Department of Natural Resource
Aggregate Resource Mapping Program

Heather E. Arends

Division of Lands and Minerals

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Minnesota Ground Water Association Spring Conference

With major contributions from

Dennis Martin and Kevin Hanson

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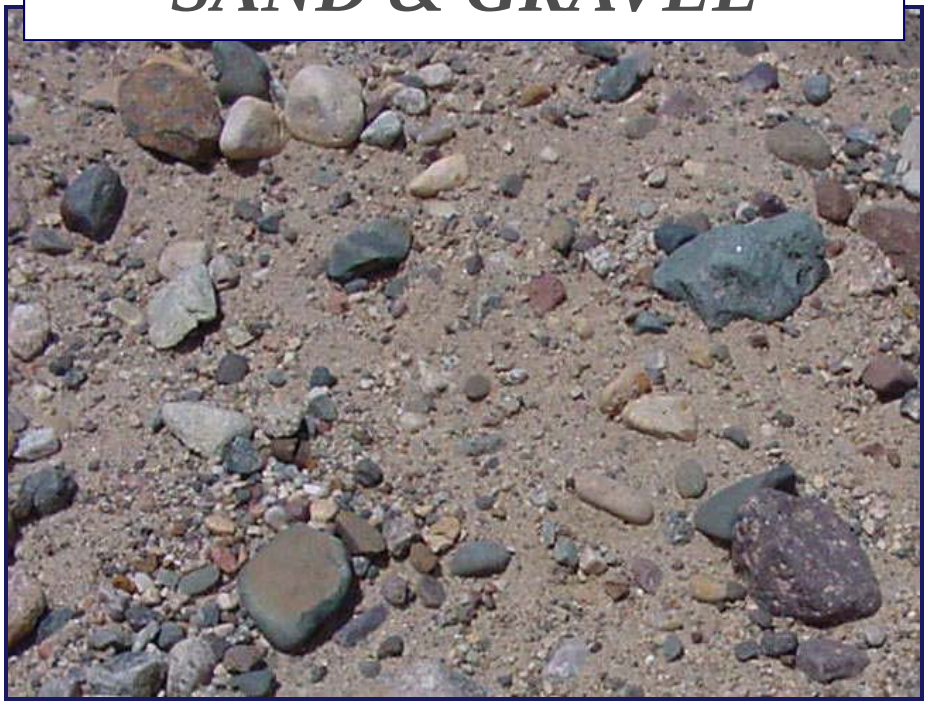
CONSTRUCTION AGGREGATES

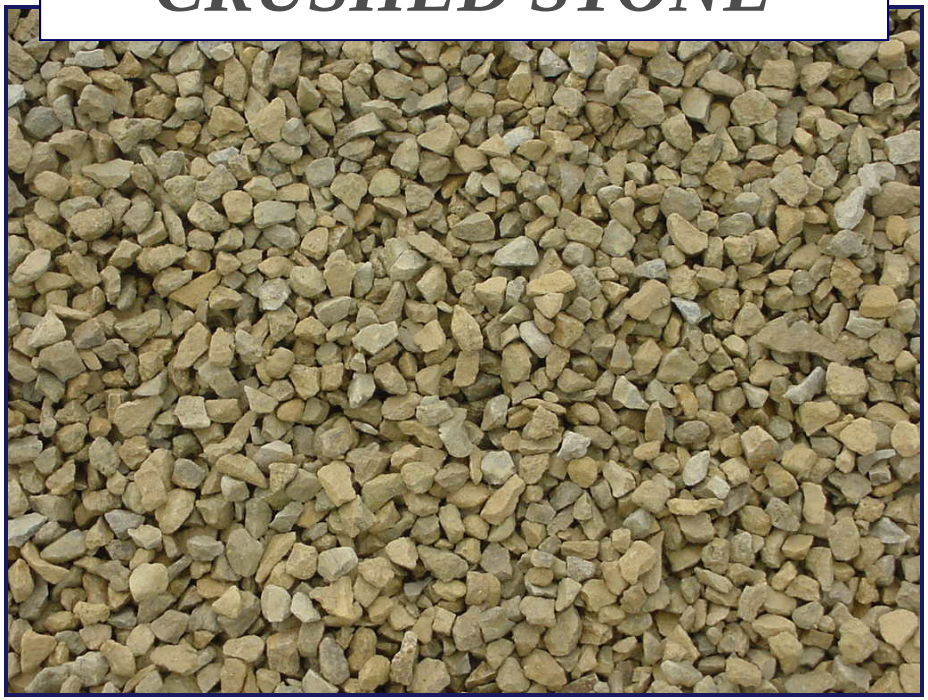
A non-renewable resource

SAND & GRAVEL



Naturally occurring sediment that has been sorted and deposited by flowing water.

CRUSHED STONE



A product of mechanically breaking down bedrock like granite, quartzites, basalts and limestones.

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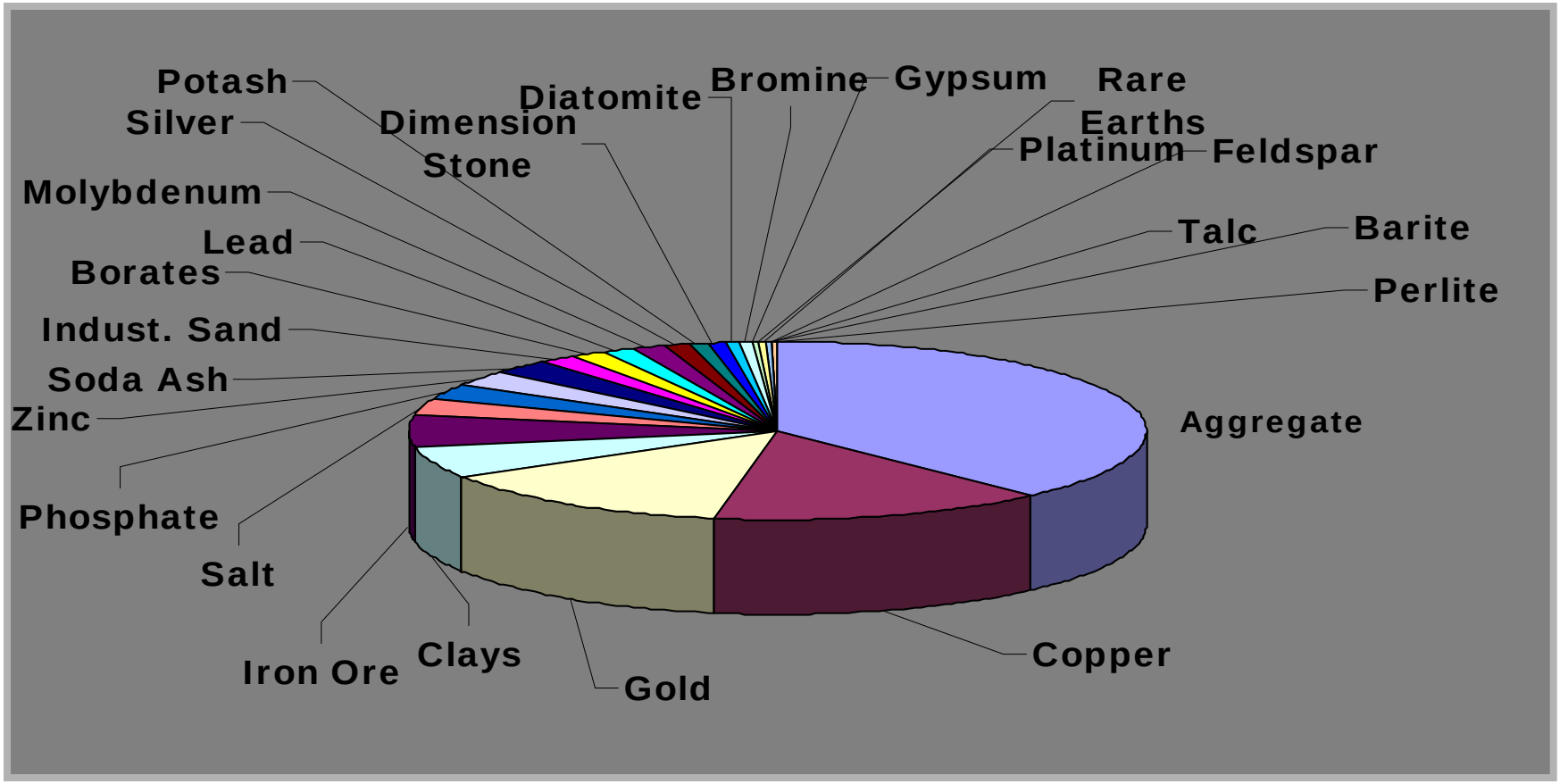
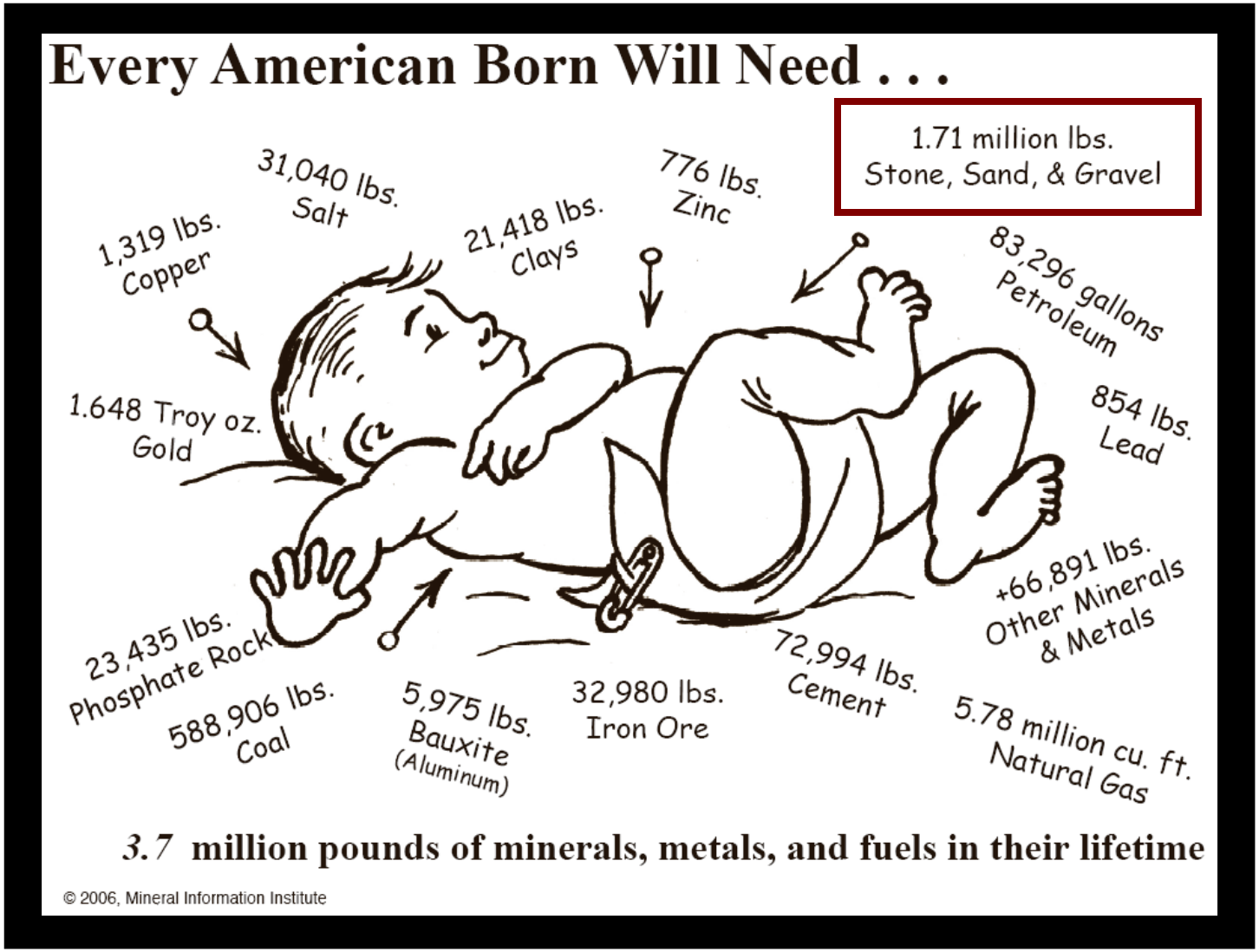
Aggregate Industry

