



**IMPLEMENTING THE PERFECT  
LONG TERM WATER SUPPLY  
STRATEGY FOR BEND, OREGON**

**2016 AWWA Regional Conference – Boise, ID  
Patrick Griffiths – City of Bend  
Water Resources Manager**



**ALTERNATE TITLE:**

**A FUNNY THING HAPPENED ON THE WAY TO  
PLANNING, SECURING AND FINANCING A LONG  
TERM, CLIMATE RESILIENT, CLIMATE ADAPTED,  
CLIMATE PROOF, DROUGHT PROOF,  
REGULATORY COMPLIANT, SUSTAINABLE, FISH  
FRIENDLY, ESA PROTECTED, RECREATION  
FRIENDLY, 100% RELIABLE, LOW COST, ....  
LONG TERM WATER SUPPLY FOR BEND...**



## Today's Agenda:

- Engineering is the Easy part...
- Groundhog Day – A Historical Introduction
- Got Water? “State of the Deschutes”

***Act 1: Cities Wait Your Turn, Fixing Fish, Frogs and Farms***

***Act 2: Curse of the Climate Change Zombie Apocalypse***

- Bend's “Simple Little Project”...
- Predictions for the future... takeaways





## Bend, OR 2016 – a snapshot

- Population ~ 81,000
- Water Service Area ~ 60,000
- Water connections ~ 25,000
- Annual demand 2015 **4,700 MG (~14,000 AF)**
  - **50% Surface Water**
  - **50% Groundwater**
  - **~13 MGD Average Annual Demand 2015**
  - **~ 27 MGD Maximum Day Demand 2015**
- Water @ \$1.82 / CCF + base (\$22.02)
- Sewer @ \$3.38 / CCF + base (\$34.13)
  
- 21 Breweries and growing...



# WATER SUPPLY ENGINEERING – THE EASY PROCESS...

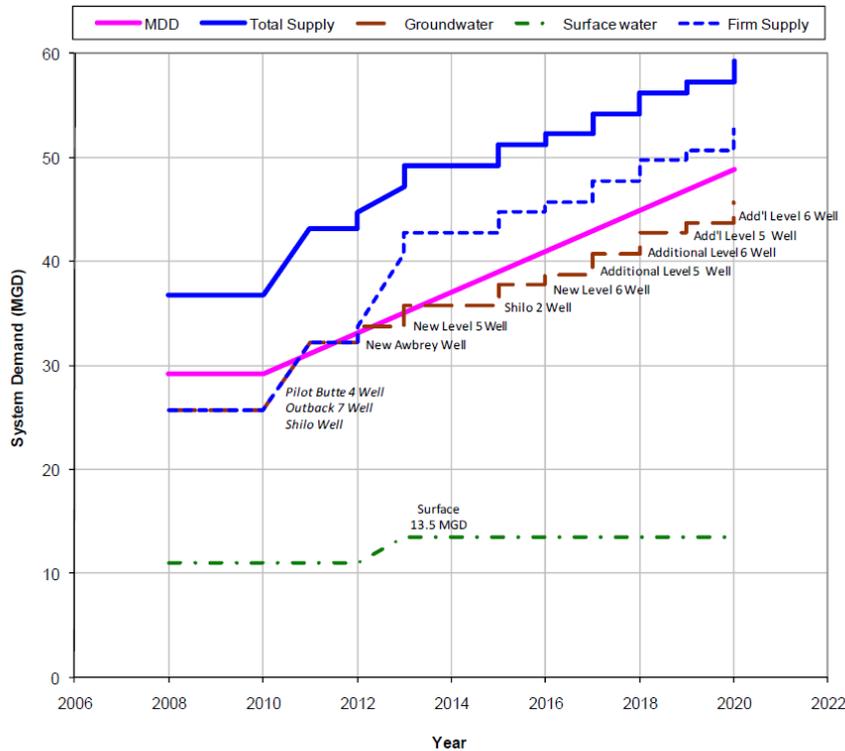


Figure E.1 – Projected MDD and supply capacity increases to year 2020

Table E.1 – Projected future water demand summary

Year	Water Demand (MGD)		
	Average Day Demand (ADD)	Maximum Day Demand (MDD)	Peak Hour Demand (PHD)
2008 <sup>(1)</sup>	12.8	29.2	48.0
10-year projection <sup>(2)</sup>	21.7	48.8 <sup>(4)</sup>	87.9 <sup>(5)</sup>
Build-out Development <sup>(3)</sup>	37.1	83.5 <sup>(4)</sup>	150.3 <sup>(5)</sup>

Notes to Table E.1:

- (1) Existing ADD, MDD & PHD based on 2008 water production records.
- (2) 10-year ADD developed assuming half of the growth to meet build-out demand at medium density development would be realized within the existing UGB, plus half of growth to meet Tetherow build-out demand and Juniper Ridge at 294 acres.
- (3) Build-out ADD assumes medium density development across the proposed UGB, plus Tetherow at 889 residential units and Juniper Ridge at 515 acres.
- (4) MDD equals ADD x 2.25 (based on historical data, see Table 3.2 in the DDS report).
- (5) PHD based on comparison of recorded peak hour and maximum day production values from 2008 and 2009. PHD:MDD factor agreed at 1.8.

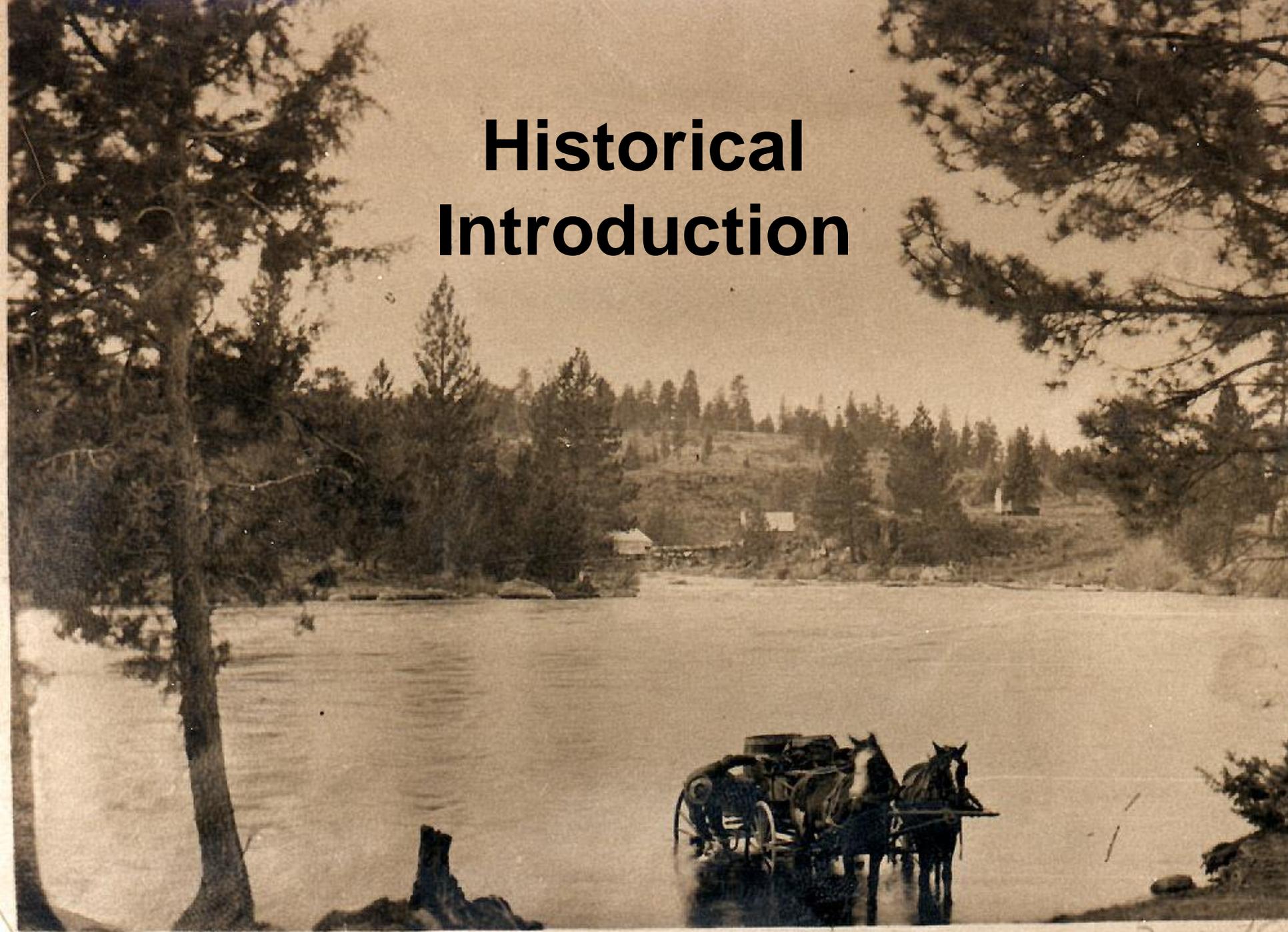
# WATER SUPPLY PLANNING – EASY PROCESS...



