SURFACE WATER HYDROLOGY

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AMERICAN BAR ASSOCIATION
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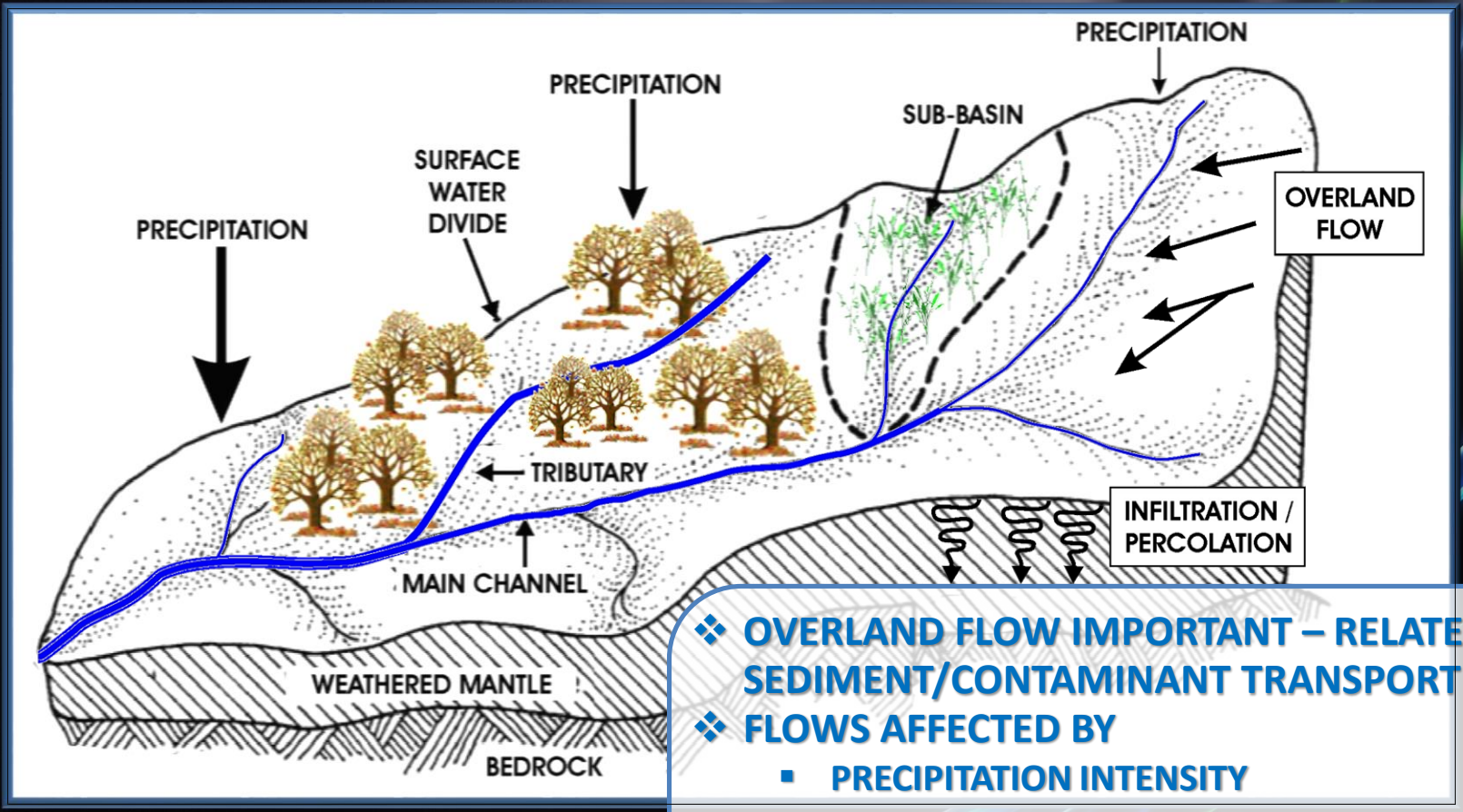
DISCUSSION TOPICS

- SURFACE WATER FLOW MECHANISMS
- LAKES / RESERVOIRS
- SEDIMENT / CONTAMINANT TRANSPORT
- FLOOD HYDROLOGY / FLOODPLAINS

SURFACE WATER FLOW SCHEMATIC



- OVERLAND FLOW IMPORTANT – RELATED TO SEDIMENT/CONTAMINANT TRANSPORT
- FLOWS AFFECTED BY
  - PRECIPITATION INTENSITY
  - VEGETATION
  - SLOPE
  - SOIL TYPE
- TIME OF CONCENTRATION

