



2005-2010 Consumptive Use of Small Man-made Water Bodies in the Platte Surface Water Basin above Columbus

PRRIP Water Advisory Committee Meeting-May 6, 2014

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Department of Natural Resources

Brown Bag
Presentations

06/14/2013

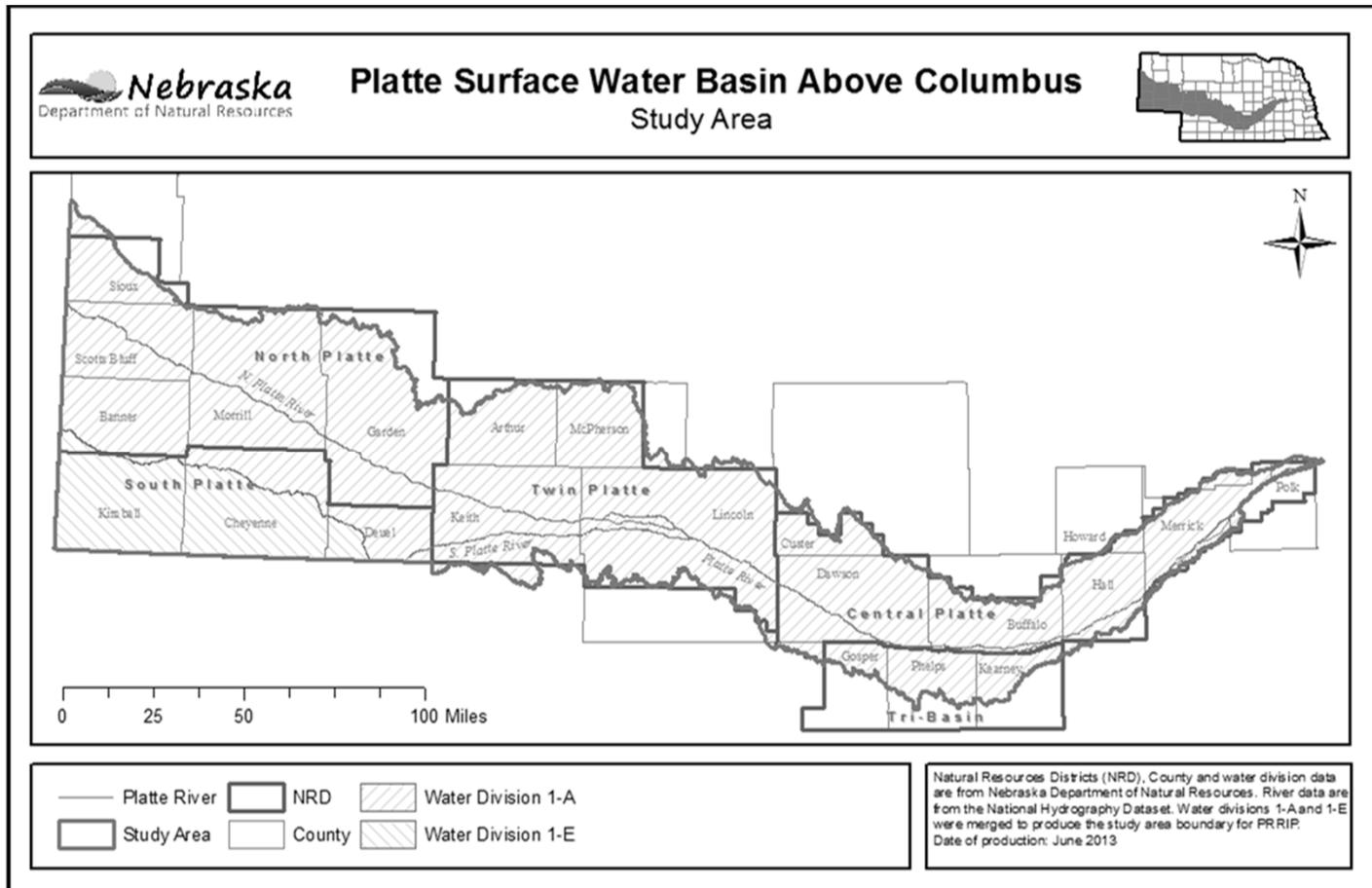
Introduction

Nebraska New Depletion Plan (NNDP) for the Platte River Recovery Implementation Program (PRRIP)

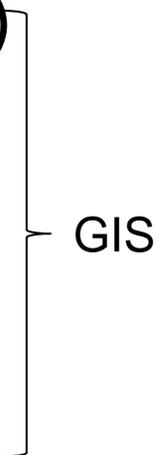
- The NNDP describes the actions Nebraska proposes to take to prevent or mitigate for new depletions to U.S. Fish and Wildlife Service (USFWS) target flows
- The Nebraska Department of Natural Resources (NDNR) has jurisdiction over surface water uses, and requires permits for
 - stream diversions, and
 - on-stream storage reservoirs greater than 15 AF
- For new or expanded sandpits, and new, small reservoirs that do not require permits, NDNR will estimate the cumulative impact on state-protected and target flows
 - Adverse effects will be mitigated by the state

Introduction

- The goal of this work was to estimate cumulative effect of new or expanded sandpits, or new reservoirs on protected flows from 2005-2010



Overview of Methods

- Create a 2005 water body inventory (baseline)
 - Create a 2010 water body inventory
 - Compare 2010 inventory to baseline
 - New or expanded sandpits
 - New reservoirs
 - Evaluate for permits/mitigation in place
 - Use the NRCS calculator to estimate consumptive use change due to new/expanded water bodies with no permits
- 
- GIS

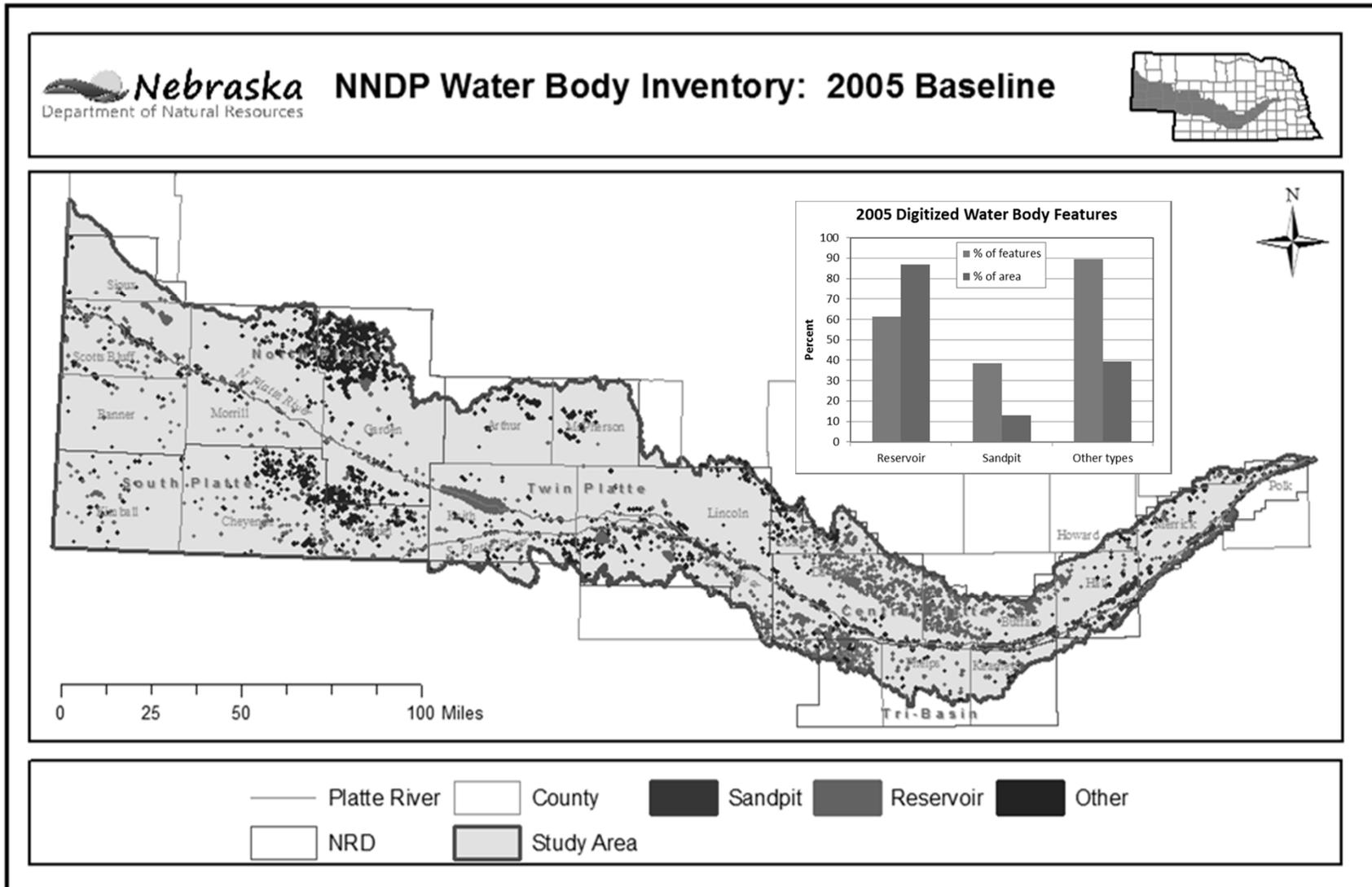
GIS Methods

Create a baseline water inventory for 2005

- In 2005, aerial imagery was scanned frame by frame and all water bodies were digitized/ categorized
- From this, the water bodies were categorized
 - Sandpits
 - Reservoirs
 - “Other”
- Resulted in roughly 11,500 features
- Whole inventory took 1200 hours to complete