**Table E.2 – Total Capital Costs – Final Build-out Solution**

<b>Cost Item</b>	<b>Cost</b>
“Surface Water Supply”	
13.5 MGD, membrane treatment, no hydro <sup>1</sup>	\$57,750,000
Additional supply to meet 23 MGD (9.5 MGD) <sup>2</sup>	\$12,825,000
New Groundwater Wells (35.7 MGD)	\$45,490,000
New Storage (14.5 MG)	\$24,130,000
New Pipe Improvements for Growth	\$43,625,000
Pipe Improvements for Fire Flow	\$11,458,000
Pump Station Expansion	\$1,744,000
New Valves	\$600,000
<b>TOTAL</b>	<b>\$197,622,000</b>

# Historical Introduction



50 m

Montg

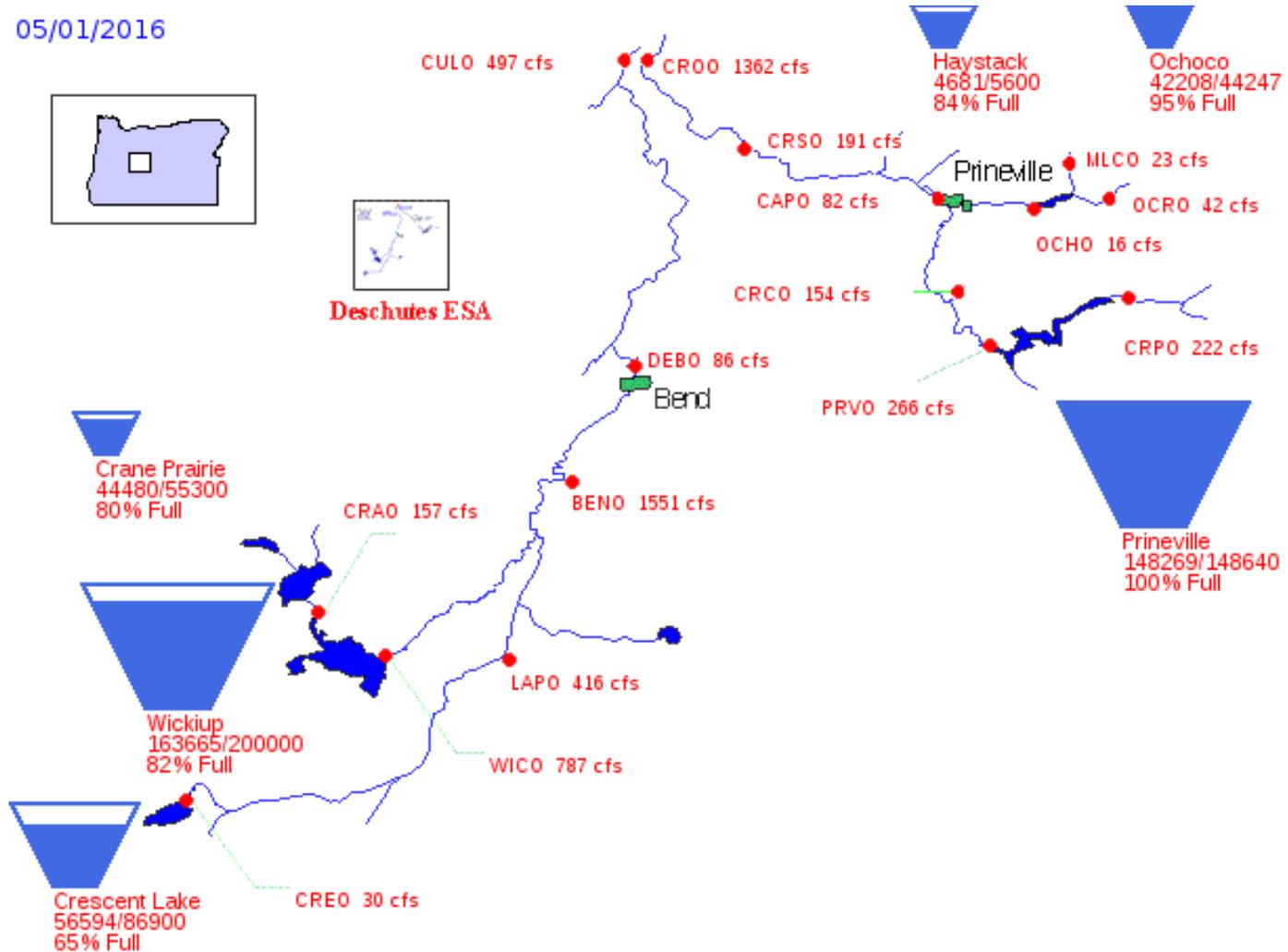
1900's  
LUMBER &  
(IRRIGATED) AGRICULTURE



N RIVER  
ORE

# USBOR – Teacup Diagram – Deschutes Basin

05/01/2016





**Bend Bulletin**

**September 11,  
1923**

**Oregon State  
Board of Health  
Letter  
to  
Bend Water  
Light & Power  
(Original Water  
Provider for Bend...)**



**To Our Water Users--**

*Please read the following letter received from the Oregon State Board of Health today:*

September 11, 1923.

Mr. T. Foley, Manager  
Bend Water, Light & Power Company,  
Bend, Oregon--

Dear Sir:

In order to make the water situation clear to the citizens of your city, I am writing this letter and sending copies to the press and City Officials.

Your Company is undoubtedly much interested in providing a safe water supply for the City of Bend. A water to be fit for domestic use must be absolutely pure and free from animal or human contamination. I have been unable to find such a supply in the Bend district. The samples taken from Spring River and Tumalo Creek were polluted and unfit for domestic purposes.

The only way of solving your problem, providing you cannot find some other source of water, is to consider a filtration plant. A filtration system will give you a clear, pure drinking water the year round. With the addition of your present purification plant, you can have a water supply that will not only be safe but will be palatable. This system will have the additional advantage of permanently safe-guarding your water supply.

The present condition of your water, caused by decaying vegetable matter, is not a real danger in itself but it makes the water highly unpalatable.

In regard to the statement that the water did not contain pathogenic organisms, I cannot subscribe to the same. The diarrhea and dysentery are undoubtedly of bacterial origin.

It is now time for the city to unite on one plan and the only one so far presented that the State Board of Health can approve is filtration and purification of the Deschutes River.

We again offer our services and will be glad to make further investigations if necessary.

Yours very truly,

SGD FREDERICK D. STRICKER,  
State Health Officer.

FDS:

The lower card is the last test made of the water in our system. We are chlorinating the city supply and are arranging for daily tests. However, until further notice, we recommend boiling the water. In the meantime we are taking steps looking to the installation of a modern filtration and sterilization plant.

OREGON STATE BOARD OF HEALTH	
WATER REPORT	
Laboratory No. 5339	Date 9-1-23
Name Bend Water Light & Power Co. (of water)	Address Bend (of water)
Source Deschutes River (filtered)	B. Cell per 100 c. c. 0
Bacteria per c. c. 5	Treasury Department Standard
"Water containing more than 100 bacteria per c. c. or more than 2 B. cell per 100 c. c. is UNFIT FOR DRINKING."	
If water does not meet above standard same should be used in the preparation of uncooked foods or for drinking purposes without boiling.	
OREGON STATE BOARD OF HEALTH	

***Bend Water, Light & Power Company***

September 11, 1923.



Mr. T. Foley, Manager  
Bend Water, Light & Power Company,  
Bend, Oregon--

Dear Sir :

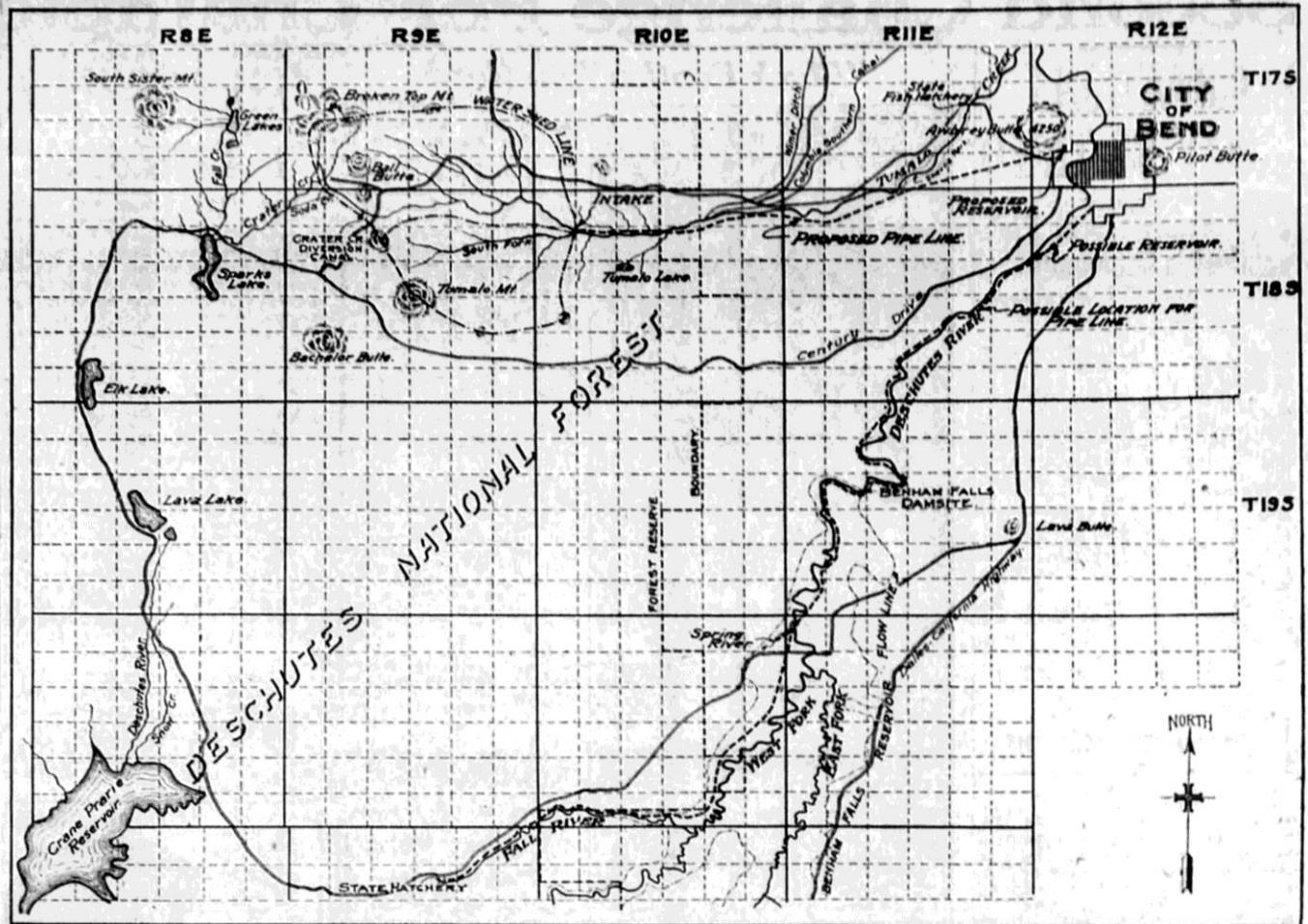
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**Possible Sources of Water Supply for City of Bend**



The above is a reproduction of drawing No. 1, appearing in the joint report of Engineers John Dubuis and R. E. Koon on the subject of Waterworks Improvement. The third installment of the report, which was submitted to the Bend City Council last Friday night follows:

**Waterworks Improvements**

A Preliminary Engineering Report by John Dubuis and R. E. Koon

tion above the city that the cost is minimum. This stream is located west of the city, drains the eastern slope of Broken Top and Tumalo mountains. It has two forks. The South fork appears to collect the drainage in the form of springs and is a supply of exceptional purity and quality. Its drainage area is entirely within the forest reserve, and according to the forest officials, contains no merchantable timber. No roads cross the

**Bend Bulletin**  
**“Waterworks Improvement”**  
**February 1925**



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# READ THIS

# VOTE TOMORROW

Tomorrow we all, as citizens face a problem of grave importance in the matter of the City Water Bond Election. In this, the last printed statement which this group will make, we ask that each and every voter consider this problem most carefully for him or herself from the facts that have been presented. We ask no more of you than a fair consideration of our statements and your further consideration of the dire results which it is possible to bring upon Bend if these bonds in the amount of \$600,000 are voted at this time and under the conditions which at this time exist.

