

The background is a light blue gradient with several realistic water droplets of various sizes scattered across the surface. The droplets have highlights and shadows, giving them a three-dimensional appearance.

AQUIFER DEPLETION IN THE GREAT LAKES REGION

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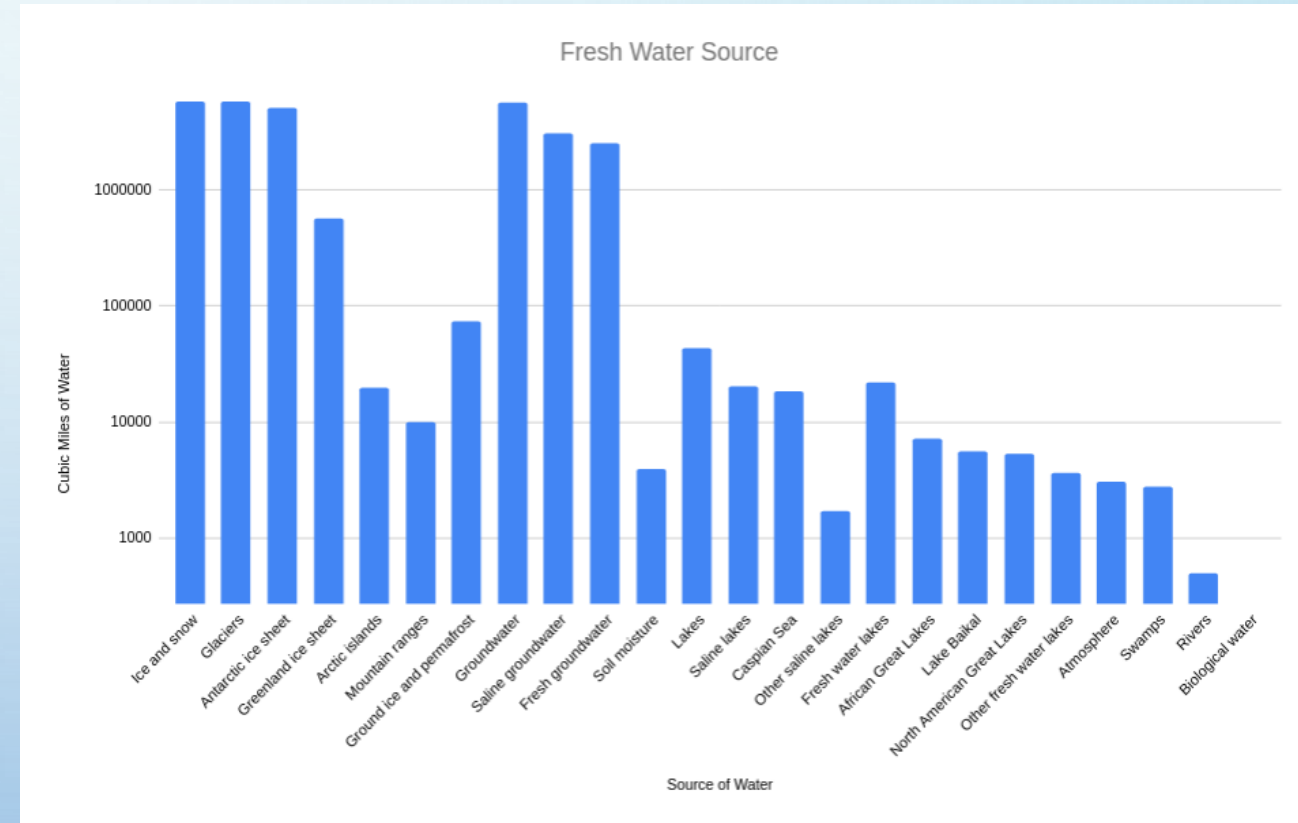
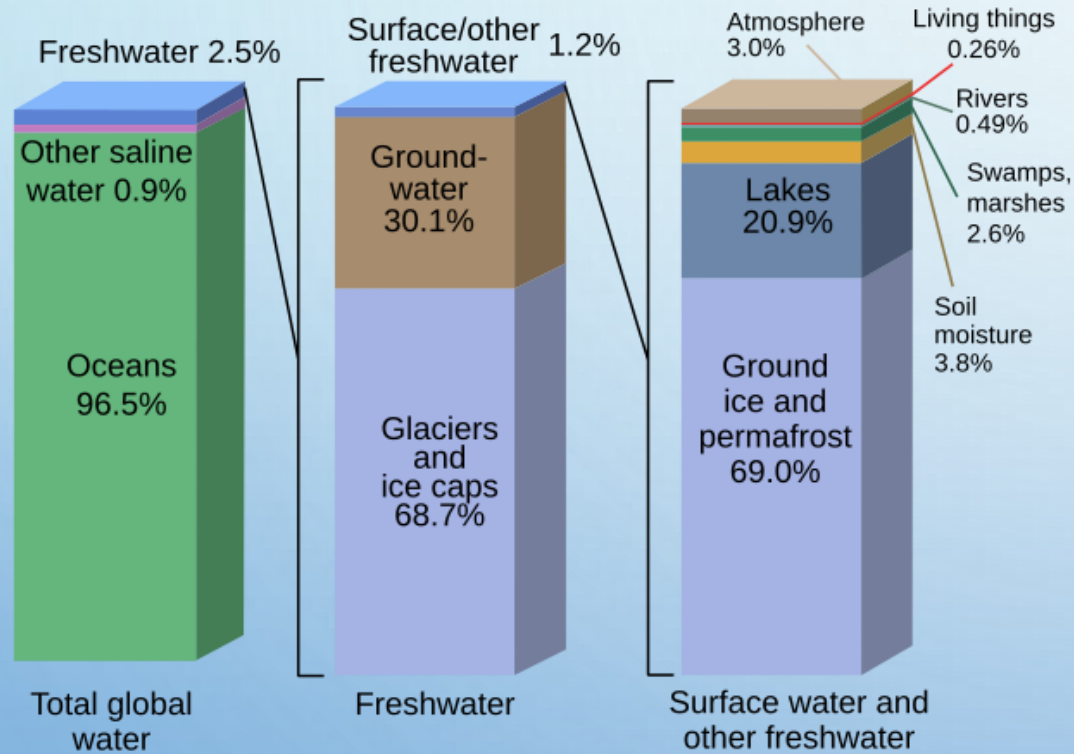
25TH ANNUAL GREAT LAKES WATER CONFERENCE

