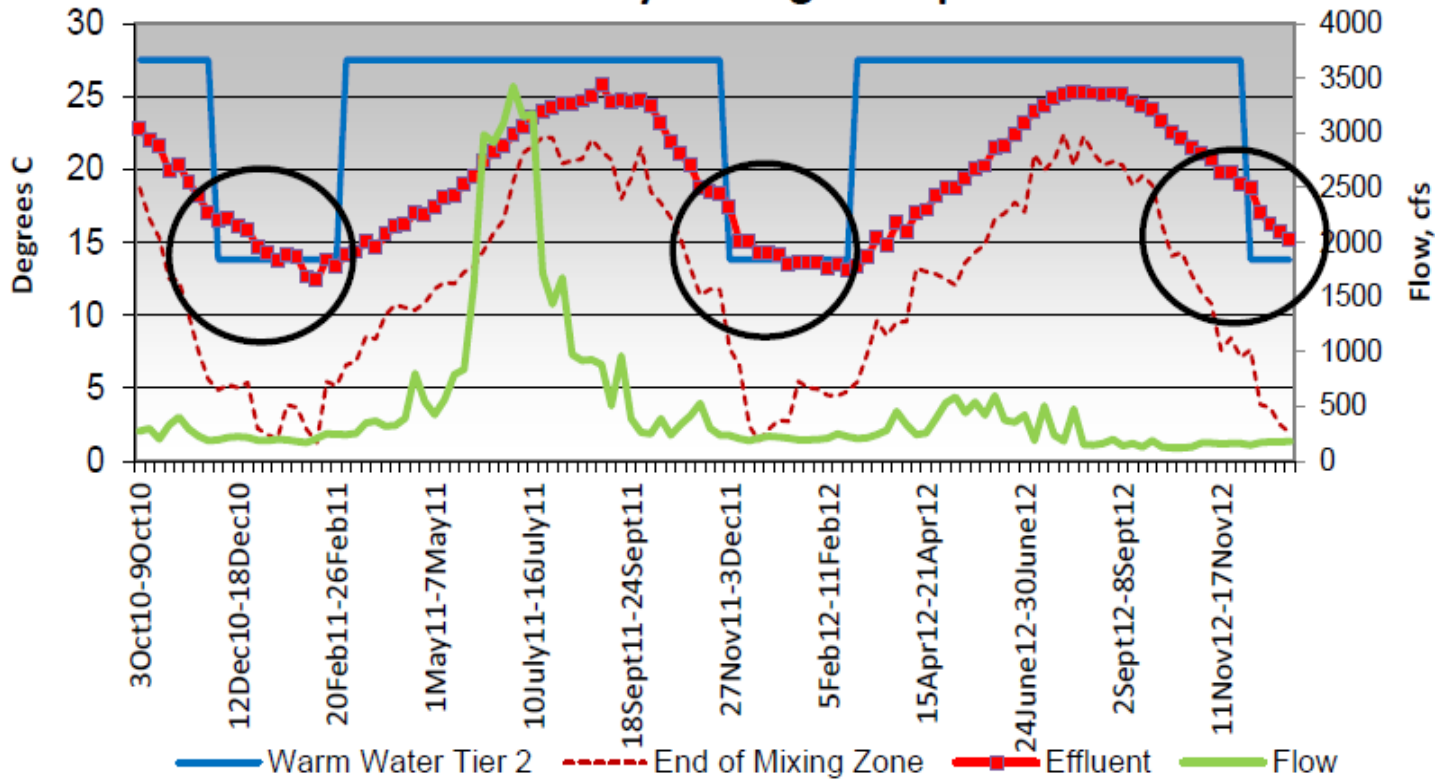
Warm Water Issues

- *As temperature standards are adopted Basin by Basin, the dischargers to warm water segments are collecting data. Numerous issues are becoming apparent.*
 - *Implementation into Permits with Mixing Zones*
 - *Calculation procedures do not allow for natural loss of temperature in winter months within the mixing zone.*

