Appendix H – Water Quality Rules, Chapter 1

Describes How The Agency Will Implement Section 20 of Chapt. 1

Section 20 of Chapter 1

Allows No Degradation That Would Cause a Measureable Decrease in Livestock or Crop Production

Section 20 is Historic – Same Language in 1970's Standards

Implementation Language Necessary Because of Elevated Levels of Salinity and Sodium in CBM Produced Water

Original Need for Appendix H was to Set Irrigation Criteria

PRBRC Petition Included Questions on Livestock/Wildlife Criteria

Livestock Protection

Livestock Criteria

By Default also Effluent Limits for Produced Water

Conventional Oil/Gas Produced Water

There Are About 400 Conventional Produced Water Discharges Located Statewide

Those in the Big Horn Basin are especially valuable to livestock operators due to the arid nature of that basin

Typical CBM Produced Water

There Are About 4,000 Constructed CBM Outfalls. Most are in the Powder River Basin

The Powder River Basin is less arid than the Big Horn Basin

Group 1 (Existing Chapter 2 Effluent Limits)

Parameter	Limit – Units
Total Dissolved Solids (TDS)	5,000 mg/l
Sulfate	3,000 mg/l
Chloride	2,000 mg/l

Group 2 (Existing Policy Limits)

Parameter	Limit – Units
Boron	5.0 mg/l (Dissolved)
Cadmium	.050 mg/l (Dissolved)
Chromium	1.0 mg/l (Dissolved)
Copper	.5 mg/l (Dissolved)
Fluoride	4.0 mg/l (Dissolved)
Lead	.1 mg/l (Dissolved)
Mercury	.01 mg/l (Dissolved)
Selenium	.1 mg/l (Dissolved)
Zinc	2.5 mg/l (Dissolved)

PRBRC Petition Included Questions on Livestock/Wildlife Criteria

DEQ/WQD Contracted with UW to do Livestock Criteria Literature Review

Report Delivered July, 2007.
Reviewed and Considered by Advisory Board in 2007-2008

Group 3 (UW Report Recommendations)

Parameter	Short Term Exposure Limit	Long Term Exposure Limit
Arsenic	1 mg/l (Dissolved)	1 mg/l (Dissolved)
Barium	10 mg/l (Dissolved)	10 mg/l (Dissolved)
Fluoride	2 mg/l (Dissolved)	2 mg/l (Dissolved)
Moly.	.3 mg/l (Dissolved)	.3 mg/l (Dissolved)
Nitrate	500 mg/l	500 mg/l
Nitrite	100 mg/l	100 mg/l
Selenium	.1 mg/l (Dissolved)	.1 mg/l (Dissolved)
Sodium	4,000 mg/l (Dissolved)	1,000 mg/l (Dissolved)
Sulfate	1,800 mg/l	1,000 mg/l

Group 4 (Agency's Proposed Limits to Advisory Board)

Parameter	Limit – Units
Total Dissolved Solids (TDS)	5,000 mg/l
Sulfate	2,000 mg/l
Boron	5.0 mg/l (Dissolved)
Cadmium	.050 mg/l (Dissolved)
Chromium	1.0 mg/l (Dissolved)
Copper	.5 mg/l (Dissolved)
Fluoride	4.0 mg/l (Dissolved)
Lead	.1 mg/l (Dissolved)
Mercury	.01 mg/l (Dissolved)
Molybdenum	.3 mg/l (Dissolved)
Selenium	.1 mg/l (Dissolved)
Sodium	1,000 mg/l (Dissolved)
Zinc	2.5 mg/l (Dissolved)