In our past statements we have endeavored to show you that the proposition as submitted by the Council is not a business like one and the voting of the bonds will hazard the future of the city, its people and its business.

## FACTS:



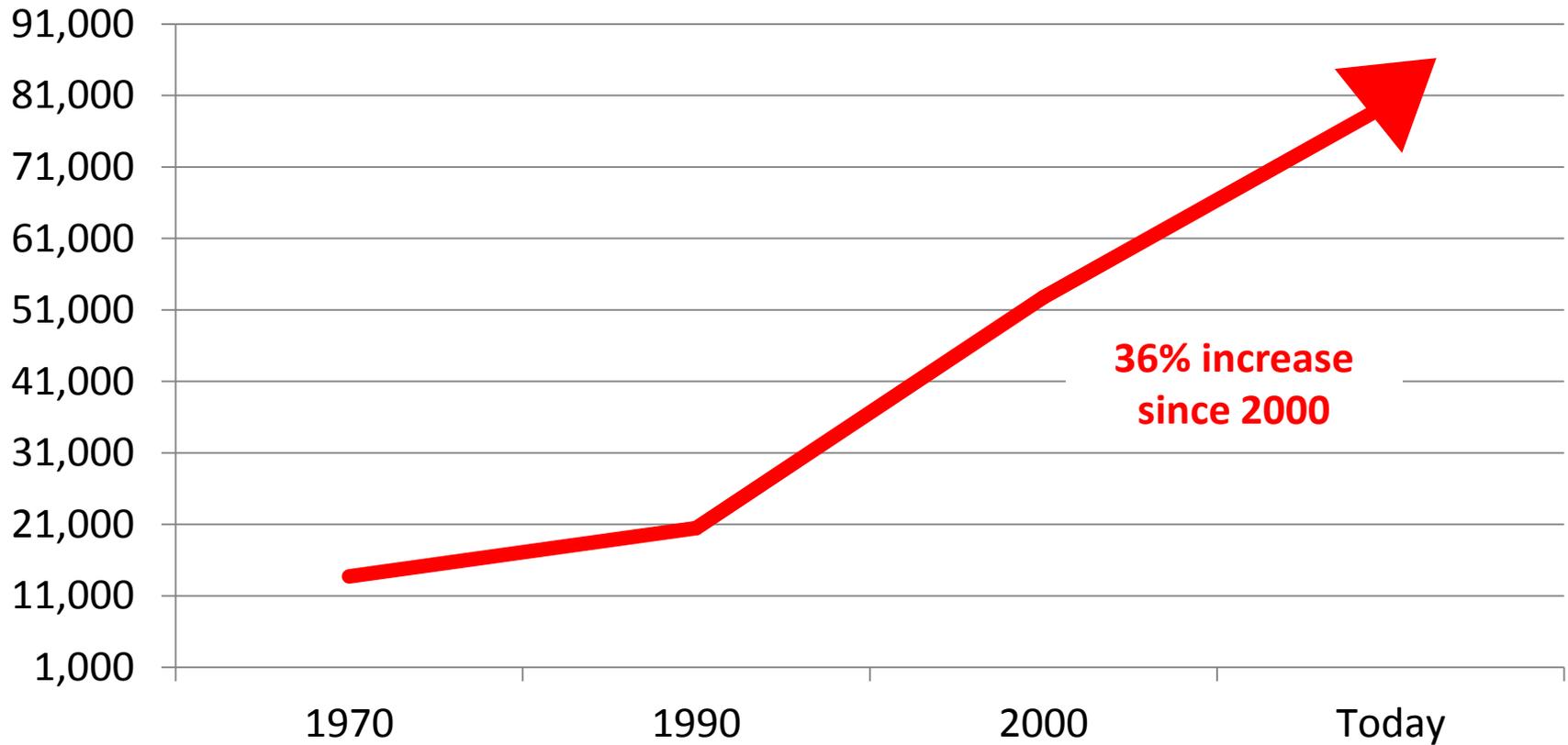
**BRIDGE CREEK HAS BEEN BEND'S PRIMARY  
WATER SOURCE SINCE 1926**

**93 Years  
Exempt  
Filtration  
Rules Until  
April 15, 2016**



# BEND GREW AND IS GROWING RAPIDLY 18,000 TO 81,000 IN 25 YEARS

## Population



# ENGINEERING ROLE IN WATER SUPPLY

Year	Engineering Studies
1964	<i>Water Master Plan</i>
1980	Water System Master Plan <b><u>REPLACE PIPELINES!!!</u></b>
2004	Became fully Metered system (2007 fully AMI)
2007	Water Master Plan Update
2009	Brown Caldwell Water Supplies Alternatives Study
2010	HDR Surface Water/ Ground Water Cost Comparison
2011	Value Engineering Study
2011	Optimization Study – Water Master Plan Update
2011	HDR Technical Report Timing of Hydro Project

**Deschutes Basin  
Got Water?**



50 ft

Montgomery





## Every Basin is somewhere on the water supply continuum



water to allocate

NO water to allocate

Today, if no “new” water is available to allocate, new water needs must be met from existing water rights

**This is when basin water planning gets very exciting...**

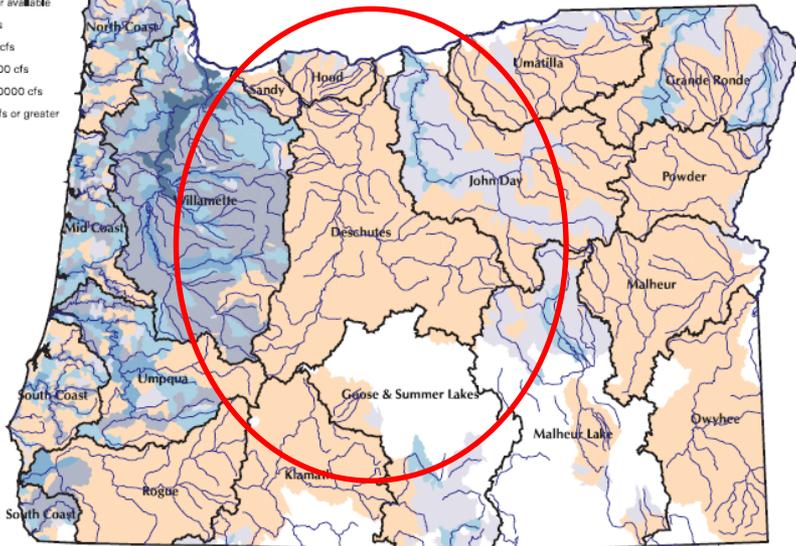


- **1913:** All reliable senior surface water in Deschutes was appropriated
- **1970's:** Lack of surface water availability forced new demands to use groundwater.
- **1990's** USGS Study: Surface & Groundwater “Connected” New GW Permits in “Limbo” – Scenic Waterway
- **2002:** Oregon issues groundwater mitigation rules. New groundwater permits available *with mitigation.*

# NO ADDITIONAL SURFACE WATER AVAILABLE

## JANUARY

- No data
- No water available
- 1 - 10 cfs
- 11 - 100 cfs
- 101 - 1000 cfs
- 1001 - 10000 cfs
- 10001 cfs or greater



Map produced August 12, 2016, state@wrdsouthwest.com

## AUGUST

- No data
- No water available
- 1 - 10 cfs
- 11 - 100 cfs
- 101 - 1000 cfs
- 1001 - 10000 cfs
- 10001 cfs or greater