Largest Non-Fuel Minerals Industry in the World (Value and Volume)

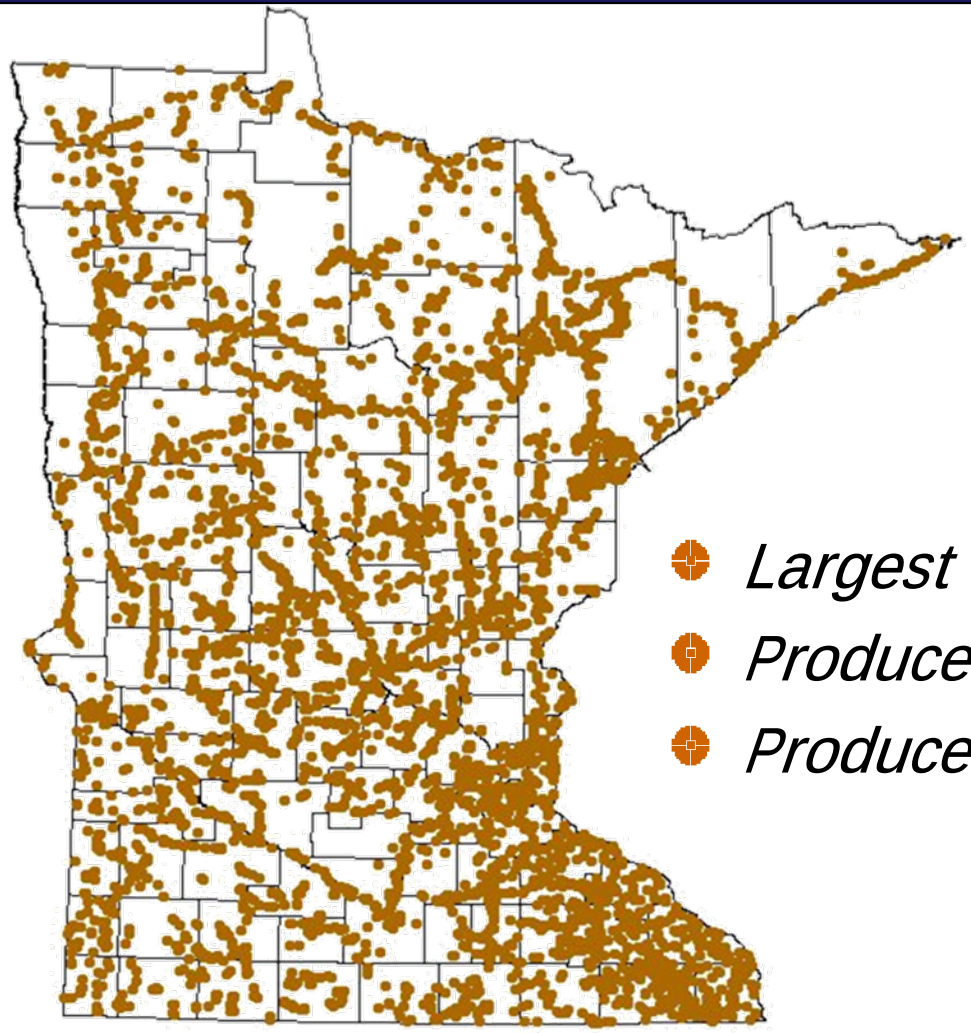


Source: USGS – Miscellaneous Reports & Talks



Source: Minerals Information Institute, 2006
www.mii.org

AGGREGATE INDUSTRY



- *Largest non-fuel industry in the US*
- *Produced in all 50 States*
- *Produced in all 87 counties in MN*

Source: Minnesota Department of Transportation
Aggregate Source Information Systems (ASIS), 2004

Overview

1. DNR Aggregate Resource Mapping Program (ARMP)

2. State-wide trends, sustainability, and permitting the next generation of mines

3. Assessing risks, environmental impacts, and reclamation of mining in terms of scale

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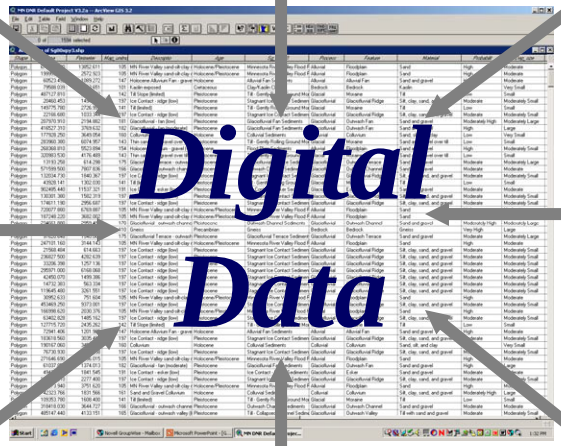
Landform Sediment Associations


Gravel Pit
Information


Drill Hole Logs


Miscellaneous
Observations

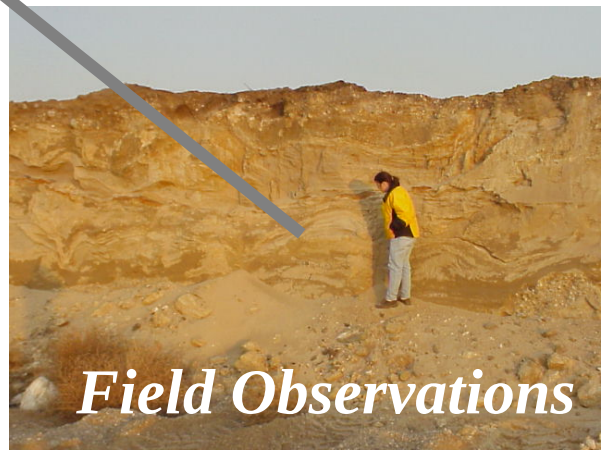

Field Samples


Digital
Data


Sieve Data-Texture


Material Observed


Aggregate Quality


Field Observations

DNR – Lands and Mineral's Aggregate Page

Minnesota Department of Natural Resources

events | a-z list | news

Recreation | Destinations | Nature | Education / safety | Licenses / permits / regs.