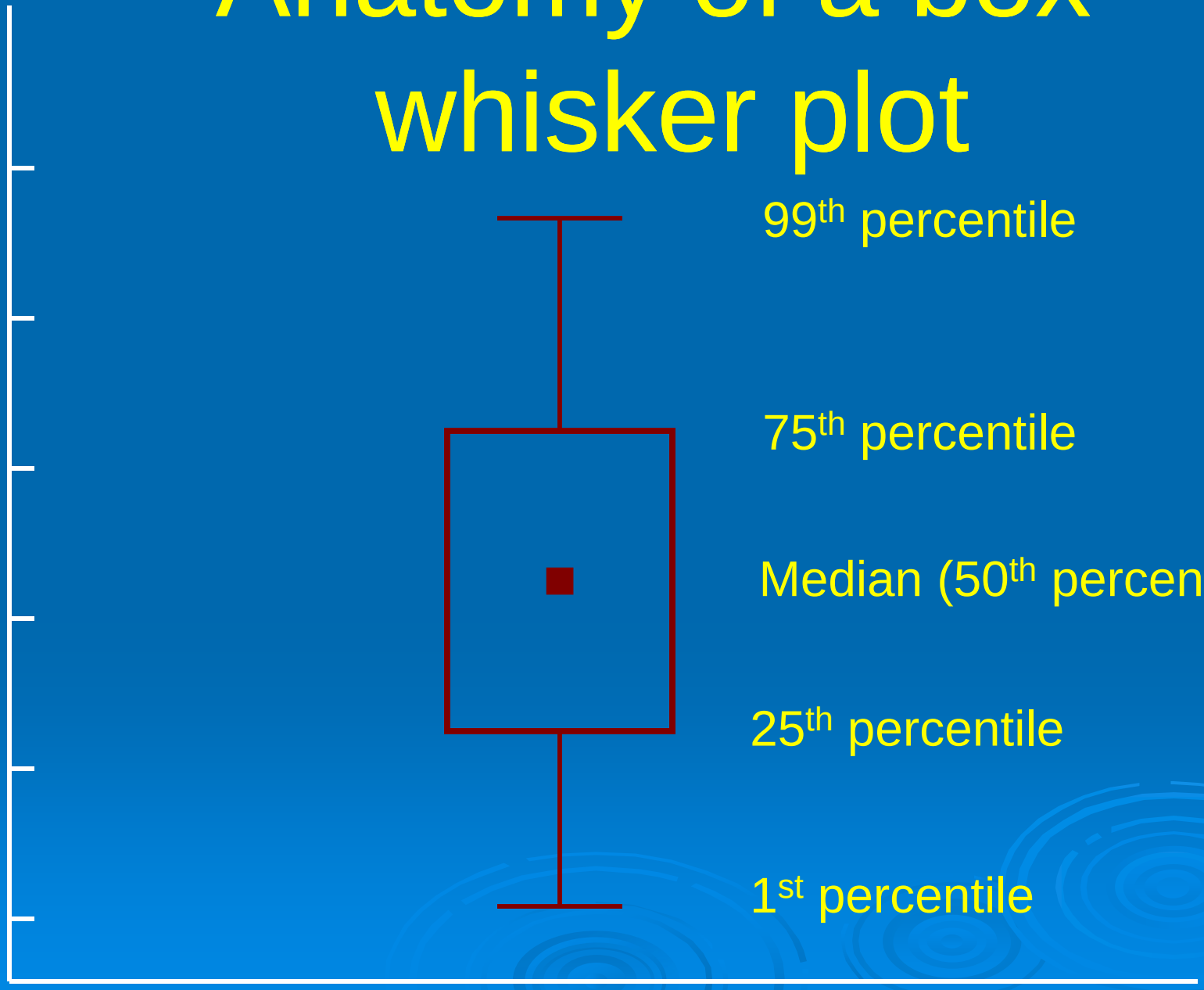
The Key Parameters

Sulfates

and

Sodium

Anatomy of a box-whisker plot