Pueblo Effluent and Arkansas River Downstream Daily Maximum Temperature



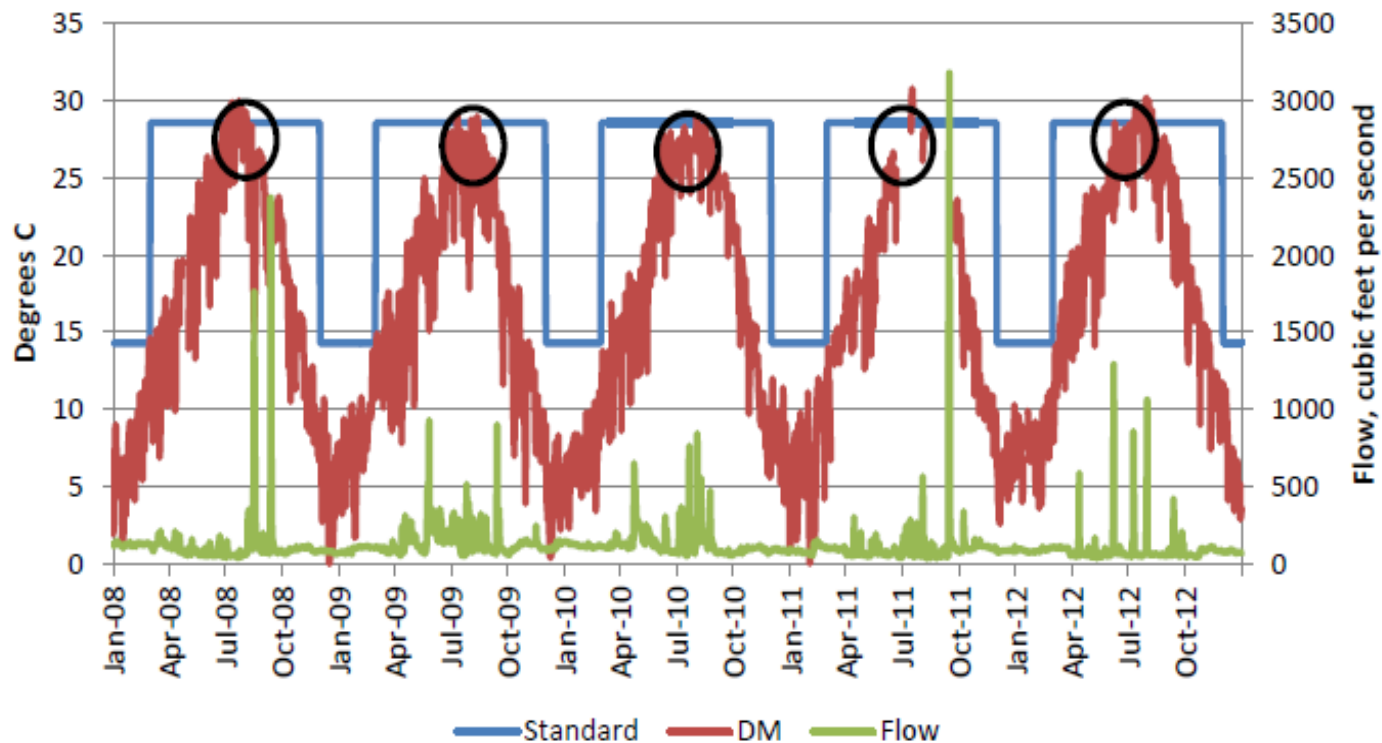
Pueblo Effluent and Arkansas River Downstream Maximum Weekly Average Temperature



