

Memorandum



DATE November 11, 2011

TO Honorable Mayor and Members of the City Council

SUBJECT Dallas Water Utilities' Drought Update and Impact Briefing

On Wednesday, November 16, 2011 you will be briefed on Dallas Water Utilities' Drought Update and Impact. The briefing material is attached for your review.

If you have questions or need additional information, please let me know.



Forest E. Turner
Assistant City Manager

Attachment

c: Mary K. Suhm, City Manager
Thomas P. Perkins, Jr., City Attorney
Rosa A. Rios, Acting City Secretary
Craig D. Kinton, City Auditor
Judge C. Victor Lander, Administrative Judge
A.C. Gonzalez, First Assistant City Manager
Ryan S. Evans, Assistant City Manager
Jill A. Jordan, P.E., Assistant City Manager
Joey Zapata, Interim Assistant City Manager
Jeanne Chipperfield, Chief Financial Officer
Frank Libro, Public Information Officer
Helena Stevens-Thompson, Assistant to the City Manager – Council Office

Dallas Water Utilities' Drought Update and Impact

Dallas Water Utilities
November 16, 2011

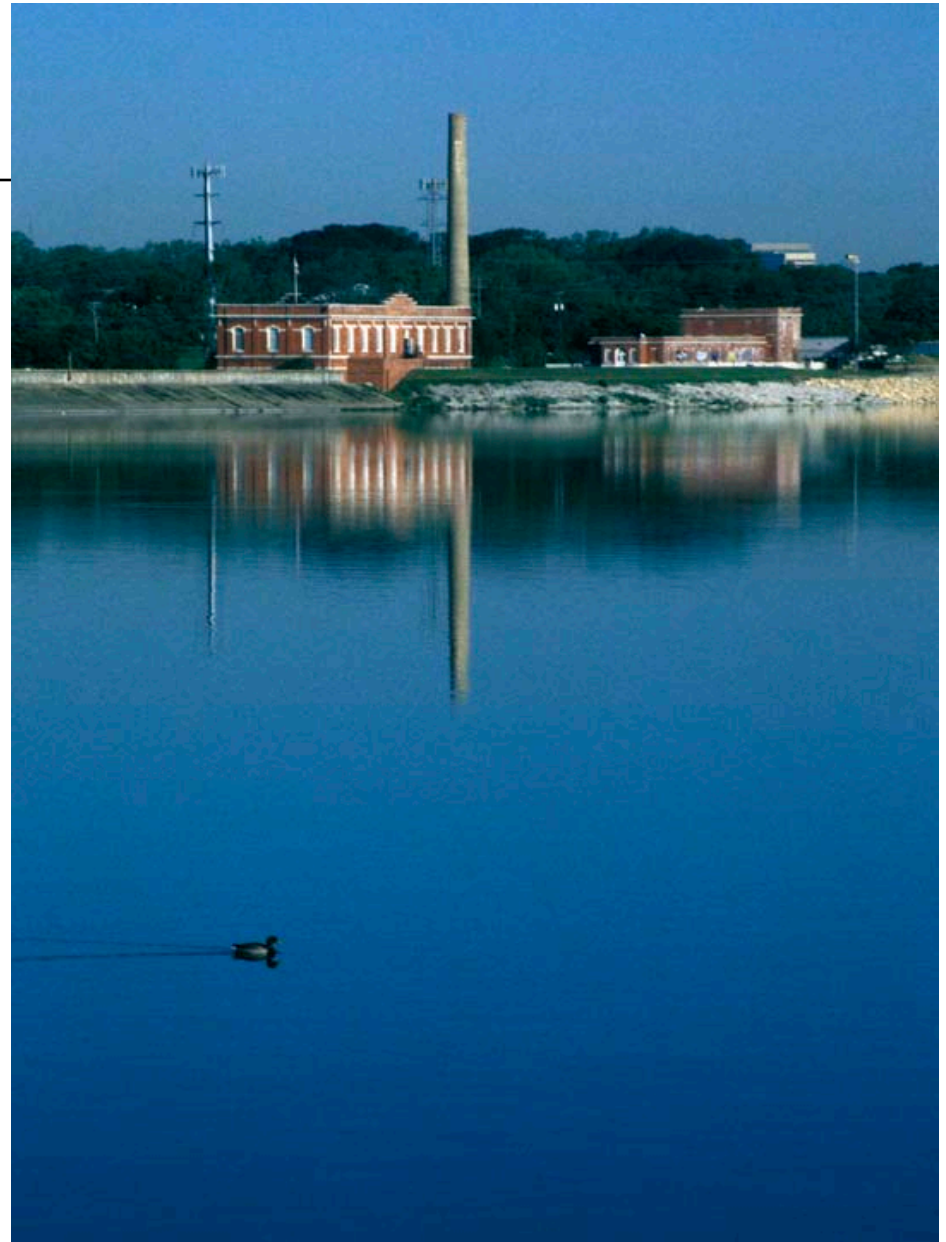


Purpose

- This briefing provides an overview of:
 - Ongoing drought weather conditions and its impact on Dallas water supply
 - Water treatment capacity restrictions
 - Probable water sales to other area water providers
- Communication plan for the implementation of drought stages, and enforcement actions
- Provides recommendations and next steps for Council consideration

Outline

- Background
- Drought Conditions
- Dallas' 2012 Water System Treatment Capacity Restrictions
- Probable Water Sales
- Communication Plan, Steps, and Enforcement
- Actions and Next Steps
- Appendix

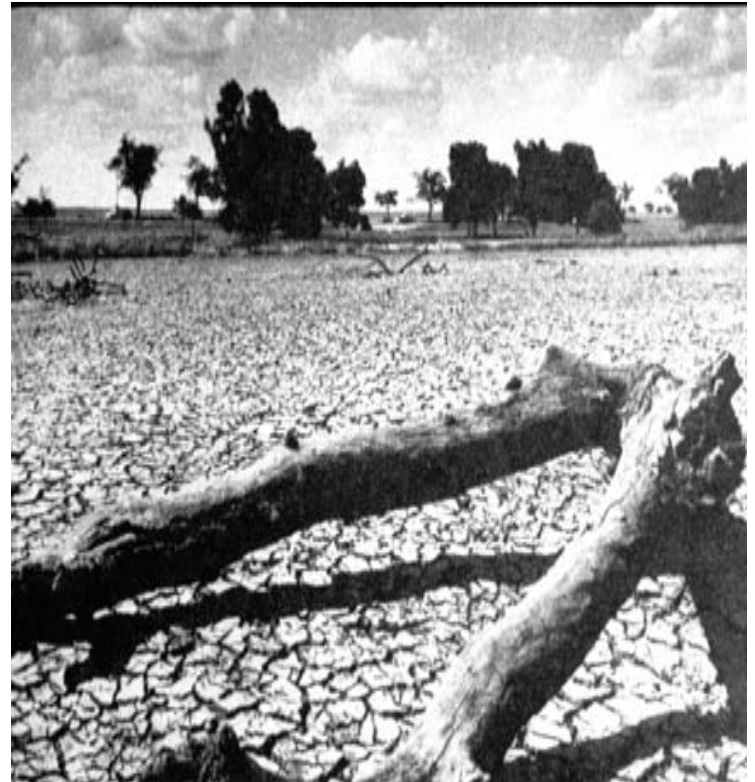




Background

Background: Historical Drought & Drought-like Conditions

- Since 1822, at least one drought has hit somewhere in Texas every decade
- A drought can be generally defined as a period of relatively little or no rainfall
- Severe drought from 1951 - 57
 - Salty water diverted from Red River
 - City leaders vowed "never again"
- Dallas' water supply now planned to provide water through the drought of record
- Drought conditions experienced in the Dallas area in 1996, 2000, 2006 and since May 2010



