Streamflow Information for the Next Century

A Plan for the National Streamflow Information Program

Current Date

USGS

This presentation is a summary of a report prepared by a group of USGS managers and scientists on a plan for a National streamflow information program. The group was charged with reviewing the results of a recent evaluation of the USGS streamgaging network and preparing a vision for a streamflow information program for the next century. The group included:

John Costa, Office of Surface Water

Jared Bales, NC District

Dave Holtschlag, MI District

Ken Lanfear, Office of Information

Steve Lipscomb, ID District

Chris Milly, National Research Program

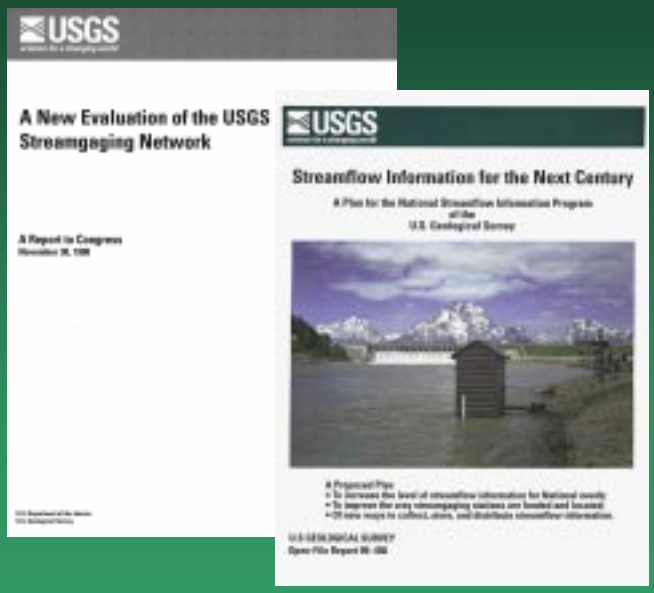
Roland Viger, National Research Program

Dave Wolock, KS District

Updated 01/06/2000

Delete this slide for stakeholder meetings.