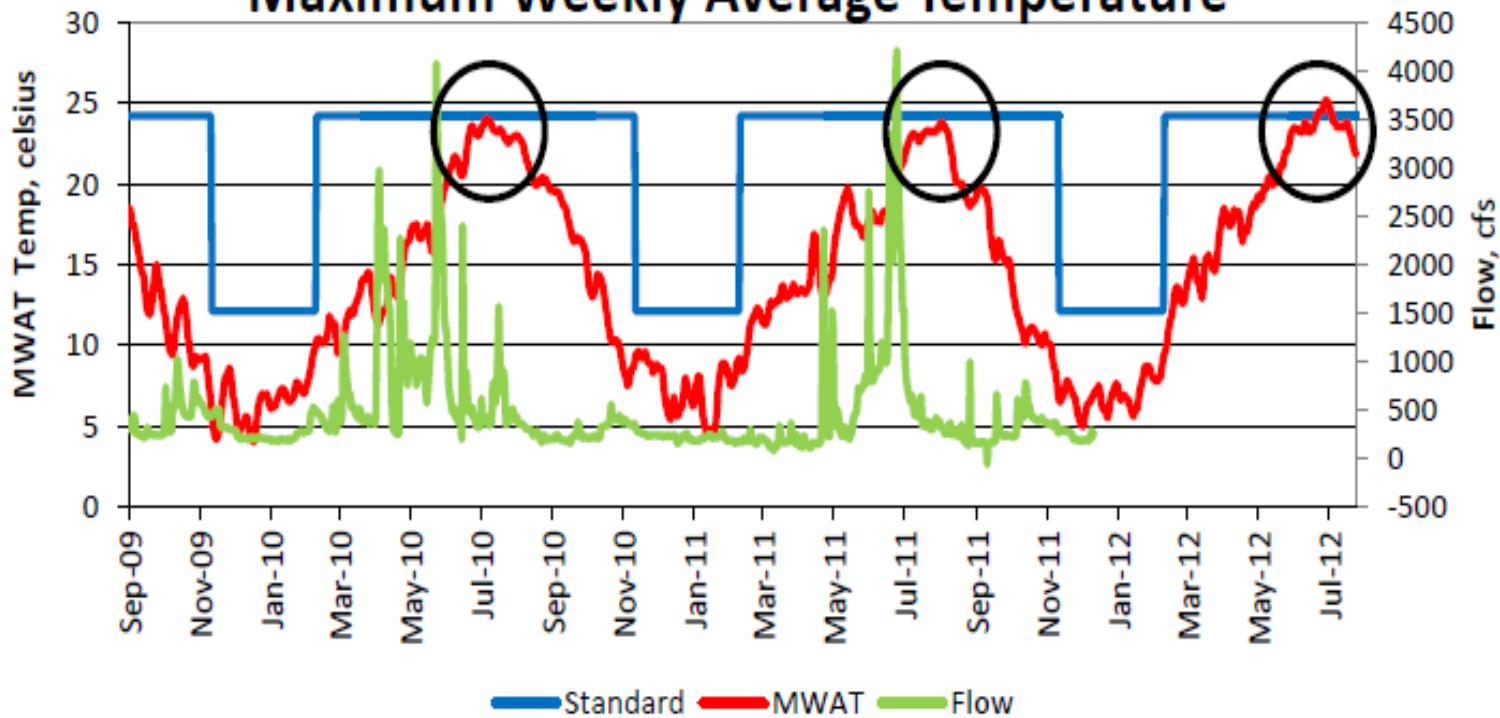
Warm Water Issues

- *As temperature standards are adopted Basin by Basin, the dischargers to warm water segments are collecting data. Numerous issues are becoming apparent.*
 - *Summer attainment*
 - *Due to a lack of warm water temperature data at the time the Commission adopted temperature criteria, a complete understanding of the thermal cycle of warm water streams in Colorado was not fully understood.*