White Rock Lake – 1950's

State of Texas Drought Requirements

- Since droughts are a frequent and inevitable factor in the climate of Texas, the State requires **drought contingency plans**
 - Because of the range of conditions that affected the more than 4,000 water utilities throughout the state in 1997, the Texas Legislature directed the Texas Commission on Environmental Quality (TCEQ) to adopt rules establishing common drought plan requirements for water suppliers
 - As a result, the TCEQ requires all wholesale public water suppliers, retail public water suppliers serving 3,300 connections or more, and irrigation districts to submit drought contingency plans
- Water utilities throughout Texas have enacted a variety of measures to reduce peak demands and to extend their water supplies
- Drought plans for water utilities such as Dallas are required to be updated every 5 years

Dallas' Water Rights and Supply

- Surface water is owned by the State of Texas
- Dallas has been granted extensive water rights by the State in return for Dallas' promise to serve a defined area approved by Council and included in the State water plan which includes customer cities
- Dallas has yet to enter Stage 1, but has requested that citizens and customers voluntarily adopt a maximum of twice a week watering
- If weather conditions persist, Dallas' Drought Plan Stage 1 criteria related to lake levels (i.e., lakes 35% depleted) could occur as early as March 2012
- Stage 1 projections depend on:
 - Future precipitation amounts
 - Long range forecasts
 - Water supply demands, and
 - Drought vulnerability of other suppliers in the Upper Trinity Basin

Background: Dallas' Water Supply

- Safe and sufficient water supply is critical to the economic success of Dallas and its service area
- Existing reservoirs were constructed as a result of planning actions from the 1950s
- Dallas initiated a series of long range water supply plans in 1959, 1979, 1990, 2000, and 2005
- Dallas' plan is to have enough reservoir firm yield to meet water demands throughout a drought equal to the 1950s drought of record
- Dallas' ranking for planned new water supply sources has been based on:
 - Costs – capital construction and power
 - Efficiency
 - Environmental impact
 - Likelihood for development

Dallas' Drought Contingency Plan

- Plan based on a simulation of 1950s drought of record conditions
- Simulation is a monthly time step using inflows, evaporation rates, water demands, lake capacities, and priorities for meeting water demands (where more than one entity is taking water from the lake)
- According to the drought plan, Dallas' lakes during a drought equivalent to the drought of record
 - Should be 75 percent full in approximately 1.5 years
 - Should be 50 percent full in approximately 3.5 years
- Currently we are on track with the Drought Plan as Dallas' current connected supply is 75% full (25% depleted), 1.5 years later

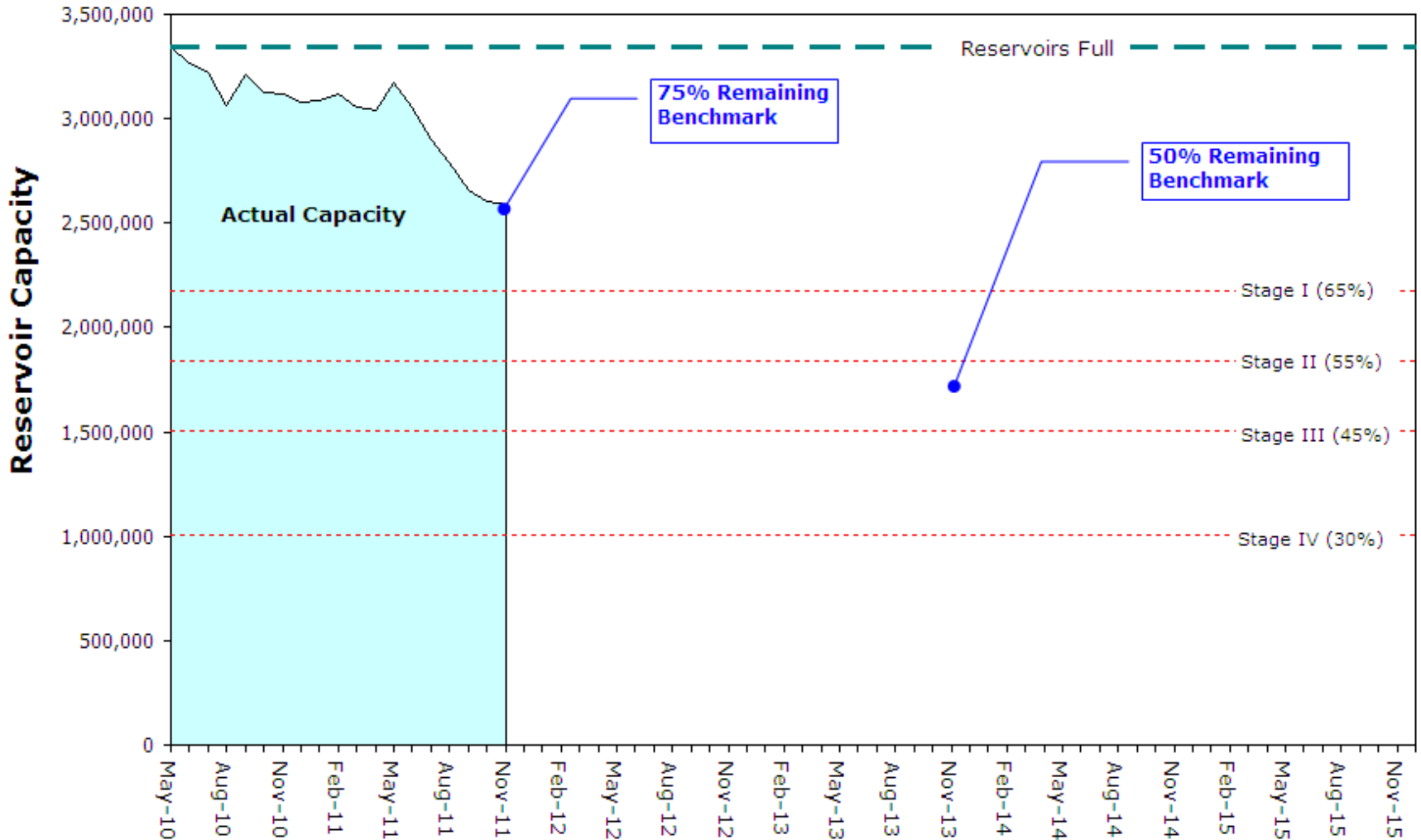
Dallas' Drought Contingency Plan

(continued)

- The heat and lack of rainfall in 2011 was the worst one year drought on record
- Also, ongoing construction at Dallas' East Side Water Treatment Plant will result in water treatment restrictions in June 2012
- A prudent approach is to move forward with watering restrictions early, with a call for mandatory restrictions on December 12, 2011

Total Reservoir System Condition and Analysis

(Lakes Ray Roberts, Lewisville, Grapevine, Ray Hubbard, Tawakoni and Fork)



Graph shows the depletion of Dallas' reservoirs, and when the lakes should be 75% and 50% depleted.