National Streamflow Information Program



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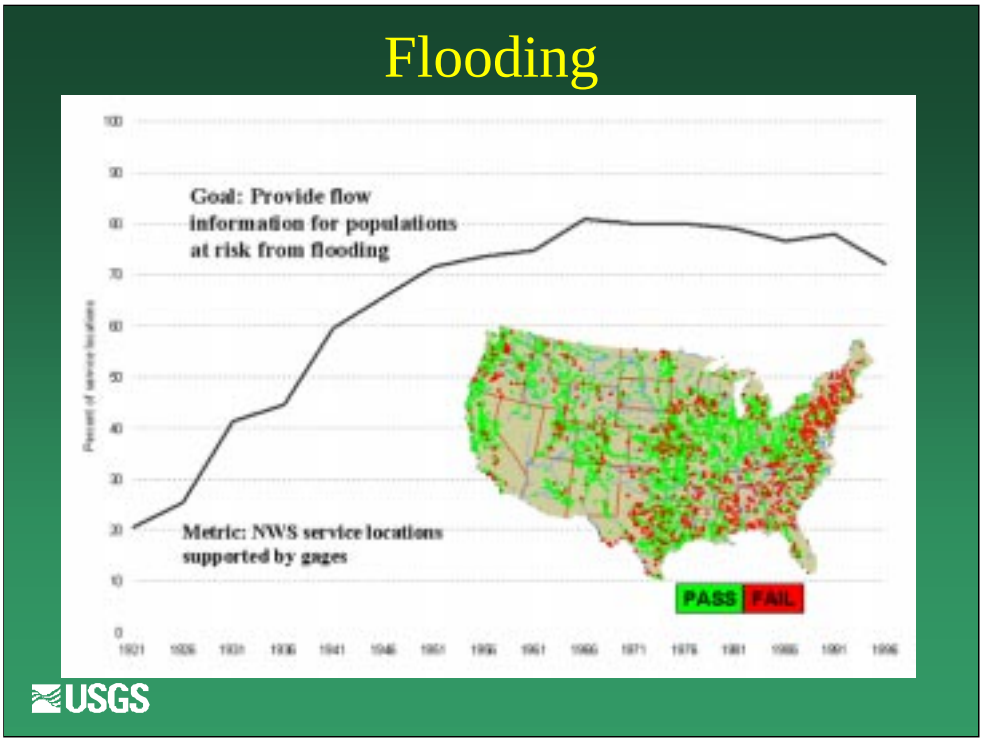
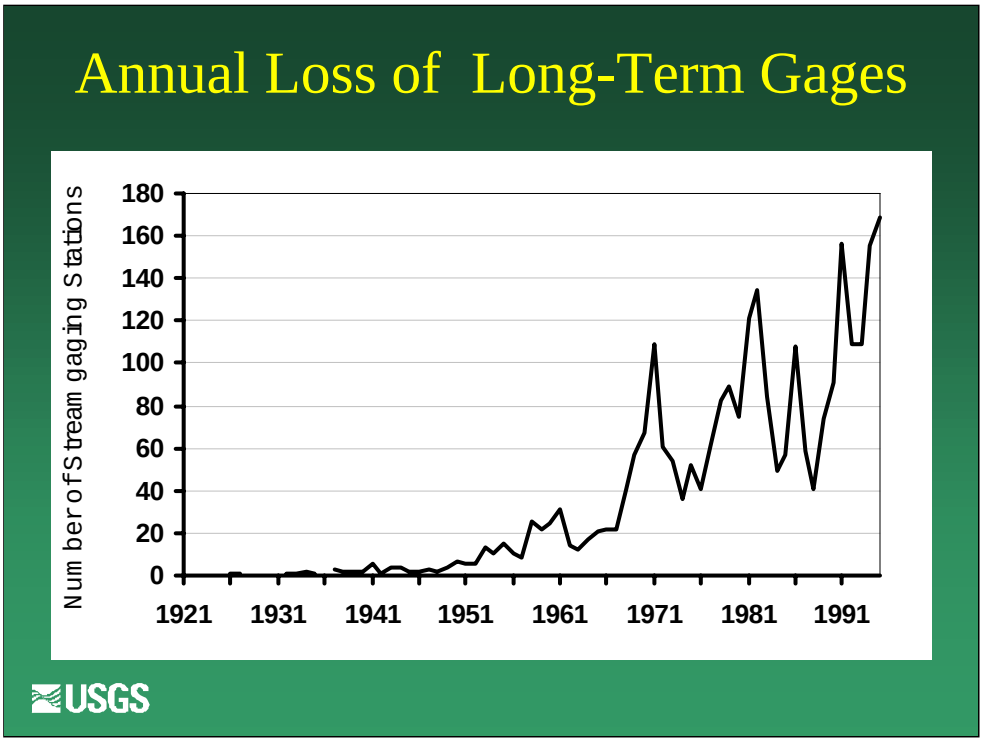
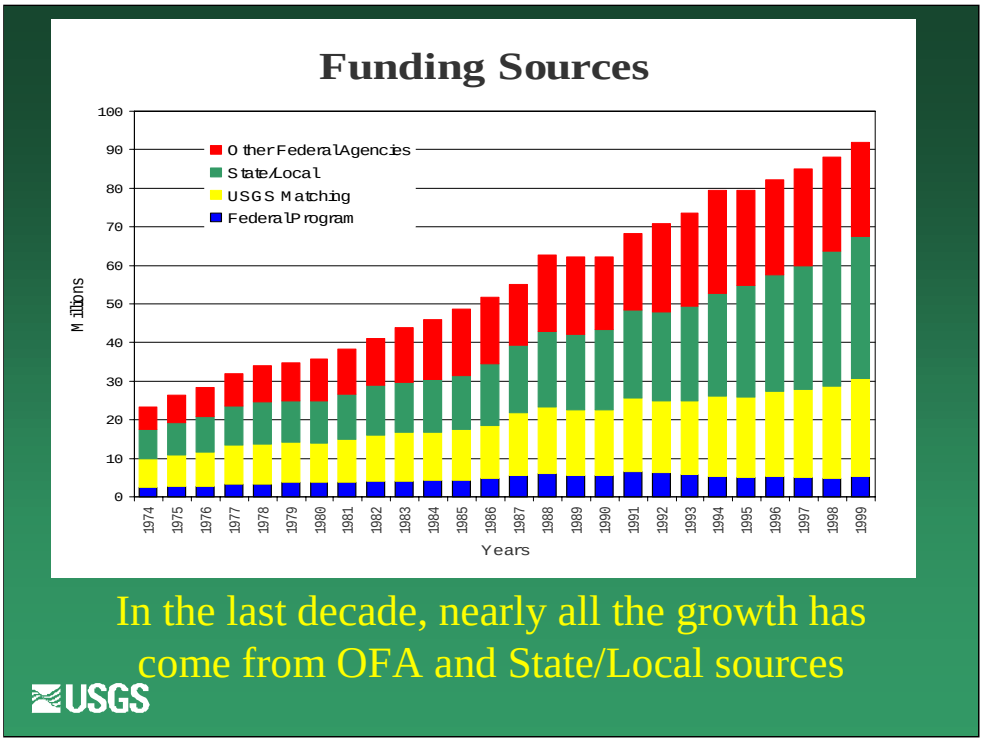
This slide shows the two reports that have been prepared about the USGS streamgaging network in the past year. The report on the left is the report that Congress requested in the 1998 appropriation report. This report identified a number of concerns about the network. The second report is our vision for meeting the streamflow information needs of the Nation in the next century