FORT KNOX GOLD PROJECT
ALASKA

- WATER DEMAND = 14,000 ac-ft/yr = 8,600 gpm
- DESIGNED WATER SUPPLY RESERVOIR TO MEET DEMAND

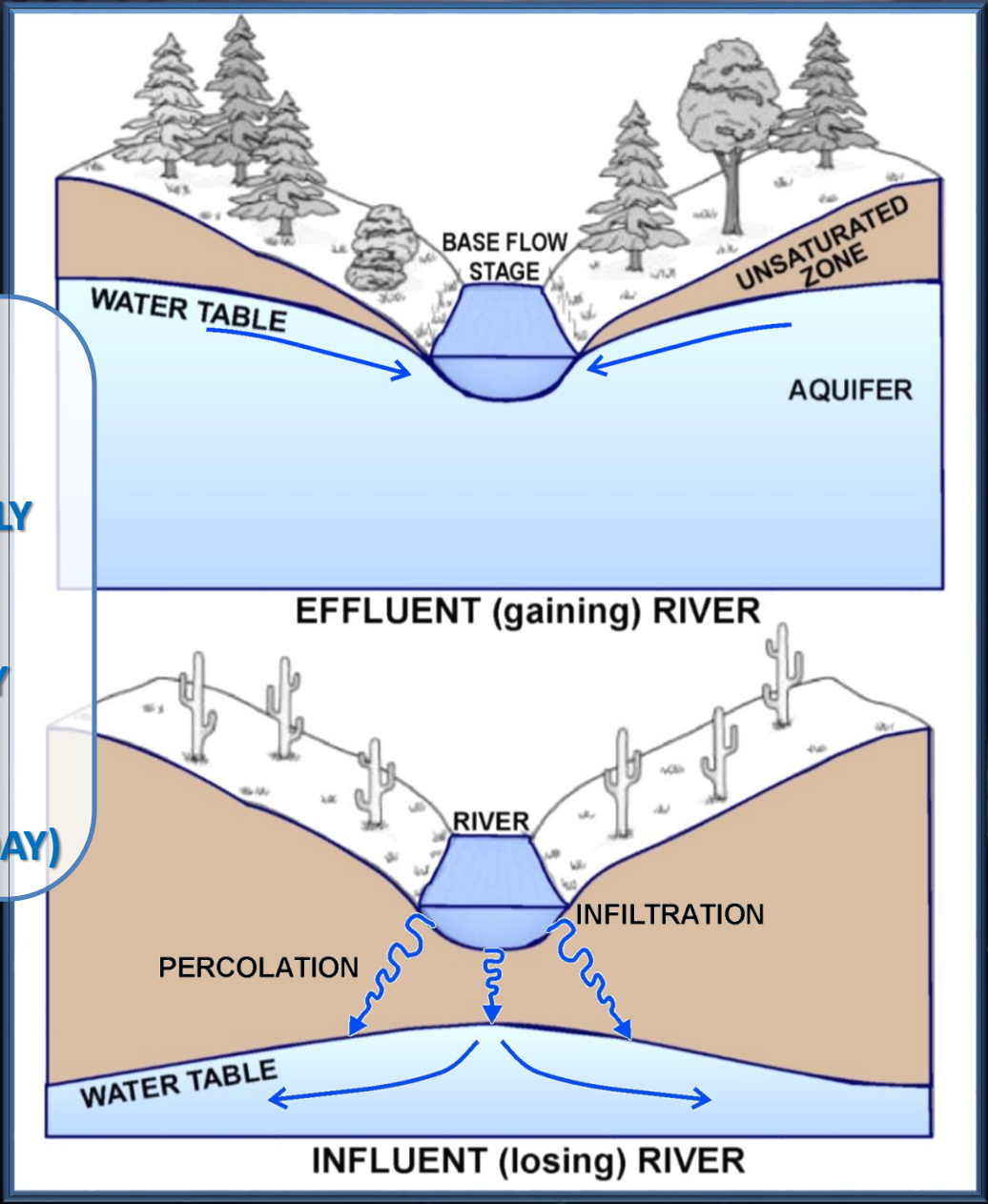
- LARGEST GOLD MILLING OPERATION IN WORLD
- DIDN'T HAVE SUFFICIENT LAND POSITION TO DEVELOP ADEQUATE WATER SUPPLY