Home > Lands & Minerals >

Aggregate resources

- Aggregate home
- Completed counties
- Methodology
- Aggregate mapper
- Additional information

Division of Lands & Minerals

- Main page
- Aggregate maps
- Contacts
- FAQs
- For kids - Digging into MN Minerals
- Geology recreation
- Land sale
- Metallic minerals lease sale
- Mineral exploration
- Minerals Education Workshop
- Monthly data releases
- Preference rights leases
- Public access to minerals data: 100 years of data
- Publications
- Regional Operations

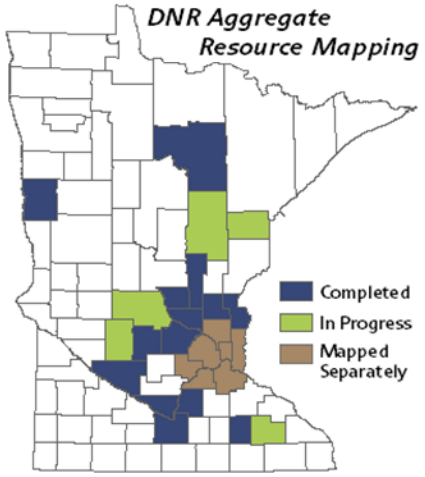
Aggregate Resource Mapping

Dennis Martin, Manager
dennis.martin@dnr.state.mn.us
500 Lafayette Road
St. Paul, MN 55155-4045
Tel. 651-259-5405

The Aggregate Resource Mapping Program (ARMP) began in 1984 when the Minnesota Legislature passed a law (MN Statute 84.94) to:

- Identify and classify aggregate resources out side of the Twin Cities metropolitan area,
- Give aggregate resource information to local units of government and others for making comprehensive land-use and zoning plans,
- Introduce aggregate resource protection, and
- Promote orderly and environmentally sound development of the resource.

On a statewide basis, we are in a transition from a time of local abundant supply of aggregate resources to a time of adequate availability to local scarcity. There is a need to plan for the future supply of aggregate before they are irretrievably lost.



Several factors can reduce the availability of aggregate resources. As a result, the delivered price of aggregate resources is increasing due to increasing transportation distances to the market. Since roughly half of the total amount of aggregate consumed each year in Minnesota is used for public roads and public works projects, it is in the tax payer's interest to plan and promote the orderly development of low-cost, locally available construction material.

This site provides information about the distribution of quality aggregate resources to local units of government, citizens, land use planners, private companies, and environmental groups. Completed aggregate resource plates are available free of charge in several formats:

- Digital maps and data can be downloaded.
- Data can be viewed interactively on Aggregate Mapper.
- Paper maps and CD-ROMS are available by request. Contact Dennis Martin either by phone or email (see information at top of page).

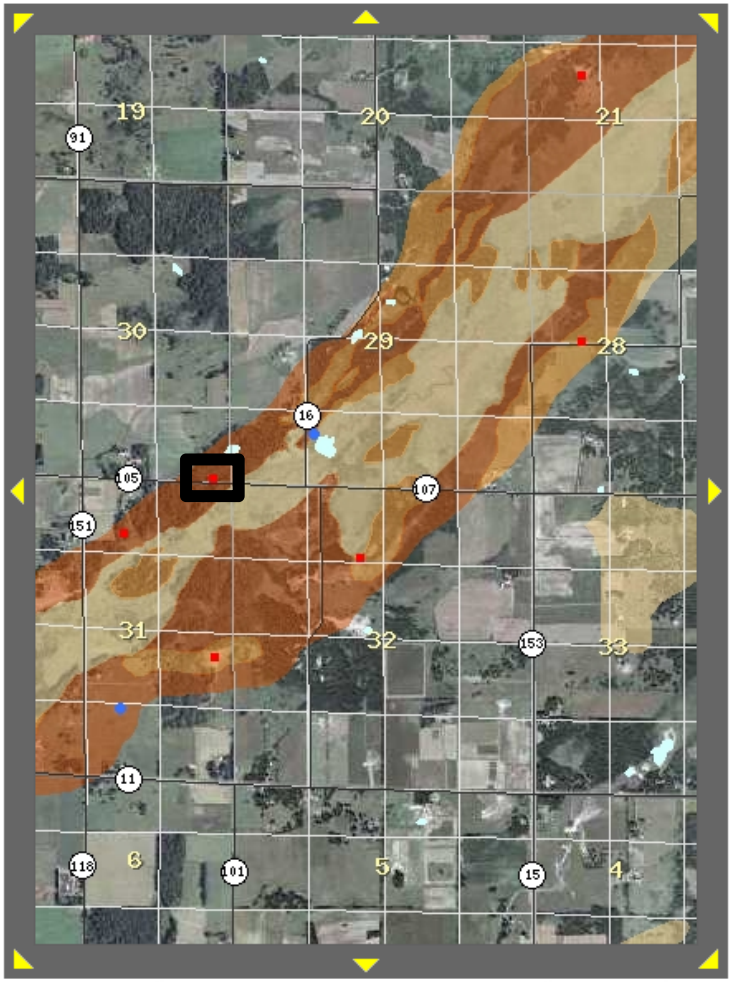
http://www.dnr.state.mn.us/lands_minerals/aggregate_maps/index.html

ARMP DATASETS

Over 11 years of using GIS and databases, ARMP has collected:

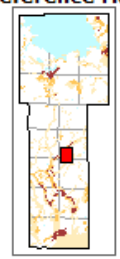
- 11,000 Field Observation Points
- 5,300 Gravel Pits, Quarries, and Borrow Pits

Mille Lacs County



Approximate Scale ~ 1:25000

Reference Map



- Zoom In
- Zoom Out
- Re-center
- Query features

Only Aggregate Potential layers and Observations layers can be queried. Query results open in a new window. If you cannot see query results disable your browser's pop-up blocker.

Layers

Aggregate Potential

Not viewable below a scale of 1:24,000

- [x] Highly Desirable Sand & Gravel
- [x] Moderately Desirable Sand & Gravel
- [x] Less Desirable Sand & Gravel
- [ ] Aggregate Potential Outlines

- [ ] Highly Desirable Crushed Stone
- [ ] Moderately Desirable Crushed Stone
- [ ] Less Desirable Crushed Stone
- [ ] Crushed Stone Potential Outlines