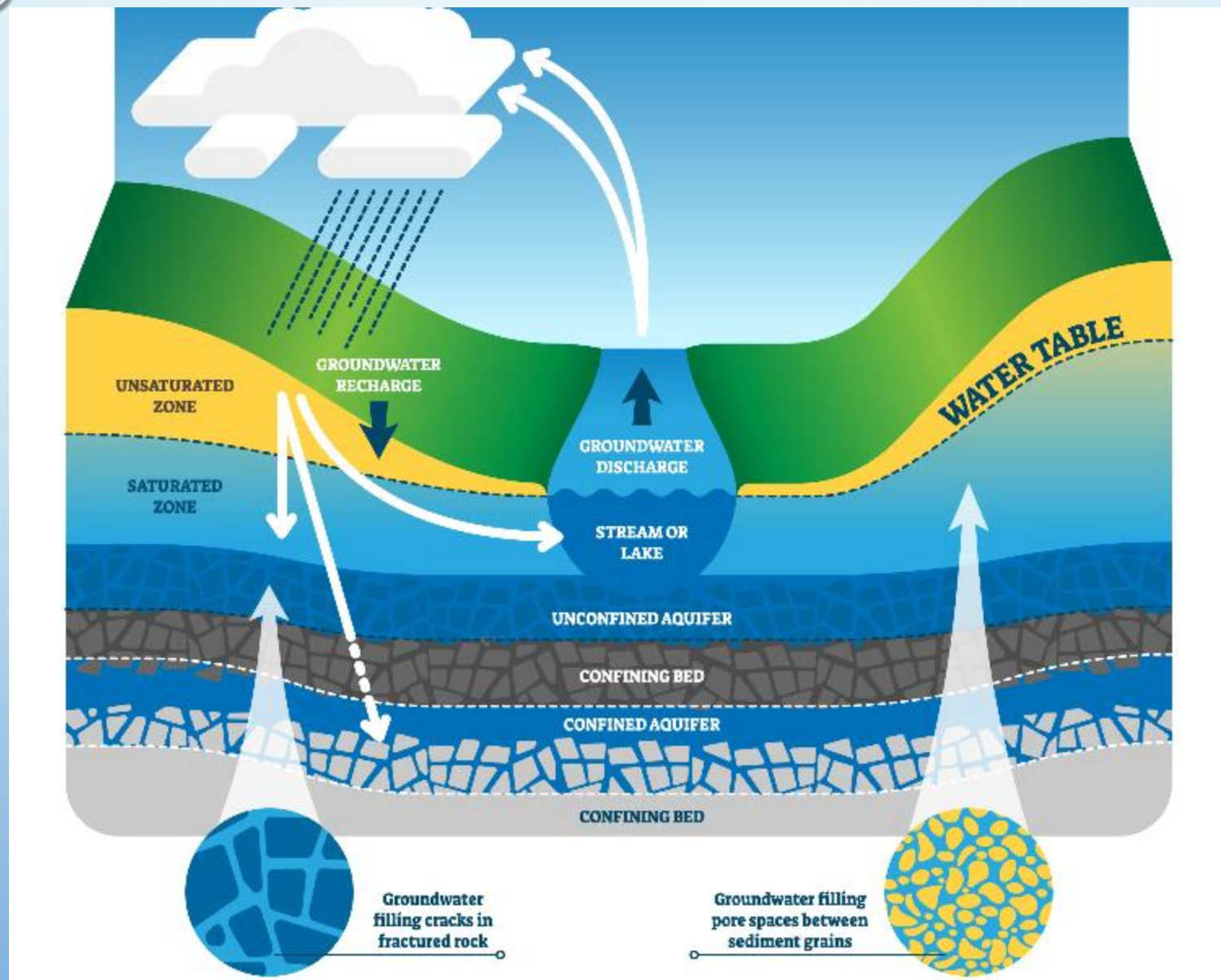
WATER SECURITY AND THE GREAT LAKES REGION