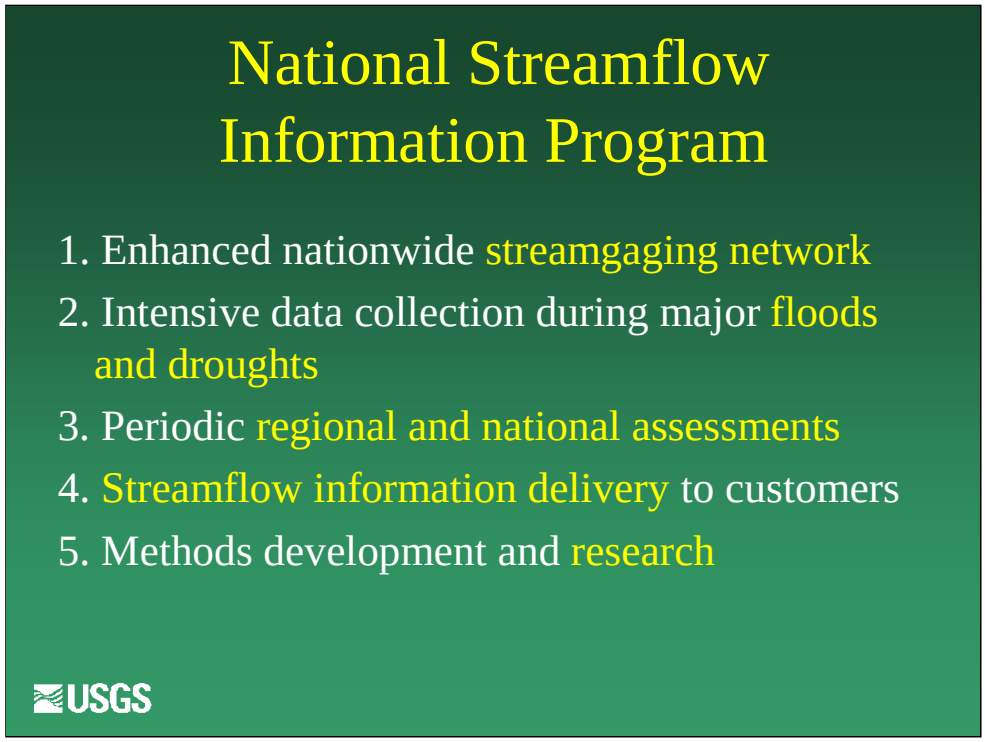
This slide is an example of the evaluation performed for the report to Congress. We identified the major Federal goals of the streamgaging network and then assessed how well the network was meeting the goals. The assessment of the National Weather Service forecast locations is typical of all the goals. Attainment of the goal to support all service locations peaked in the early 1970s and then gradually decreased. Attainment of all the goals either leveled off or decreased between the late 1960s and mid 1970s.



Another disconcerting aspect of the network that was identified during the evaluation was the increasing loss of long-record streamgaging stations. This slide slows the number of stations with 30 or more years of record that were discontinued each year. There has be a progressive increase in the number of stations discontinued. Between 1990 and 1996, an average of 130 stations with long-term records were discontinued each year.



Much of the decrease in attainment of Federal goals and the loss of long-term stations is attributable to the decrease in the relative contribution of USGS appropriations in support of the network. Between 1974 and 1999, the USGS share of the funding for the network decreased from about 50 to 33 percent. This has resulted in us having less leverage for supporting stations that meet Federal goals including long-term stations for assessing streamflow trends and the effects of climate and land use changes.



There are 5 major components of the National Streamflow Information Program. An enhanced streamgaging network to meet the streamflow and related information needs of the Nation is the major component of the program, but all the components are critical to enhancing and modernizing the delivery of streamflow information.