Observations

- [x] County Well Index
- [x] Gravel Pits and Quarries
- [ ] Field Observations

Hydrography

- [ ] Wetlands
- [ ] Streams
- [x] Lakes

Overlays

- [x] PLS Lines
- [x] Roads
- [x] Municipalities

Background Images

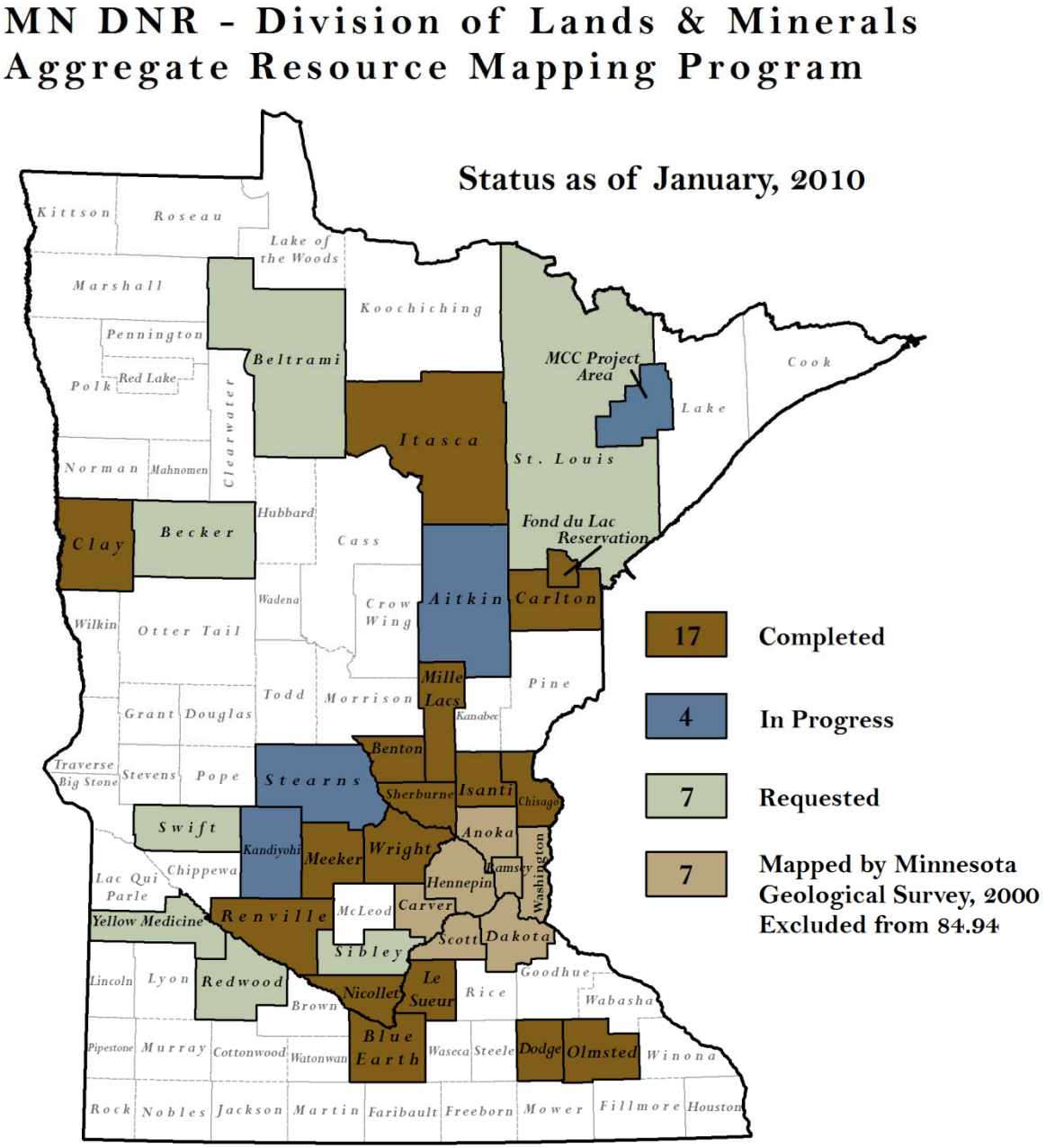
You may need to zoom in several levels for some background images to display.

- [ ] Elevation
- [x] 2003 FSA Photos
- [ ] 1991 NAPP Photos
- [ ] USGS Topo Map

Update Layers

Reset to defaults

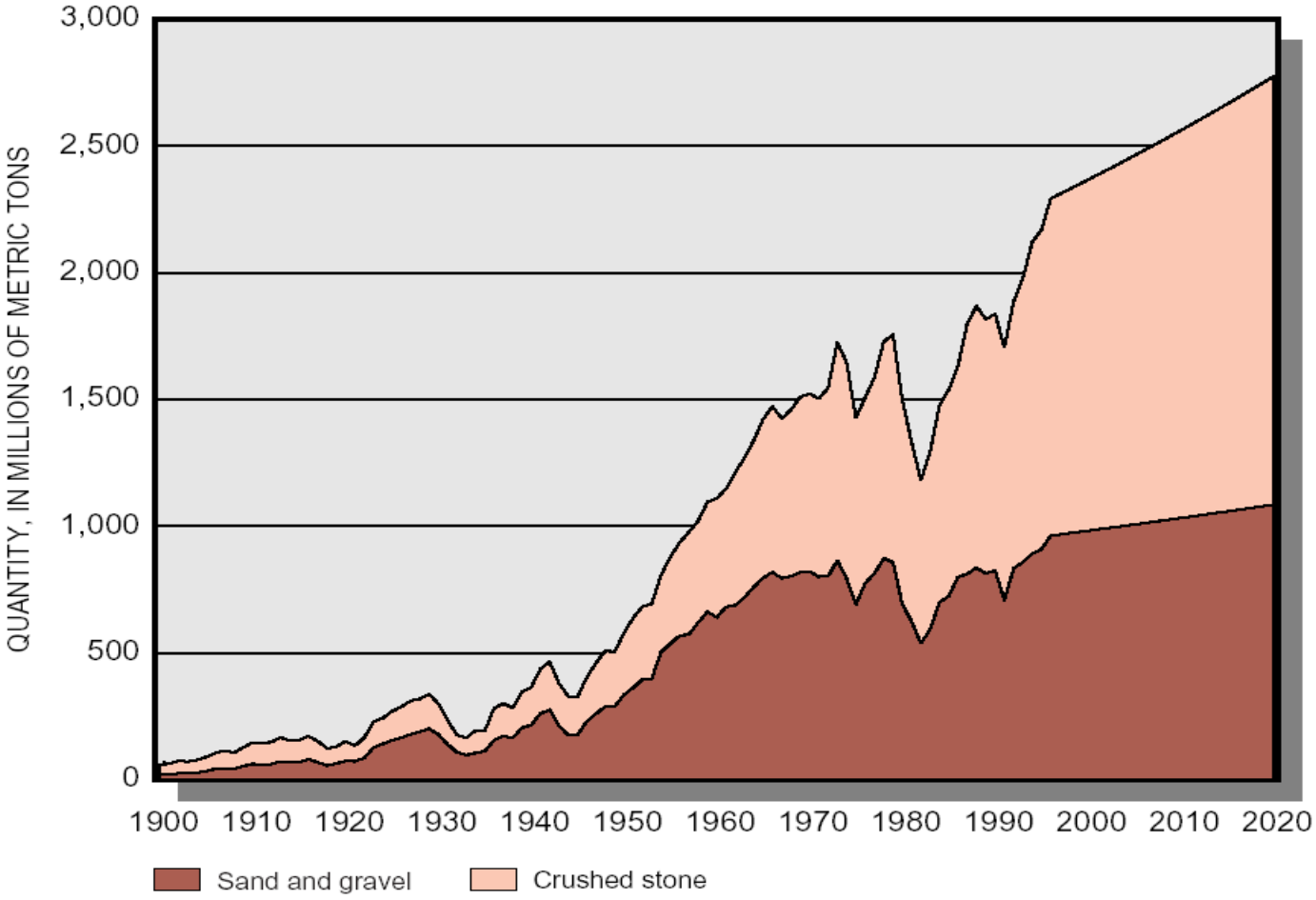
Current Status of ARMP



Approximately 50% of aggregate in MN is consumed by **publically** *funded projects*

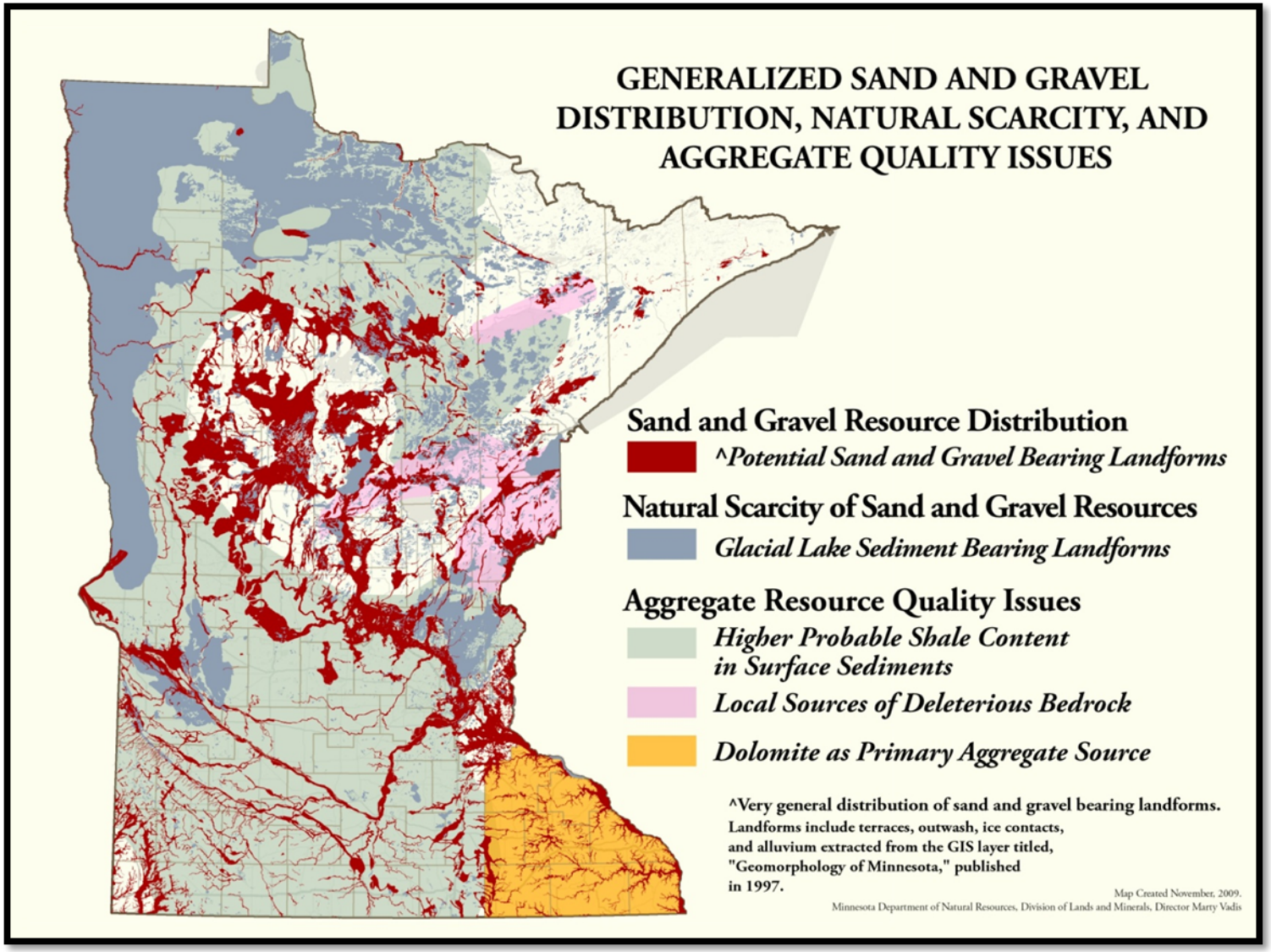
….and roads require on-going supplies of aggregate