UNIVERSITY OF TOLEDO

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Where is Earth's Water?





GROUNDWATER

- ONLY 2.5 PERCENT OF THE GLOBES WATER IS FRESH
- GROUNDWATER REPRESENTS 95 PERCENT OF EARTH'S FRESHWATER NOT FROZEN IN THE POLES OR GLACIERS
- GROUNDWATER PROVIDES DRINKING WATER FOR HALF OF THE UNITED STATES POPULATION
- MOST GROUNDWATER IN THE US IS USED FOR AGRICULTURE, PARTICULARLY IRRIGATION

AQUIFERS IN THE GREAT LAKES REGION



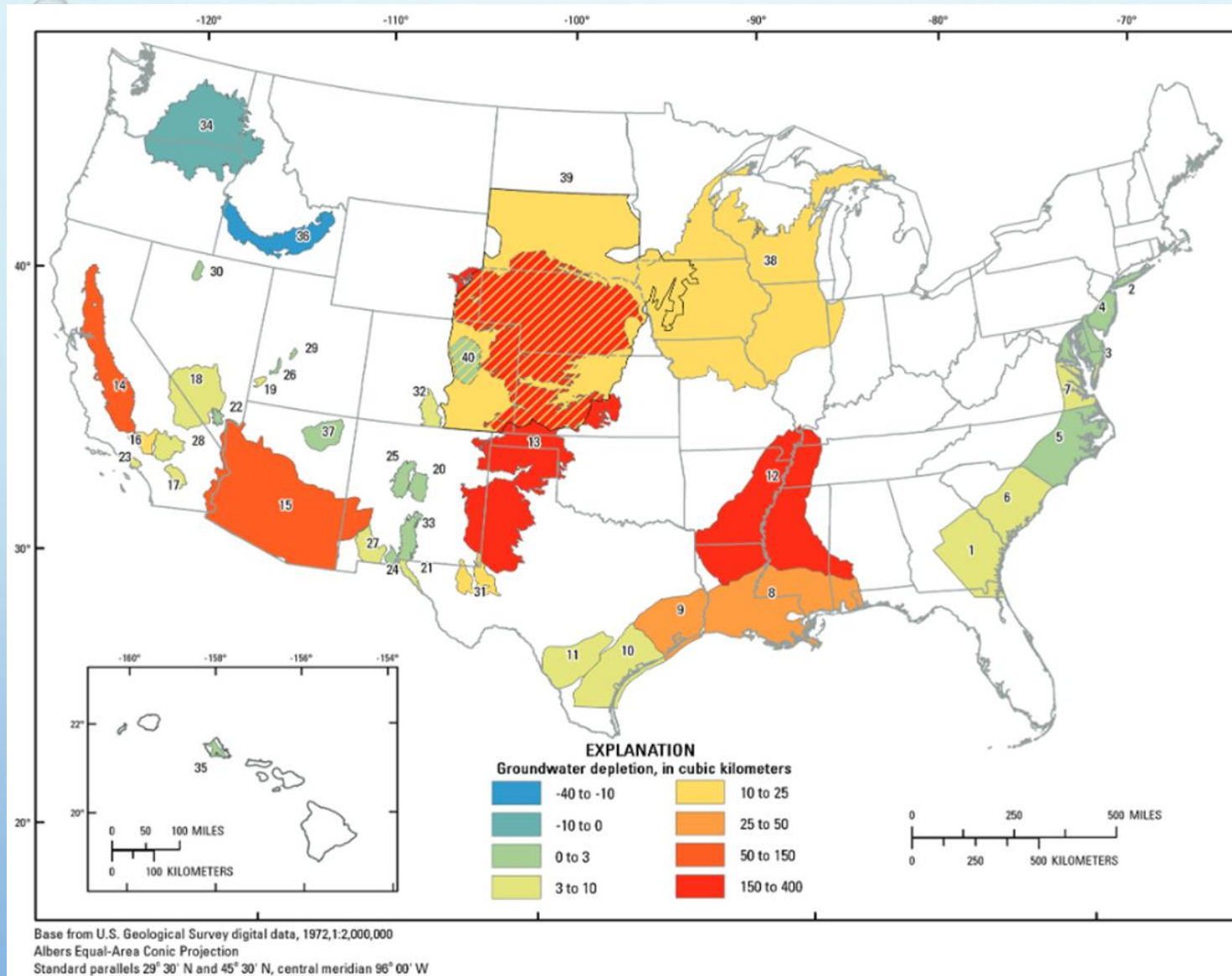


Figure 2. Map of the United States (excluding Alaska) showing cumulative groundwater depletion, 1900 through 2008, in 40 assessed aquifer systems or subareas. Index numbers are defined in table 1. Colors are hatched in the Dakota aquifer (area 39) where the aquifer overlaps with other aquifers having different values of depletion.

DATA ON DEPLETION

- WHAT IS AN AQUIFER?
- IT IS VERY HARD TO CALCULATE HOW MUCH WATER IS LEFT IN AN AQUIFER
- NASA CAN ASSESS AQUIFER DEPTHS FOR VERY LARGE AREAS LARGER THAN A STATE (I.E. OGALLALA)
- HOWEVER, IT IS DIFFICULT TO DETERMINE HOW MUCH WATER IS IN A SPECIFIC AREA OF AN AQUIFER, OR HOW MUCH WATER IS IN A SMALL AQUIFER.
- THE ABSENCE OF ADEQUATE PUMPING DATA MAKES WATER BUDGETS HIGHLY INACCURATE

GROUNDWATER MINING

- GROUNDWATER IS HEAVILY OVER-PUMPED
- DIESEL PUMPS CAN PUMP THOUSANDS OF GALLONS PER MINUTE
- IT CAN TAKE MILLIONS OF YEARS TO FILL AN AQUIFER, AND DECADES TO EMPTY IT
- GROUNDWATER OVERDRAFT
 - SHRINKS WETLANDS AND DRIES UP RIVERS AND SPRINGS
 - DAMAGES FOUNDATIONS, ROADS, BRIDGES
 - REDUCES VEGETATION
 - DEGRADES WATER QUALITY
 - EXACERBATES DROUGHT