Drought Conditions

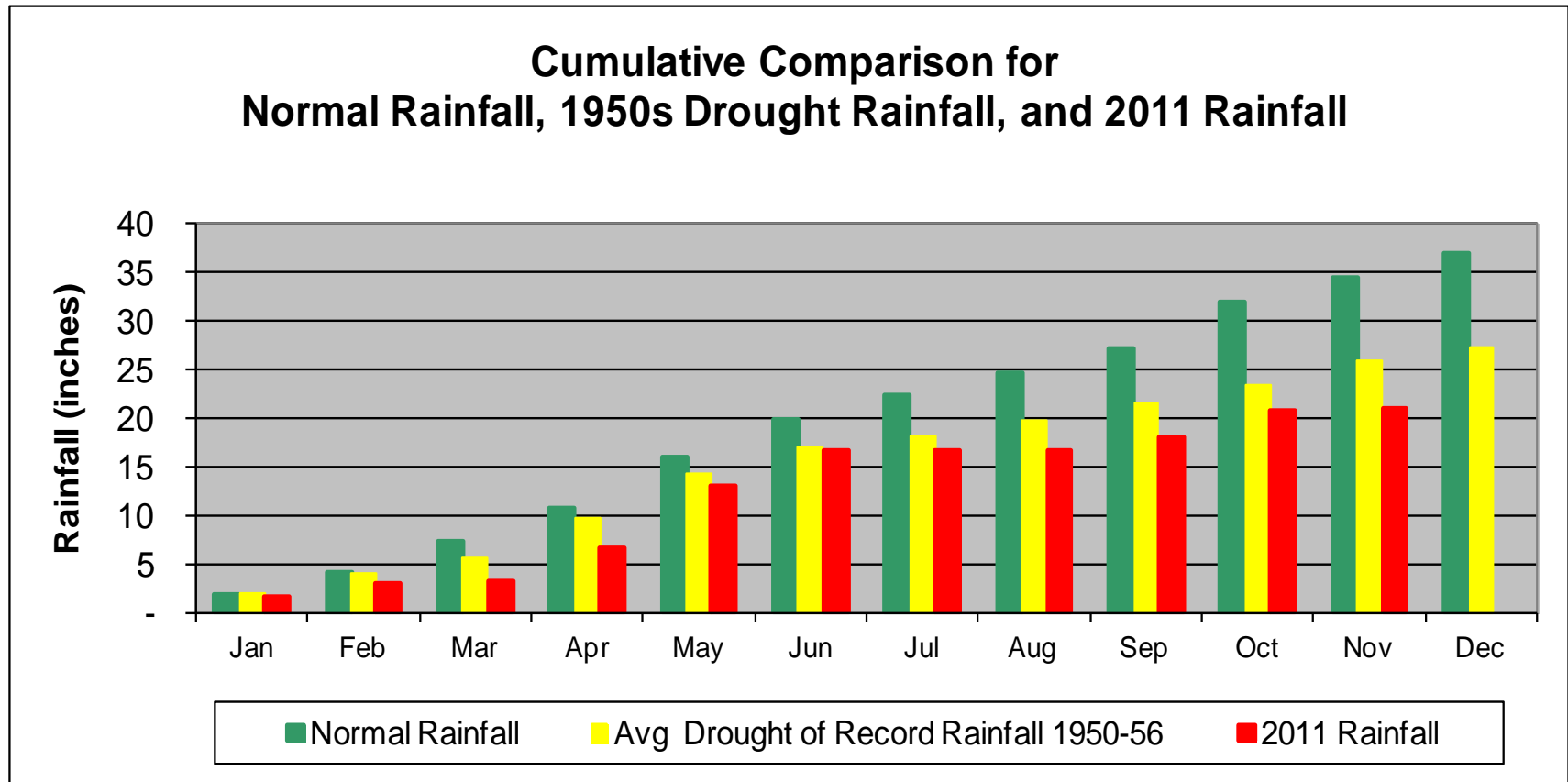
2011 Drought Observations

- “The state climatologist for Texas says the record drought of 2011 could be only the beginning of a dry spell that could last until 2020” - *Austin American-Statesman*
- “Triple-digit temperatures will be the norm in Texas within a few decades...according to the state climatologist” *Dallas Morning News*
- “Texas is now in the midst of its most severe one-year drought on record, according to the State Climatologist” – *The Texas Tribune*
- “At this point, all I can say is that we’re in a period of frequent Texas drought until further notice,” he said. “This period, with both the Pacific and Atlantic working against us, might be over in a couple of years, or it might last another 15 or 20 years. It seems likely to last another decade.” State Climatologist *Southwest Farm Press*

Drought Conditions: Current Situation

- 2011 has been the driest year on record in the State since 1895, when the State began keeping rainfall records
- The past summer was also the hottest on record
- Estimated costs are more than \$5.2 billion in agricultural losses and \$250 million in wildfire devastation
- Texas state climatologist has indicated that the drought may be similar to the 1950s drought and this weather pattern may continue until 2020
- As shown on the next slide, 2011 rainfall is less than the average during the 1950s drought of record