***DEMAND**: Despite short-term economic trends, aggregate demand continues to grow over the long term*

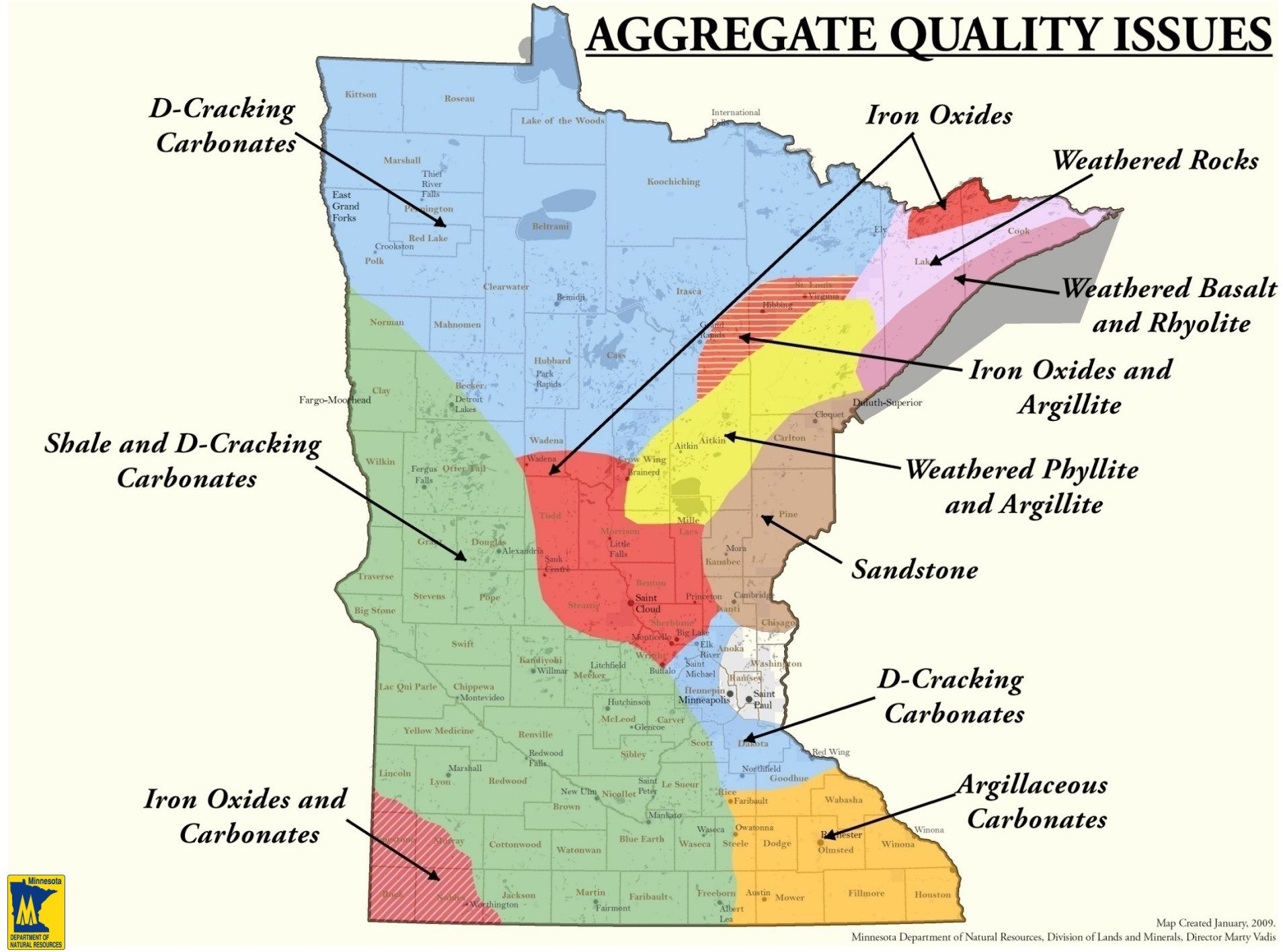


National aggregates production in the United States with projections to 2020, based on growth rate of 1.0% for stone and 0.5% for sand and gravel.

LOCAL MARKETS AND UNEVEN DISTRIBUTION



AGGREGATE QUALITY ISSUES



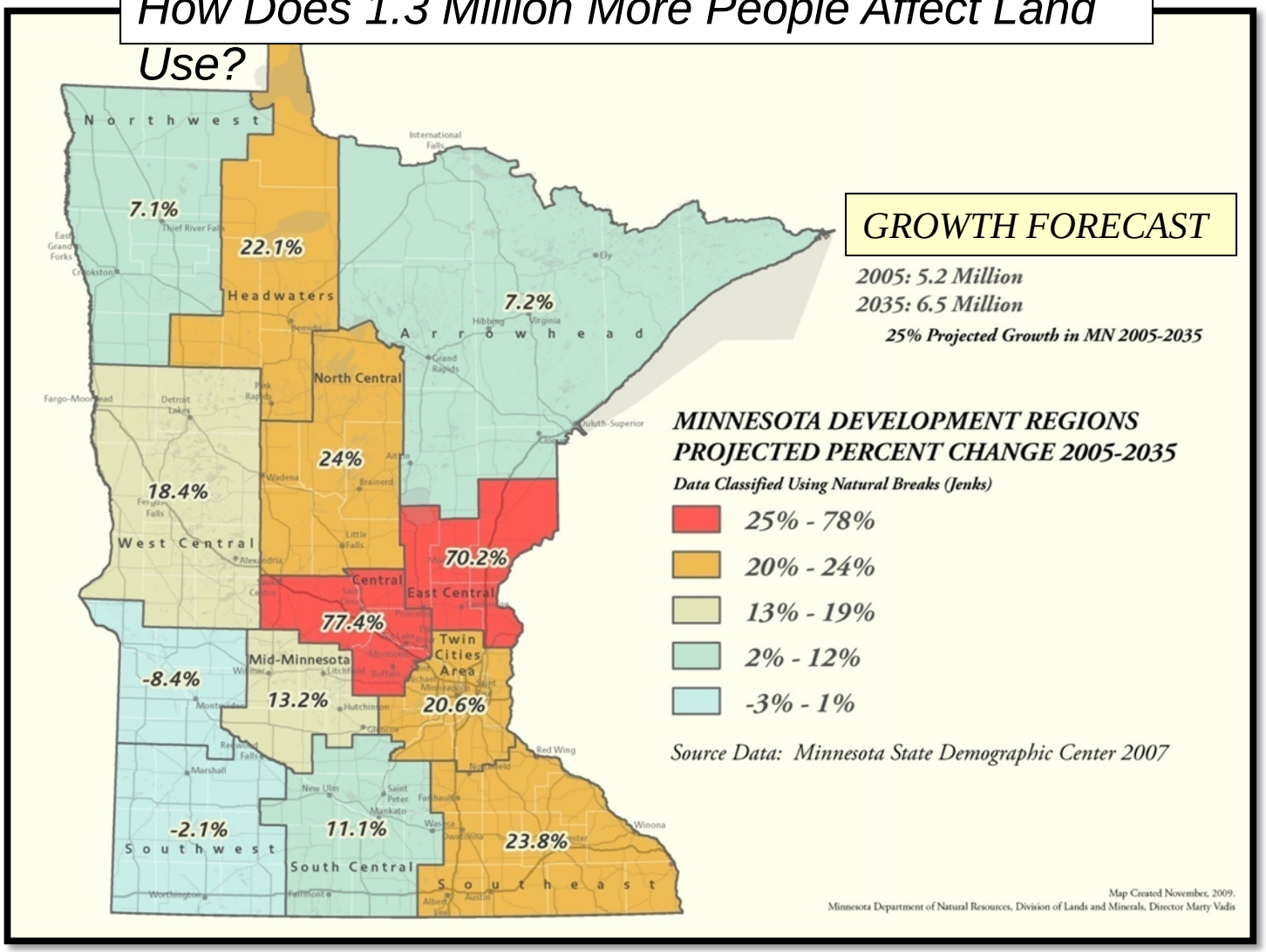
Minnesota Department of Natural Resources