WITHDRAWING GROUNDWATER IN THE GREAT LAKES REGION

- MOST OF THE STATES IN THE GREAT LAKES REGION USE THE “REASONABLE USE DOCTRINE” FOR GROUNDWATER.
 - THE DOCTRINE OF REASONABLE USE REQUIRES THE WATER TO BE PUT TO A REASONABLE USE ON THE OVERLYING TRACT OF LAND AND DOES NOT PERMIT WATER TO BE TAKEN TO ANOTHER TRACT.
 - REASONABLE USE OBSERVED IN MICHIGAN, ILLINOIS, OHIO, MINNESOTA
 - THIS LEGAL DOCTRINE STATES THAT A LANDOWNER MAY WITHDRAW GROUND WATER AND USE IT FOR A BENEFICIAL PURPOSE UNLESS THE WITHDRAWAL:
 - ☐ UNREASONABLY CAUSES HARM TO ANOTHER BY LOWERING THE WATER TABLE OR REDUCING ARTESIAN PRESSURE
 - ☐ EXCEEDS THE LANDOWNER'S REASONABLE SHARE OF THE ANNUAL SUPPLY OR TOTAL STORE OF GROUND WATER
 - ☐ HAS A DIRECT AND SUBSTANTIAL EFFECT UPON A WATERCOURSE OR LAKE AND UNREASONABLY CAUSES HARM TO A PERSON ENTITLED TO USE ITS WATER

GROUNDWATER DOCTRINE IN GREAT LAKES STATES

Table 1: Comparison of Existing Groundwater Withdrawal Regulation in EPA Region 5

Policy or Regulation	MN	WI	IL	MI	IN	OH
Defines what a high-capacity well is		X	X	X	X	
Includes special groundwater districts	X	X			X	X
Considers the cumulative impact of withdrawals	X	X		X	X	X
Recognizes the groundwater-surface water connection*	X*	X		X		
Considers other states' water use	X	X		X	X	



“

NONE OF THIS MAKES ANY SENSE WITHOUT METERING

”

- A LACK OF METERING IS A MAJOR LOOPHOLE WHICH URGENTLY NEEDS TO BE CLOSED
 - WITHOUT METERING, WE HAVE NO IDEA HOW MUCH WATER IS BEING WITHDRAWN FROM A GIVEN WELL
- 

CONCLUSION: POLICY RECOMMENDATIONS

- 1. BETTER INFORMATION IS NEEDED REGARDING WATER BUDGETS FOR: HIGH-USE AREAS (SUCH AS FOR MUNICIPAL SUPPLIES, QUARRIES OR AGRICULTURAL IRRIGATION AREAS), IMPROVED MONITORING AND UNDERSTANDING OF WATER TABLE ELEVATIONS, PRESSURE HEADS AND BASEFLOW; AND BETTER FORECASTS OF FUTURE CONDITIONS.
- 2. INCREASE STRATEGIC RESOURCE INVESTMENT AT THE BASIN SCALE FOR INTEGRATED GROUNDWATER-SURFACE WATER MONITORING, MODELING AND RESEARCH TO BETTER DETERMINE SUSTAINABLE YIELDS IN WITHDRAWAL PERMITTING AND PROVIDE TECHNICAL SUPPORT FOR POLICY CHANGES AND PROGRAM IMPROVEMENTS.
- 3. FOR STAKEHOLDERS AND GROUNDWATER-SURFACE WATER RESOURCES MANAGERS TO ANSWER SPECIFIC QUESTIONS, THEY NEED MODEL OUTPUTS AND TOOLS WITH SEASONAL TO ANNUAL RESOLUTION AT THE TRIBUTARY WATERSHED, LOCAL, AND STATE LEVELS.

POLICY RECOMMENDATIONS CONTINUED

- THERE IS A GROWING NEED TO DEVELOP A SOUND SCIENTIFIC UNDERSTANDING OF GROUNDWATER/SURFACE WATER INTERACTIONS (GSI) ON THE SCALE OF THE BINATIONAL GREAT LAKES BASIN DUE TO THE PRESSURES ARISING FROM AGRICULTURAL AND OTHER HIGH-VOLUME USES OF GROUNDWATER, IX POPULATION CHANGES, ECONOMIC-INDUSTRIAL DEMANDS AND ENVIRONMENTAL FLOW REQUIREMENTS.
- THE PROJECTED STRESSES THAT CLIMATE CHANGE WILL BRING TO THE WATER CYCLE WITHIN THE GREAT LAKES REGION AND BEYOND ARE OF PARTICULAR CONCERN.
- A BASIN-SCALE UNDERSTANDING CAN INFORM QUESTIONS THAT APPLY AT SMALLER SCALES WITHIN THE BASIN BY PROVIDING CONTEXT AND BOUNDARY CONDITIONS FOR ADDRESSING QUESTIONS AT SUBREGIONAL TO LOCAL SCALES.

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THANK YOU!

STAY IN TOUCH!

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