Map produced February 05, 2016, state@wrdsouthwest.com

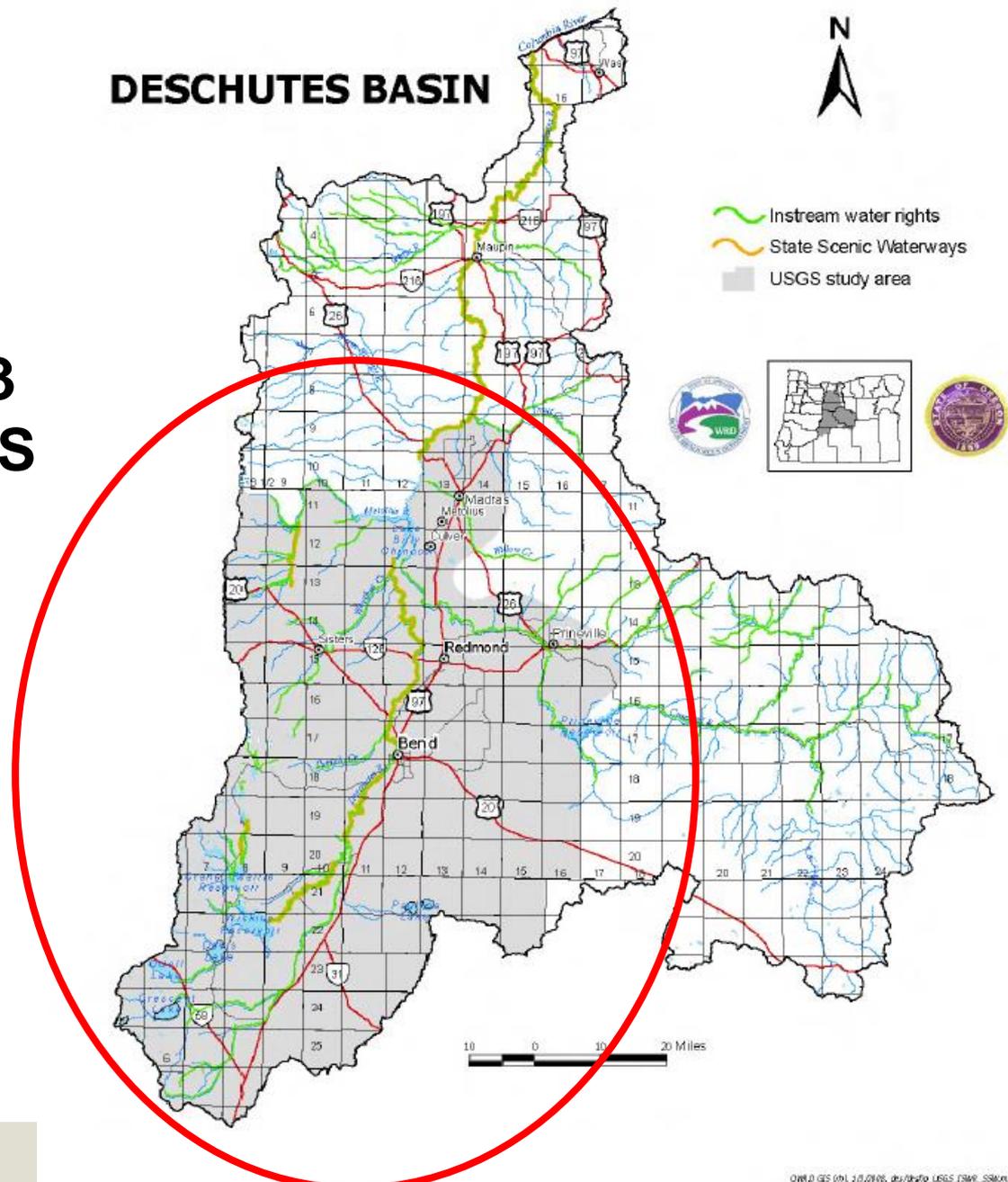
# NO "NEW" WATER AVAILABLE IN THE BASIN

**SURFACE WATER 1913  
GROUNDWATER- 1990'S**

**"MITIGATION"  
REQUIRED FOR ANY  
NEW GW  
(SURFACE WATER)**

**"CAP & TRADE  
SYSTEM"**

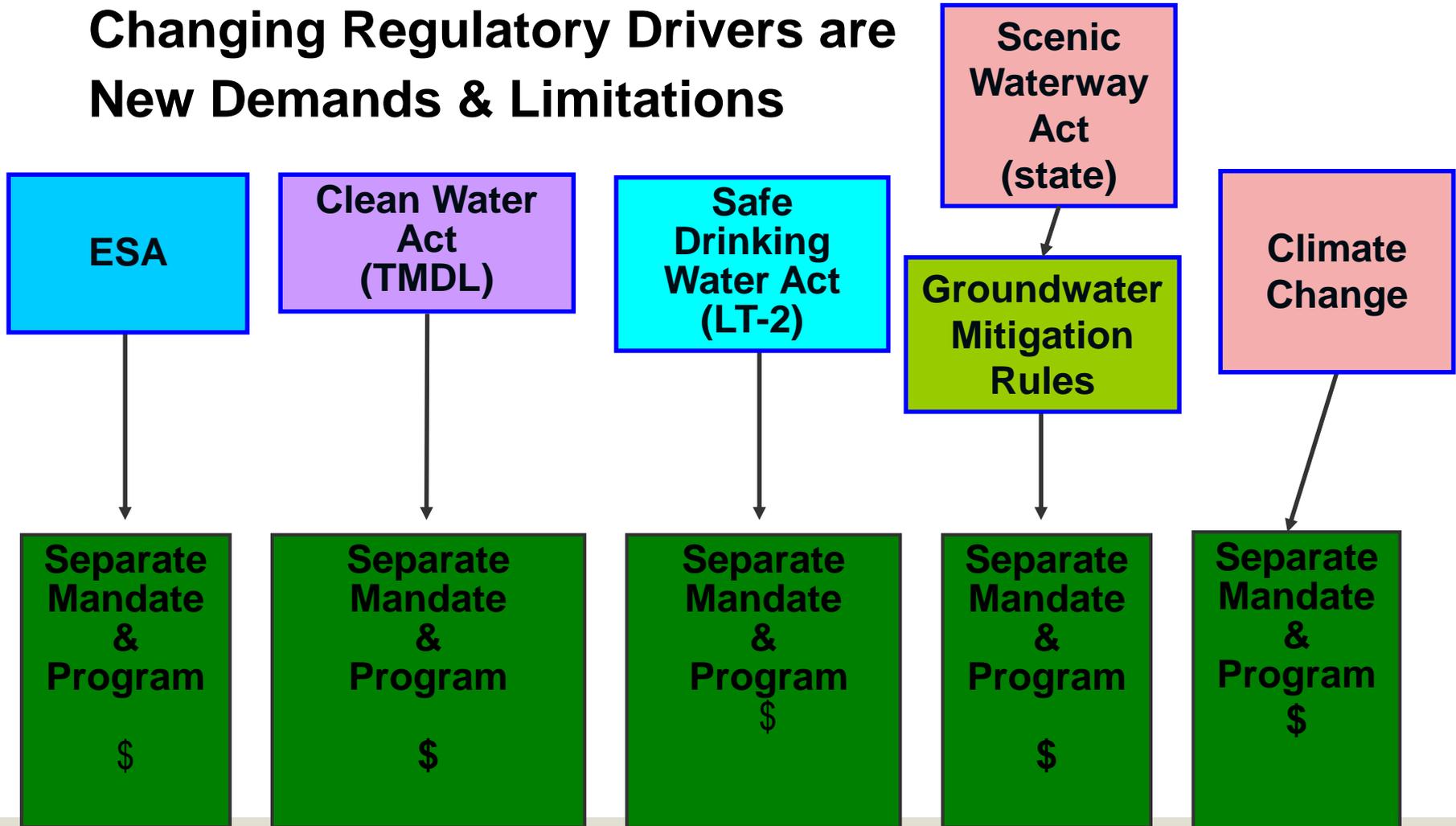
## DESCHUTES BASIN



# Water: Drivers of Change...

## Not Just Growth

Changing Regulatory Drivers are  
New Demands & Limitations



# 2006 Estimated Water Demands

**Water Utility's**  
**2%**

Water Utility Service areas that include Urban Growth Boundary – typically municipal providers

**Outside UGB's**  
**10%**

Resorts (private utility, golf, irrigation, etc), non district farms, small users

**Agricultural**  
**13%**

Existing Irrigation Districts seeking more reliable water rights (less reliance on storage), source switches, within current boundaries

**Instream Flows**  
**75%**

Water for fish, habitat, water quality (temp), scenic, recreation – values associated with “instream uses”

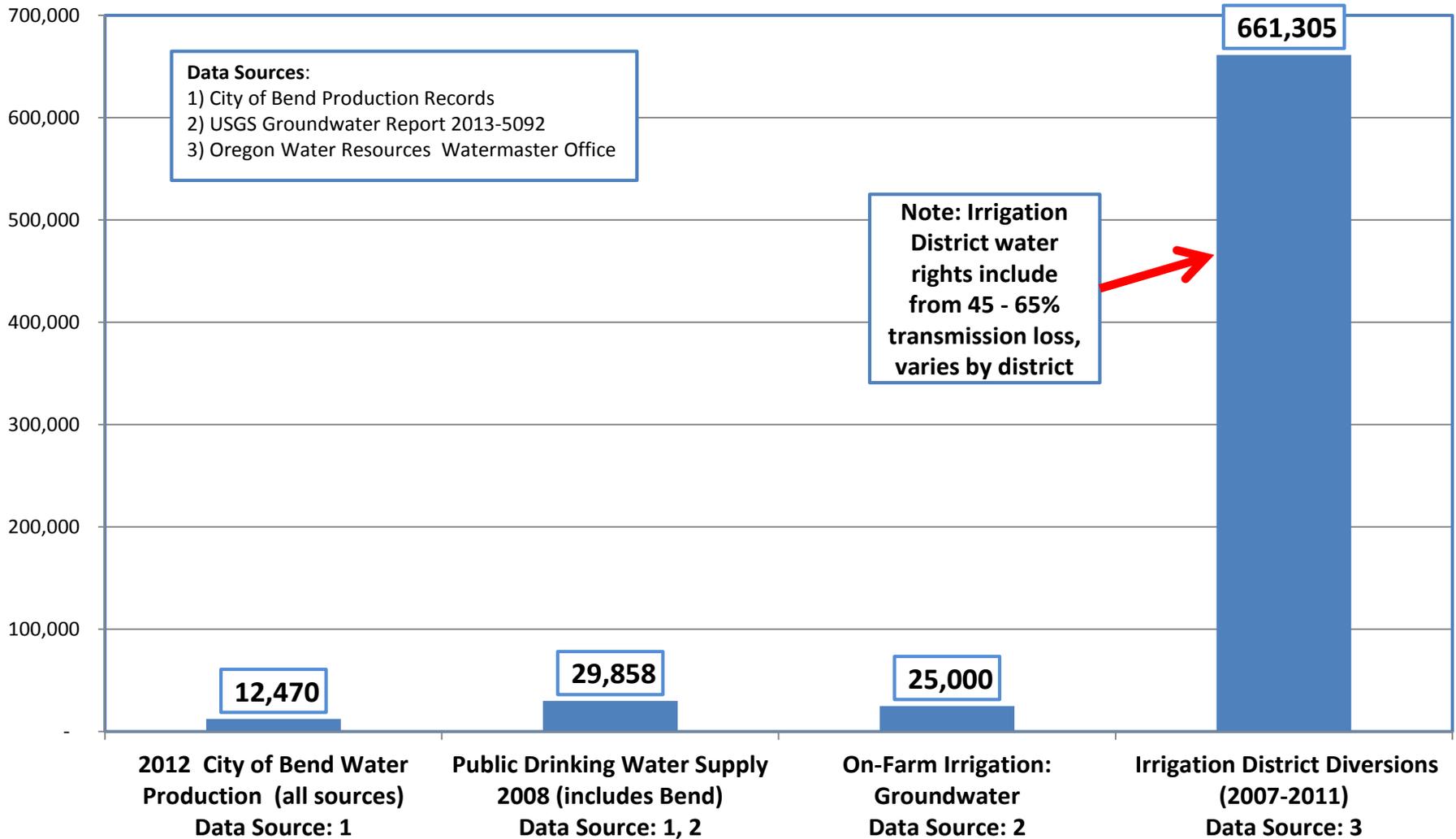
**250,000 AF**

# Deschutes Basin: "Magnitudes of Use Comparison Chart"

Annual Diversion by Major User Groups - (All Water Uses not Included)

(Districts divert for 180 Day Irrigation Season, Bend and Public Supply are 365 day totals)