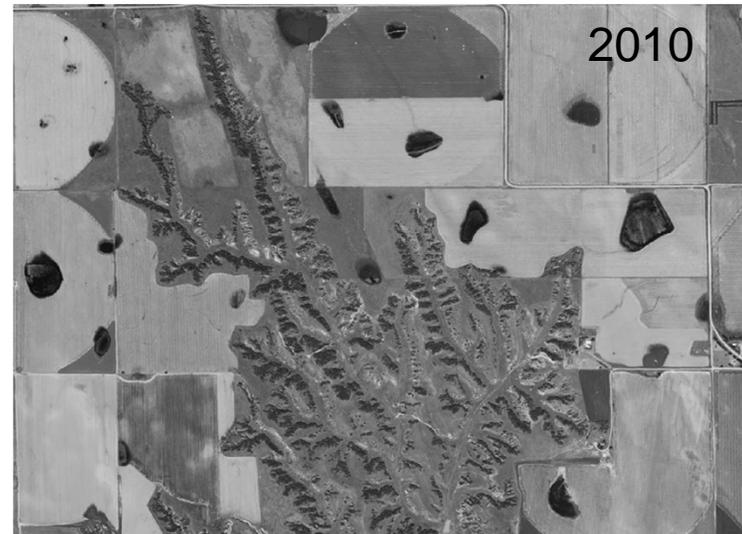
GIS Methods

Create a baseline water inventory for 2005



GIS Methods: Create a 2010 water body inventory

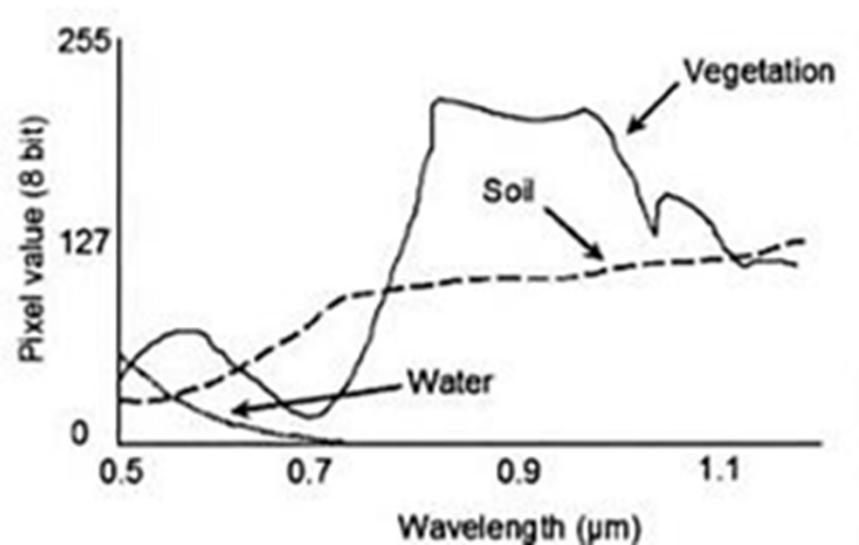
- In 2010, the 2005 baseline methods and final dataset were reviewed, as well as aerial imagery
- 2010 was a much more wet year, resulted in roughly 3-4 times as much water
 - potential for 4000 hours of labor if same methods were employed



GIS Methods

Create a 2010 water body inventory

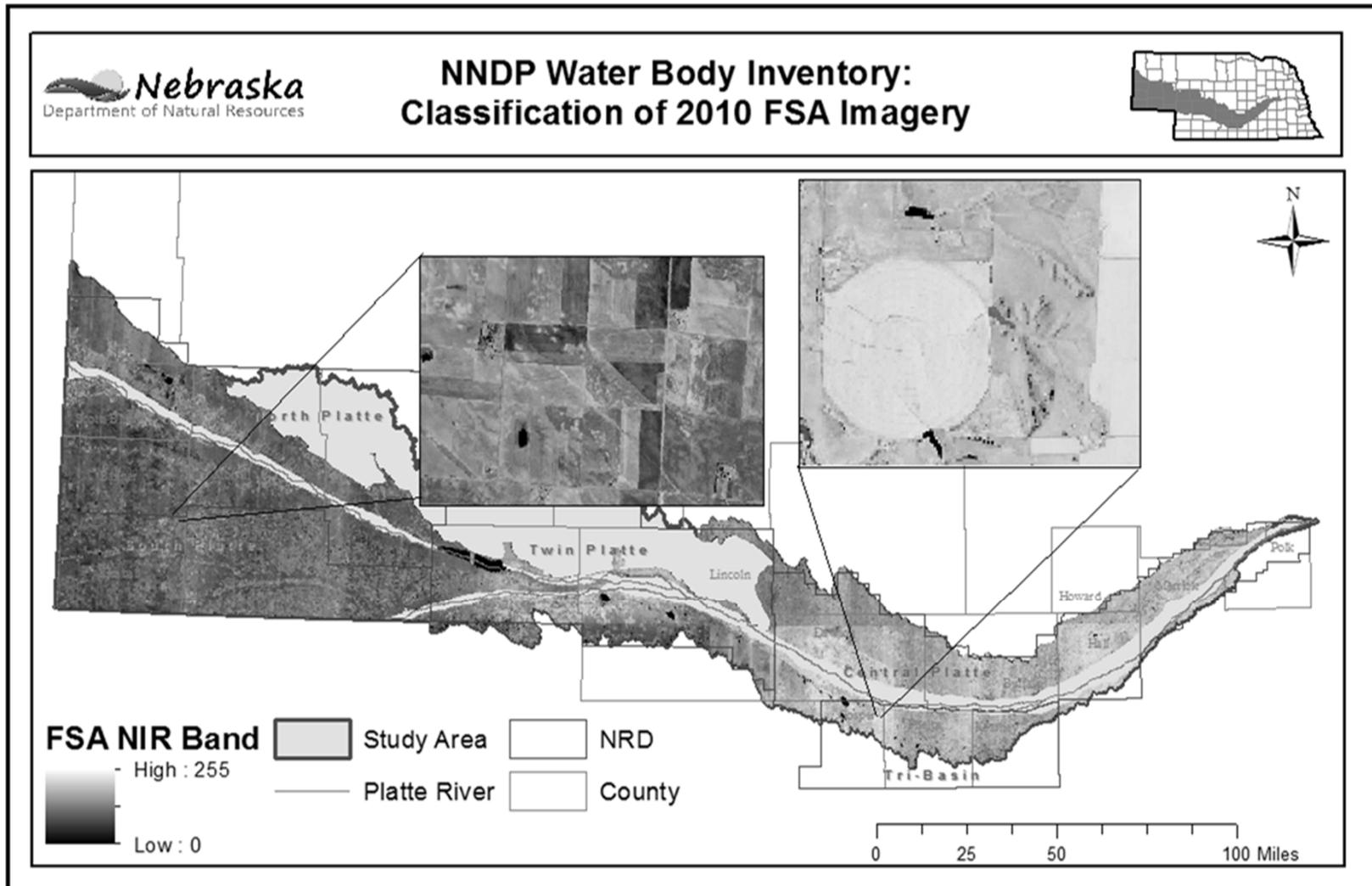
- Semi-automatic approach
- Classification of FSA imagery to identify water
 - Utilized Near-Infrared band values



From Mather and Koch, 2011

GIS Methods

Create a 2010 water body inventory

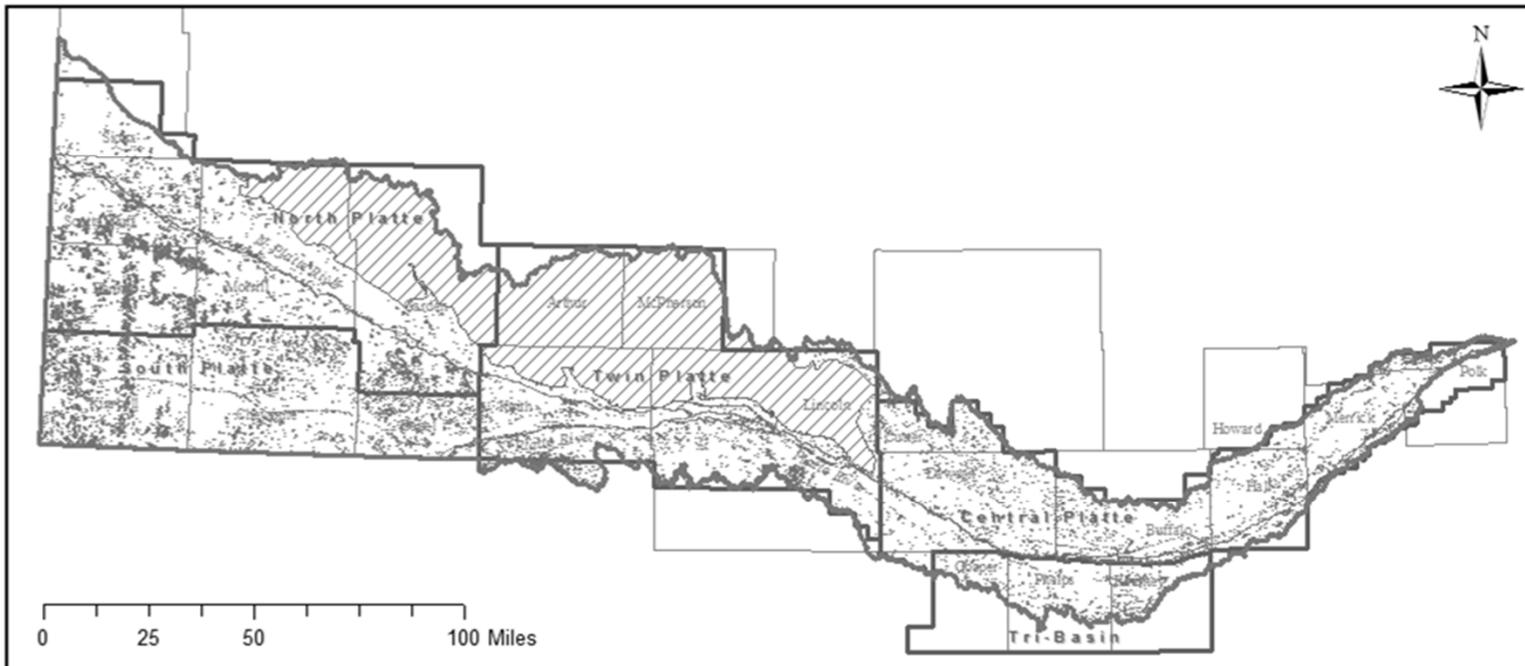


GIS Methods

Create a 2010 water body inventory



Platte Surface Water Basin Above Columbus
 2010 Water Bodies Over 1 Acre Identified by the
 Remote Sensing Process