Map Created January, 2009.
Minnesota Department of Natural Resources, Division of Lands and Minerals, Director Marty Vadis

DEPLETION OF PERMITTED MINES

POPULATION GROWTH

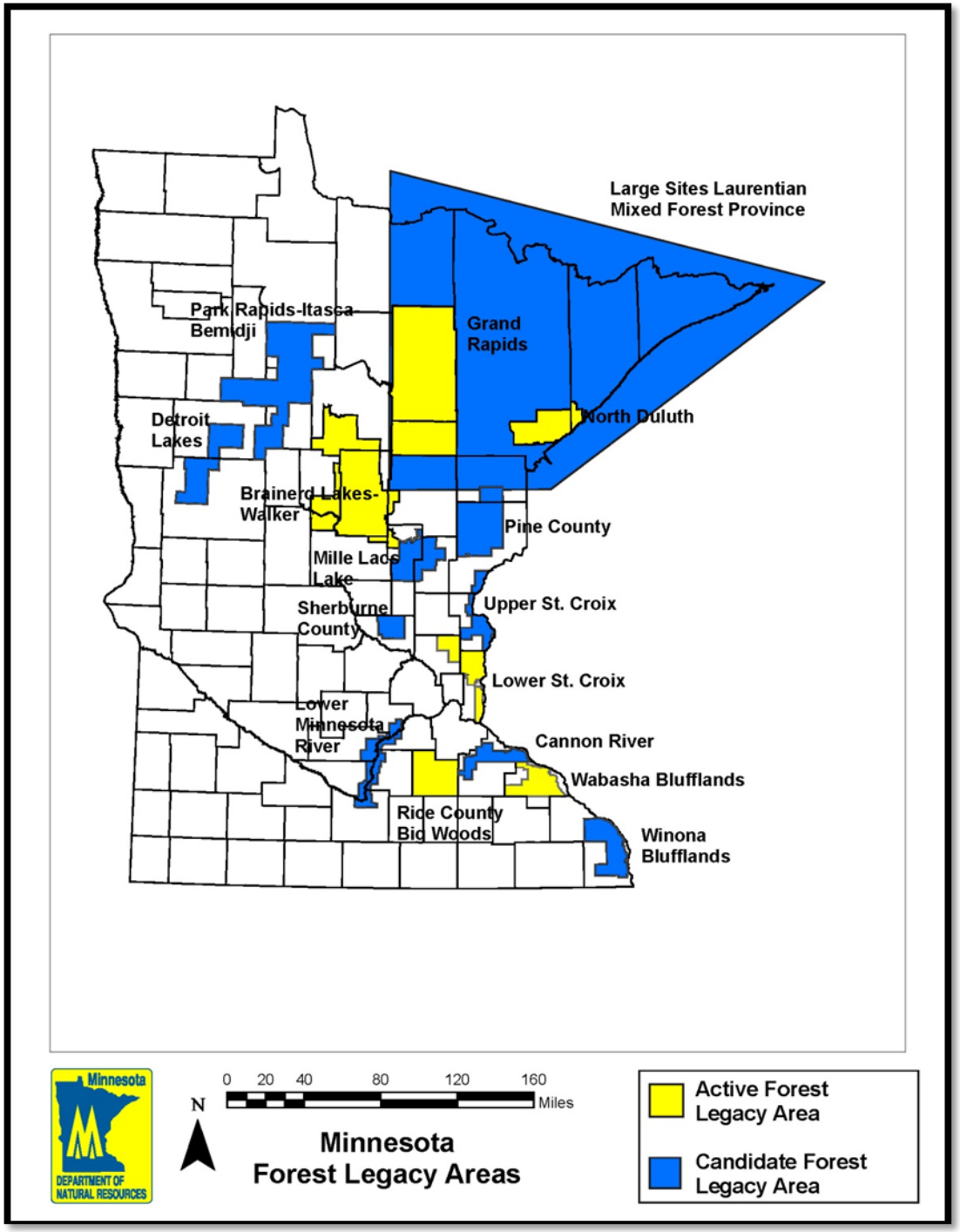
How Does 1.3 Million More People Affect Land Use?



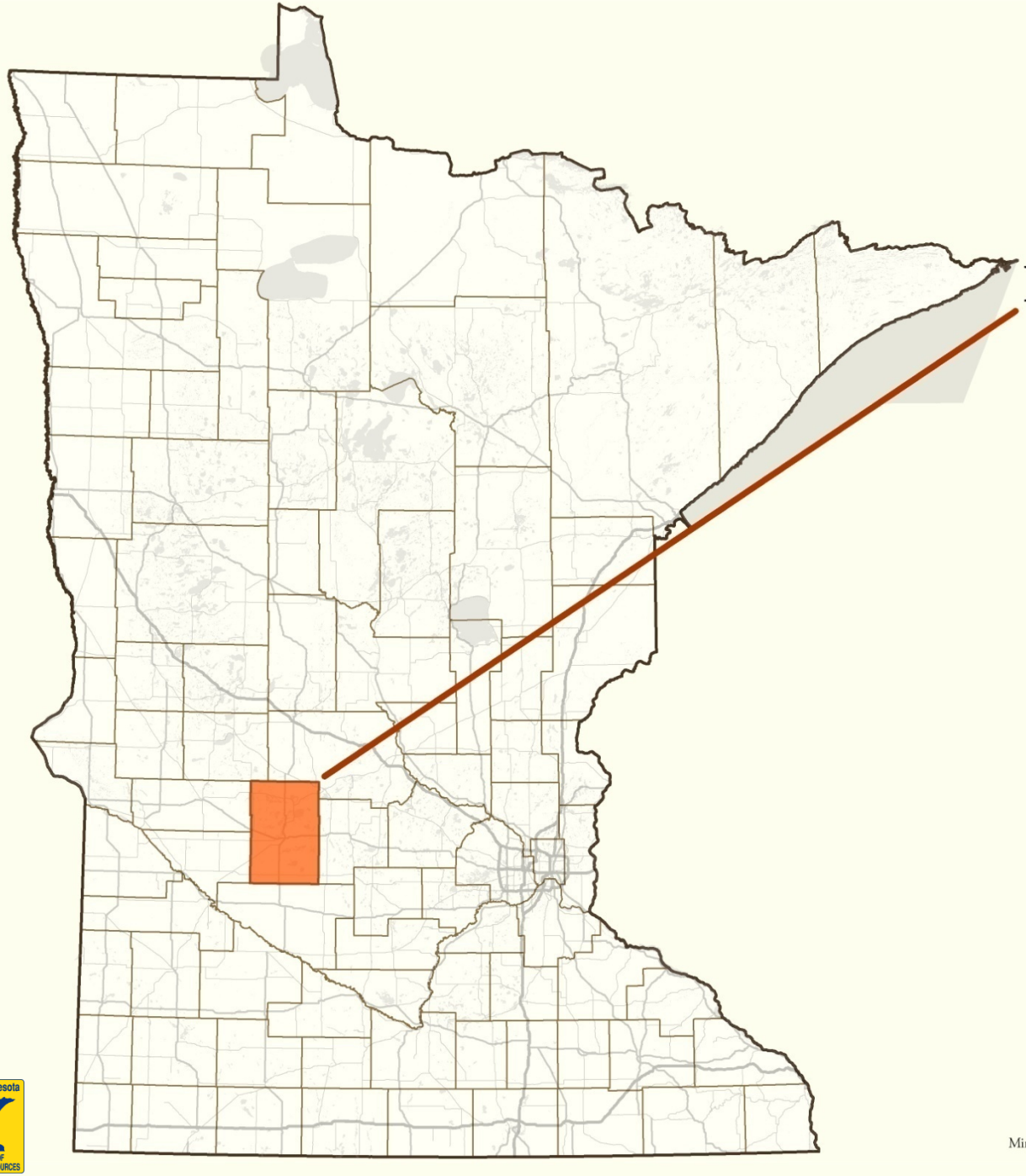
LAND USE that precludes mining

Forest Legacy Areas in *Minnesota*

Conservation Goal: ~828 Square Miles



MAP SOURCE - MN DNR
http://files.dnr.state.mn.us/assistance/backyard/forestlegacy/forestlegacy_areamap.pdf