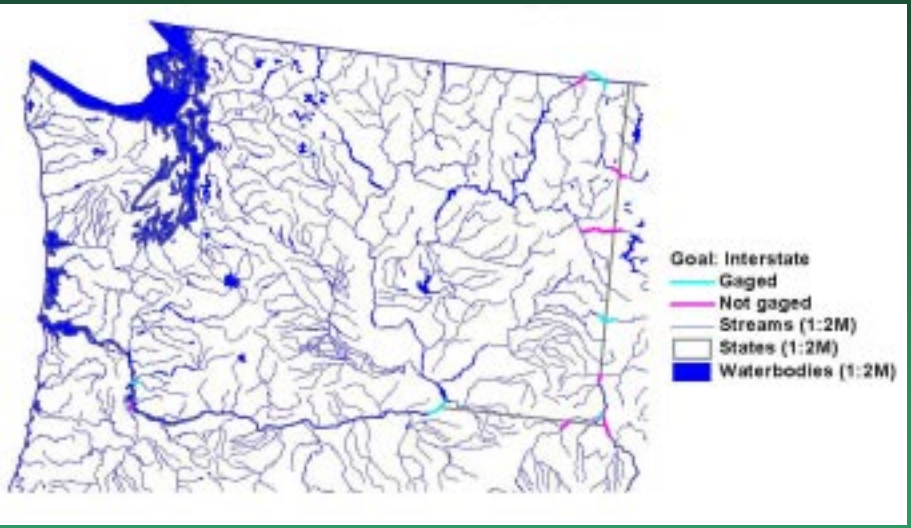
#1 - Streamgaging Network
Critical Federal-Interest

Critical Federal Interests	Number of sites or reaches to be served	Level of attainment in 1996, in percent	Number of additional streamgaging stations needed to meet goal
Flows across State lines	350	56	160
NWS Flood-Forecasting Sites	3,100	66	1,10
Flows from key river basins	350	57	150
Sentinel Watersheds	800	58	350
Water Quality	700	76	320
TOTALS			2,080

USGS

This table summarizes our vision of the base Federal-interest network. These are locations or stations that would be operated in the USGS network even in the absence of support from funding partners. It includes 5,150 stations that meet five major Federal goals. Compacts and Decrees includes our mandated responsibilities of operating streamgaging stations as part of river basin compacts and Supreme Court decrees. It also includes locations where major rivers cross state and international boundaries. The next category is the service locations or forecast points of the National Weather Service. The water budget category includes stations at or near the terminous of each of the hydrologic accounting units. Stations at these locations are used to monitor the flux of streamflow in major rivers throughout the Nation. The long-term change category include stations that are hydrologic climatic data network stations within each of the unique polygons formed by the intersection of hydrologic accounting units and ecoregions. These polygons were used to ensure an adequate spatial distribution of stations. The last category includes both USGS water-quality monitoring locations and river reaches that have been designated with impaired water quality. The USGS stations include 40 NASQAN II stations on large rivers, 60 NAWQA stations on intermediate-sized rivers, and 50 Benchmark stations on relatively small rivers and streams. The other stations in this category are for providing information for effective water-quality management and restoration of rivers with severely degraded water quality.

Flows across State lines



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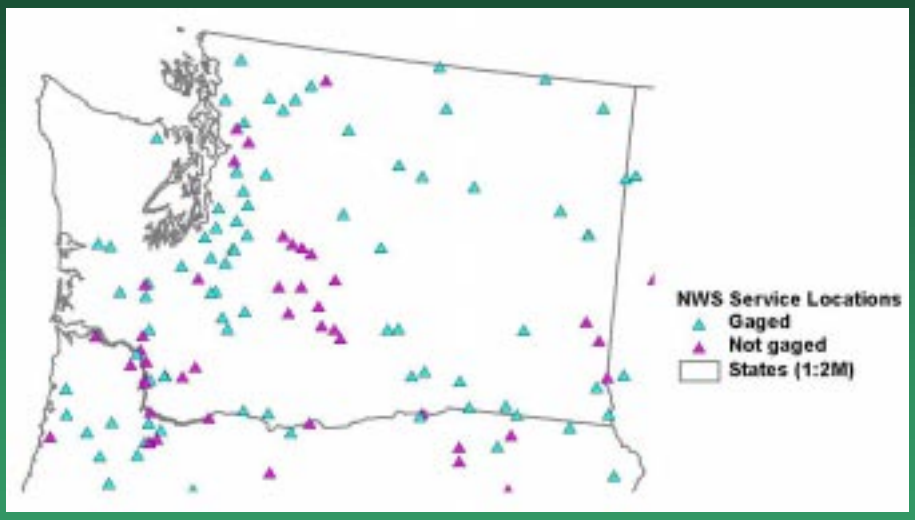
NWS Flood-Forecasting Sites