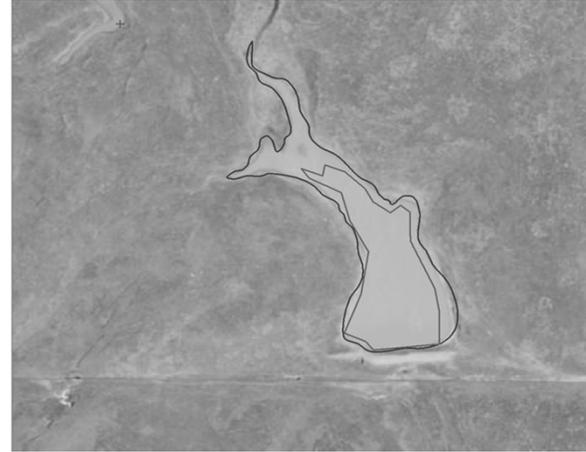


Platte River	NRD	Water bodies from Remote Sensing Over 1 Acre
Study Area	County	Sandhills

Date of Production: June 2013

GIS Methods

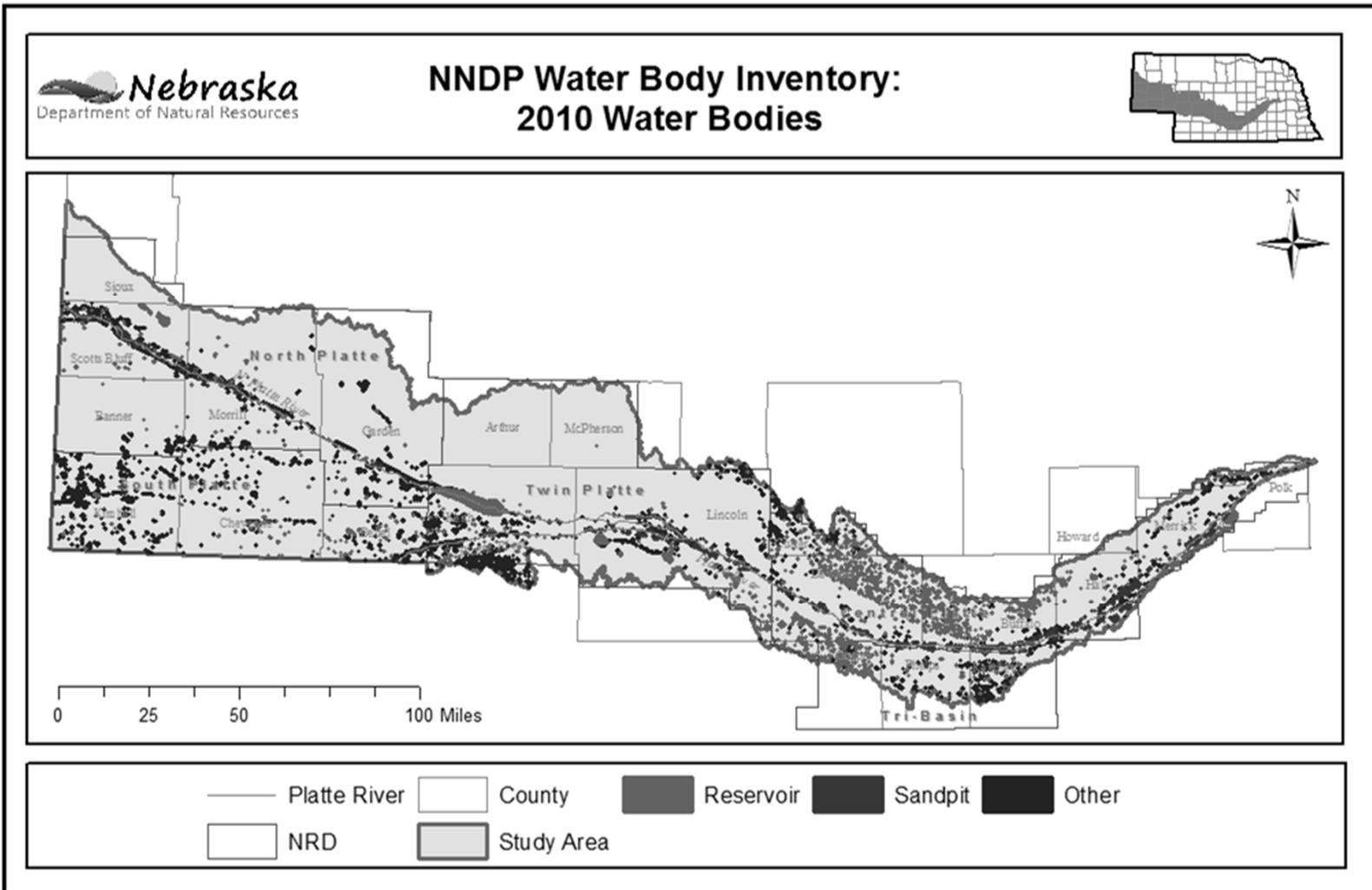
Manual Editing of Classified Features



 2010 Water body
 2005 Water body (

GIS Methods

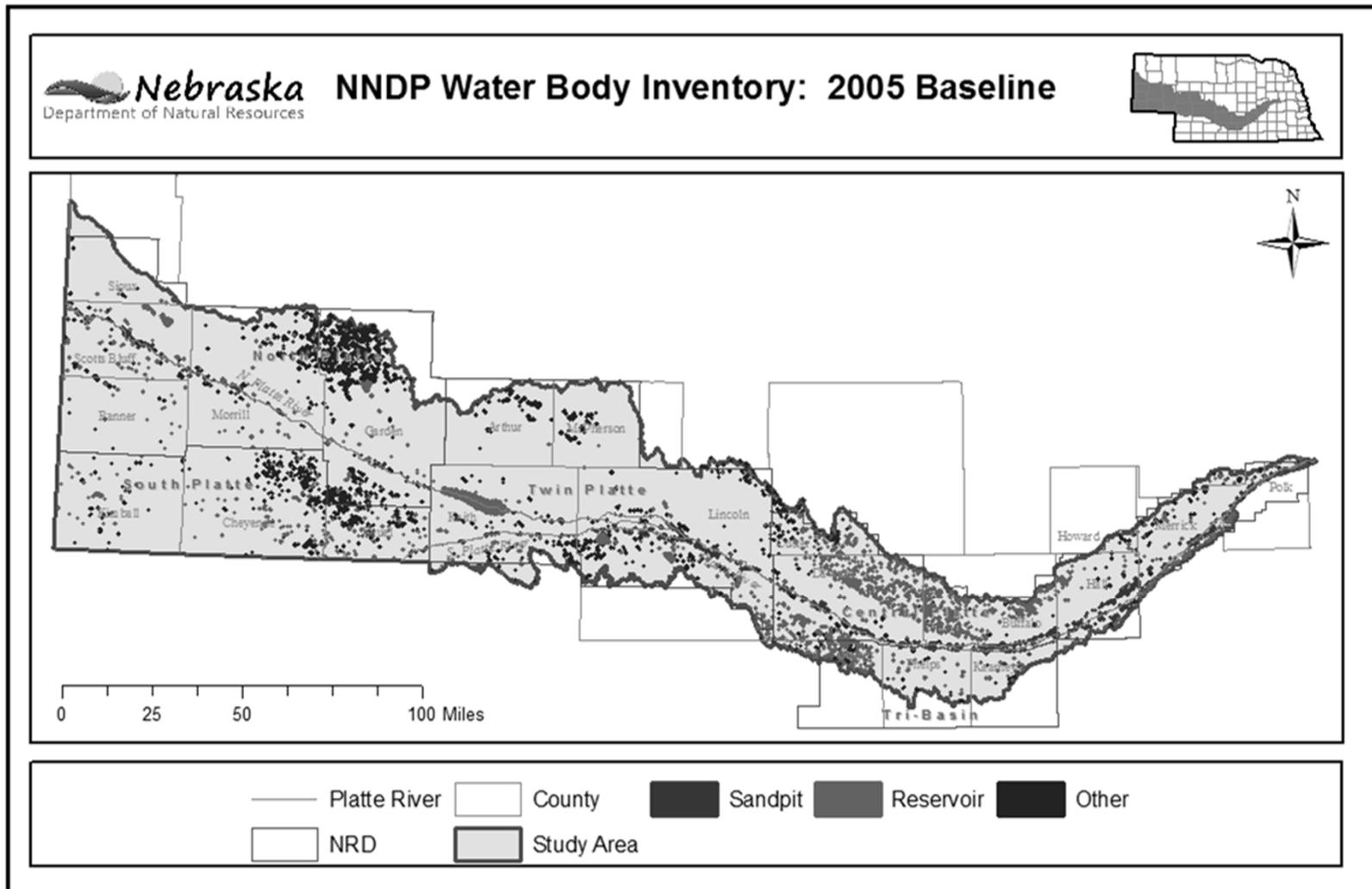
Classification of 2010 water body inventory