99th percentile

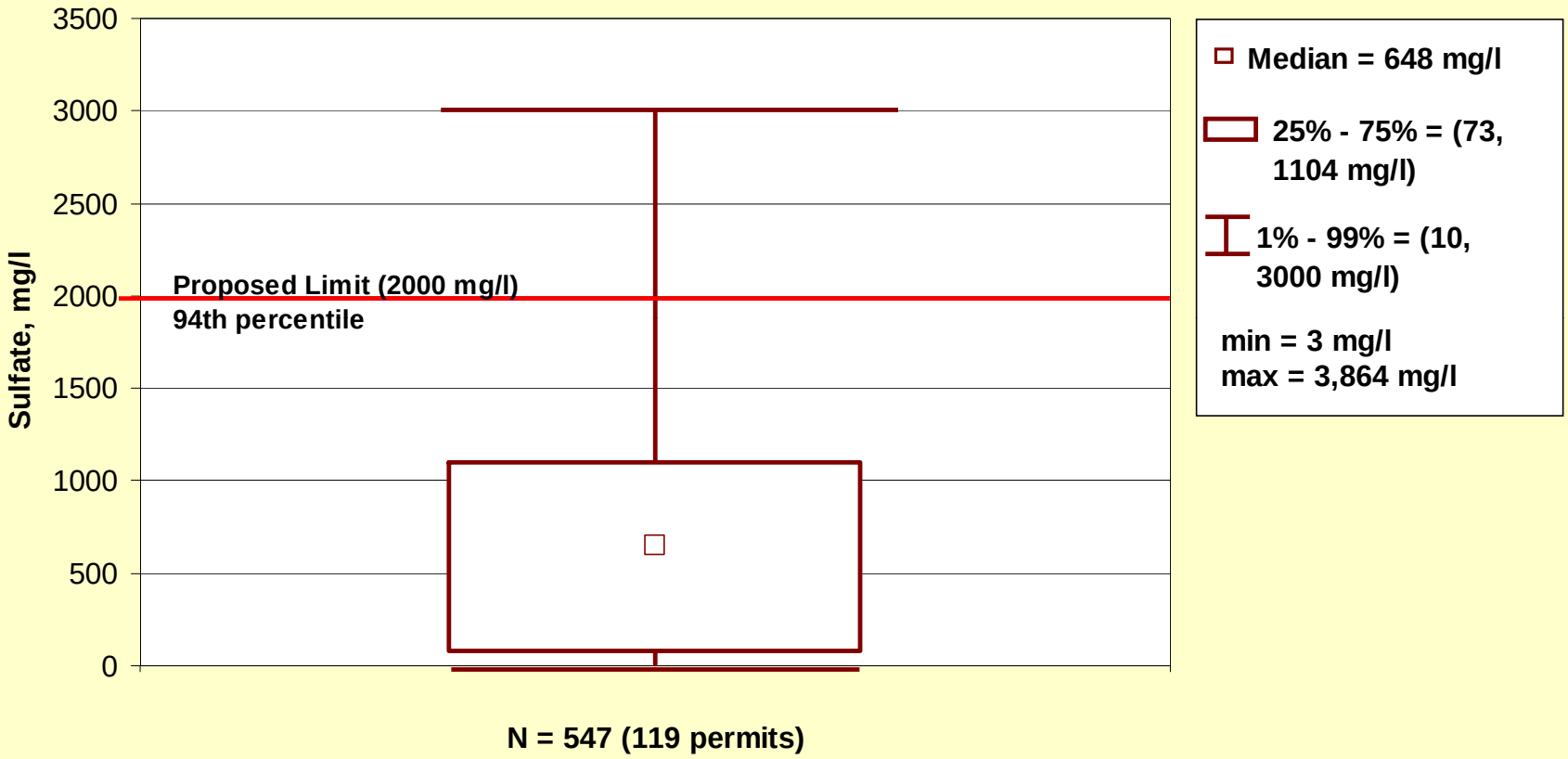
75th percentile

Median (50th percentile)