Drought Conditions: Rainfall Comparison



Note: 2011 rainfall data is through 11/9/11

Monitoring Drought Conditions - Dallas

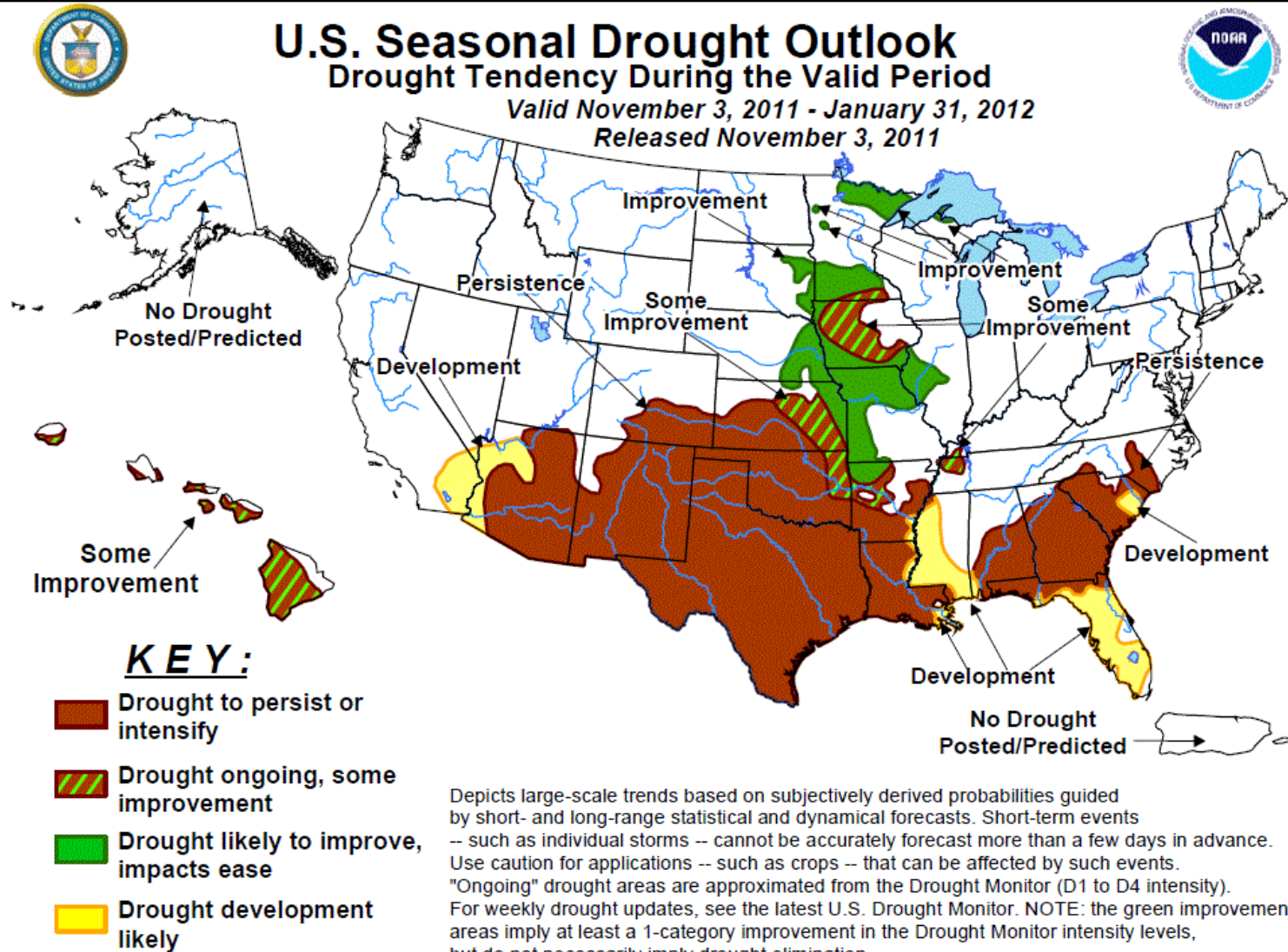
- Perform Computerized Drought Simulations
 - Prior to drought
 - During drought
- Water Supply and Drought Monitoring
 - Lake Levels
 - Reservoir Capacity
 - Long Range Weather Forecasts
 - Palmer Drought Index
- Initiate drought plan stages as appropriate



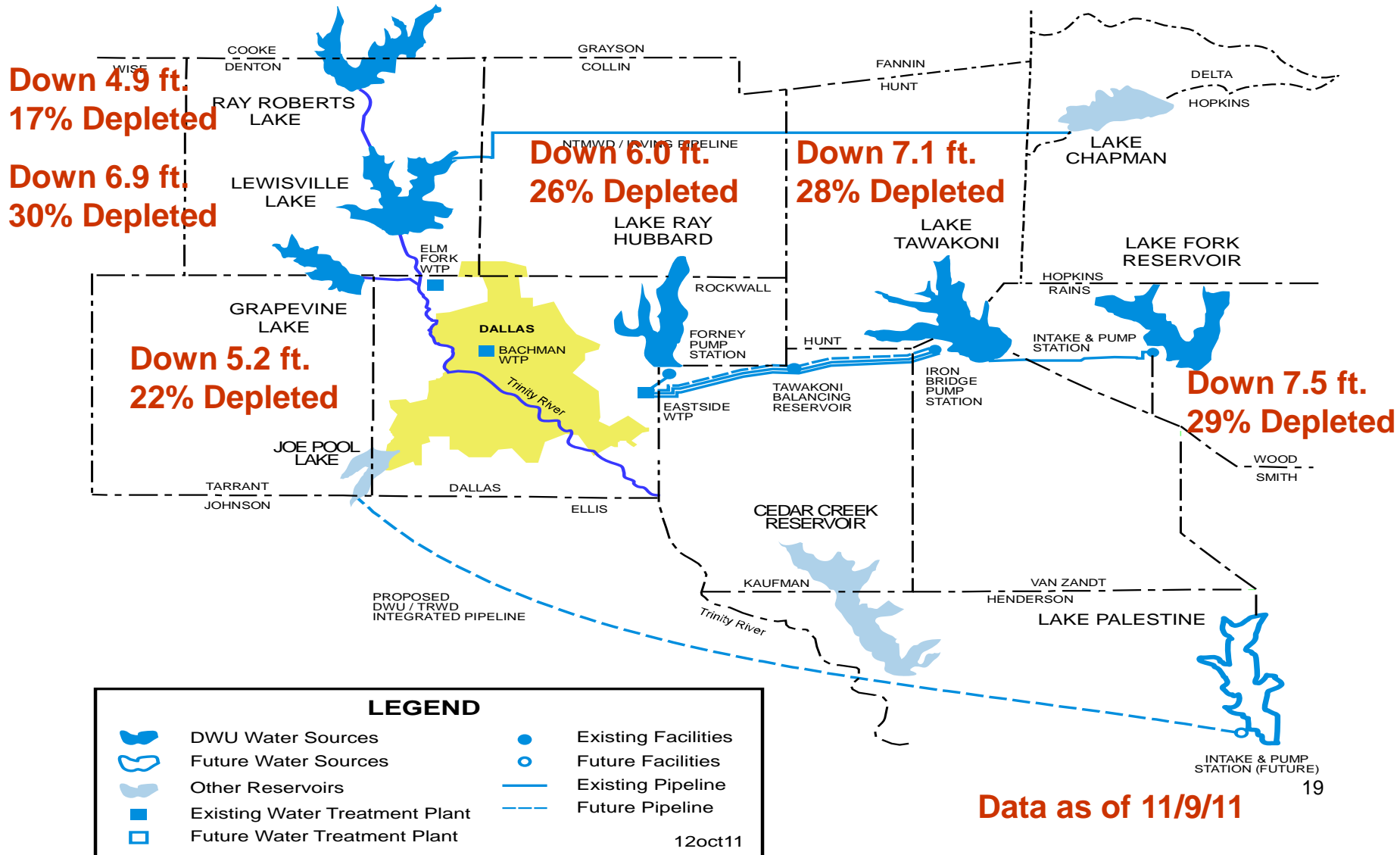
Dallas' Staff Drought Related Actions

- Briefed the Council on August 17, 2011 on the Water Operations Management Plan
 - Provided update on the ongoing drought conditions
 - Provided information regarding possible treatment capacity limitations in 2012
- Sent drought memo to Council in August 2011 and press release asking the public to voluntarily restrict outside watering to no more than two time per week
- Media campaign with other area providers, including the Lawn Whisperer campaign
- Provided drought update memos to the Council in September and October 2012
- Had discussions with other area water providers regarding the impact of the drought on their operations and their responses to the drought