TYPES OF RIVERS

- PERENNIAL – FLOWS CONTINUOUSLY
- EPHEMERAL – FLOWS IN RESPONSE TO STORMS
- INTERMITTENT – FLOWS SEASONALLY

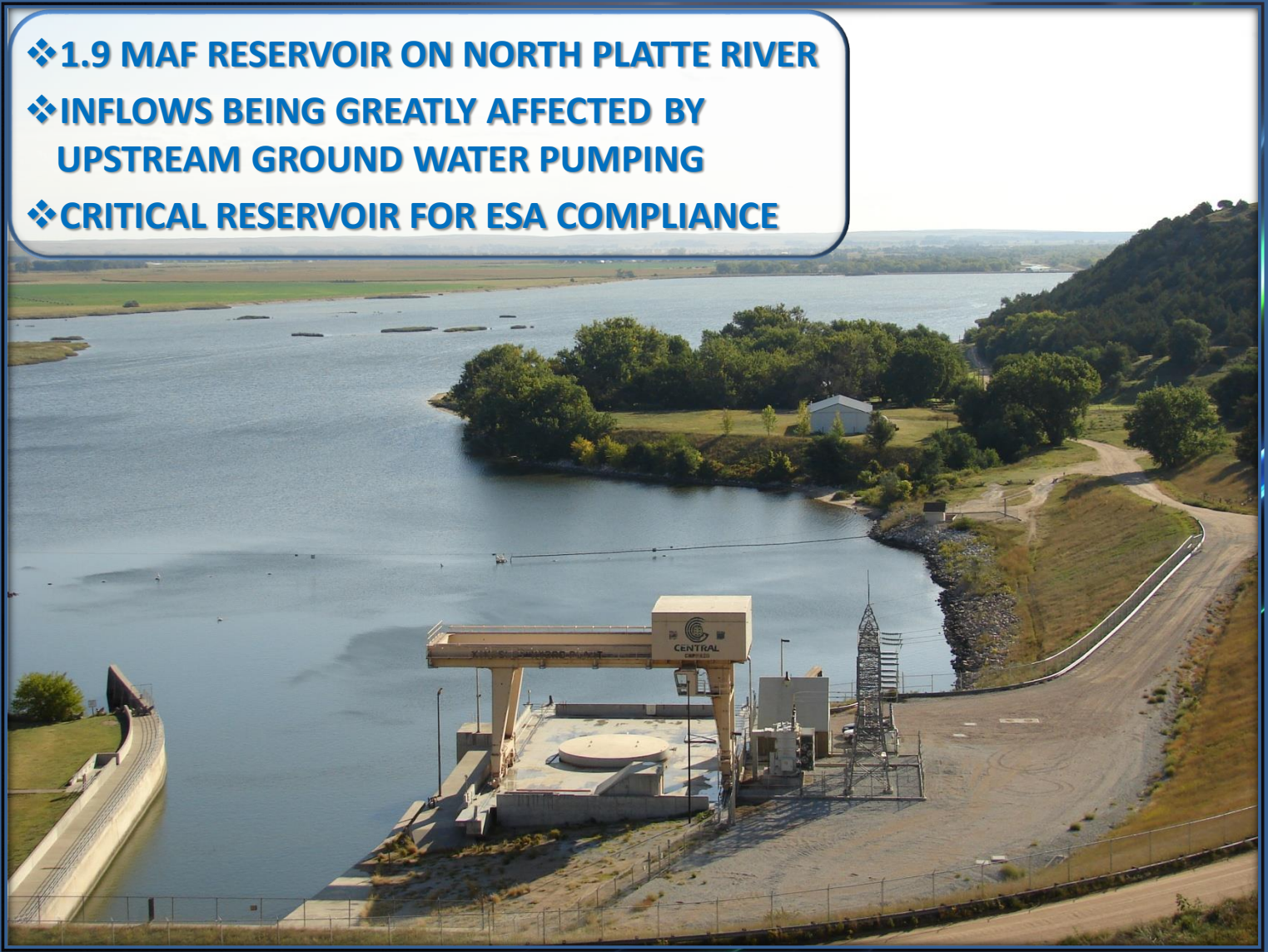
GAINING / LOSING STREAMS

- SURFACE WATER / GROUND WATER INTERACTION
- CAN VARY SPATIALLY AND TEMPORALLY IN SAME STREAM
- LARGE VARIABILITY IN FLOW COMPONENT (1 FT/SEC vs 1 FT/DAY)