25th percentile

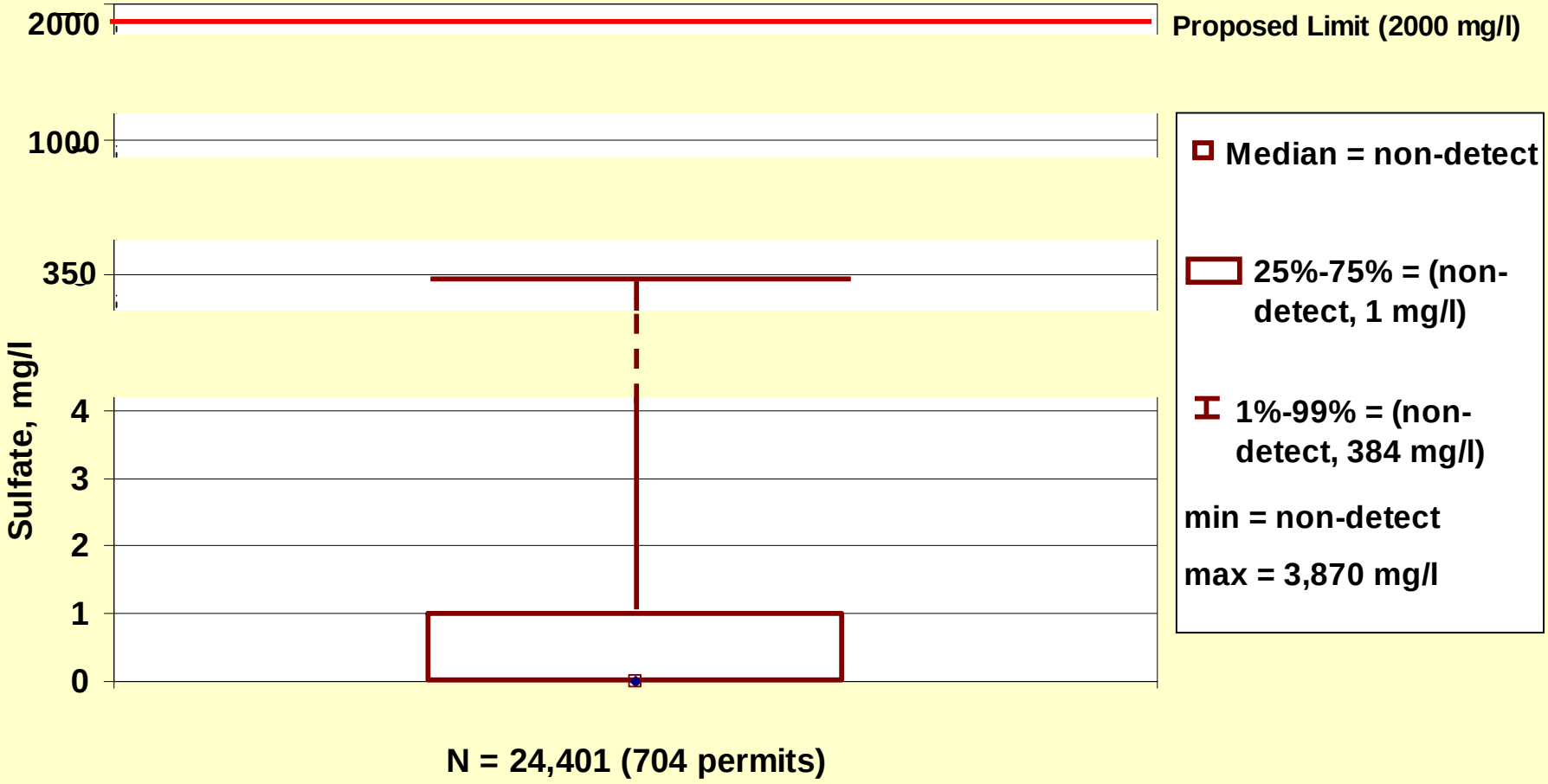
1st percentile

Sulfate Concentrations in Oil Treater Discharges