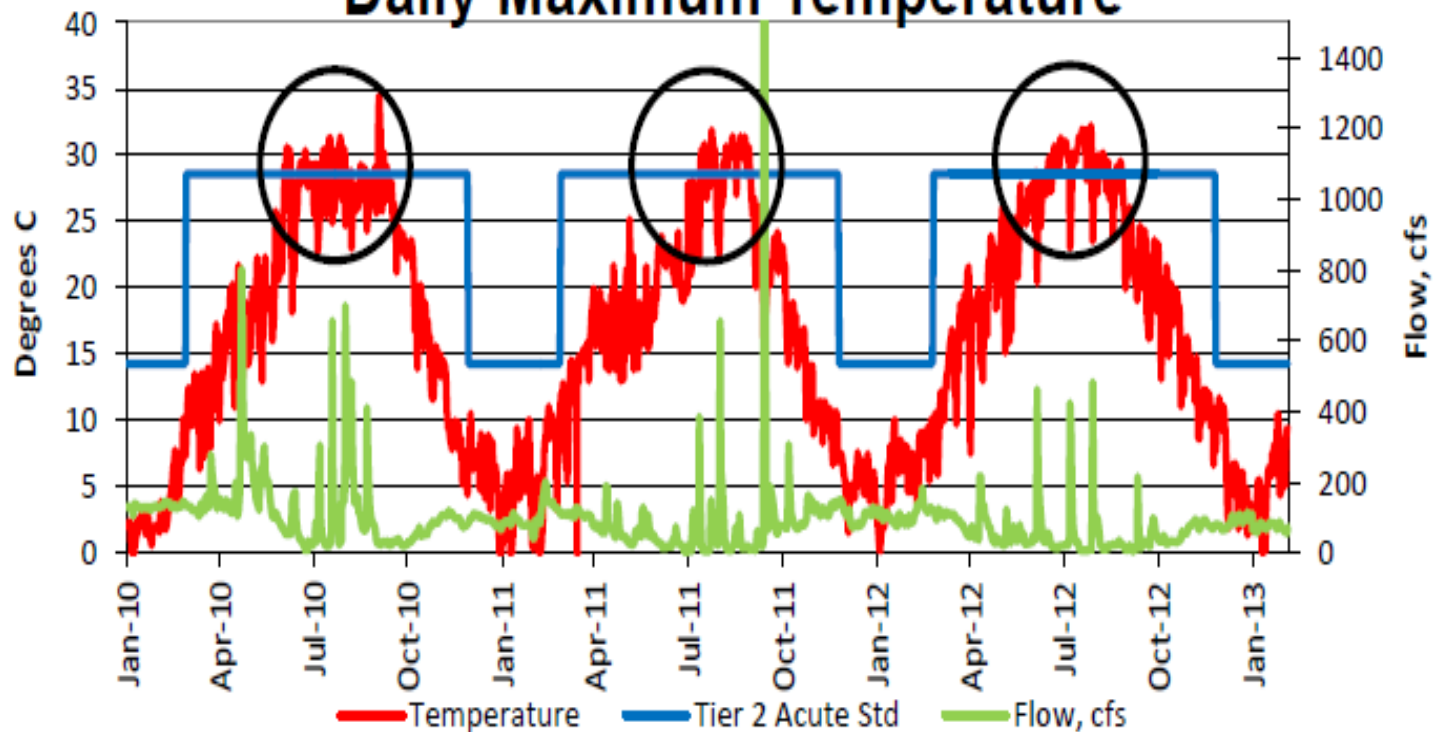
Fountain Creek Near Fountain, CO Daily Maximum Temperature



