Zortman & Landusky Mines
Water Management

Artesian Well WS-3 before replacement wellhead control installed

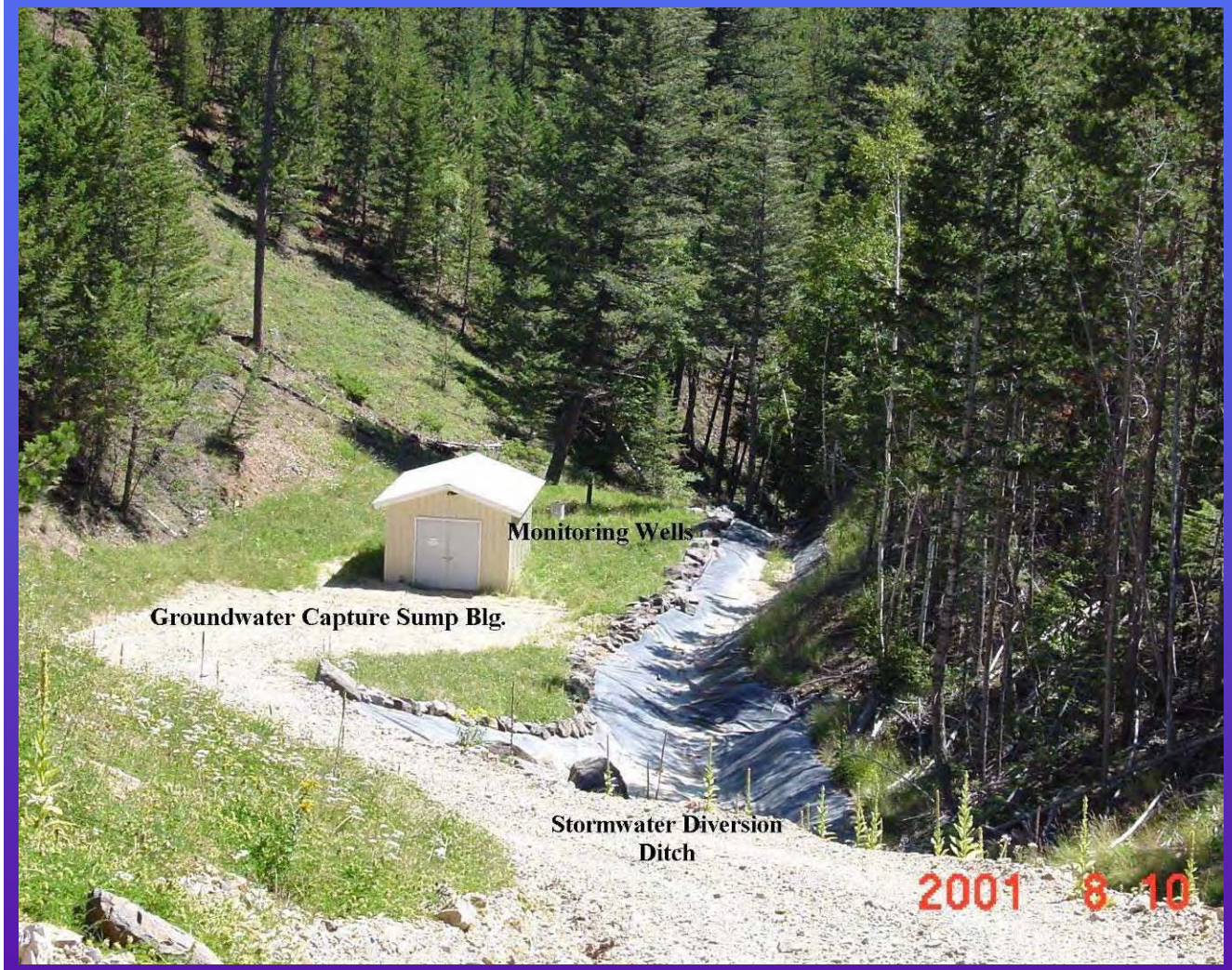
- ARD Seepage Capture Systems
- ARD Treatment Systems
- Leach Pad Solution Treatment
- Stormwater Management

ARD Seepage Capture Systems

Seepage Capture Pond in Ruby Gulch Downstream of Zortman Mine

- Installed starting in 1993
- Routed seepage to heaps
- Upgraded in 1996

ARD Seepage Capture Systems



- 7 Capture Systems in 6 Drainages
- Routes seepage to WTP
- Sized for 100-year, 24-hour event

ARD Treatment Systems

- Two Water Treatment Plants (WTP)
- Zortman Mine WTP, 1994
- Landusky Mine WTP, 1997

Inside the Landusky Mine Water Treatment Plant. Plant Runs 24/7 at about 350 gpm.