Data Source(s):
WYPDES Inspection Reports, WETT reports

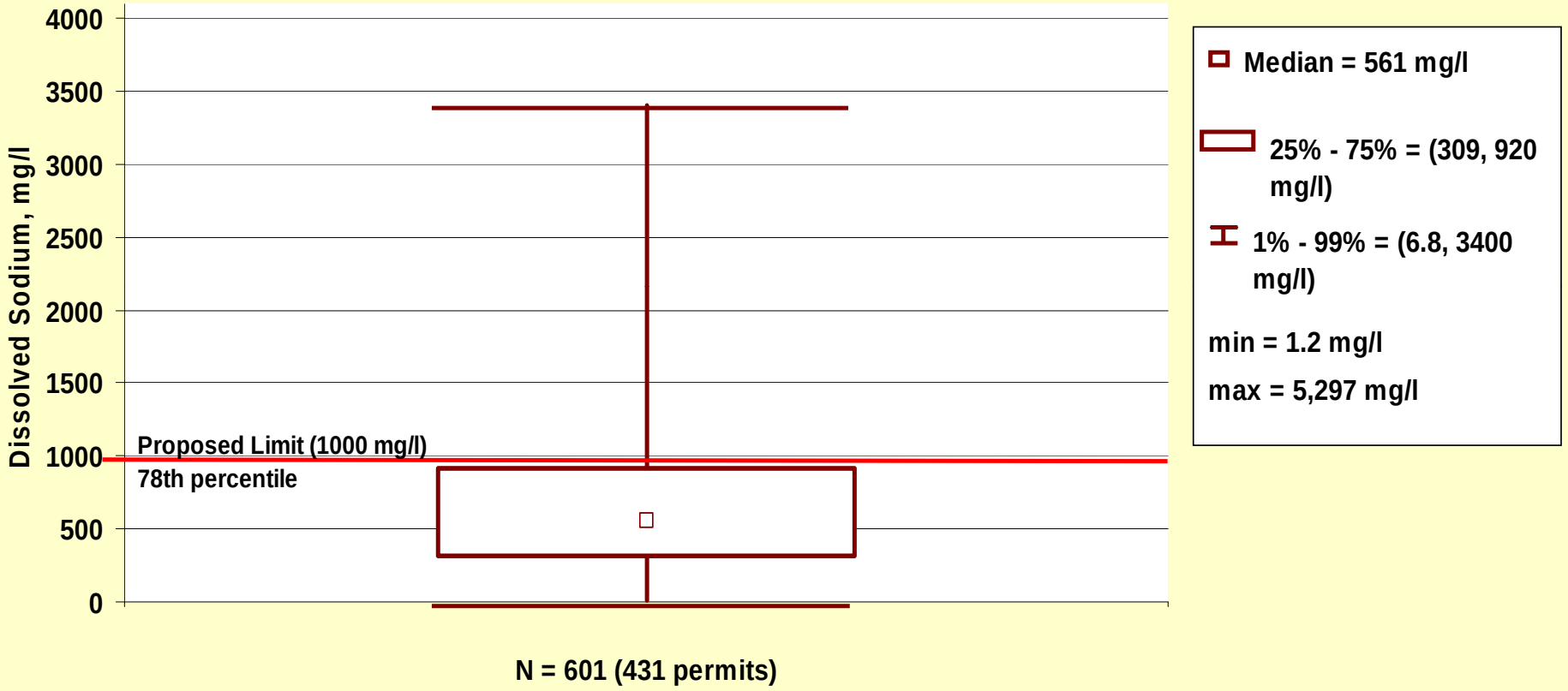
Sulfate Concentrations in CBM Discharges