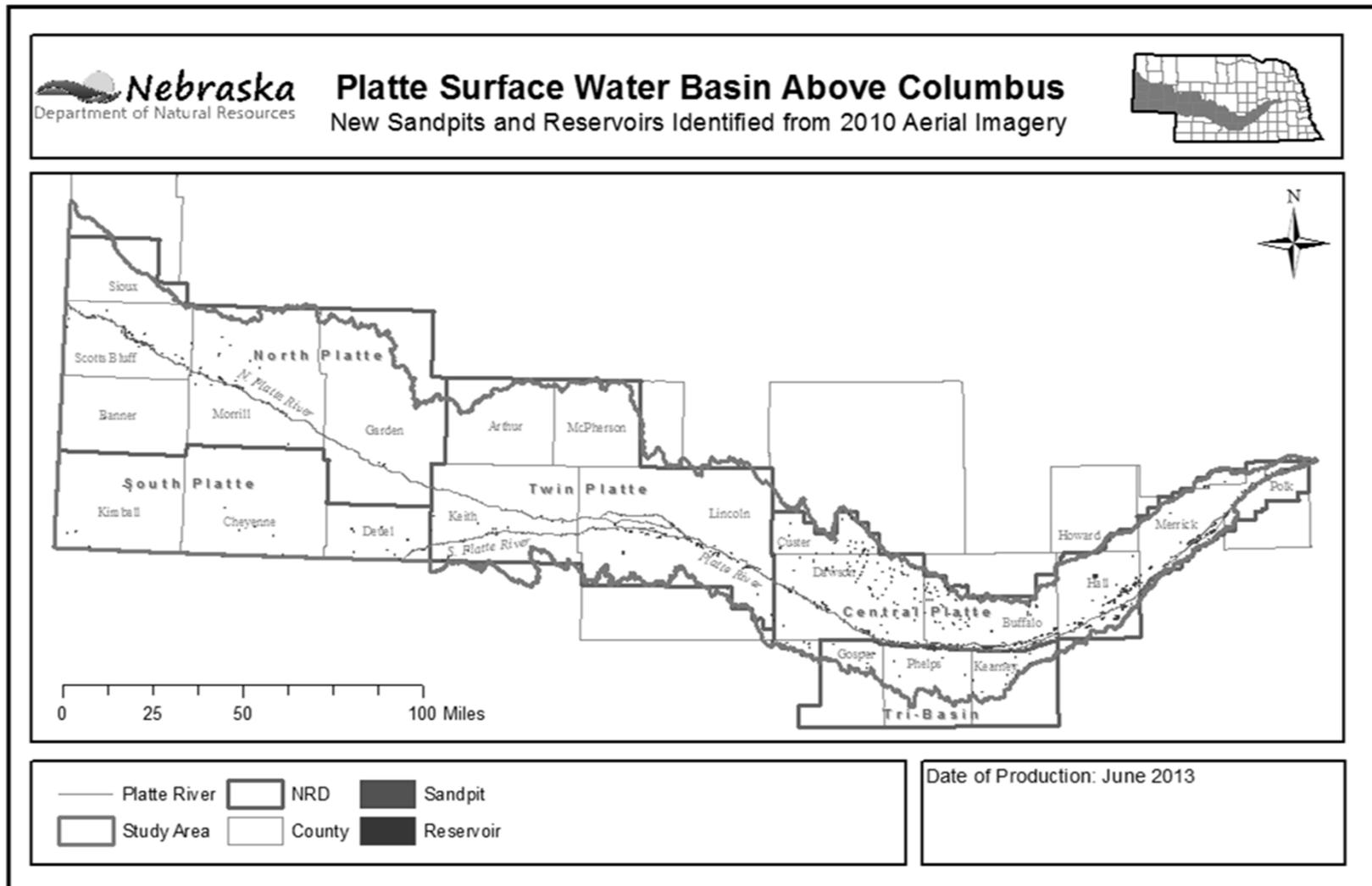
2,583 water bodies classified as sandpits or reservoirs (53,557 acres)

GIS Methods

Overlay with 2005 water body inventory



Potential Sandpits and Reservoirs for Change Analysis



758 sandpits and reservoirs preliminarily designated as changed (3,723 acres)

Criteria for Inclusion in Change Analysis

Reservoirs

- New embankment
- No permits
 - Surface water right or dam safety plan
 - If a right or plan exists, check for depletions and mitigation already in place

Sandpits

- Active gravel pit
- No estimated depletions or mitigation
- Account for land reclamation

Reservoir Change Analysis Criteria: New Embankment

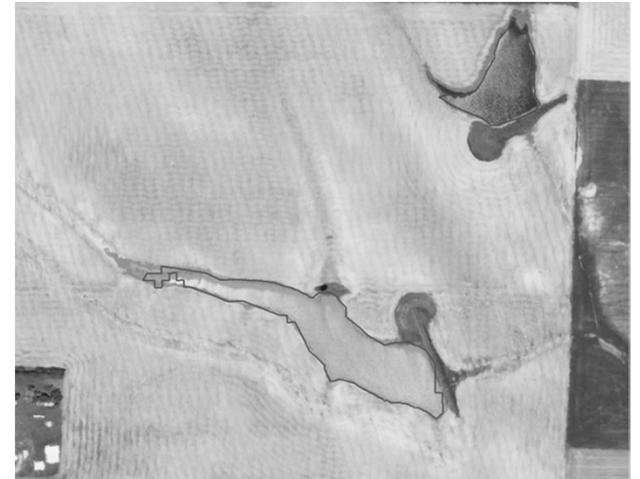
- New embankment physically present after 2005



2005



2006



2010

Sandpit Change Analysis Criteria: Activity

- Sandpit criteria
 - Sand around new/expanded sandpits
 - Looked at expanded portions, accounted for reclaimed portions



2005



2010



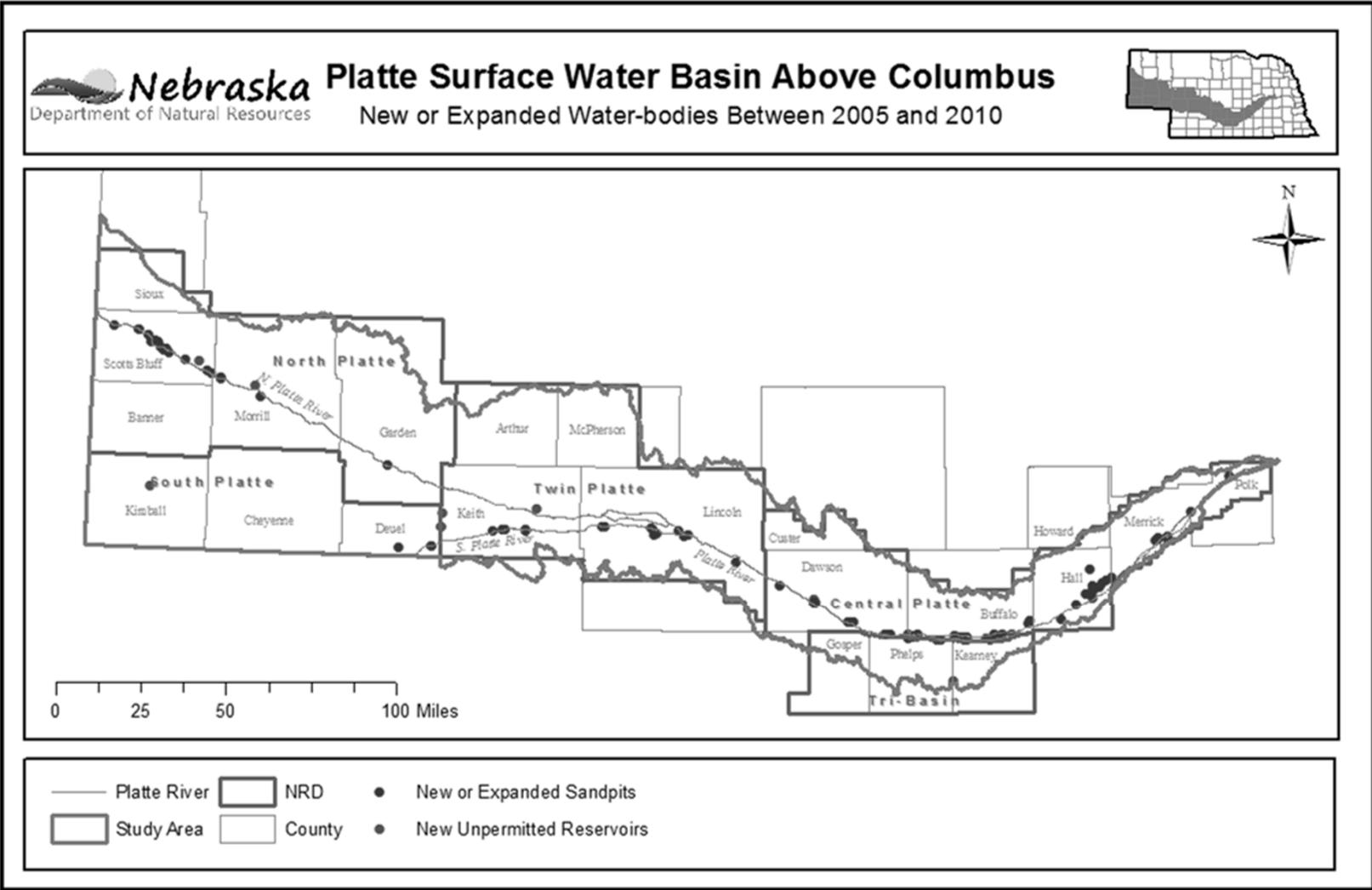
Reduced Areas
Expanded Areas

NRD Review

- Features Identified as new or expanded were sent to NRDs for review
- A few features had not changed due to man's activities,
- A few features had been mitigated
- These were removed from subsequent analyses