South Platte at Weld Cty Rd 8 Maximum Weekly Average Temperature



Fountain Creek at 8th Street in Pueblo Daily Maximum Temperature

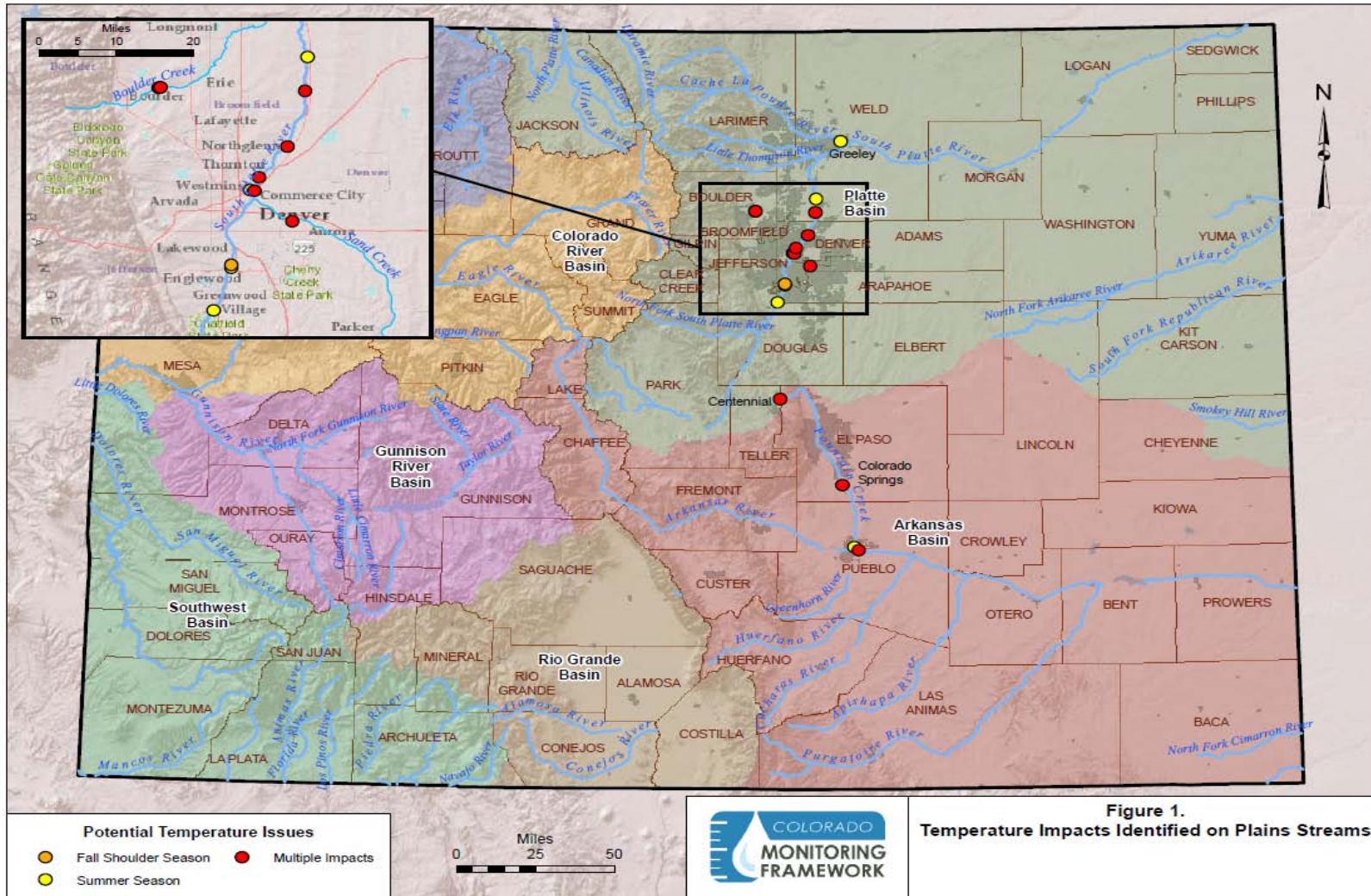




Fountain Creek

*Can you see the
problem?*

Known locations with Issues



Factors Not Considered

- *Many factors contribute to water temperatures*
 - *Legal water diversions and exchanges*
 - *Ambient air temperatures*
 - *Channel morphology*
 - *Vegetative cover*
 - *Drought*
 - *Urbanization*
 - *Changes to composition of vegetation*
 - *Increased runoff*

Treatment \$\$\$\$

Chillers

Pavement heat exchange

Wetlands

????



Regulatory Options \$\$\$



Discharger Specific Variances

Temporary Modification

Site Specific Standards

*Section 316 (a) waiver (temperature for nuclear that
may be a possibility to apply to wastewater)*