(Acre Feet)





## Other Water Needs.... TBD!

Steelhead



**PELTON PROJECT  
HYDRO  
RELICENSING**

**Reintroduction  
of “listed”  
Steelhead above  
Pelton Dam...  
Whychus Creek  
Crooked River**

**Currently designated  
an “Experimental  
Population” under  
7(j) designation for  
species  
(*temporary* liability  
protection...)**

# ENDANGERED SPECIES ACT (ESA) HABITAT CONSERVATION PLANNING (HCP) GOAL: OBTAIN INCIDENTAL TAKE PERMIT (MULTIPLE SPECIES)

- Districts Initiated in 2007 with reintroduction of ESA listed steelhead
- 7 Irrigation Districts & City of Prineville have potentially harmful (take) activities to listed species
- 8 years of effort and over \$5.0 million and counting, will likely require X+ (?) more years & dollars
- Requires coordination and involvement of a number of stakeholders

- CTWS
- PGE
- DRC
- American Rivers
- Water Watch
- Trout Unlimited
- US Fish & Wildlife
- NOAA
- BOR
- BLM
- OWRD
- ODFW
- DEQ
- COCO (CO Cities)
- Others



## Other Water Needs... TBD!



Oregon Spotted Frog  
Listed August 29, 2014

**Lawsuit filed (WaterWatch,  
CBD) Injunction Denied  
Settlement / Mediation  
Underway**

+

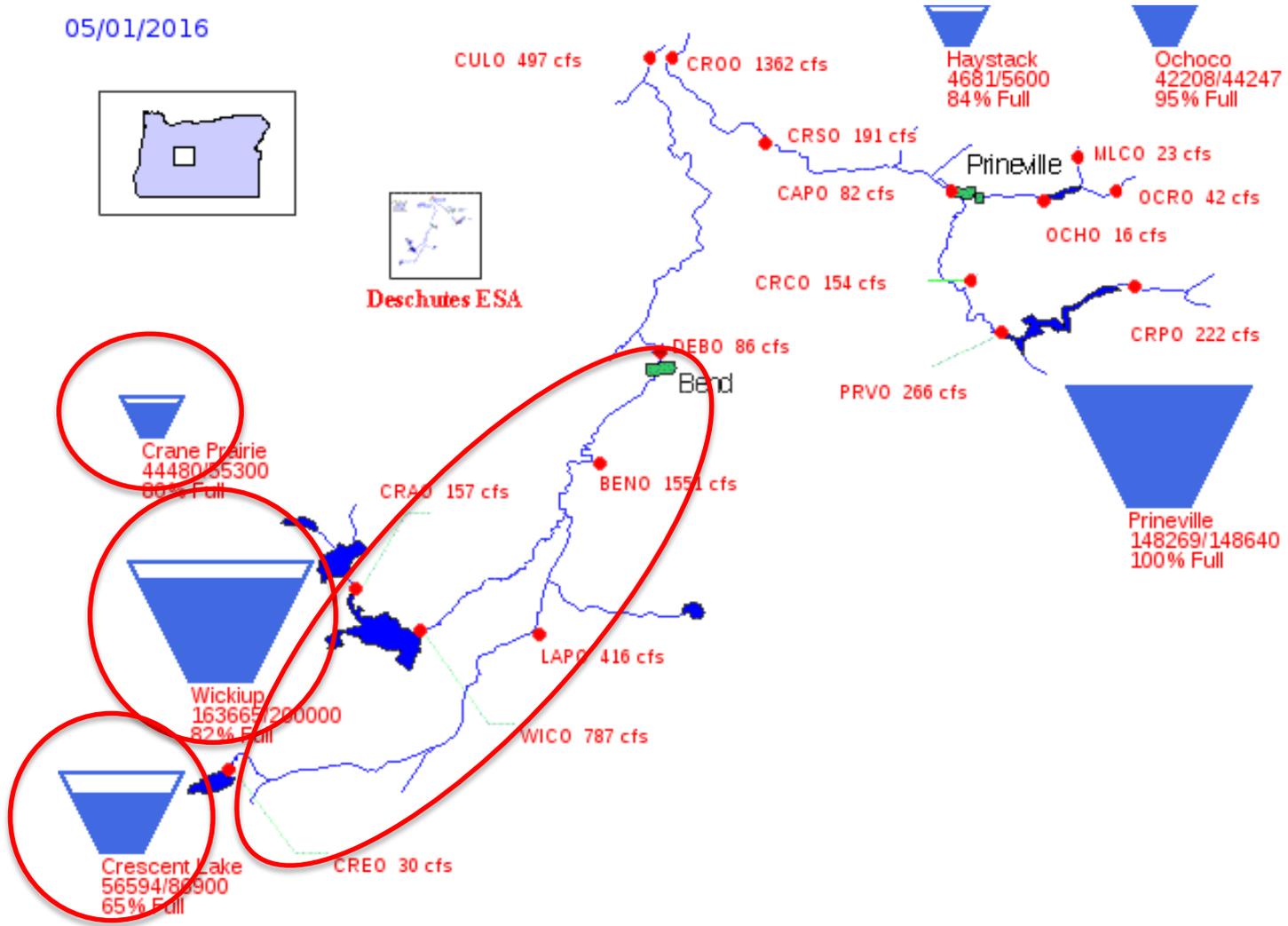


Steelhead

**Currently Experimental  
Population 7(j)  
designation for species  
(temp liability protection)**

# USBOR – Teacup Diagram – Deschutes Basin

05/01/2016



# BUT WHAT ARE YOU DOING ABOUT CLIMATE CHANGE?



Climate Change...  
Snow or no snow?  
Surface or groundwater?  
Mitigation or Adaptation?





# THE UPPER DESCHUTES BASIN STUDY

Water for agriculture, rivers & cities

- **Develop a comprehensive analysis of water supply and demand, integrating and updating the analyses to account for climate change**
- **Analyze how existing operations and infrastructure will perform under the projected future water supply conditions and demands**
- **Develop and evaluate options for addressing identified water imbalances**
- **Complete analysis to compare relative cost, environmental impact, risk, stakeholder response, and other common attributes of identified options**