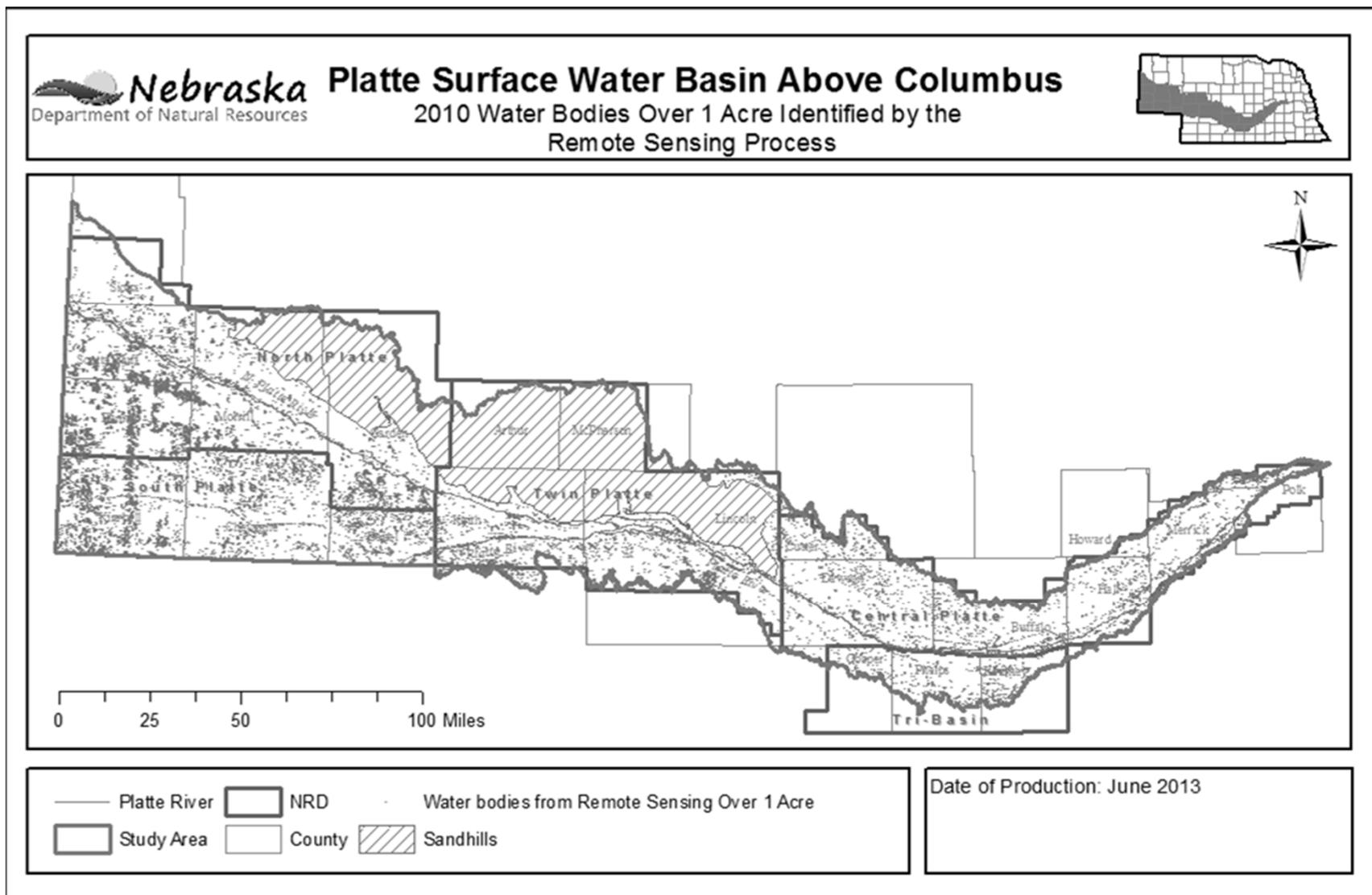


Sandpits and Reservoirs for ET Change



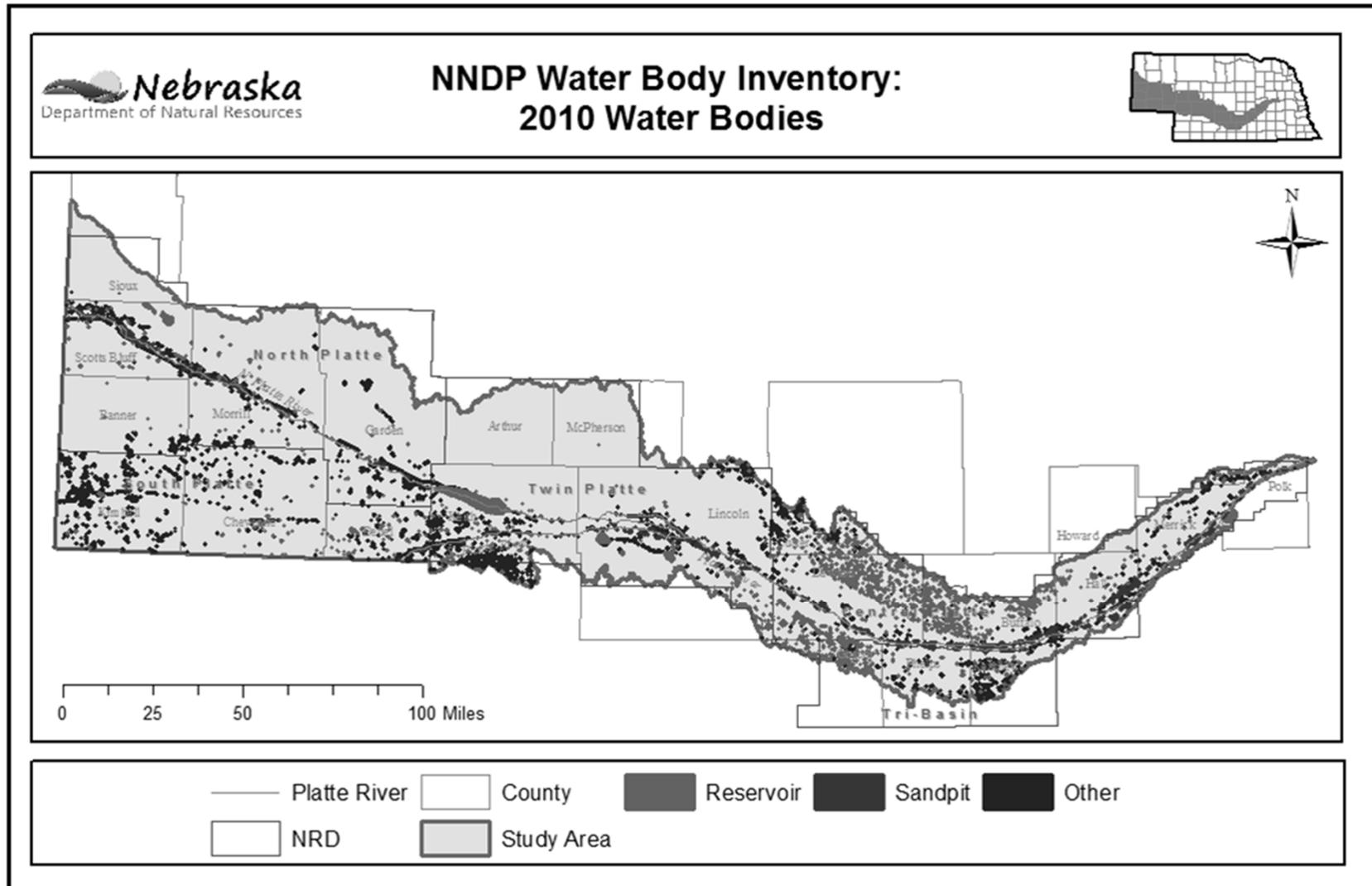
94 sandpits, and 9 reservoirs for change analysis

Synopsis of steps to create water body layer for change analysis



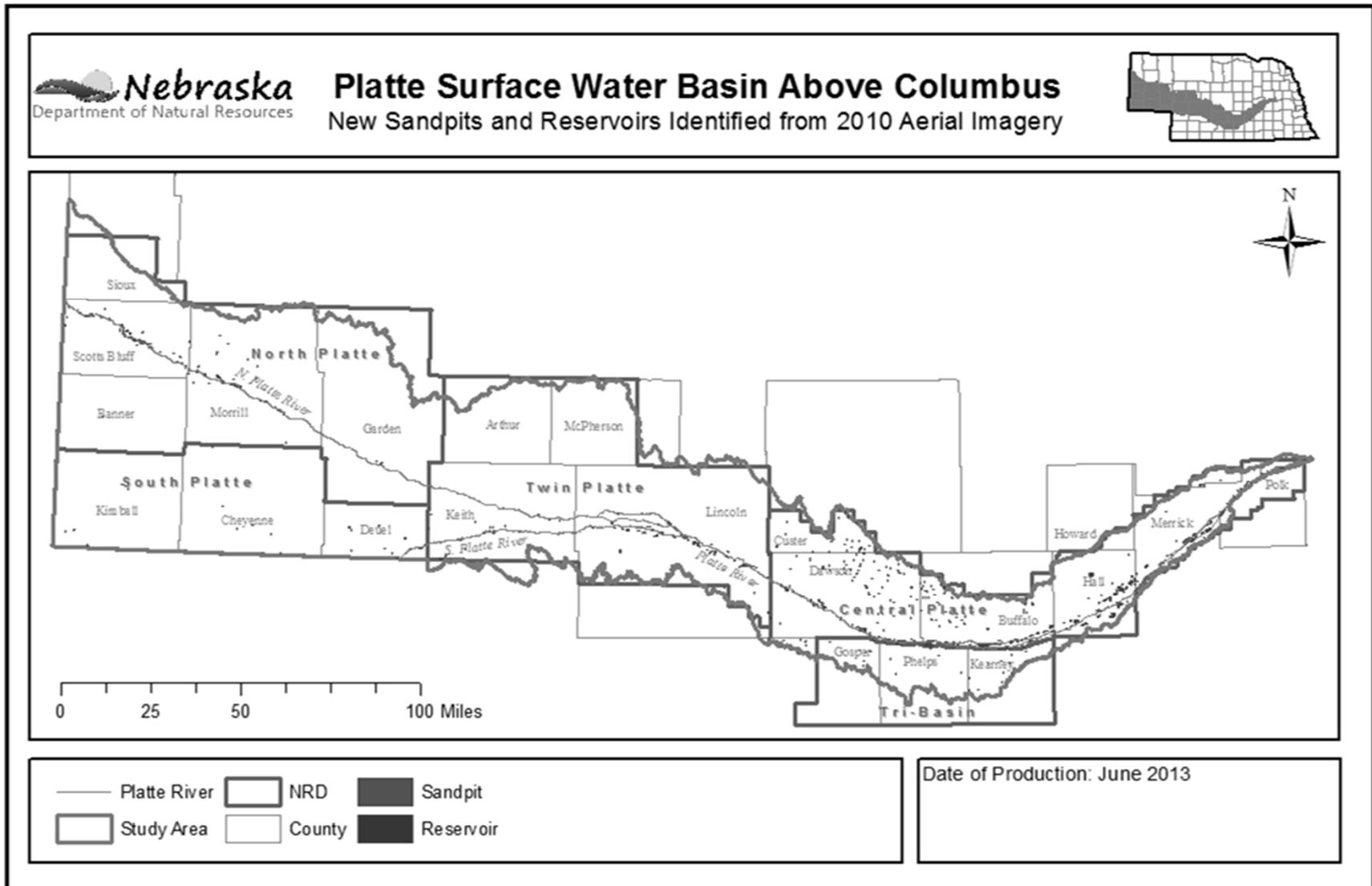
19,043 features (122,431 acres)