LAKE McCONAUGHY NEBRASKA

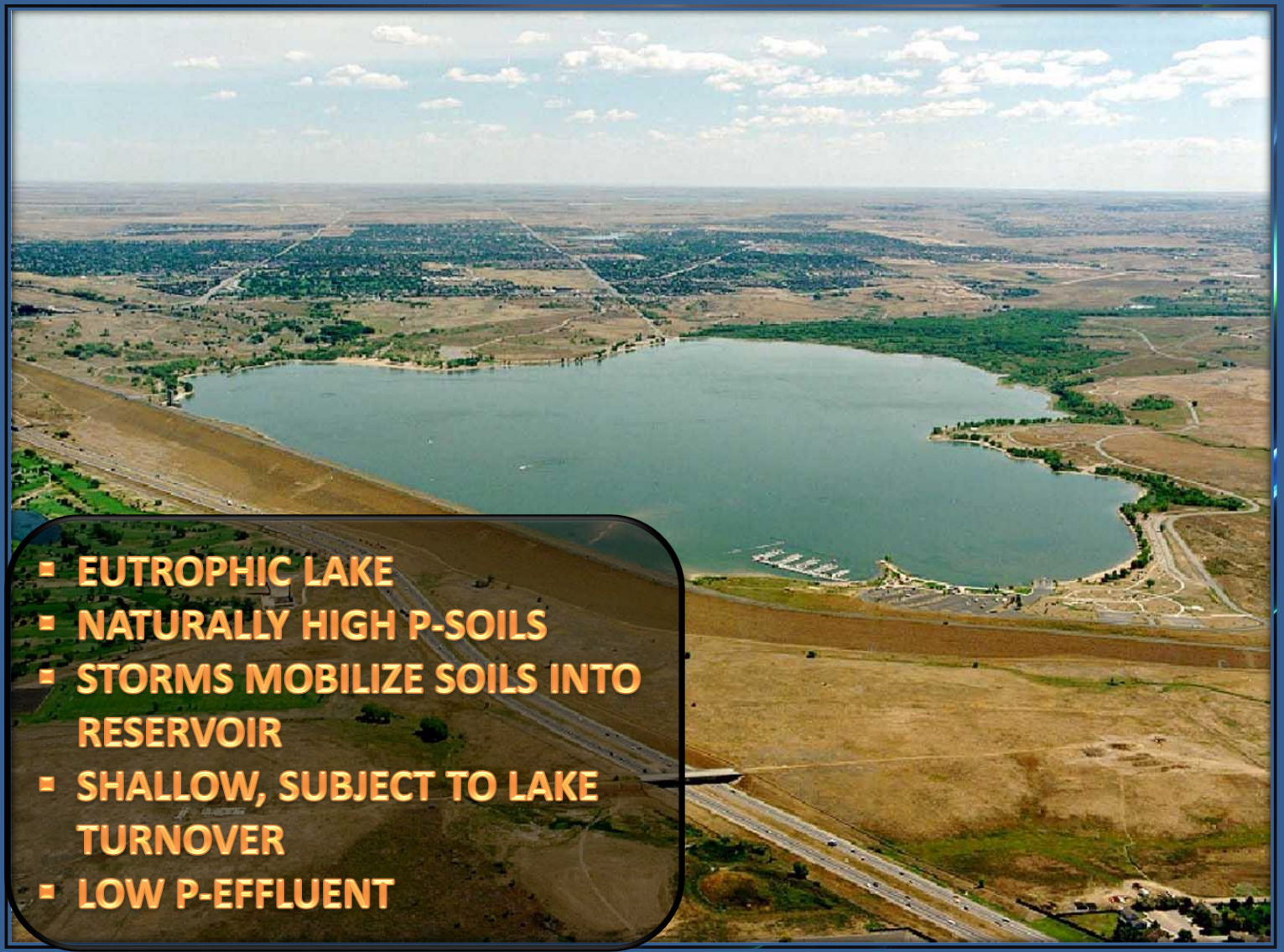
- 1.9 MAF RESERVOIR ON NORTH PLATTE RIVER
- INFLOWS BEING GREATLY AFFECTED BY UPSTREAM GROUND WATER PUMPING
- CRITICAL RESERVOIR FOR ESA COMPLIANCE



LAKES & RESERVOIRS

- RUNOFF CAN DICTATE LAKE CONDITIONS
- COLD WATER/WARM WATER RESERVOIRS
- PRODUCTIVITY (OLIGOTROPHIC/EUTROPHIC)
- LAYERING AND TURNOVER (SENSITIVITY TO ENVIRONMENTAL EFFECTS AND WATER QUALITY)