Drought Conditions: Future Outlook



Status of Dallas Water Supply Reservoirs



Drought Conditions and Contingency Plan

- Drought Contingency Plan Updated June 2010
- Drought Triggers are based on either supply capacity, system capacity or contamination issues
- Dallas' current connected supply is approximately 75% full (25% depleted)

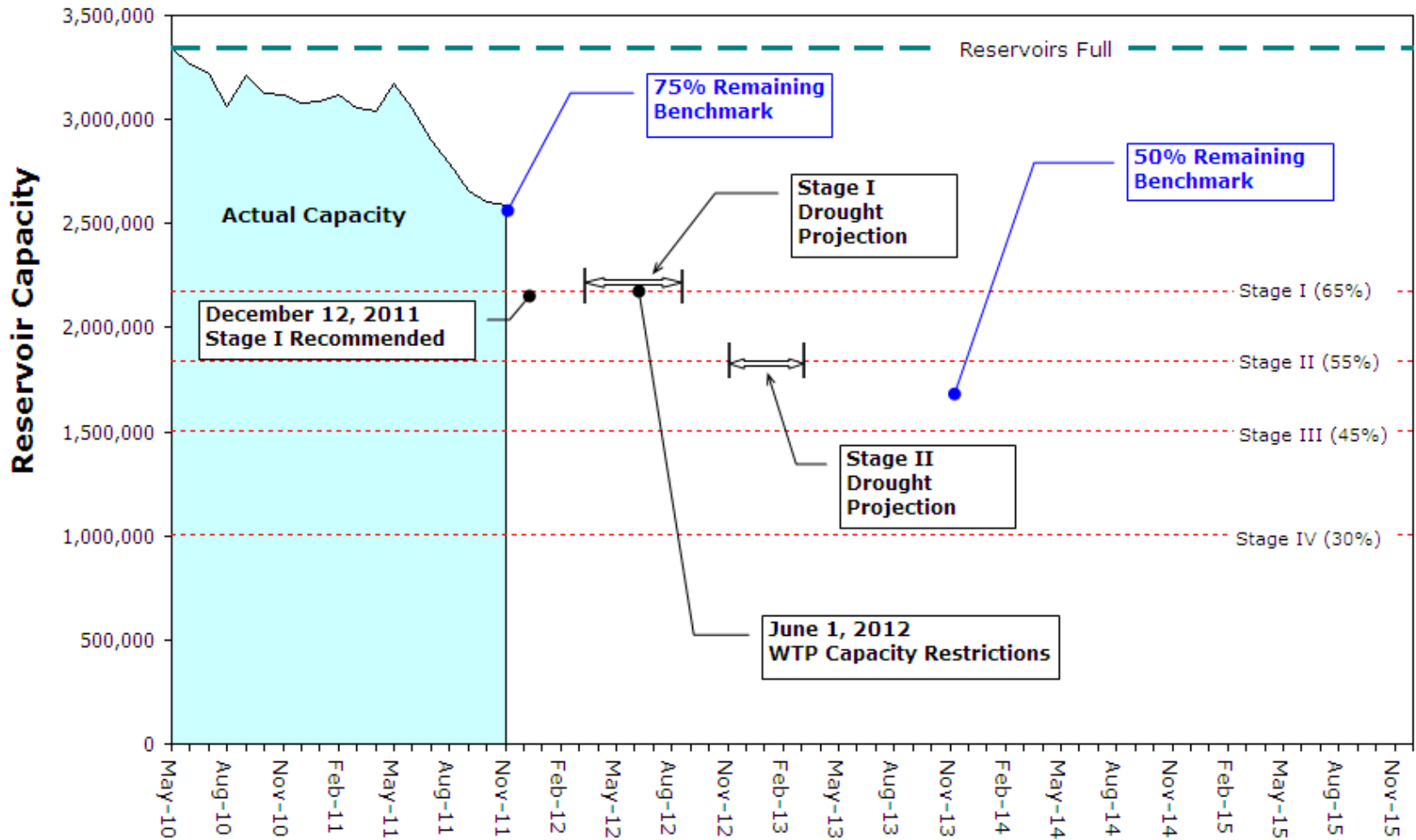
Drought Stage	Supply Capacity % full - (% depleted)	System Capacity % of delivery capacity for consecutive days
1	65% - (35%)	85% for 4 days
2	55% - (45%)	90% for 3 days
3	45% - (55%)	95% for 2 days
4	30% - (70%)	98% for 1 day

Drought Stages and Responses

- Even though Stage 1 (where Dallas' connected lakes are 35% depleted) is forecasted as early as March 2012, to be more cautious the recommendation is to enact Stage 1 effective December 12, 2011
- Primary impact to customers from Stage 1 is mandatory maximum of twice weekly outdoor watering
- In addition, Stage 2 restrictions may occur as early as November 2012 due to:
 - Lake depletion
 - In response to system treatment capacity limitations
 - In response to sales of raw water to other entities (discussed later)
- Primary impact to customers from Stage 2 is mandatory maximum of once a week outdoor watering
- Additional information on Dallas' drought stages is located in the Appendix

Total Reservoir System Condition and Analysis

(Lakes Ray Roberts, Lewisville, Grapevine, Ray Hubbard, Tawakoni and Fork)



Graph shows how Dallas' reservoirs should be depleted over time, and the projected drought stages related to weather and water treatment plant restrictions. 22

Drought Conditions for Other Area Providers in 2011

- Other area water providers are experiencing restrictions due to lack of rainfall, reservoir location, and other drought related factors

Stage	Dallas	North Texas Municipal Water District (NTMWD)	Tarrant Regional Water District (TRWD)	Upper Trinity Regional Water District (UTRWD)
Stage 1	December 12, 2011	April 19, 2011	August 29, 2011	July 13, 2011
Stage 2		August 11, 2011		
Stage 3		November 1, 2011		
Stage 4				

Comparison of Drought Plans for Dallas and Other Area Water Providers – Stage 1

- Selected actions for Dallas, North Texas Municipal Water District (NTMWD), Tarrant Regional Water District (TRWD), and Upper Trinity Regional Water District (UTRWD)

Stage 1	Dallas	NTMWD	TRWD	UTRWD
Reduction Goal	5%	2%	5%	1%
Supply Triggers	35% depleted	35% depleted	25% depleted	35% depleted
Major Actions	Landscape watering restricted to 2X per week	Voluntary water conservation	Landscape watering restricted to 2X per week	Voluntary water conservation