Synopsis of steps to create water body layer for change analysis



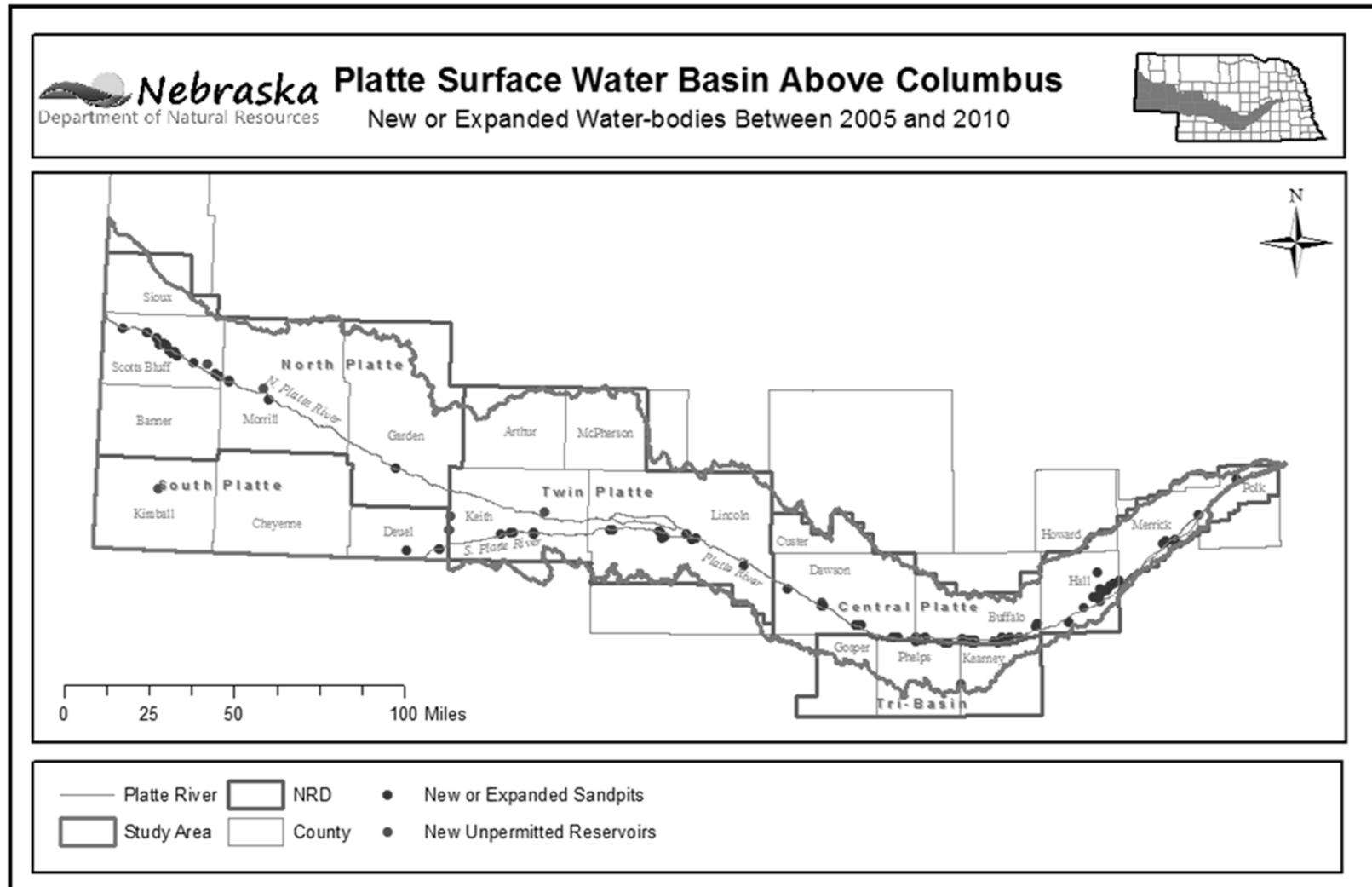
2,583 sandpits and reservoirs (53,557 acres)

Synopsis of steps to create water body layer for change analysis



758 sandpits and reservoirs (3,723 acres)

Synopsis of steps to create water body layer for change analysis



Sandpits: 94 (728 acres); Reservoirs: 9 (19 acres)

Breakdown of evaluated water bodies

CHANGE ANALYSIS RESERVOIR IDENTIFICATION PROCESS		
Procedure	Number of Features	Area (acres)
Reservoirs classified from 2010 imagery	1,578	45,507
Reservoirs not included in 2005 inventory	573	1,521
Reservoirs with new embankments between 2005 and 2010	11	405
New reservoirs with permits between 2005 and 2010	(2)	386
New unpermitted reservoirs between 2005 and 2010	9	19

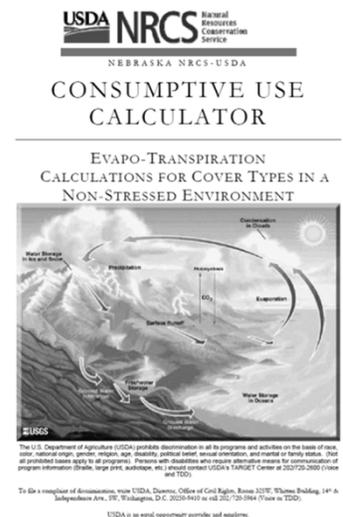
CHANGE ANALYSIS SANDPIT IDENTIFICATION PROCESS		
Procedure	Number of Features	Area (acres)
Sandpits classified from 2010 imagery	1,005	8,050
Sandpits with area change from 2005	185	2,202
New/expanded sandpits identified from visual analysis	98	736
New sandpits with mitigation	(4)	8
New/expanded sandpits between 2005 and 2010	94	728

Methods

Evapotranspiration (ET) estimation using NRCS
ET calculator

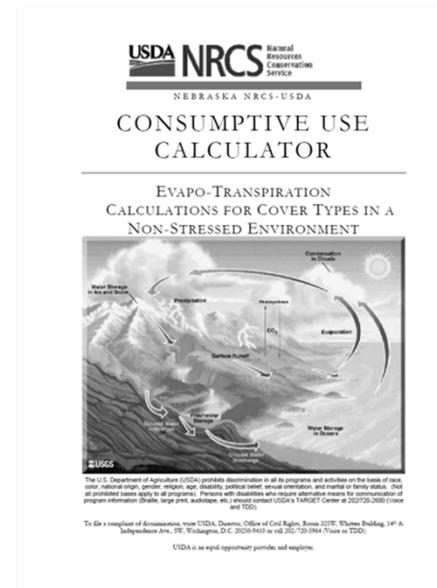
NRCS ET Calculator

- Created by Natural Resources Conservation Service (NRCS)
- Consumptive use change assessment in Platte basin
- Average monthly ET of 46 land covers
 - Grasslands
 - grass cool mid; grass cool short; grass cool tall; grass warm mid; grass warm short; grass warm tall;
 - grass pasture good; grass pasture bad
 - Wetlands
 - wet tall grasses; wet cattail/bulrush moist; wet cattail/bulrush standing water;
 - wet linear; wet short veg moist; wet short veg standing water
 - Water
 - water shallow; water deep
- March to November ET