CHERRY CREEK RESERVOIR COLORADO

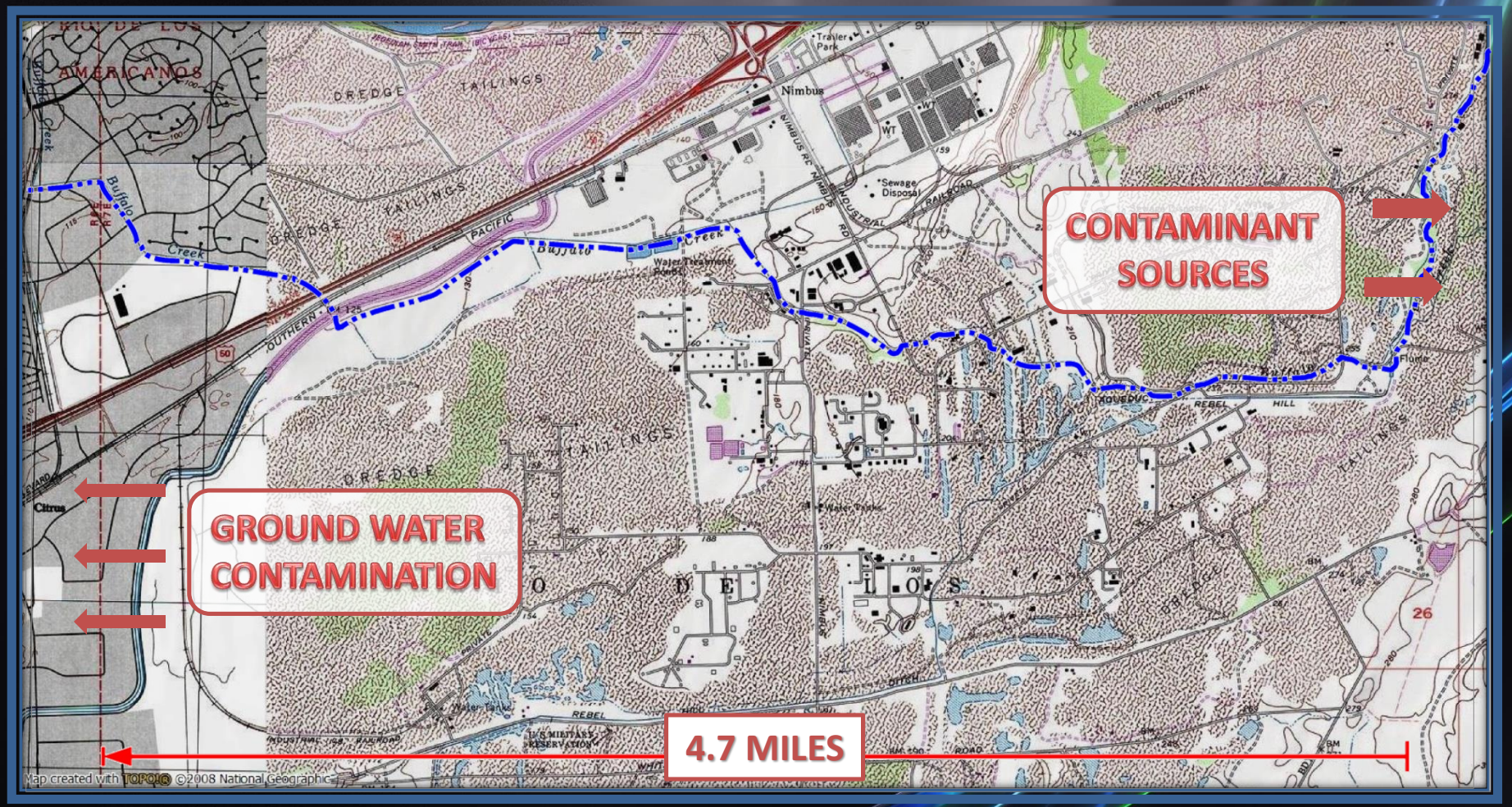


- EUTROPHIC LAKE
- NATURALLY HIGH P-SOILS
- STORMS MOBILIZE SOILS INTO RESERVOIR
- SHALLOW, SUBJECT TO LAKE TURNOVER
- LOW P-EFFLUENT

SEDIMENT / CONTAMINANT TRANSPORT

- OVERLAND
  - CARRIED WITH SURFACE RUNOFF
  - CAN CREATE NATURAL OR ANTHROPOGENIC (SOIL-CONTAMINATED SITES) TRANSPORT
- CHANNEL
  - COARSE vs FINE DEPOSITION
    - CONTAMINANT SORPTION
  - DEPOSITION vs MOBILIZATION