ARD Treatment Systems

- Lime Precipitation for Metals & Acidity
- Treated 2 Billion Gallons Since 2000
- Average Cost $2.866 per 1000 Gallons

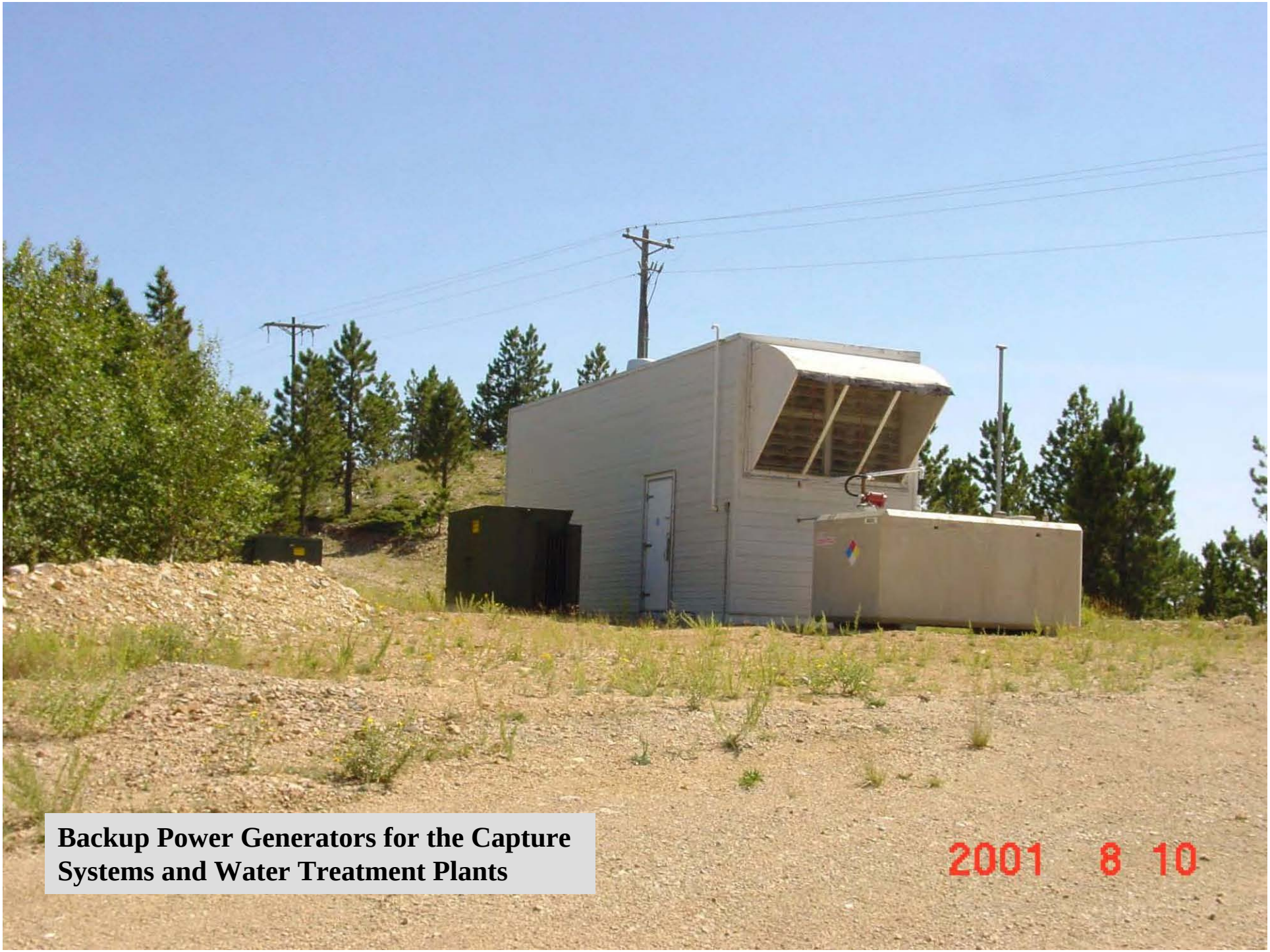
Zortman Water Treatment Plant

Parameter	Influent (variable)	Treated Water	% Removal	Downstream State Standard
pH	3.5	7.5	---	6.5 to 9
Arsenic	0.015 ppm	<0.003 ppm	>80%	0.018 ppm
Cadmium	0.2 ppm	0.004 ppm	98%	0.005 ppm
Iron	35 ppm	0.3 ppm	99.1%	0.3 ppm
Manganese	30 ppm	6.0 ppm	80%	---
Lead	0.005 ppm	<0.003 ppm	>50%	0.015 ppm
Sulfate	3000 ppm	2400 ppm	20%	---

Landusky Water Treatment Plant

Parameter	Influent (variable)	Treated Water	% Removal	Downstream State Standard
pH	6.0	6.8	---	6.5 to 9
Arsenic	0.15 ppm	<0.025 ppm	>83%	0.018 ppm
Cadmium	0.010 ppm	0.004 ppm	60%	0.005 ppm
Iron	>10 ppm	0.3 ppm	>97%	0.3 ppm
Manganese	>5.0 ppm	2.7 ppm	>40%	---
Lead	0.004 ppm	<0.003 ppm	>50%	0.015 ppm
Sulfate	>1000 ppm	800 ppm	20%	---

Sludge from the water treatment plants is place in shallow ponds on top of the lined leach pads to solidify.