Comparison of Drought Plans for Dallas and Other Area Water Providers – Stage 2

Stage 2	Dallas	NTMWD	TRWD	UTRWD
Reduction Goal	15%	5%	10%	5%
Supply Triggers	45% depleted	45% depleted	40% depleted	45% depleted
Major Actions	Stage 1 efforts continue and:	Stage 1 efforts continue and:	Stage 1 restrictions continue and:	Stage 1 efforts/restrictions continue and:
	Landscape watering restricted to 1X per week	Landscape watering restricted to 2X per week	Landscape watering restricted to 1X per week	Mandatory watering schedule required*, no watering between 10 a.m. and 6 p.m. from June 1 through Sept. 30
	Hosing of paved areas, buildings or windows prohibited. Recreational use of water prohibited	Prohibit planting of cool season grasses	Ornamental fountain use and filling of swimming pools with automatic valves prohibited.	Recreational use of water prohibited
			Wet street sweeping prohibited	

Comparison of Drought Plans for Dallas and Other Area Water Providers – Stage 3

Stage 3	Dallas	NTMWD	TRWD	UTRWD
Reduction Goal	20%	10%	20%	15%
Supply Triggers	70% depleted	55% depleted	55% depleted	55% depleted
Major Actions	Stage 1 & 2 restrictions continue and:	Stage 1 & 2 restrictions continue and:	Stage 1 & 2 restrictions continue and:	Stage 1 & 2 restrictions continue and:
	Landscape watering restricted to 1X per week by means of soaker hoses, hand held hoses and buckets only. Foundations may be watered for 2 hours on scheduled day.	Landscape watering restricted to 1x every seven days from April 1 - Oct. 31; Landscape watering restricted to 1x every two weeks from Nov. 1 - Mar. 31	All landscape watering prohibited except for foundations and trees	Landscape watering restricted to 1X per week
	Watering golf courses prohibited except for greens and tee boxes. Municipal watering prohibited except for golf course greens and tee boxes.	Hosing of paved areas, buildings or windows prohibited	Golf course greens may only be watered by hand before 10 a.m. and after 6 p.m.	Use of soaker hoses, hand watering or drip irrigation of foundations and landscaped areas may used be any day, limited to 6 p.m. to midnight.
	Wet street sweeping prohibited	No hydroseeding, hydromulching or sprigging	Establishment of new landscaping prohibited.	
	Operation of ornamental fountains and ponds prohibited. Draining, filling or refilling or permitting pools, hot tubs, ornamental ponds and fountains prohibited.	Ornamental fountain use prohibited. Existing swimming pools cannot be drained/refilled.	Operation of ornamental fountains and ponds prohibited. Draining, filling or refilling or permitting pools, hot tubs, ornamental ponds and fountains prohibited.	Permitting of new swimming pools, hot tubs, spas and ornamental fountains suspended
	Vehicle washing prohibited except as needed for health, sanitation or safety reasons and vehicles may only be washed at a commercial car wash	Washing or rinsing of vehicles prohibited unless using hose end cut off nozzle.	Vehicle washing prohibited except as needed for health, sanitation or safety reasons and vehicles must be washed at a commercial car wash.	Vehicle washing restricted to commercial car washes.
	10% rate increase for high water demand users (greater than 10,000 gallons per month).	Initiate rate surcharge for use over certain level	Commercial users required to reduce consumption by a set percentage TBD by Water Utilities Director	Initiate rate surcharge on retail usage
	No new applications for water service connections or facilities will be approved		Hotels required to encourage linen and towel reuse. Restaurants required to serve water only on demand.	

Comparison of Drought Plans for Dallas and Other Area Water Providers – Stage 4

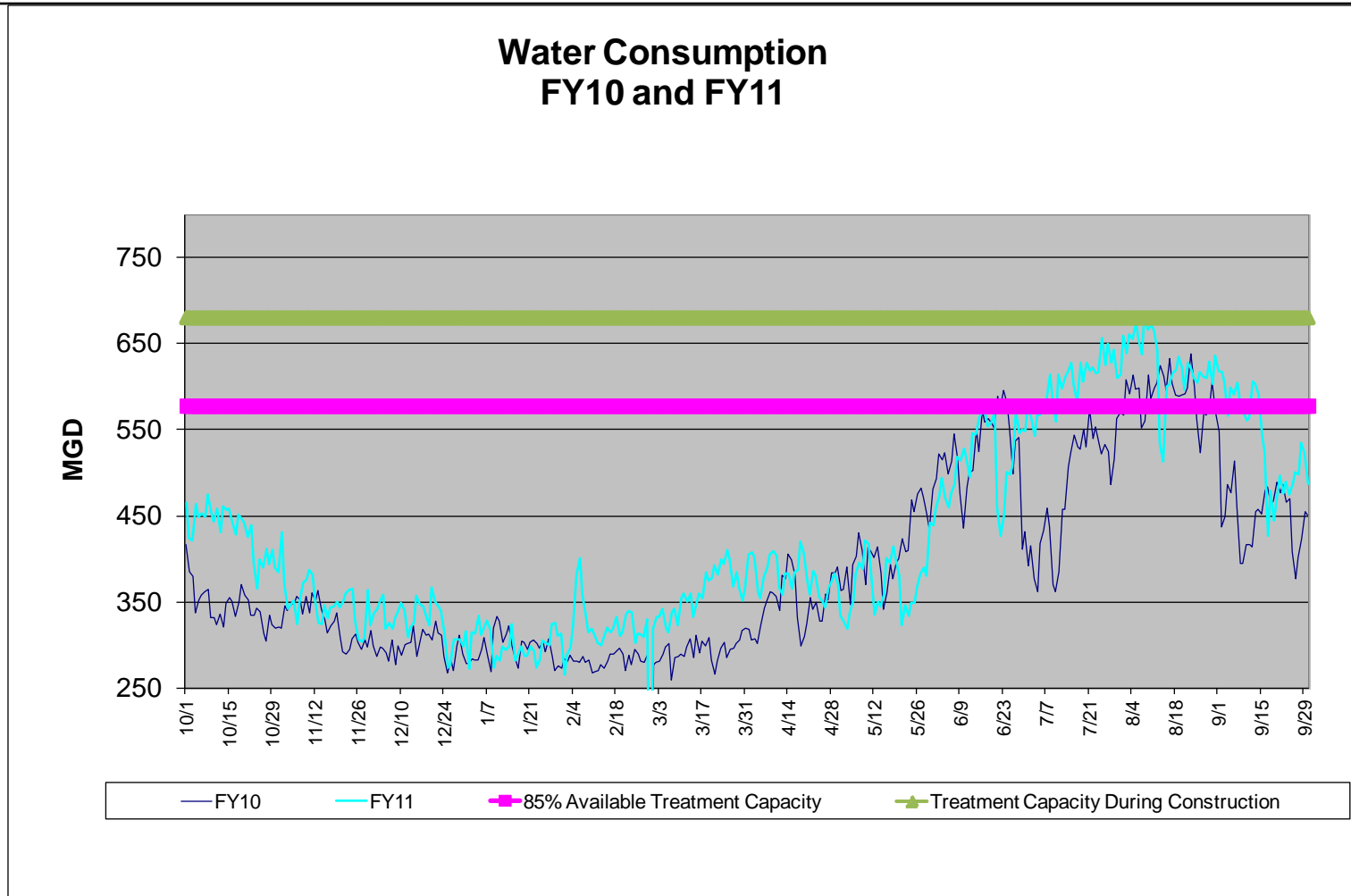
Stage 4	Dallas	NTMWD	TRWD	UTRWD
Reduction Goal	25%	TBD by official designee	No Stage 4	25%
Supply Triggers	70% depleted	65% depleted		70% depleted
Actions	Stage 1, 2 & 3 restrictions continue and:	Stage 1, 2 & 3 restrictions continue and:		Stage 1, 2 & 3 restrictions continue and:
	All landscape irrigation absolutely prohibited (foundations may be watered per conditions under Stage 3)	Commercial and Residential landscape watering prohibited (except for foundations and trees which can be watered with hand held hose, soaker or drip irrigation for 2 hours of any day)		Landscape watering prohibited (except for foundations and trees which can be watered with hand held hose, bucket, soaker or drip irrigation for 2 hours of any day)
	Washing of vehicles absolutely prohibited	Washing of vehicles prohibited (except for health, sanitation and safety). Irrigation of golf courses prohibited except for greens and tees. Initiate rate surcharge for all water use over normal rates.		Washing of vehicles prohibited
	Water allocation actions may be taken by Director to discourage water use.	Permits for private pools suspended. Water may be added to maintain pool level but draining and refilling prohibited.		Increase rate surcharge to retail customers