AEROJET - CALIFORNIA



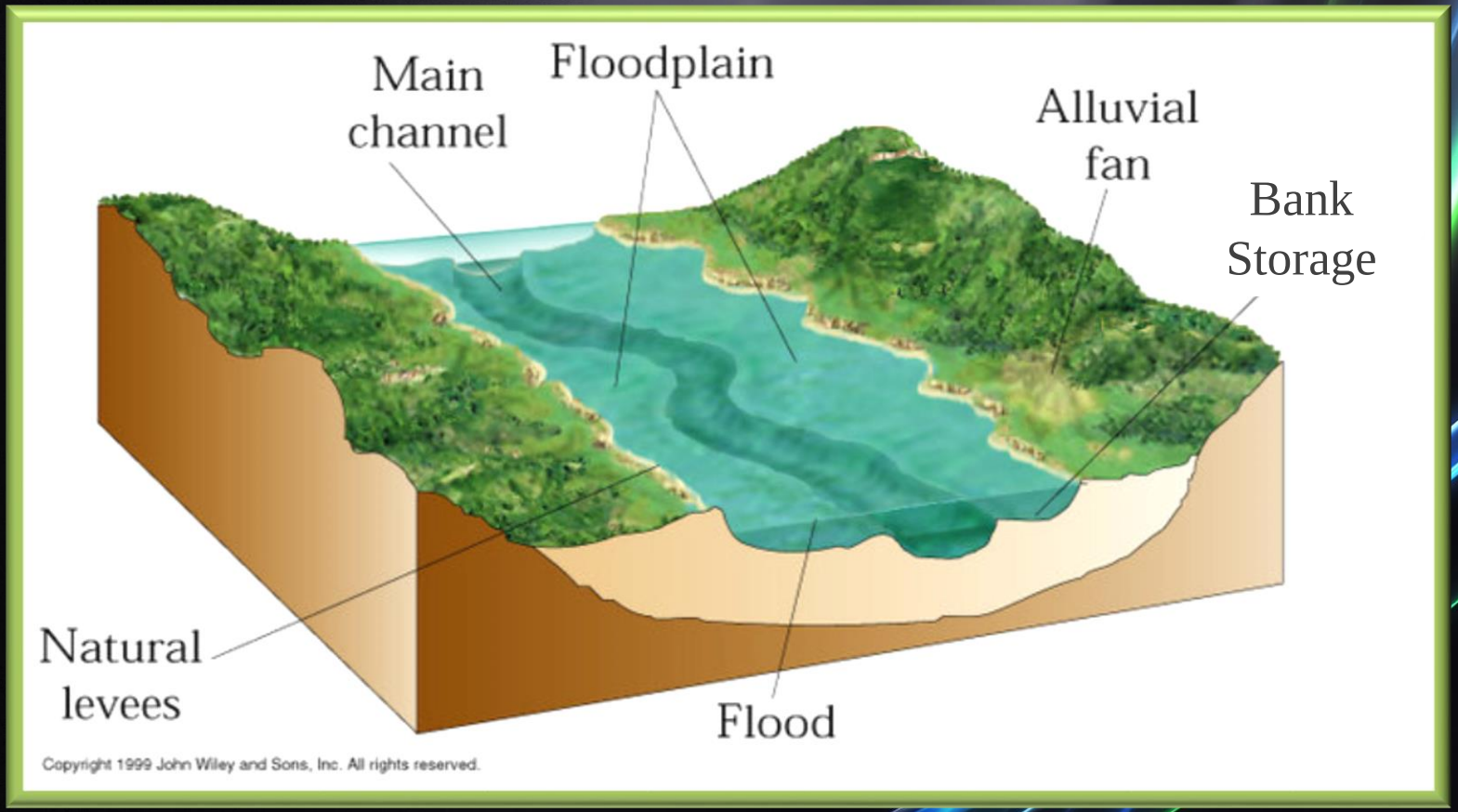
CONTROLLING SEDIMENT / CONTAMINANT TRANSPORT