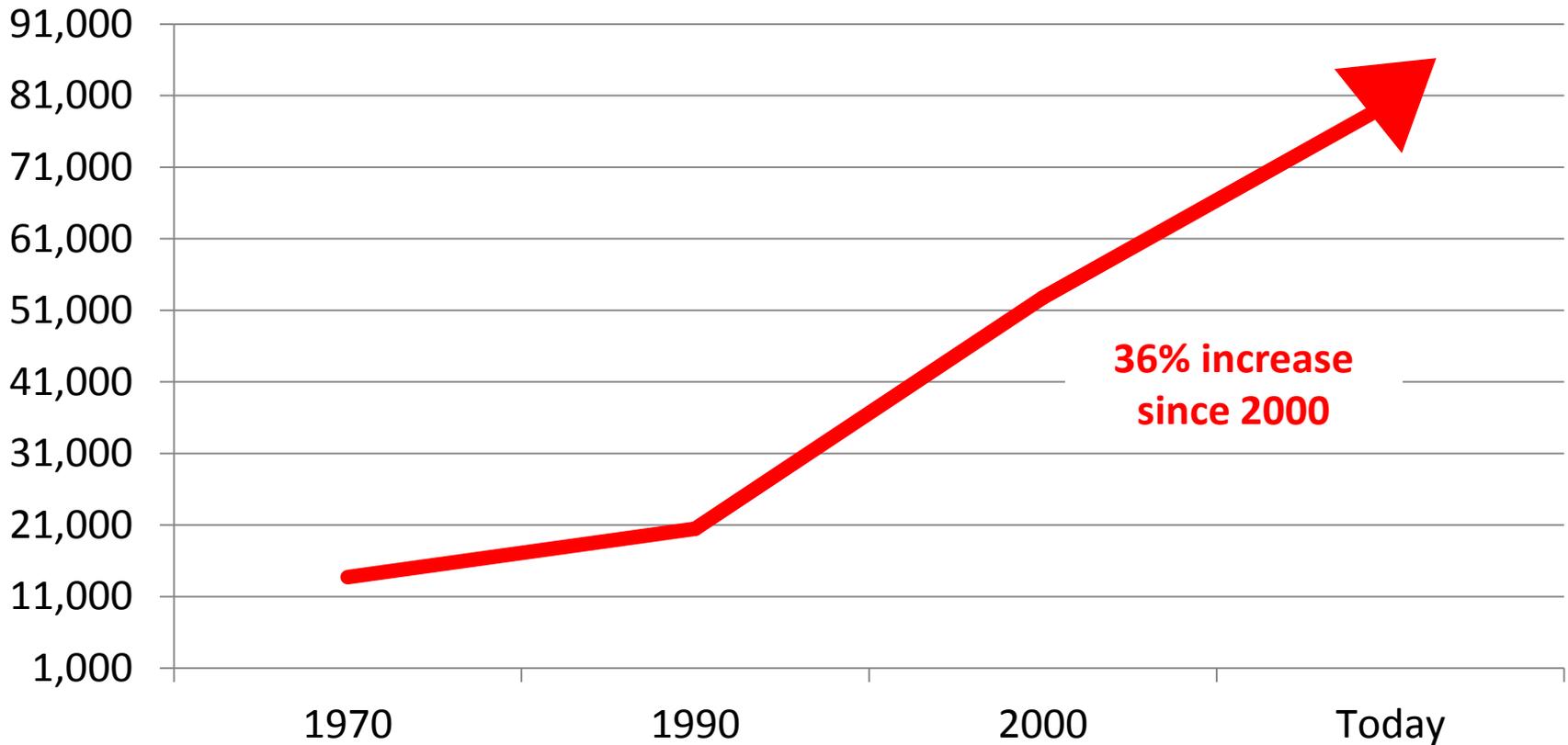


**WHEW...**



# BEND GREW AND IS GROWING RAPIDLY 18,000 TO 81,000 IN 25 YEARS

## Population



# BEND'S WATER SUPPLY PORTFOLIO

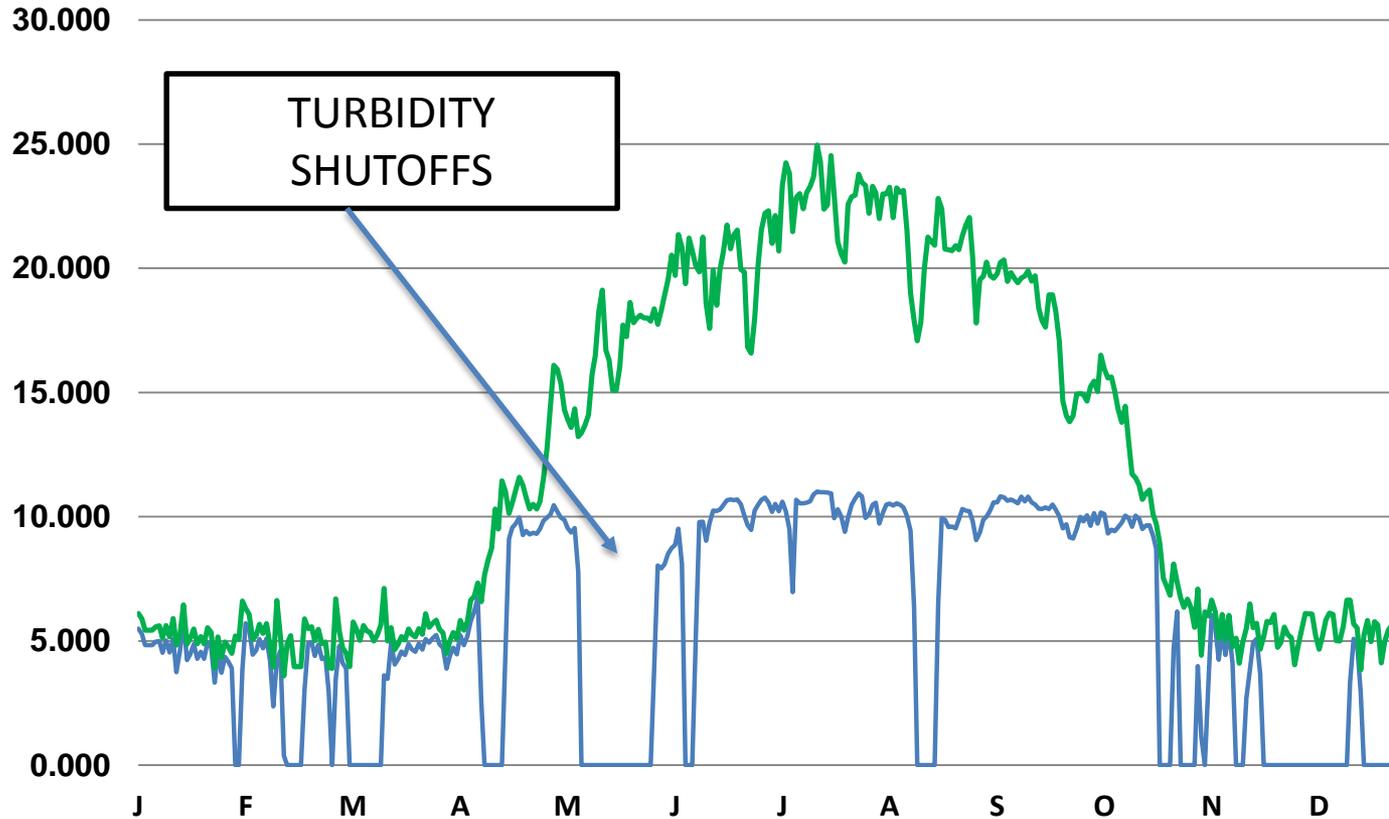
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- Surface Water
- Groundwater
- Conservation & Efficiency (WMCP)
- Recycled Water

# 2014 Total Daily Water Production

with surface water production  
(MGD)



— Daily Surface Water Production  
— Daily Total Water Production



FAILING PIPES

“FULLY DEPRECIATED”  
FACILITIES...



LT-2 Rules



FIRE

# LEVEL OF SERVICE CONSIDERATIONS

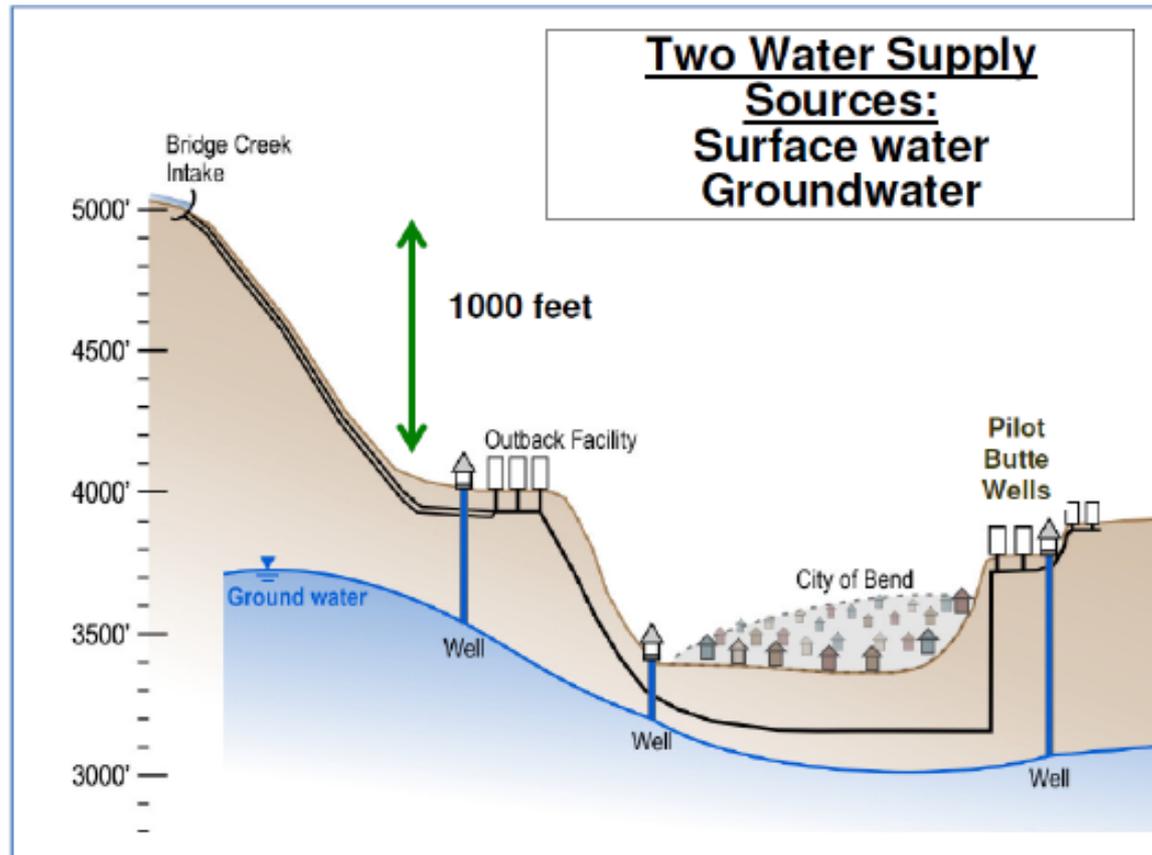


- Meet regulatory requirements
- Maintain City Control
- Maximize existing assets
- Minimize cost (capitol, O&M) of supply
- Maintain current water aesthetics
  
- Maintain dual source of supply
- Provide flexibility for future
- Minimize energy consumption
- Achieve environmentally sound projects
- Maximize potential for renewable energy
- Maintain ability to provide community safety (serve peak during power outage, fire)

# CLIMATE CHANGE CONSIDERATIONS



- ✓ **Meet regulatory requirements**
  - Maintain City Control
  - Maximize existing assets
  - Minimize cost (capitol, O&M) of supply
  - Maintain current water aesthetics
  
- ✓ **Maintain dual source of supply**
- ✓ **Provide flexibility for future**
- ✓ **Minimize energy consumption**
- ✓ **Achieve environmentally sound projects**
- ✓ **Maximize potential for renewable energy**
- ✓ **Maintain ability to provide community safety (serve peak during power outage, fire)**



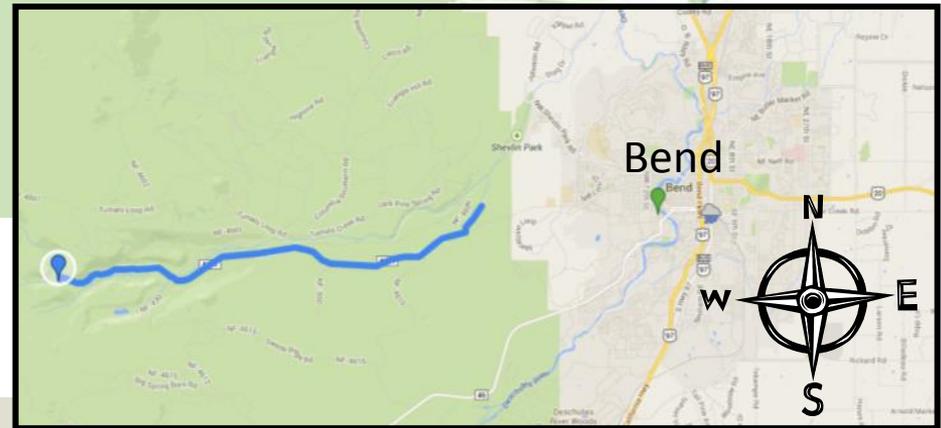
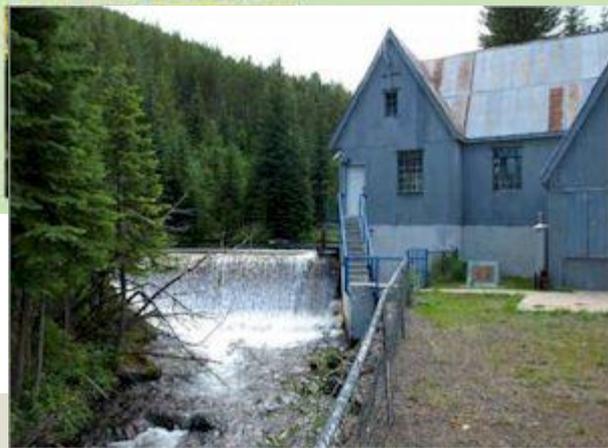
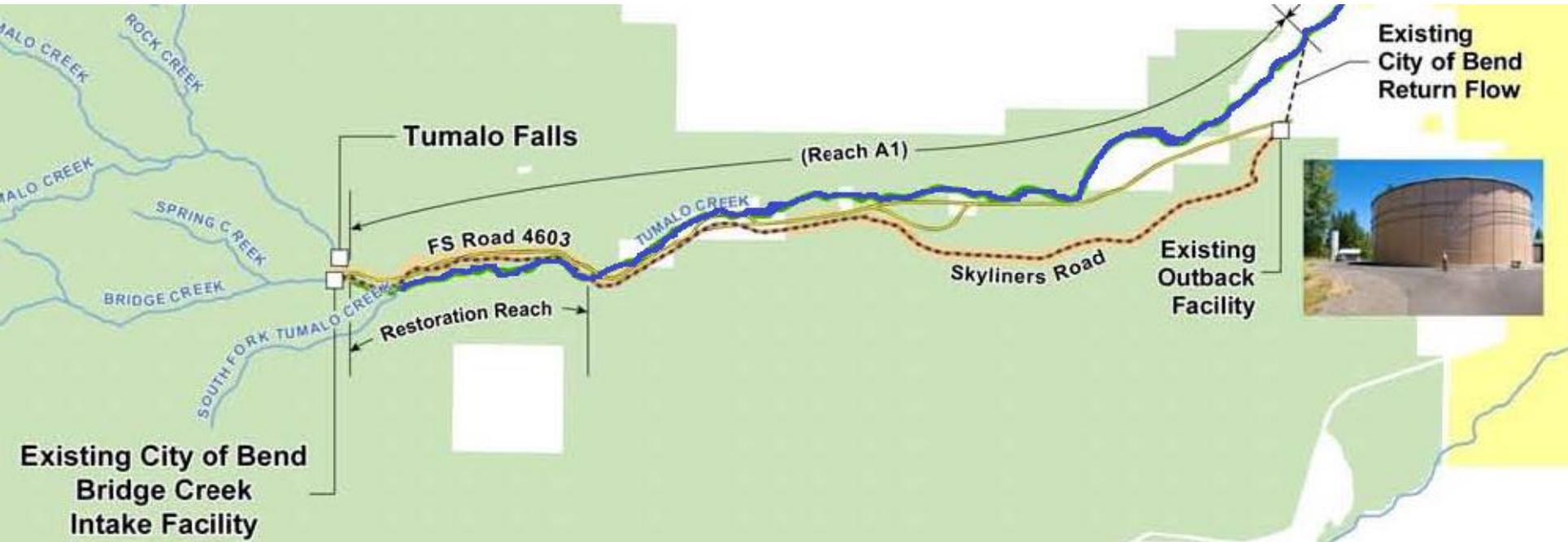
**Figure 2. City of Bend's Dual Source Water System: Groundwater pumped from 300- to 750-feet below the City and Surface Water Flowing by Gravity without pumping from 1,320-feet above the City**