828 Square Miles Equals Approximately the Size of Kandiyohi County, MN

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Conservation Easements and Acquisitions

ACQUISITIONS

- *The Nature Conservancy Acquisitions*
- *DNR Acquisitions*
- *The Trust for Public Lands Acquisitions*
- *Federal Fish and Wildlife Acquisitions*
- *Pheasants Forever Acquisitions*
- *Ducks Unlimited Acquisitions*
- *Tribal Acquisitions*
- *Public Land Acquisitions for Trails (Old Railroads and OHVs)*
- *County Natural Area Acquisitions, e.g. Dakota & Washington Counties*

DESIGNATIONS

- *Wild and Scenic River*
- *Buffers around National Parks, Lake Superior*
- *Conservation Overlay Districts*

EASEMENTS

- *DNR Easements*
- *Federal Forest Legacy Conservation Easements*
- *Federal Fish and Wildlife Easements*
- *Prairie Banks*
- *Farm Easements in Federal Programs; (CRP & RIM)*

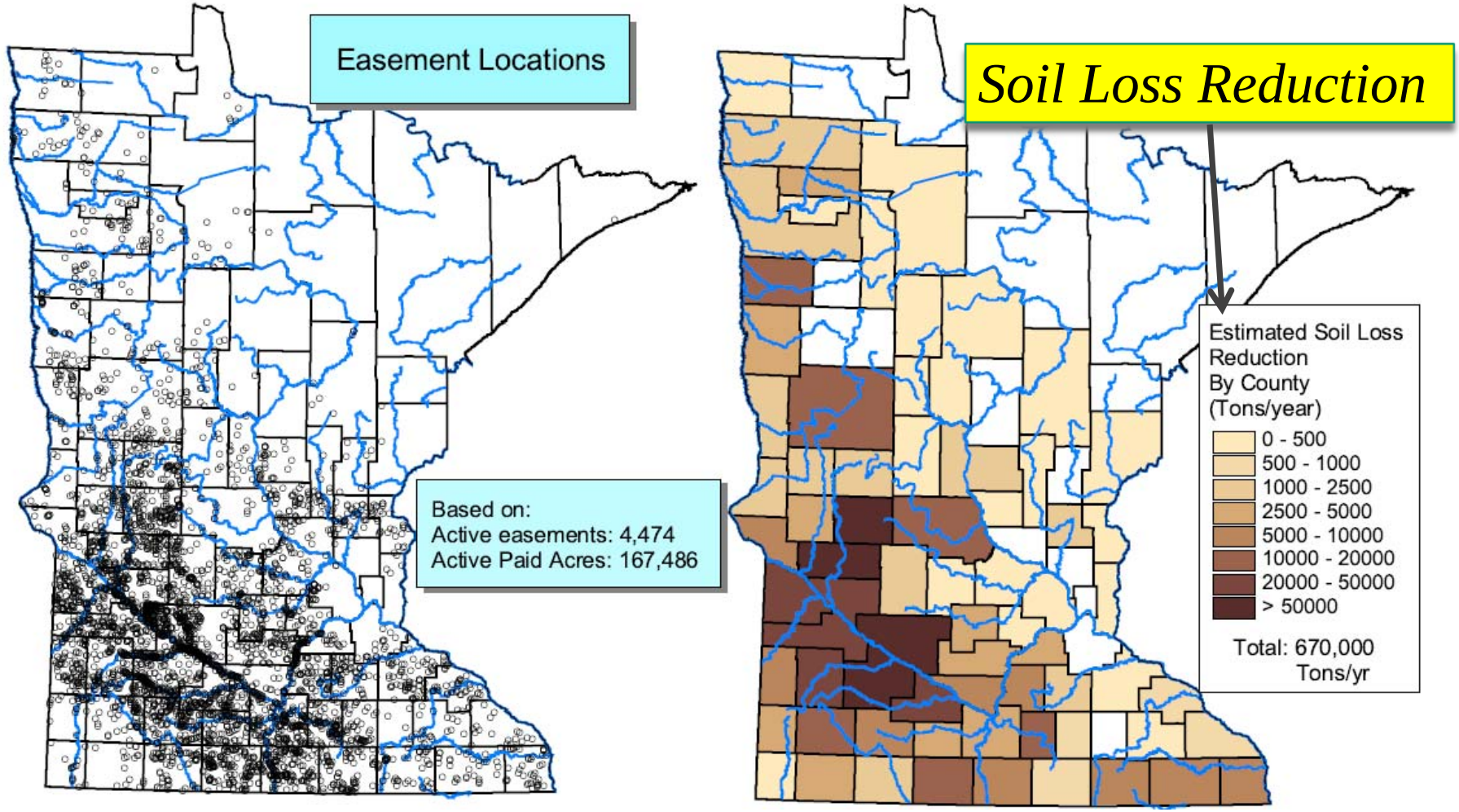
PROTECTED FEATURES

- *Calcareous Fens (203 sites)*
- *Karst Areas*
- *Old Growth Forests*
- *Native Prairie*
- *State Historic Preservation Designations, Archeology, and other Cultural Sites*
- *Protected Landforms- eskers, bluffs, etc.*

Minnesota DEPARTMENT OF NATURAL RESOURCES

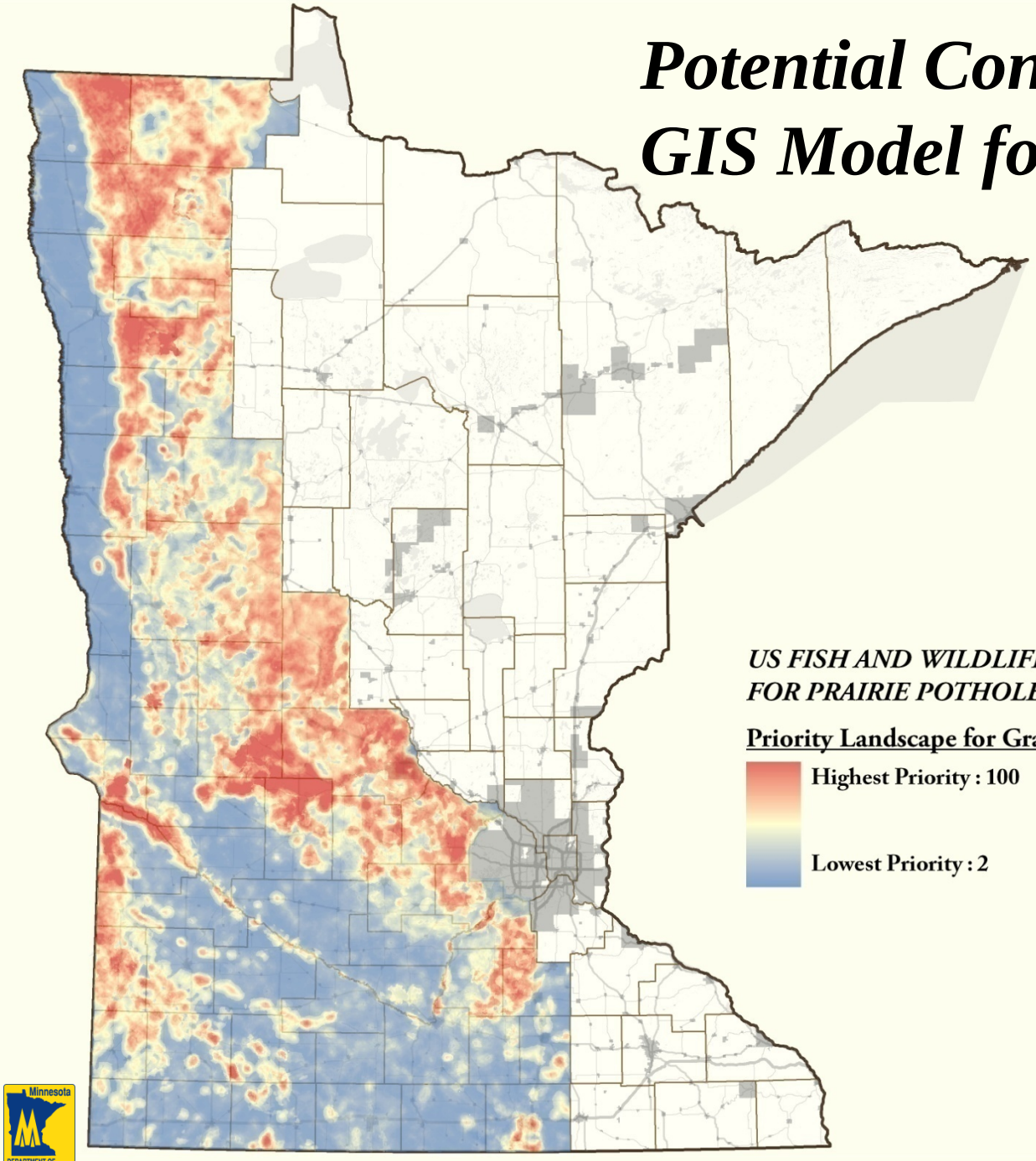
EXAMPLE OF POSITIVE OUTCOMES OF CONSERVATION EASEMENTS

Benefit of Conservation Easements: Soil Loss Reduction



Data and Map Source: Report via LARS (1997-2002) and eLINK (2003-present) http://www.bwsr.state.mn.us/easements/lars1.pdf