N = 24,401 (704 permits)

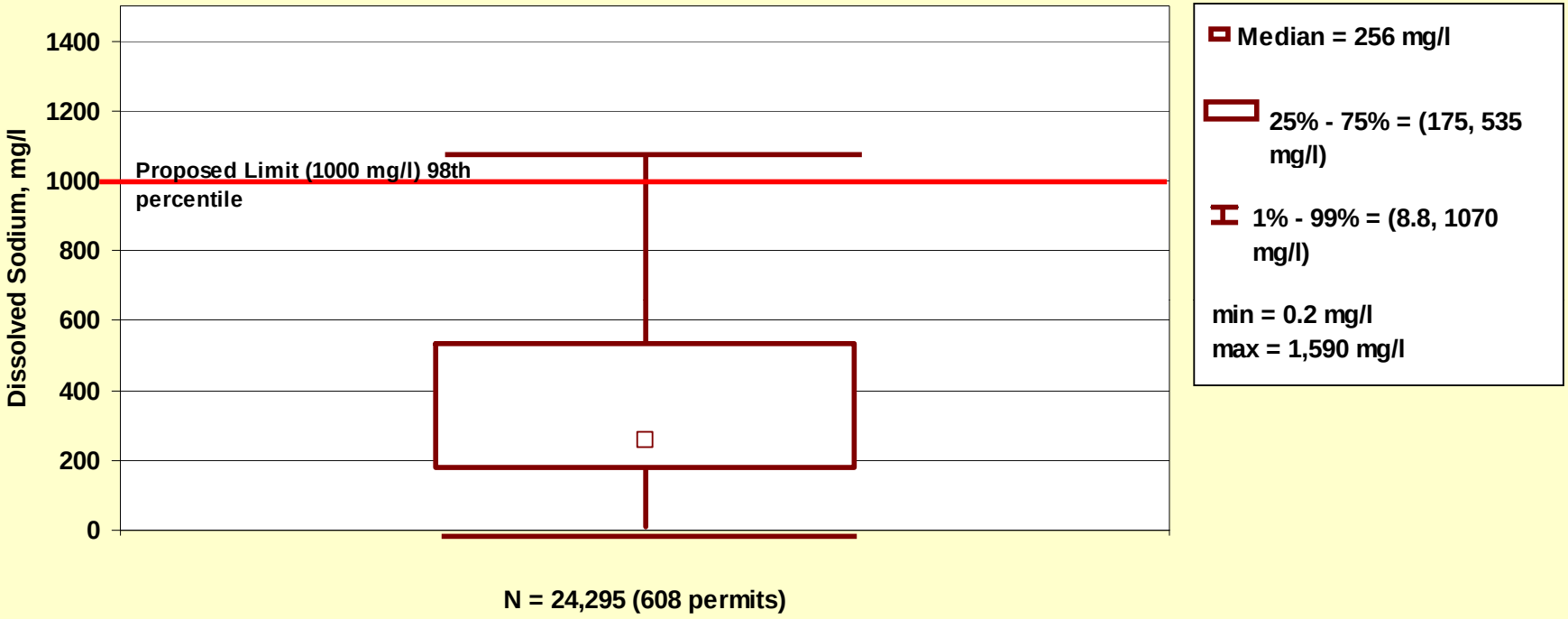
Data Source(s): WYPDES Discharge Monitoring Reports