Dallas' 2012 Water System Treatment Capacity Restrictions

Water System Treatment Capacity

- Ongoing construction at the East Side Water Treatment Plant will provide water quality improvements, rehabilitation and increased plant capacity for future demand
- This construction will result in a temporary water treatment capacity restriction of 680 MGD (a 25% reduction in treatment capacity) for Dallas' treated water system during the Spring/Summer of 2012
- As a result of this limitation, along with drought weather conditions, service restrictions to customers are anticipated
- Stage 1 would be triggered when customer demand reaches 85% (578 MGD) of the 680 MGD delivery capacity for 4 consecutive days
- The following chart shows that restrictions would be needed in both FY10 (a relatively wet year) and FY11 (a dry year)

Water Use and 2012 Water System Restriction



Note: Graph shows that water restrictions would be needed in FY10 and FY11. FY10 was a relatively wet year; FY11 was hot and dry.

Probable Water Sales

State of Texas Rules

- Surface water is owned and permitted by the State of Texas
- House Bill 2694, passed in 2011, allows the State to suspend or adjust water rights during drought or emergency water shortage
- In addition, Texas Water Code, § 11.139 allows the commission to grant an emergency permit, order, or amendment to an existing permit, certified filing, or certificate of adjudication for a period of 120 days
 - May be renewed for an additional 60 days
 - For conditions which present an imminent threat to the public health and safety

Probable Water Sales

- Dallas has been approached by other entities to purchase water from us
 - Luminant, North Texas Municipal Water District (NTMWD), and City of Irving
- Other area cities and entities may also request the sale of water from Dallas
- Water sales, assuming drought conditions continue as forecasted may have the following impact:
 - Sales of water to others may require Dallas to implement stronger drought measures, i.e., Stages 2-4
 - Sales of water may also change DWU's budget assumptions



Probable Water Sales - Process

- We have received preliminary information regarding probable sales
- We will be working with the entities to negotiate the terms and conditions
- Details will be finalized over the next six months including length of contract, volume of water, conditions of service, pricing and other considerations

Probable Water Sales - Luminant

- Current Luminant raw water contracts
 - Lake Fork - 12,000 ac-ft for Martin Lake thru 2050
 - Lake Fork – 6,000 ac-ft short term contract for Martin Lake thru 2011
 - Elm Fork of the Trinity River – 9,550 ac-ft for North Lake thru 2018
- Martin Lake used to cool its power generating units
 - Additional water needed to keep lake level high enough for intake and water temperature necessary for cooling
- Luminant power generation facilities at North Lake have been decommissioned
- Contract request for additional water
 - Lake Fork - 8,000 ac-ft for Martin Lake for a two year term
 - Elm Fork of the Trinity River – release 9,550 ac-ft contract as a term of the new contract (reduces demand on the western water supply system)
 - Contract anticipated by Spring 2012

Probable Water Sales - NTMWD

- NTMWD is not currently a water customer of Dallas
- NTMWD water supply sources
 - Lavon – 49% full
 - Chapman – 27% full
 - Texoma – 0% available (due to Zebra mussels)
- Potential raw water purchase amounts from Dallas - 27 MGD to 60 MGD
- Contract requested by NTMWD to be completed in the Spring 2012 timeframe

Probable Water Sales – City of Irving

- ❑ Irving has a treatment services contract with Dallas to treat 40 MGD of their Lake Chapman water
- ❑ Irving also purchases a small amount of treated water from Dallas (approx. 15%)
- ❑ Lake Chapman is 69% depleted
- ❑ Depending on future rain and weather conditions, Irving's water supply in Chapman may be at risk
- ❑ At Irving's request, Dallas staff has met to discuss possible water sales to Irving
- ❑ At this time, a formal water sale request has not been made to Dallas

Communication Plan, Steps, and Enforcement

Communication Plan – City Government and Other Agencies

- Director recommends drought stage to City Manager
- City Manager calls for implementation of drought stage and notifies City Council
 - Drought stage is effective for 60 days (for example December 12, 2011 - February 9, 2012)
 - Council resolution required to extend drought stage beyond 60 days
 - Council may authorize extensions in 120 day increments (for example February 10, 2012 - June 8, 2012)
- City Manager sends memo copy to department heads
- DWU submits Stage 1 notification to Executive Director of TCEQ within required 5 business days
- DWU submits Stage 1 notification to other area agencies – hospitals, hotels, commercial businesses, etc.

Communication Plan – Retail Customers

- ❑ City Manager orders Stage 1 by public announcement (press release)
- ❑ Stage 1 order published in newspaper within 24 hours after public announcement
- ❑ Prepare and mail drought water bill insert
- ❑ Update dallascityhall.com and savedallaswater.com websites with drought message to include mandatory watering schedule
- ❑ Submit mail notifications to City announcement lists (internal and external)
- ❑ Use social media drought messaging through City of Dallas and Lawn Whisperer Campaign



Communication Plan – Wholesale Customers

- Fax and email copies of press release and CMO memo to wholesale customer cities contacts
- Mail certified mail packet announcing initiation of Stage 1 within 24 hours after public announcement
- Require implementation of "like" procedures by wholesale water customers

Drought Plan Restrictions Enforcement

- Enforcement will be accomplished using Code Enforcement and Dallas Water Utilities personnel
- Any person who violates this Plan is guilty of a misdemeanor and, upon conviction, shall be punished by a fine of not less than \$250 and not more than \$2,000
- Each day that one or more of the provisions in this Plan is violated shall constitute a separate offense
- If a person is convicted of two or more distinct violations of this Plan, upon due notice to the customer, DWU may:
 - Install a flow restrictor to limit the amount of water that will pass through the meter in a 24-hour period; or
 - Discontinue water served to the premises