# ALTERNATIVES ANALYSIS (2008/2009)



- Best option to address LT2, pipelines, wild fire potential:
  - Reconstruct/upgrade intake facility
  - Build a replacement pipeline in roadways and out of the forest
  - ★ • Build membrane filtration water treatment facility at city owned Outback site
  - Build hydrogeneration facility (end of pipe)

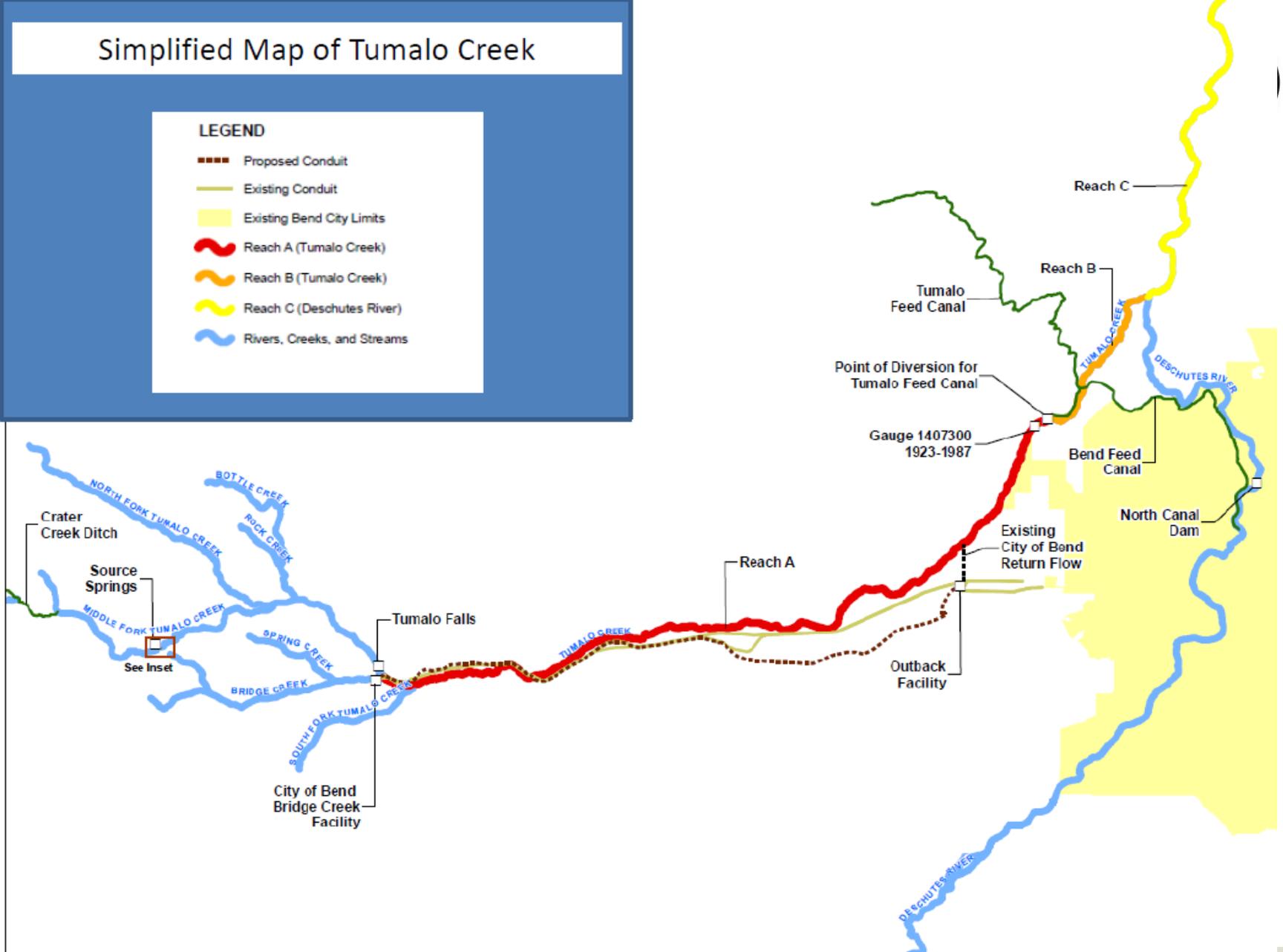
# City of Bend Surface Water System NEPA PROCESS – Environmental Assessment



# Simplified Map of Tumalo Creek

## LEGEND

- Proposed Conduit
- Existing Conduit
- Existing Bend City Limits
- Reach A (Tumalo Creek)
- Reach B (Tumalo Creek)
- Reach C (Deschutes River)
- Rivers, Creeks, and Streams

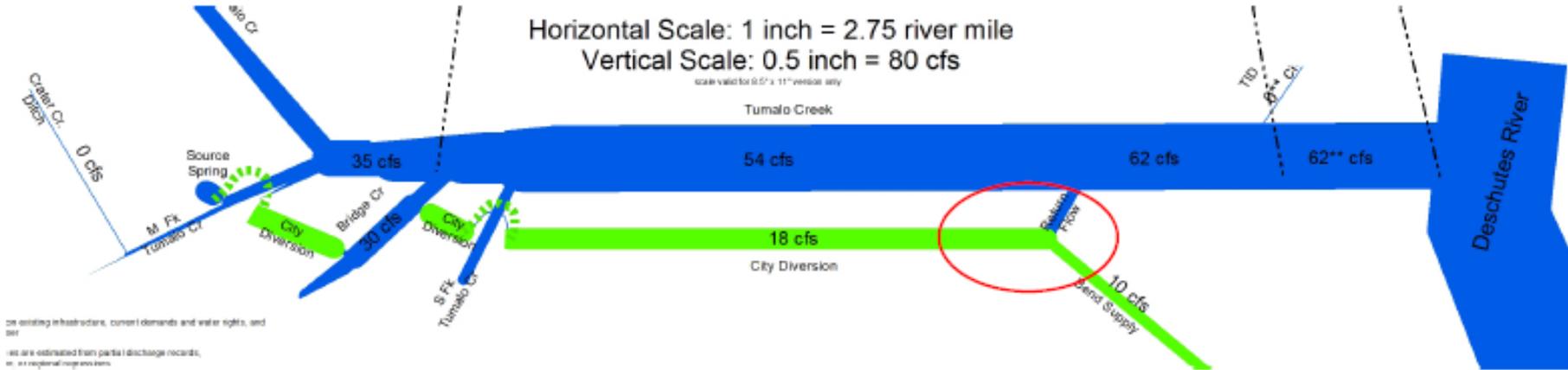


# PIPELINES OVER FEDERAL LAND - CAUTION



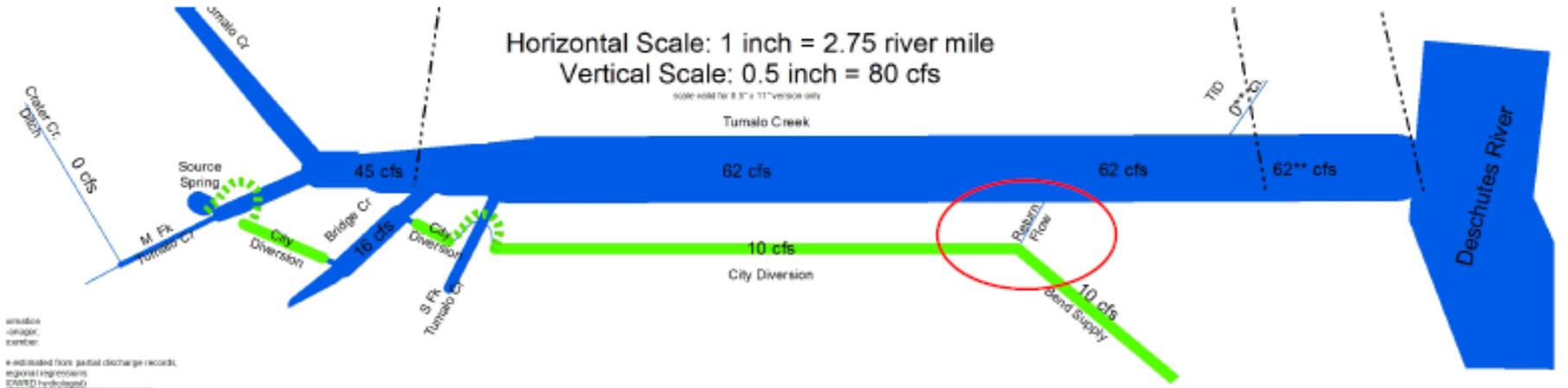
## NON-IRRIGATION SEASON (WINTER FLOWS, Typical December)

### Existing



on existing infrastructure, current demands and water rights, and  
are estimated from partial discharge records,  
in regional regressions.