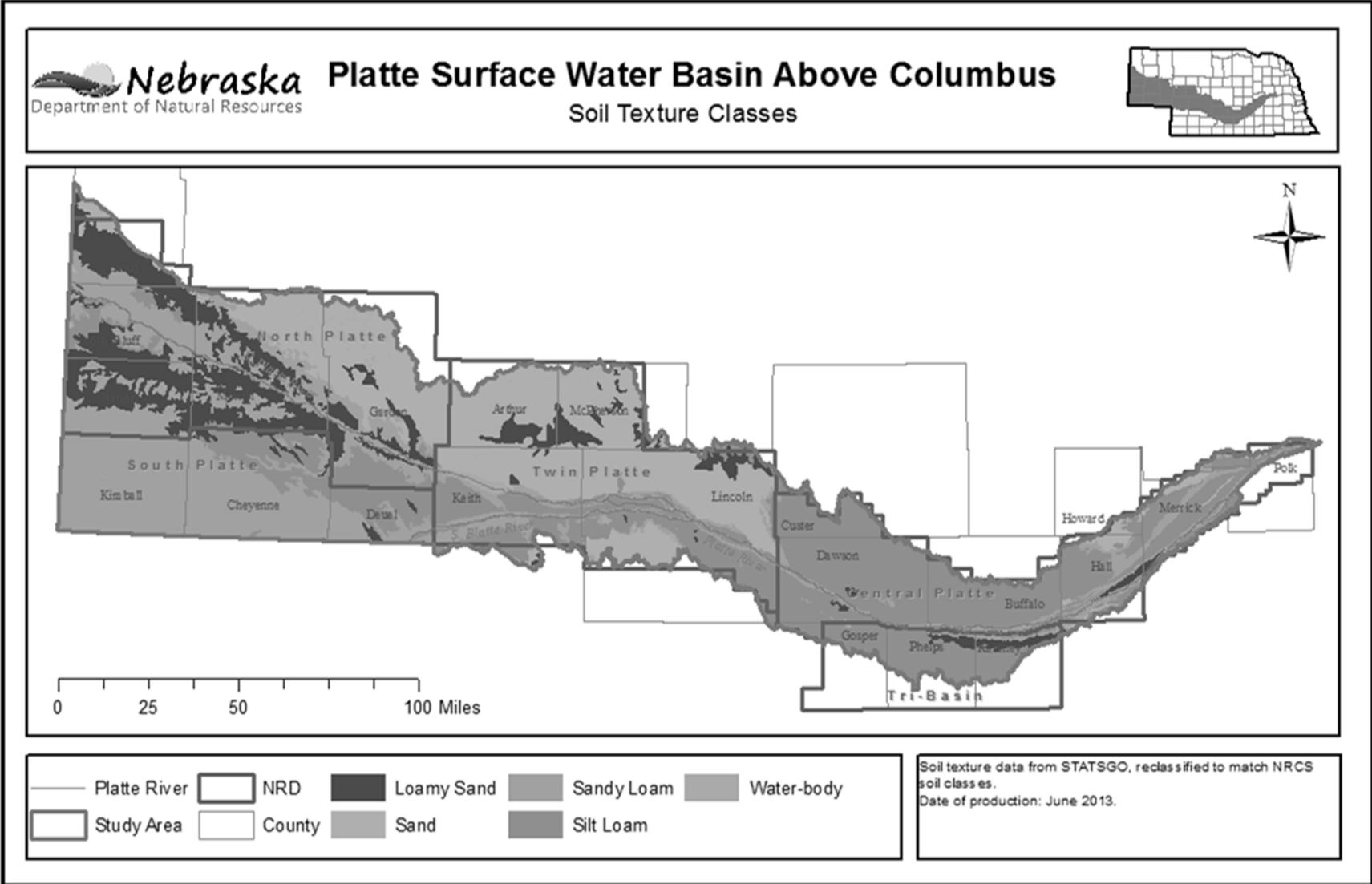


Methods: ET Calculation

- Data for ET Calculator
 - Location and acres
 - GIS process
 - Soil type
 - STATSGO (horizon 1)
 - Land cover
 - CALMIT 2005 land cover dataset
 - UNL CSD native vegetation
 - Location in ET climate areas
 - NRCS consumptive use calculator guide



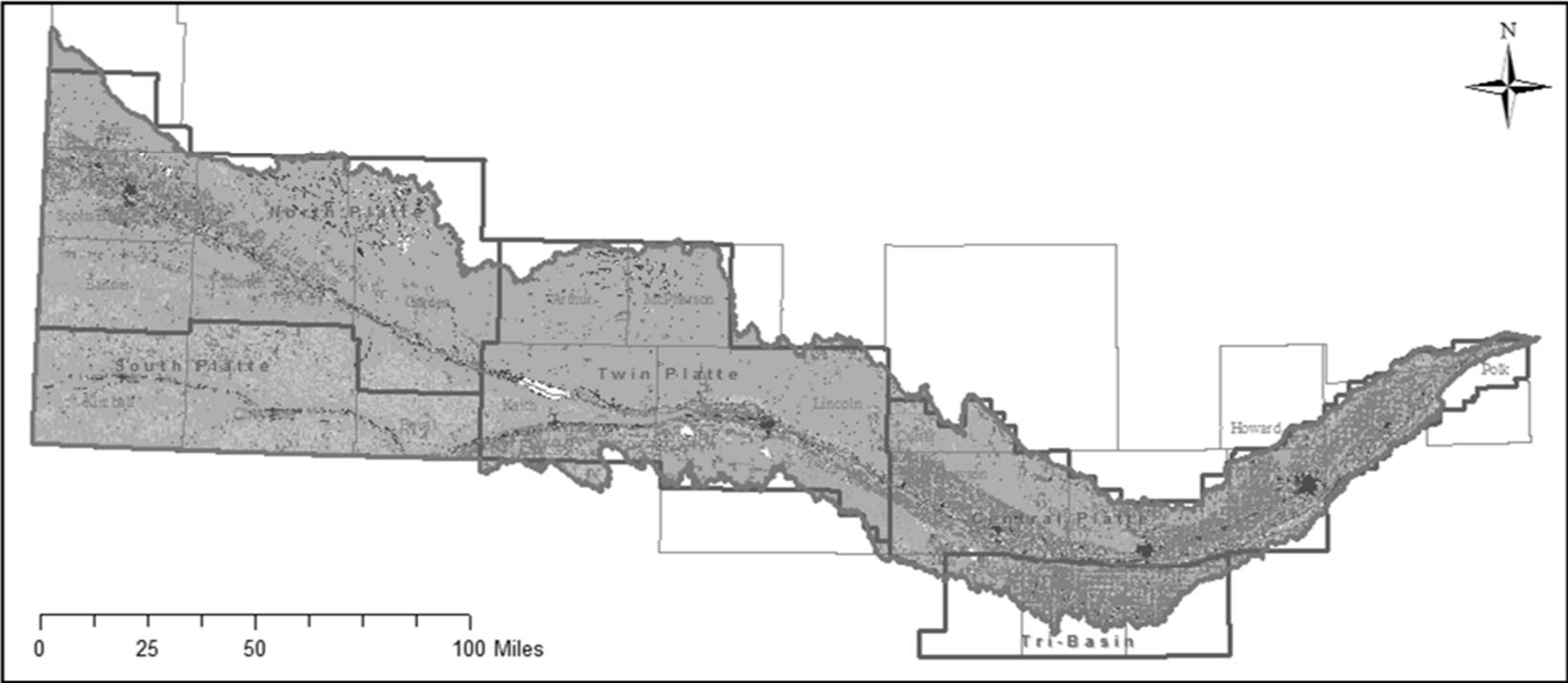
Methods: ET Calculation



Methods: ET Calculation

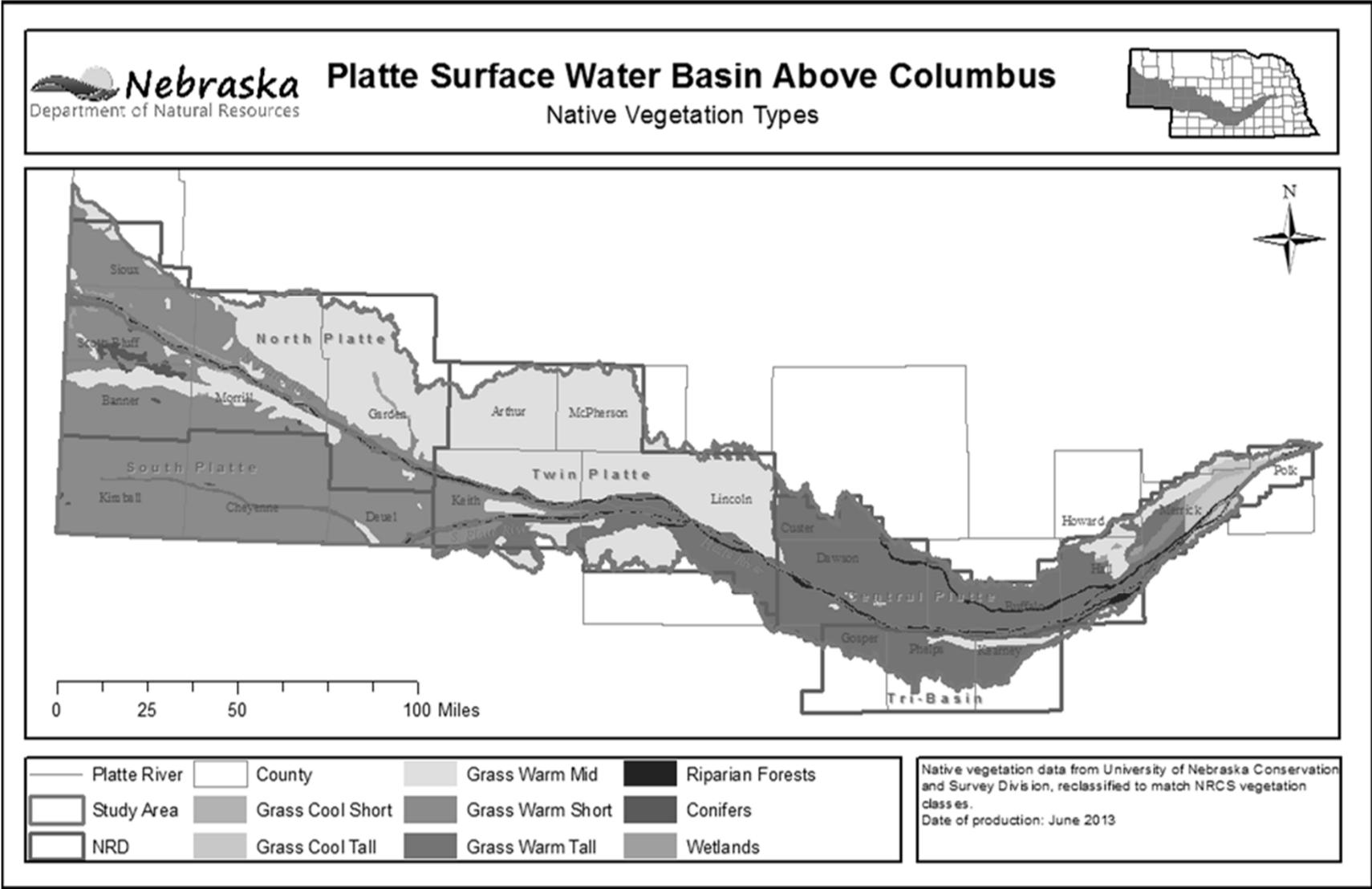


Platte Surface Water Basin Above Columbus
CALMIT 2005 Land Cover



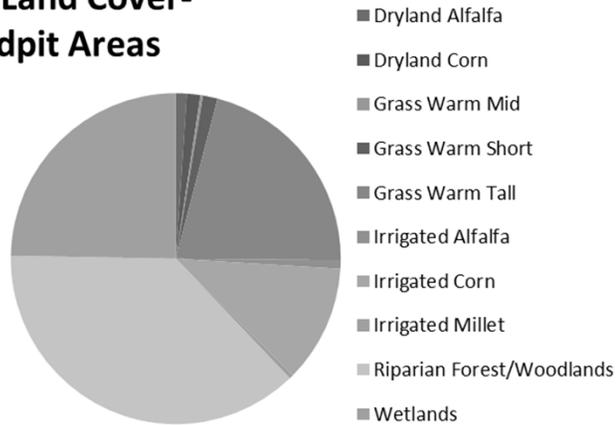
Land cover classes from the University of Nebraska Lincoln (UNL) Center for Advanced Land Management Information Technologies (CALMIT) 2005 Nebraska Land Use Patterns. County and water division data are from Nebraska Department of Natural Resources. River data from the National Hydrography Dataset. Date of Production: June 2013