Dissolved Sodium Concentrations in Oil Treater Discharges



Data Source(s): 1980's oil treater screening data

Dissolved Sodium Concentrations in CBM Discharges



N = 24,295 (608 permits)

Data Source(s): WYPDES Discharge Monitoring Reports

Grandfather Effect

46 of 462 Oil Treater Permits are Post 1/1/98

938 of 955 CBM Permits are Post 1/1/98

Projected Effects on Existing Oil Treater Permits

2 or 3 could not meet 2,000 mg/l sulfate

About 10 could not meet 1,000 mg/l sodium

Projected Effects on Existing CBM Permits

About 18-20 could not meet 1,000 mg/l sodium

Summary of Comments to Advisory Board

Overwhelming Majority Said "Make No Changes to Current Limits"

Advisory Board's Recommendation

Make No Changes to Current Limits

Recommended Changes Due to Comments to EQC

Add Livestock Watering Waiver Language to the Rule

Irrigation

Purpose

Translates the narrative goal of Chapter 1 Section 20 into numeric limits for Electrical Conductivity (EC) and Sodium Adsorption Ratio (SAR) on a site-specific or watershed basis.

“No Measurable Decrease” in Crop Production

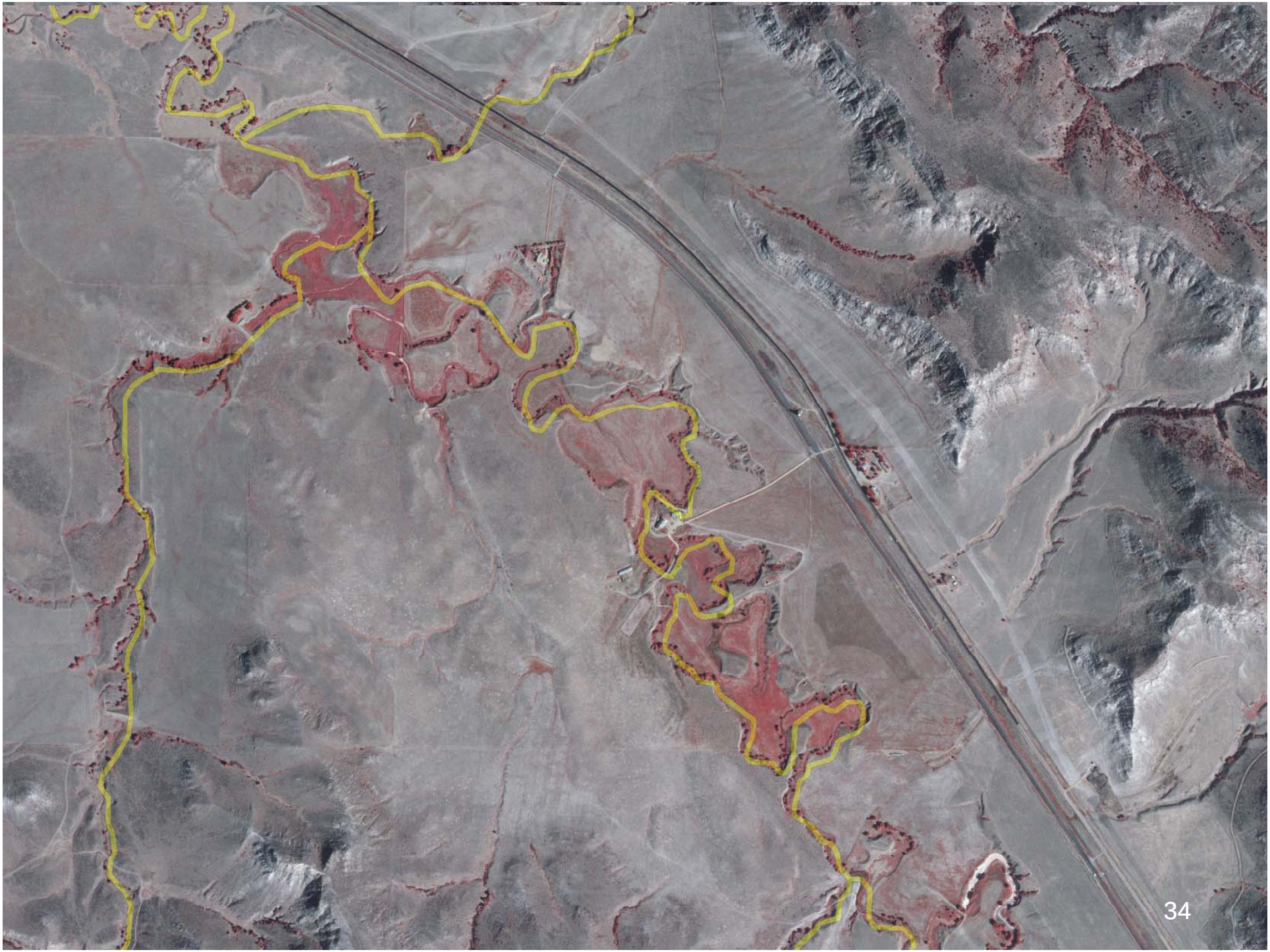
Phrase implies pre-existing agricultural uses of a stream or drainage prior to application for a WYPDES discharge permit.

Artificially Irrigated Lands:

- Applies to active agricultural uses.
- Identified by the presence of canals, ditches, spreader dikes, spray irrigation systems, or other constructed mechanism intended to divert water.

Naturally Irrigated Lands (Bottomlands):

Land along stream channels due to periodic flooding or sub-irrigation which can be used for agricultural purposes.