- DIVERSIONS AROUND CONTAMINATED AREAS
- RETENTION / DETENTION PONDS
- DROP STRUCTURES

FLOOD HYDROLOGY / FLOODPLAINS

- EFFECT ON STREAM AND ALLUVIAL PLAIN
- BANK STORAGE

FLOODPLAIN


Main channel
Floodplain
Alluvial fan
Bank Storage
Natural levees
Flood
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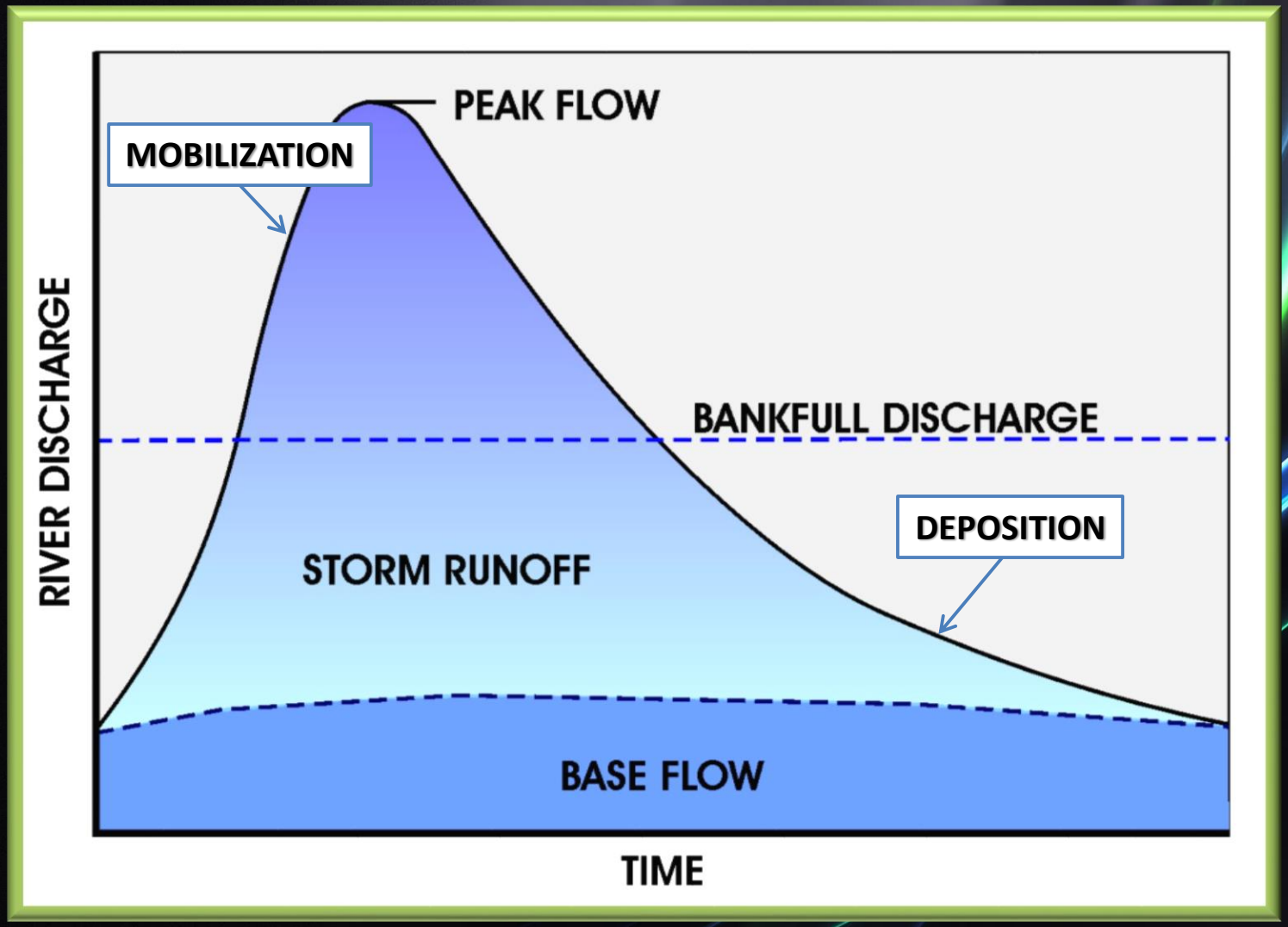
FLOOD HYDROGRAPH