Potential Conservation Areas: GIS Model for Duck Habitat



US FISH AND WILDLIFE SERVICE CONSERVATION MODEL FOR PRAIRIE POTHOLE REGION:

Priority Landscape for Grassland Conservation

Highest Priority : 100

Lowest Priority : 2

About the GIS Data:

The grassland conservation layer is the result of a modeling effort. The intent was to define priority landscapes for strategic conservation of grasslands and wetlands to benefit a suite of priority species. The data was created by the HAPET office of the USFWS, as part of the Working Lands Initiative, a joint effort between DNR, USFWS and other agencies and NGOs. The source is LandSat TM data and National Wetlands

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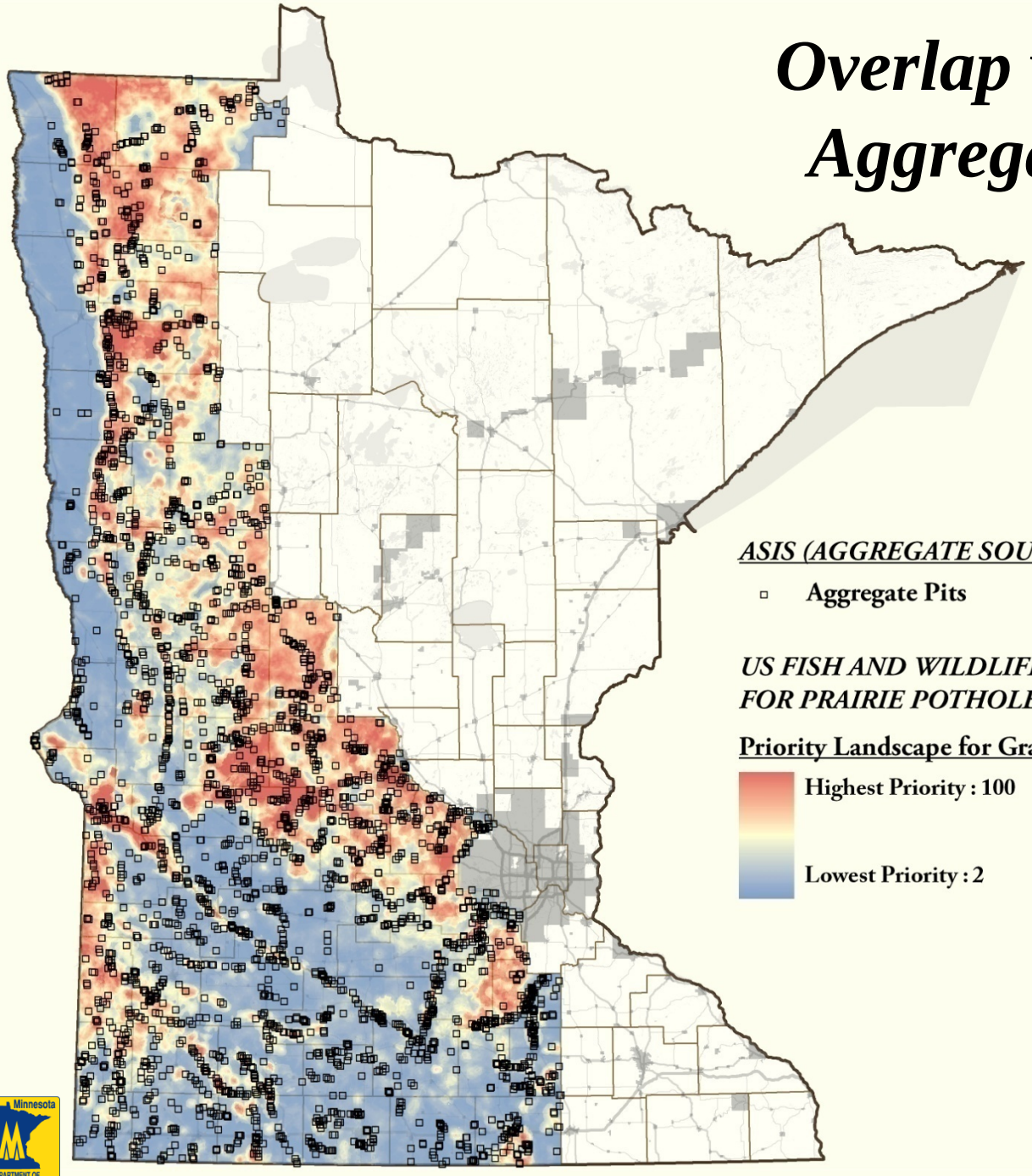
Overlap with Historic Aggregate Deposits



ASIS (AGGREGATE SOURCE INFORMATION SYSTEM)

- Aggregate Pits

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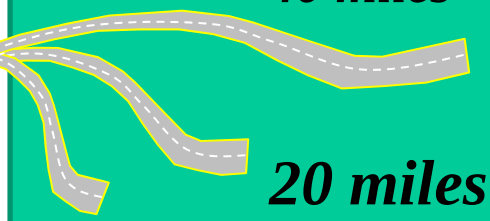
Availability = Sustainability

Having a local supply of aggregate is an important sustainability issue for maintaining and developing communities of all sizes

TRANSPORTATION COSTS

Example $7.00/short ton at the mine site + *Cost of Round Trip Truck Haul* = ***Total Delivered Cost***

What's the Cost to haul to a job site

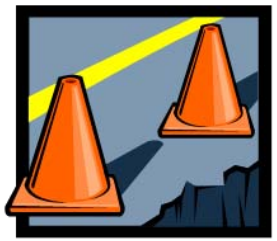


Local Sources Offer Lower Delivered Cost

The benefits of buying local

Lowers Transportation/ Energy Costs

Reduces a Community's Carbon Footprint



Decreases Heavy Vehicle Road Wear

Governance of Construction Aggregate Resources

Involves numerous entities and decisions

Current Supply

Use of Permitted and "Grandfathered" Sources

Depletion

Depletion Rates Driven by:
- ***Local Market Demand***
- ***"Import" Market (e.g. Twin Cities)***

Future Supply

Development of New Permitted Sources

Requires:
- ✓ ***Willing Landowner <u>with</u> Deposit***
- ✓ ***Willing Mining Company***
- ✓ ***Local Government Approval***
  - ***Planning and Public Notice***
  - ***Zoning***
  - ***Permitting***
- ✓ ***Input from Neighbors***
- ✓ ***Input from Interest Groups***

Sand and Gravel Mining Above Water Table

Sand and Gravel Mining Below Water Table

- *Backhoe - material piled, processed, etc.*
- *Typically used in smaller S&G pits*

SAND AND GRAVEL MINING

AGGREGATE MINING

Crushed Stone Mining – Mined in Benches

Risks, Impacts, and Reclamation

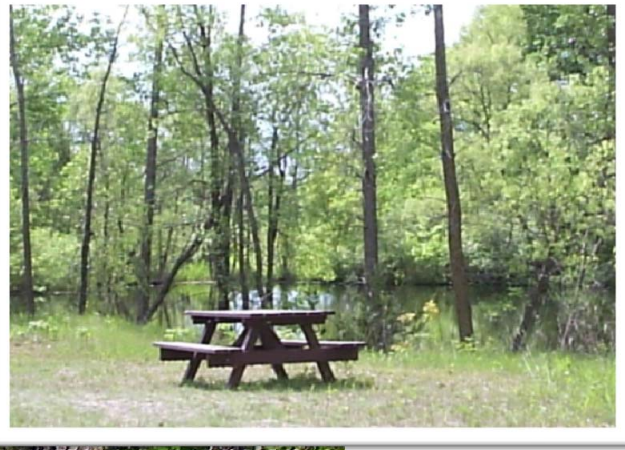
- Scale: Large, high-quality deposits near markets are regionally important resources. Public benefits to mining.
- What are the environmental impacts of not mining a site.
- Deeper mines vs. wider mines:
  - How does restrictions to mining below the water table increase surface disturbances
- Aggregate mining and land use.
- Aggregate is a finite resource.
- Aggregate mining is a temporary land use.
  - Short-term impacts
  - Long-term impacts

MINING IS A TEMPORARY LAND USE

Farmland

Over time, landscapes will recover

Mining = Temporary Land Use



Questions