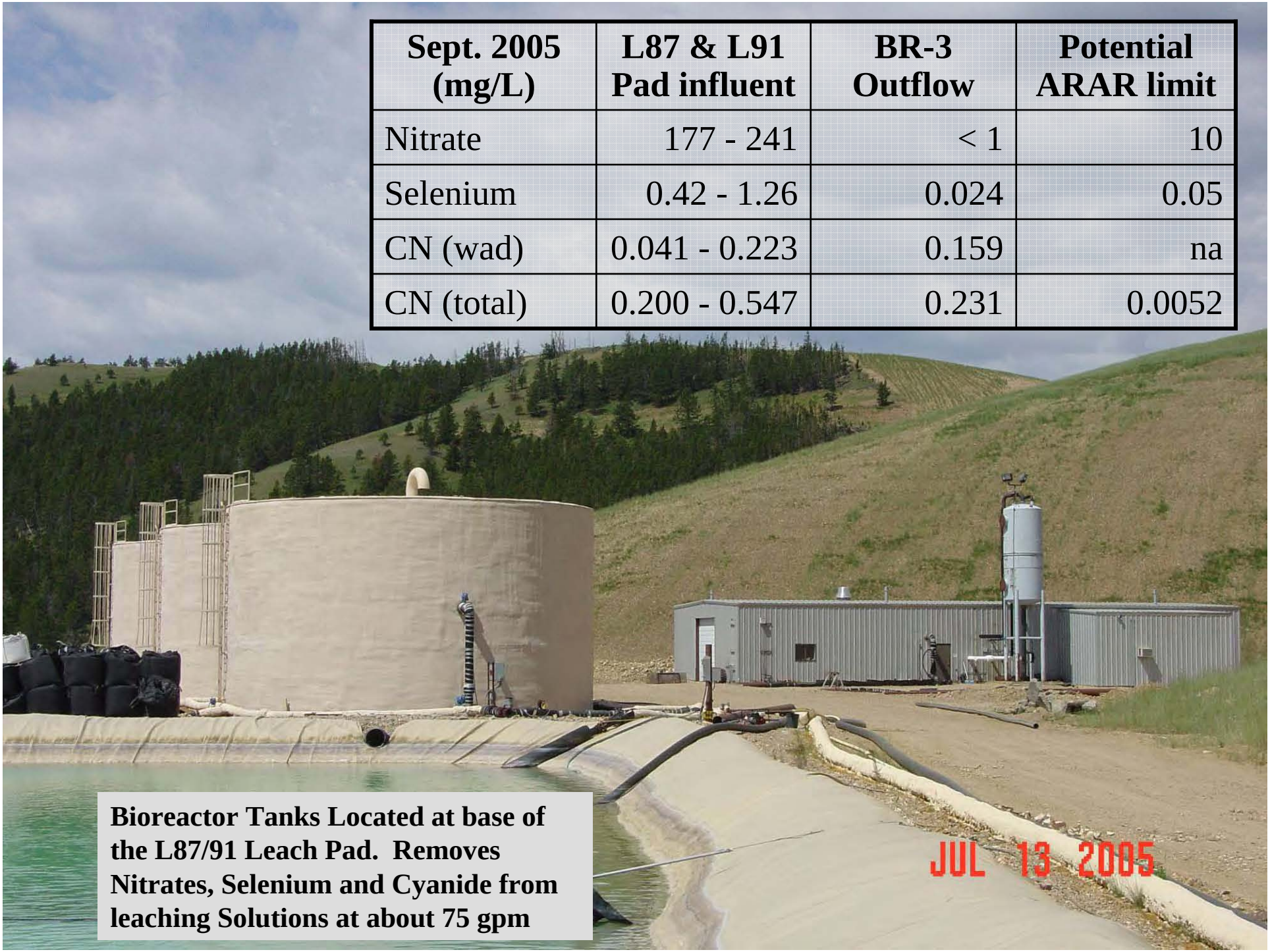


Backup Power Generators for the Capture Systems and Water Treatment Plants

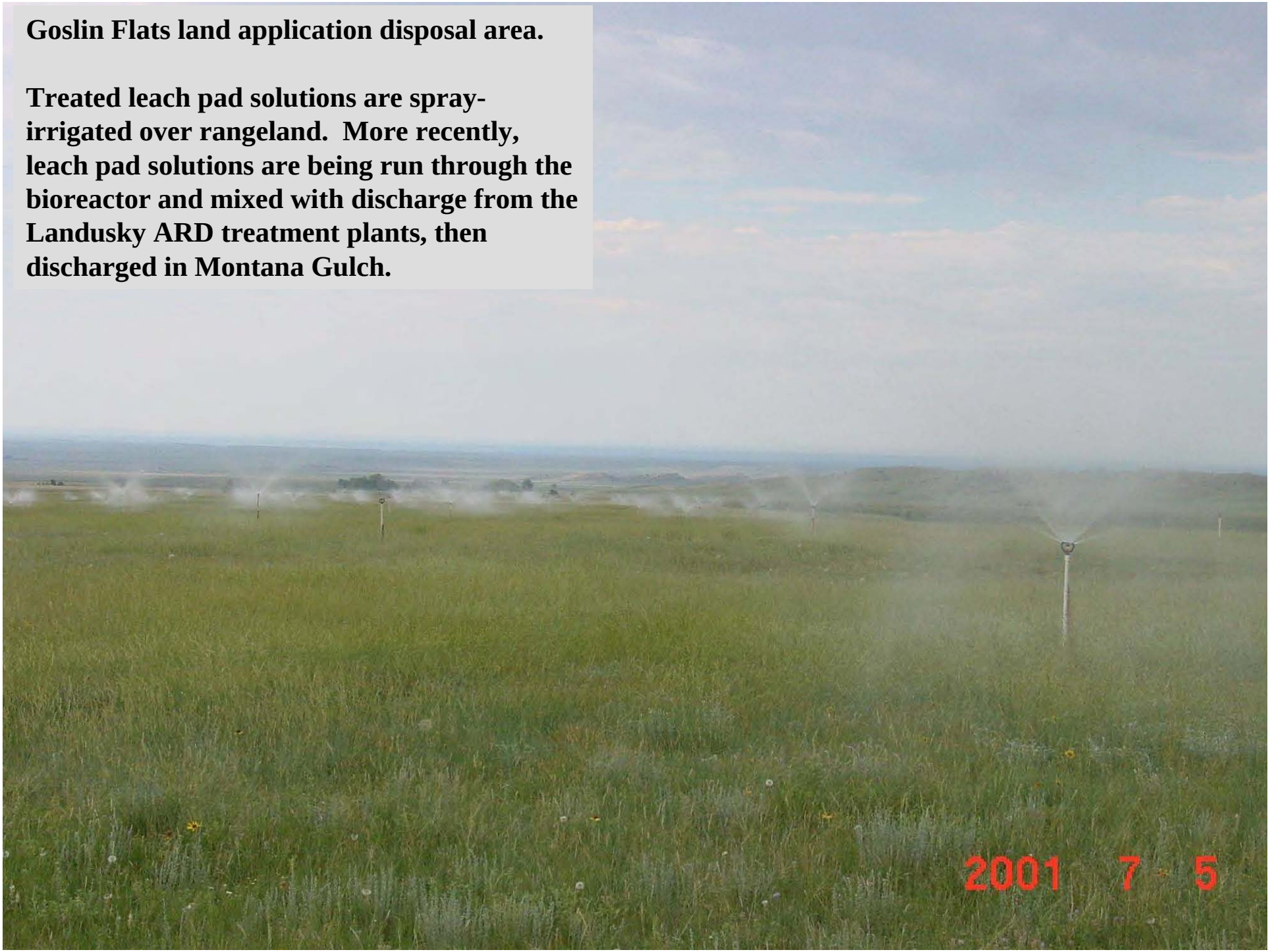
Leach Pad Solution Treatment

- Heaps accumulate millions of gallons precipitation per year
- Contains nitrates, selenium, & cyanides
- Some heap solutions are acidic

Sept. 2005 (mg/L)	L87 & L91 Pad influent	BR-3 Outflow	Potential ARAR limit
Nitrate	177 - 241	< 1	10
Selenium	0.42 - 1.26	0.024	0.05
CN (wad)	0.041 - 0.223	0.159	na
CN (total)	0.200 - 0.547	0.231	0.0052



Bioreactor Tanks Located at base of the L87/91 Leach Pad. Removes Nitrates, Selenium and Cyanide from leaching Solutions at about 75 gpm

Goslin Flats land application disposal area.

Treated leach pad solutions are spray-irrigated over rangeland. More recently, leach pad solutions are being run through the bioreactor and mixed with discharge from the Landusky ARD treatment plants, then discharged in Montana Gulch.