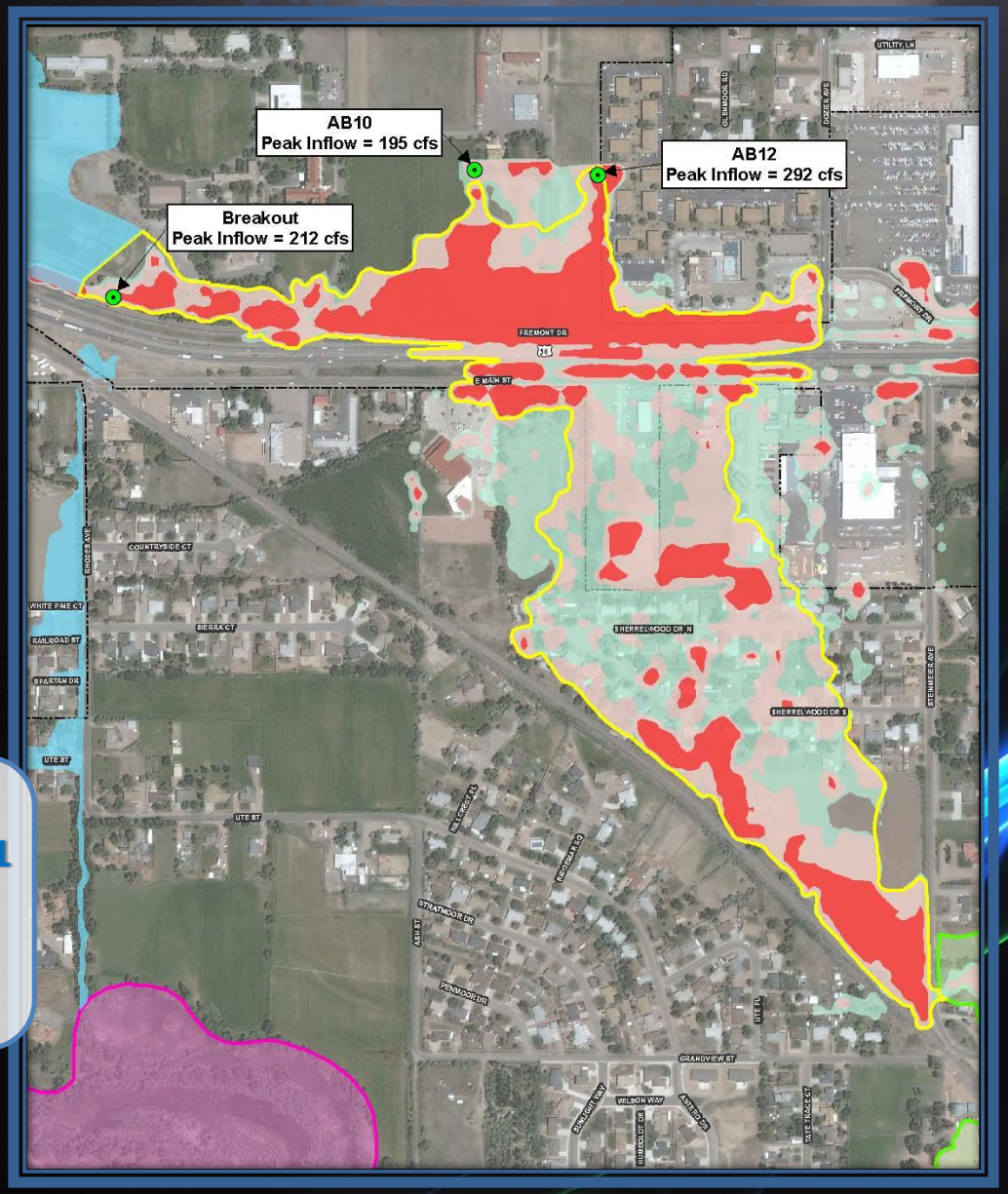
FLOOD HYDROLOGY / FLOODPLAINS

- EFFECT ON STREAM AND ALLUVIAL PLAIN
- BANK STORAGE
- WATER QUALITY
  - MOVEMENT OF CONTAMINANTS / SOILS
  - COMBINATION SURFACE FLOW / GROUND WATER FLOW

FLOODPLAIN MAPPING

- IDENTIFIES AREAS THAT ARE PRONE TO FLOODING BASED ON HYDROLOGY AND LAND USE
- NOT ALL AREAS HAVE BEEN MAPPED
- IMPORTANT TO UNDERSTAND FOR REMOTE MINING/INDUSTRIAL SITES
- DETAILED FLOOD MAPPING CAN CHANGE WITH TIME, PARTICULARLY IN URBANIZING AREAS

CAÑON CITY COLORADO



- NO DETAILED MAPPING UNTIL 2011
- CREATED NEW 100-YR FLOODPLAIN AREAS

PRINCIPAL POINTS

- SURFACE WATER AND GROUND WATER ARE OFTEN HYDRAULICALLY CONNECTED
- DRAMATIC DIFFERENCES IN TRANSPORT MECHANISMS/TIMES
- SURFACE FLOWS SUBJECT TO MUCH GREATER VARIABILITY – SPATIALLY AND TEMPORALLY – THAN GROUND WATER
- FLOW CONDITIONS CAN AFFECT WATER QUALITY
- RUNOFF CAN BE HIGHLY VARIABLE, BASED ON A NUMBER OF FACTORS
- FLOW CONDITIONS DICTATE THE TRANSPORT OR DEPOSITION OF SOILS / CONTAMINANTS


THANK YOU!
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