Methods: ET Calculation

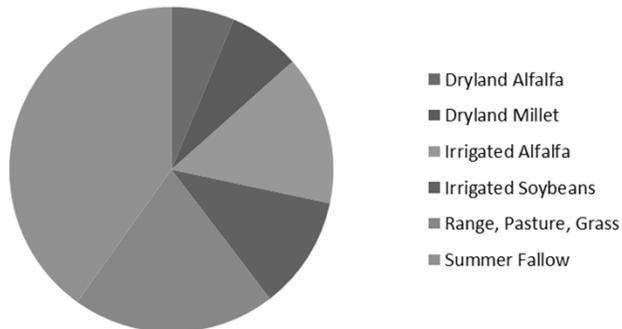


Methods: Prior Land Use for ET Calculation

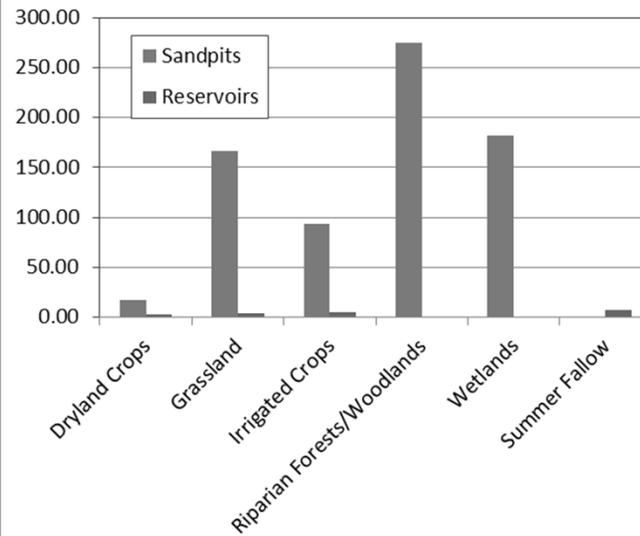
2005 Land Cover-Sandpit Areas



2005 Land Cover-Reservoir Areas



Former Land Cover for New/Expanded Water Bodies

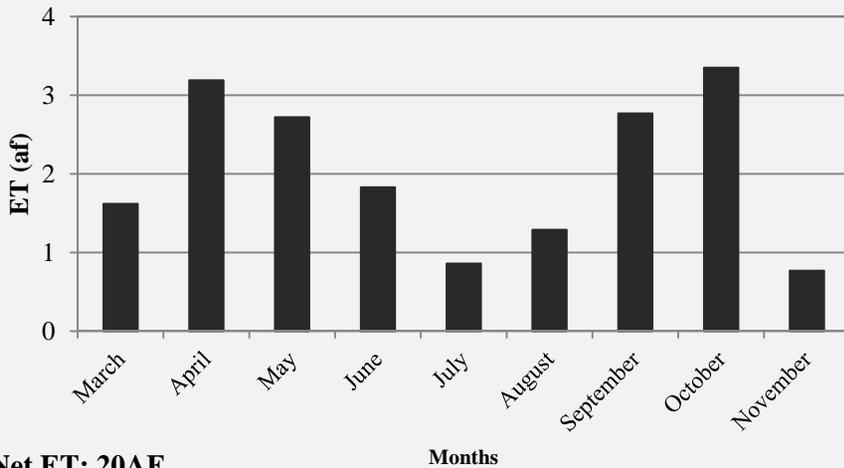


Methods: ET Calculator Assumptions/Decisions

- 2005 land cover
 - CALMIT land cover
 - UNL CSD native grasses
 - Wet tall grasses for wetlands
 - Average ET of cottonwoods and willows for riparian trees
- 2010 land cover
 - Shallow water (<1m) for reservoirs
 - Deep water (>1m) for sandpits
- Reclaimed sandpit land
 - 2010 land cover: Sand
- Irrigation application timeframe: May to September

Results: ET Change 2005 to 2010

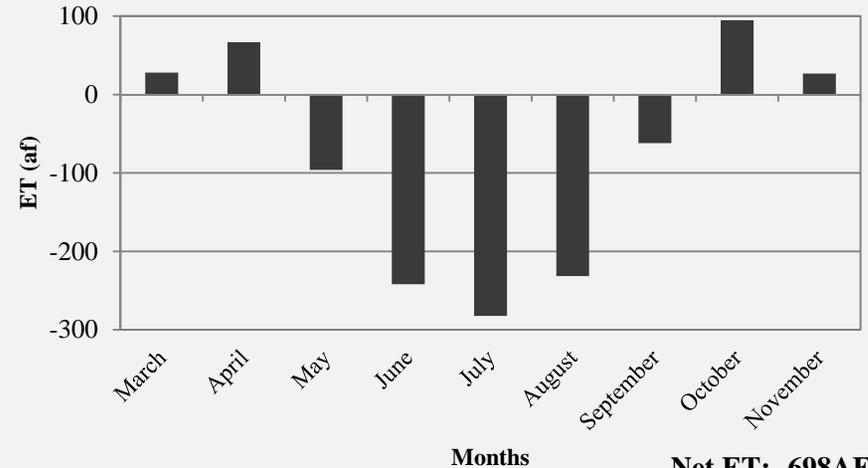
Study Area Reservoirs ET
ET Change from 2005 to 2010



Net ET: 20AF

20af ET increase from new unpermitted reservoirs

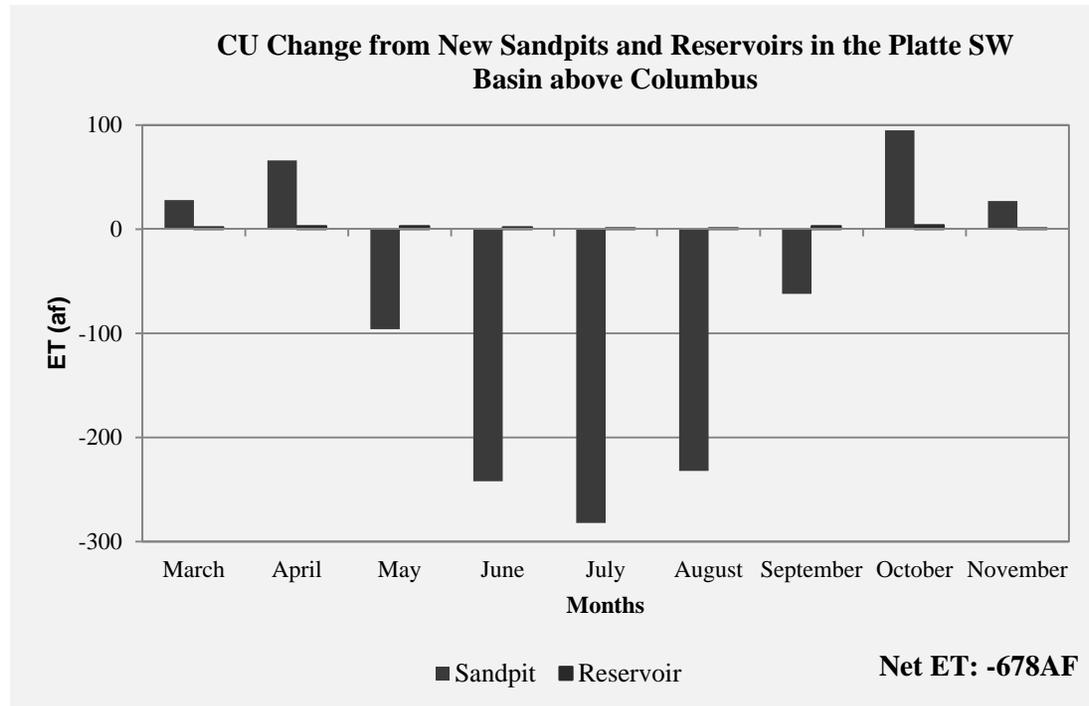
Study Area Sandpits ET
ET Change from 2005 to 2010



Net ET: -698AF

698af ET decrease from new or expanded sandpits

Results: ET Change 2005 to 2010



Overall ET decrease of 678af per year from sandpits and reservoirs

Summary

- Used geospatial technologies to identify small man-made water bodies
- Used NRCS calculator to estimate ET due to changed land cover.
- 747 acres of new reservoirs and new/expanded sandpits
- Increase in ET during all months for reservoirs
- ET increase in non-irrigation months and decrease in irrigation months for sandpits
- Overall annual decrease of 678af in consumptive use via ET
- 2500 hours to create inventory and run ET calculations

Thank you



Department of Natural Resources

Sandpit operation along the Platte River in Gosper
County.

Amy Zoller, MS, Integrated Water Management Analyst
Nebraska Department of Natural Resources

References

Mather and Koch, 2011. Computer Processing of Remotely-Sensed Images: An Introduction, Fourth Edition. John Wiley & Sons, Ltd, Chichester, UK. p. 142.

NRCS Consumptive Use Calculator, online at <http://dnr.nebraska.gov/iwm/prrip-nrcs-consumptive-use-calculator-report>

Data Sources

- 2005 Farm Service Agency Digital Aerial Imagery: <http://dnr.ne.gov/databank/DigitalImagery.html>
- CALMIT 2005 Statewide Land Use Dataset: <http://calmit.unl.edu/2005landuse/statewide.php>
- UNL CSD Native Vegetation Dataset: <http://snr.unl.edu/data/geographygis/NebrGISland.asp>
- National Hydrography Dataset: <http://dnr.ne.gov/databank/nhd.html>
- STATSGO Soil Data: <http://www.dnr.ne.gov/databank/statsgo1.html>
- NRCS ET Areas: NRCS Consumptive Use Calculator <http://dnr.nebraska.gov/iwm/prrip-nrcs-consumptive-use-calculator-report>