Actions and Next Steps

Actions and Next Steps

- City Manager will be enacting Stage 1 watering restrictions effective Monday, December 12, 2011
- Staff will implement customer communication plan and increase role of enforcement specifically related to water use compliance
- Recommendations on sales of water will be brought to Council by Spring 2012
- Dallas may need to consider additional restrictions (Stage 2) in Spring 2012
 - Timing of Stage 2 restrictions dependent on water sales to other entities, continuation of drought conditions, and water system treatment capacity limitations



Appendix

Water Operations Management Plan

- The Management Operations Plan establishes standard operating policies, procedures, methods and processes for the operation of the City's water system
- As part of this plan, the City Council adopted drought contingency and emergency water procedures on June 9, 2010
- The contingency and emergency procedures describe the conditions that require short-term water demand management and establish policies and procedures that offer strategies for a timely response

POSSIBLE TRIGGERING CRITERIA
Reduction in Available Water Supplies
Treatment or Distribution System Capacity Limitations
System Vulnerability
System Failures
Other

Dallas' 2010 Drought Contingency Plan

Triggers

- Council adopted current plan in June 2010
- Previous plan was dated 2005
- Triggers for each Stage set for:
 - Drought
 - Capacity constraints
 - Natural or man-made contamination
- Stage 1 response calls for mandatory watering restrictions (2 day a week maximum)
- Stage 2 calls for mandatory 1 day a week watering
- Stages and responses are shown in the Appendix

Water Demand Management Triggers

- Treated Water Capacity Management Plan Triggers
 - Stage 1 - Exceeds 85% of delivery capacity for 4 consecutive days
 - Stage 2 - Exceeds 90% of delivery capacity for 3 consecutive days
 - Stage 3 - Exceeds 95% of delivery capacity for 2 consecutive days
 - Stage 4 - Exceeds 98% of delivery capacity for 1 consecutive day

- Raw Water Supply Management Plan Triggers
 - Stage 1 – 35% of supplies depleted
 - Stage 2 – 45% of supplies depleted
 - Stage 3 – 55% of supplies depleted
 - Stage 4 – 70% of supplies depleted

Process to Implement Contingency and Emergency Measures

- Utility Director responsible for ongoing monitoring of water system
- Director is responsible for recommending implementation of contingency and emergency procedures to City Manager
- City Manager may enact the measures for up to 60 days
- City Council may extend the measures beyond original 60 days for additional time periods, not to exceed 120 days each
- To be effective, measures must be published in a local newspaper within 24 hours of announcement

Comparison of Drought and Conservation Measures

- Conservation measures are used to achieve more efficient use of water resources
- Conservation examples include:
 - Water Wise landscaping (Xeriscape)
 - Time of Day Watering
 - Low Flow Showerheads
 - Repairing leaking faucets
 - Reducing the frequency of watering lawns
- Drought measures are restrictions used to ensure that water is available to meet public health, welfare, and safety needs
- Drought examples include
 - Restricting lawn watering
 - Prohibiting permitting or filling of swimming pools
 - Prohibiting operation of ornamental fountains
 - Prohibiting recreational water use

Drought Triggers and Action Measures

(City of Dallas Drought Contingency Plan adopted June 9, 2010)

Stage 1	Stage 2	Stage 3	Stage 4
35% Depleted	45% Depleted	55% Depleted	70% Depleted
Mandatory	Mandatory	Mandatory	Mandatory
<ul style="list-style-type: none"> ❑ Target 5% reduction in total Gallons Per Capita per Day (GPCD) ❑ Restrict operation of ornamental fountains and ponds to initial filling and to support aquatic life ❑ Encourage reduction in draining and refilling of swimming pools ❑ Prohibit recreation water use of faucets hoses and hydrants which use water in such a manner as to allow run-off ❑ Restrict washing of vehicles to hand held bucket (does not affect commercial car washes) ❑ Mandatory maximum 2 day a week landscape irrigation 	<ul style="list-style-type: none"> ❑ Target 15% reduction in total GPCD ❑ Prohibit hosing off paved areas, buildings, windows or other surfaces ❑ Restrict op of ornamental fountains/ponds to initial filling or support aquatic life ❑ Encourage further reduction in draining and refilling of swimming pools ❑ Prohibit recreation water use of faucets hoses and hydrants which use water to allow run-off ❑ Restrict washing of vehicles to hand held bucket (but not commercial car washes) ❑ Mandatory maximum 1 day a week landscape irrigation ❑ Foundations may be watered any day during allowed watering hours with soaker or hand held hoses 	<ul style="list-style-type: none"> ❑ Target 20% reduction in total GPCD ❑ No approval for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities ❑ 10% rate increase for high water demand users (greater than 10,000 gallons per month) ❑ Prohibit the filling/refilling of swimming pools, wading pools and Jacuzzi pools, Existing pools may add water for proper operation; no permitting of new pools ❑ Prohibit washing of vehicles (does not affect commercial car washes between 6:00 a.m. and 10:00 a.m. or 6:00 p.m. to 10:00 p.m.) ❑ Mandatory maximum 1 day a week landscape irrigation with hand held hoses and hand held buckets only ❑ Foundations may be watered for a 2 –hour period (off-peak) with soaker hose or hand held hose. 	<ul style="list-style-type: none"> ❑ Target 25% reduction in total GPCD ❑ Prohibit washing of vehicles ❑ Prohibit landscape irrigation ❑ Foundations may be watered for a 2 –hour period (off-peak) with soaker hose or hand held hose.

Twice Weekly Watering Or Less

Observations

- “Fewer but heavier lawn watering encourages deeper roots that withstand dry weather better. A deeply watered lawn should be able to go 5 to 8 days between watering.”

AgriLife Extension, Texas A&M System

- “Most lawns receive twice as much water as they require for a healthy appearance... Most gardeners can readily recognize lawn stresses due to lack of water, such as wilting and yellowing. The key to watering lawns is to apply the water as infrequently as possible, yet thoroughly.”

Texas AgriLife Extension Service -*EarthKind: Watering Landscapes*

- “This illustrates why it is so important to make sure the irrigation system is applying water as efficiently as possible. Ideally, you would apply this amount of water in one or two applications per week.” **James A. McAfee, Ph.D., Extension Turfgrass Specialist Texas AgriLife Extension** *2011 Drought Stress Problems*

Twice Weekly Watering Or Less

Observations (continued)

- “With careful observation and experience, one can determine the correct number of days between waterings.
 - Common bermuda grass lawns can go 5 to 7 days or longer between waterings without loss of quality.
 - It takes about 1/2 inch of water to achieve the desired wetting depth if the soil is high in sand, and about 3/4 inch of water if the soil is a loam.
 - For soils high in clay, an inch of water is usually necessary to wet the soil to the desired depth.” **Larry Stein and Doug Welsh, Horticulturists Texas AgriLife Extension Service**

- “...during the hot summer weather aim to water no more often than every 4 or 5 days (3 or 4 days if temperatures exceed 100°).”
Neil Sperry - *Neil Sperry's Gardens - The Definitive Word in Texas Horticulture*

- “Adjust schedule seasonally to allow for deep, infrequent watering in order to maintain an even moisture level. About 1" of water per week in the summer is a good starting point.”
Howard Garrett - *The Dirt Doctor*