### Proposed



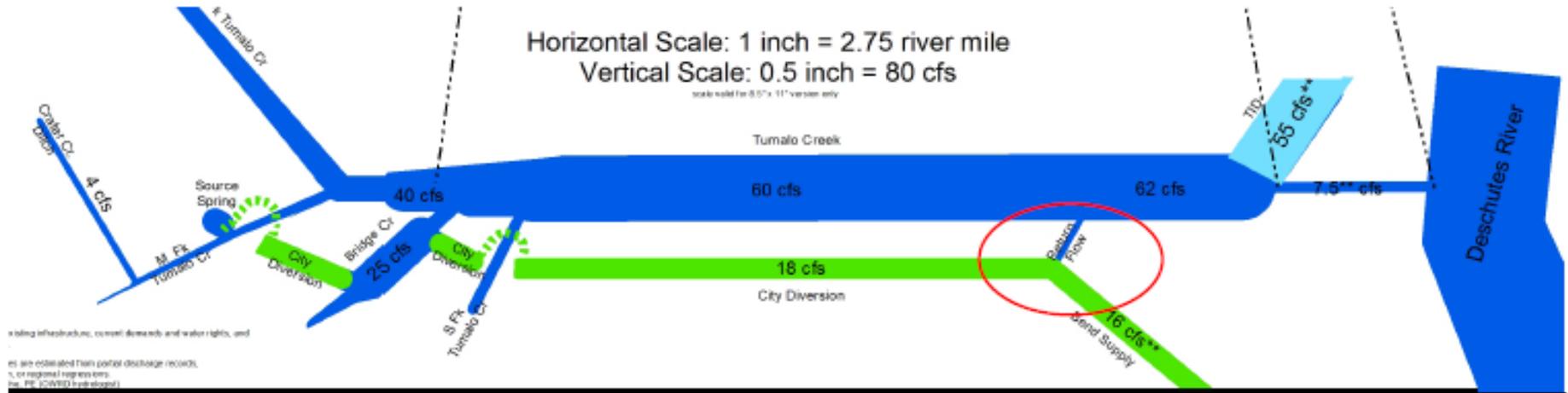
are estimated from partial discharge records,  
in regional regressions,  
BEND hydrology

# PIPELINES OVER FEDERAL LAND - CAUTION

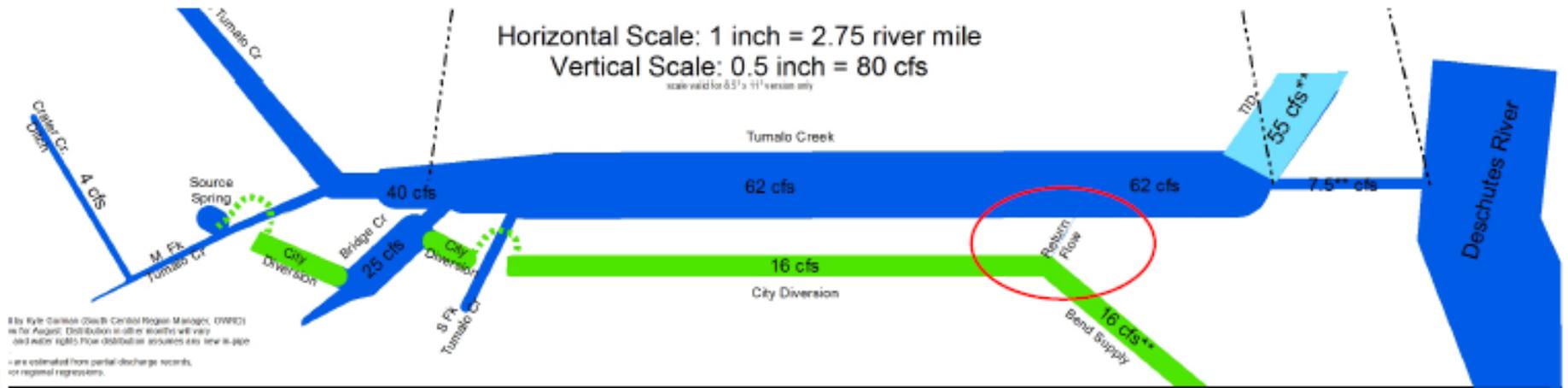


## IRRIGATION SEASON (SUMMER FLOWS, Typical August)

### Existing



### Proposed





## NEPA RESULTS

- Original ask: 21 cfs
- Modified ask: 18.2 cfs (original pipe capacity)
- Special Use Permit Conditions”
  - Limit to 18.2 cfs
  - Fish snorkeling
  - Temperature and Flow Monitoring
  - Ramping Rates
  - Annual meetings / review of data
- **Federal Court Case - Ruling in Favor**

# Pipe installation Complete!



# OUTBACK SITE - WATER FILTRATION FACILITY AND STORAGE RESERVOIRS



# NEW INTAKE STRUCTURE



# HOME STRETCH...

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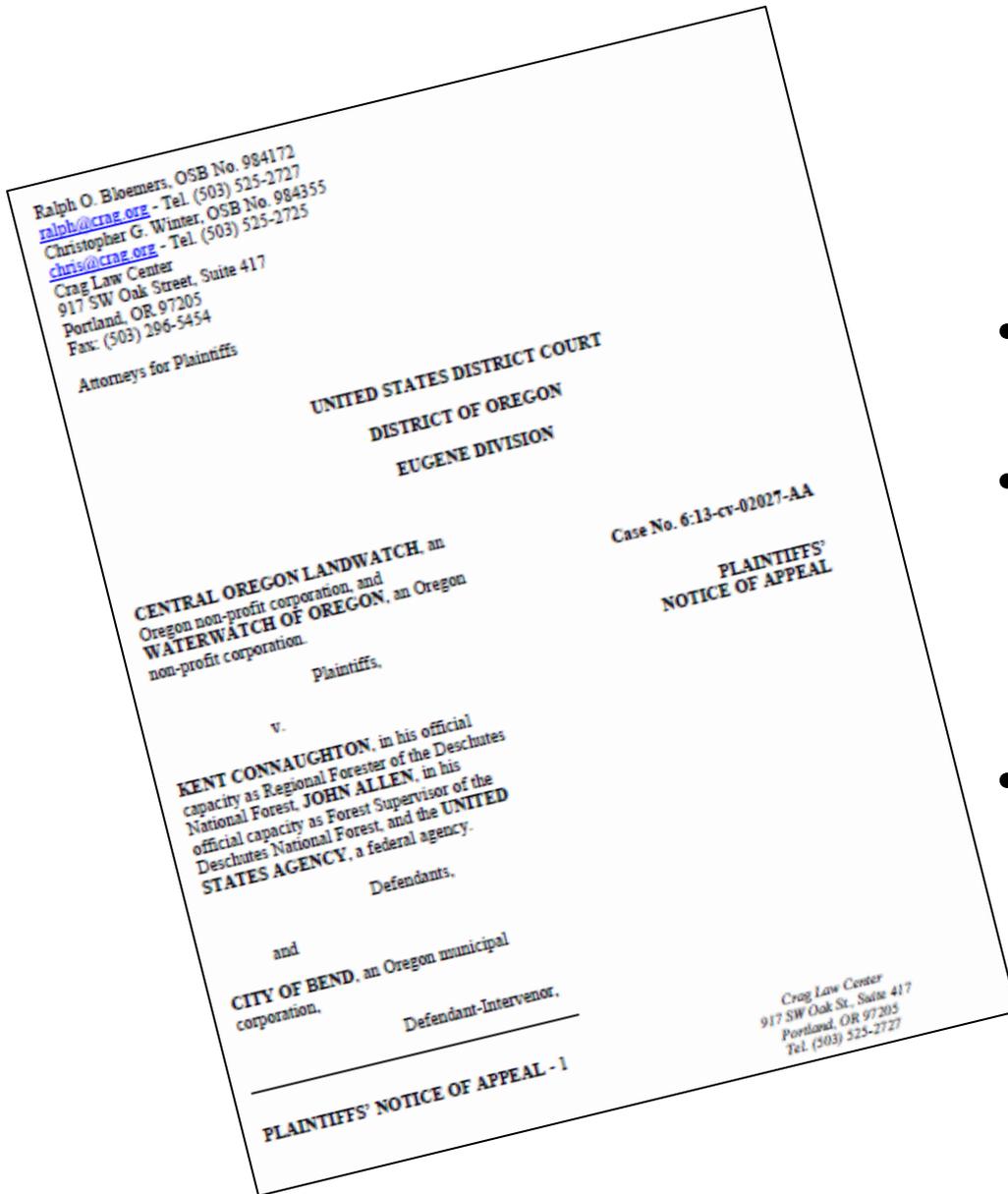


## **Bridge Creek Water Supply System Completion celebration April 15, 2016**

**You are invited to join a celebration of the new Bridge Creek Water Supply System from 2:30 p.m. to 3:30 p.m. on Friday, April 15, at the Outback Facility at 18600 Skyliners Road.**

# APPEAL – IN PROCESS

- All Briefs Filed
- Amicus by Oregon Water Utility Council and Oregon Water Resources Dept.
- Waiting to Schedule Oral Arguments





- Know your supply options (perfect your water rights)
- Know your basin's water supply history
- Partner up (thanks to OWUC and many others)
- Look WAAAAY down the road (50 years plus)
- Look at the whole field... Understand YOUR Basin conditions, future ESA and other regulatory changes
- Good water supply options build in resiliency AND climate mitigation and adaptation.
- We are all in this together!



## Questions?

Patrick Griffiths  
City of Bend – Water Resources Manager  
[pgriffiths@bendoregon.gov](mailto:pgriffiths@bendoregon.gov)