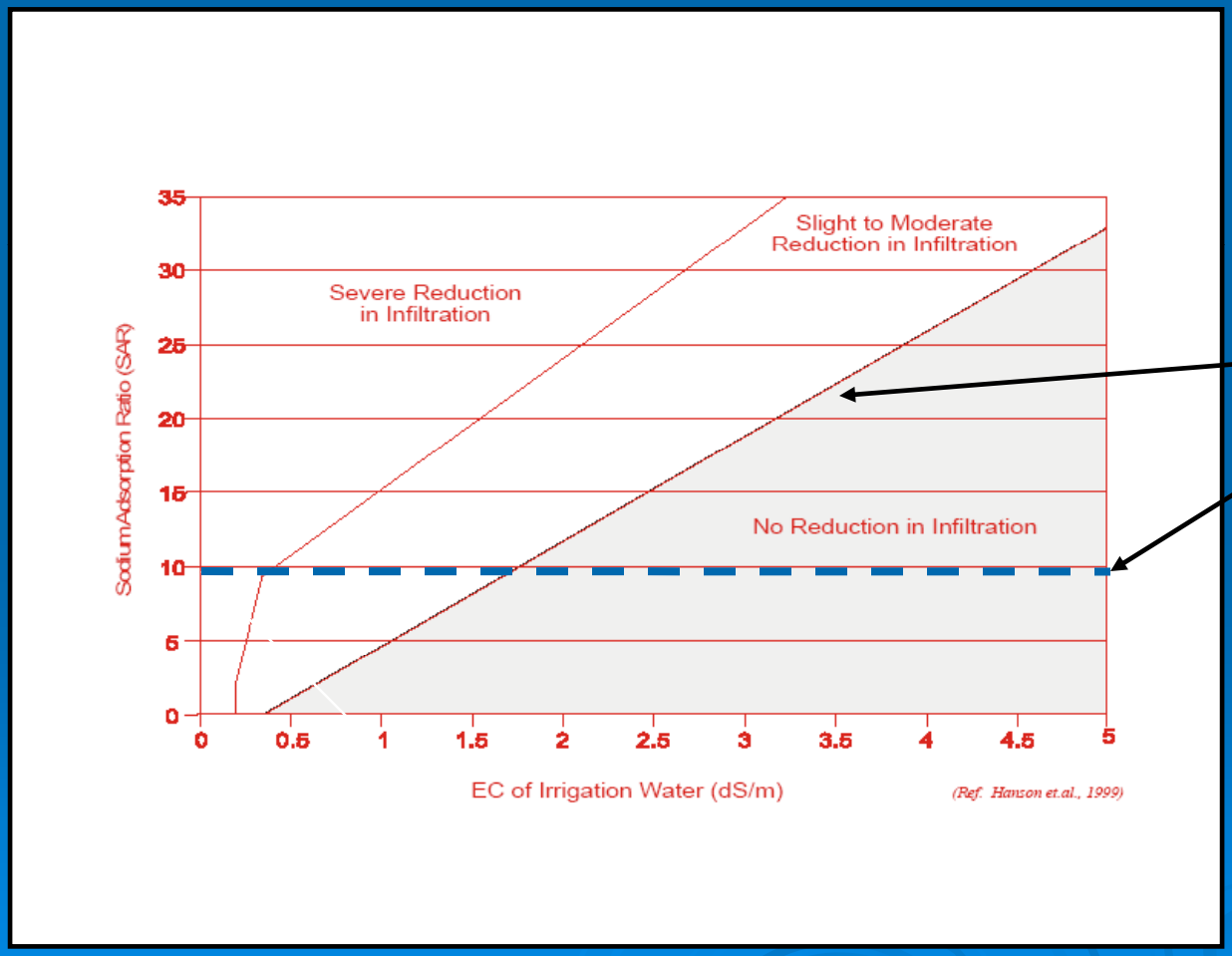


Methods for Deriving Effluent Limits

Tier 1 – Default Values

- Determine most sensitive plant species
- Set EC limit for protection of that species
- Set SAR limit using Hanson diagram

Hanson Diagram



Tier 1 effluent limit for SAR set at upper limit of "No Reduction In Infiltration":

SAR = (7.10 x EC) – 2.48

SAR not to exceed 10
- Tier 1 only -

Tier 2 – Background Water Quality

- Unable to meet Tier 1 levels – 2nd option: determine background water quality
- EC determined using measured stream data or calculated based on soil analysis
- SAR is based on discharge water quality
- No cap on SAR

Tier 3 – “No Harm Analysis”

- Unable to meet Tier 2 levels – 3rd option: comprehensive study of affected areas.
- EC and SAR based on site specific conditions (i.e. landowners using soil amendments)

Irrigation Waiver

Exception to EC and SAR limits:

- Provides option for landowners to accept water without regard to irrigation protection
- All landowners affected by discharge must be will to accept risks of lower quality water
- Only granted in association with an irrigation management plan that provides reasonable assurance that lower quality water will be confined to target lands

Reasonable Access Requirement

- Where landowner chooses to deny access, EC and SAR limits based on best information that can be reasonably obtained

- Involves using alternate locations with similar conditions to determine EC and SAR

Summary of Comments to Advisory Board

- Naturally Irrigated Lands
- Tier 1 default limits
- Use of USDA vs. Bridger Plant Materials literature
- Use of Tier 2 and Tier 3 options
- Reasonable Access Requirement

Summary of Comments to EQC

- Naturally Irrigated Lands
- Tier 1 default limits
- Use of Tier 2 and Tier 3 options
- Reasonable Access Requirement
- Willow Creek and Pumpkin Creek decisions

Recommended Changes Due to Comments to EQC

- Strike language in definition of “Naturally Irrigated Lands” – Section (c)(i)(B)
- Add “naturally irrigated lands” to Section (c)(iv)