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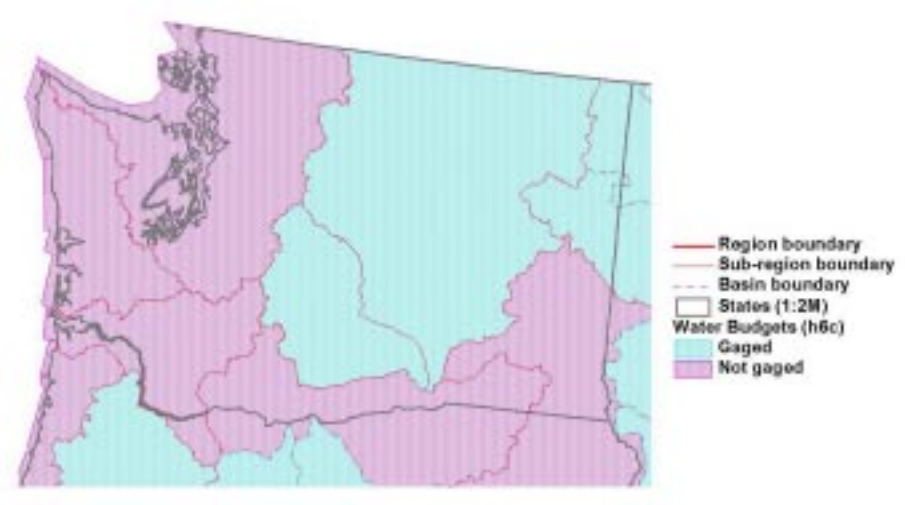
Flows from key river basins



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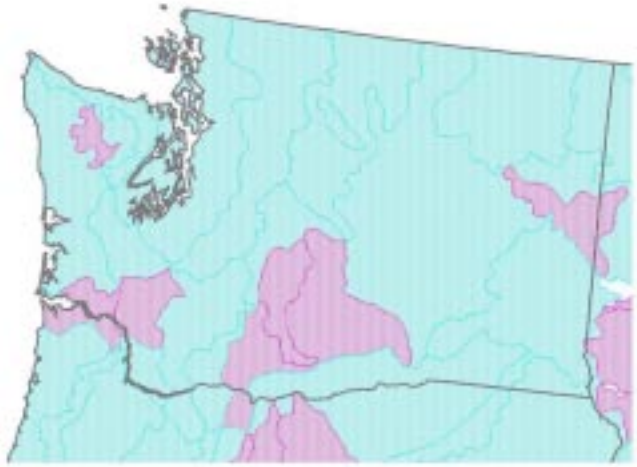
Sentinel Watersheds



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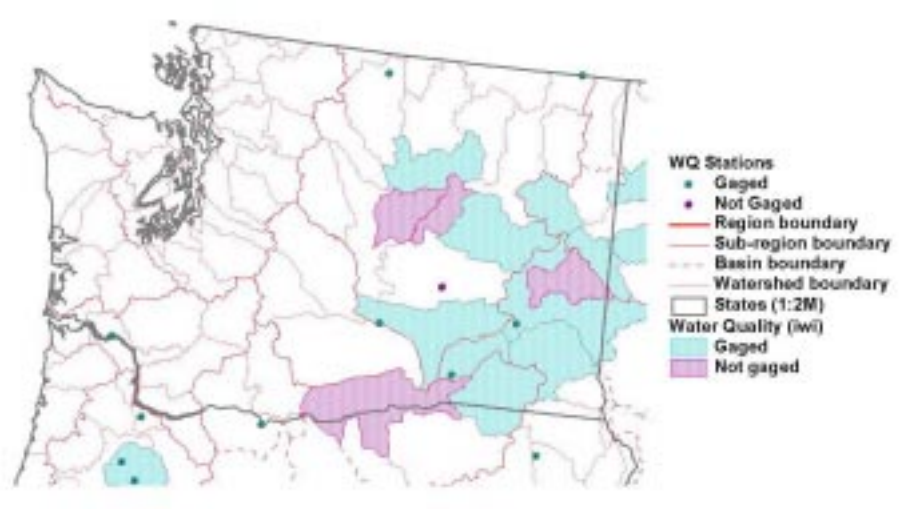
Water Quality



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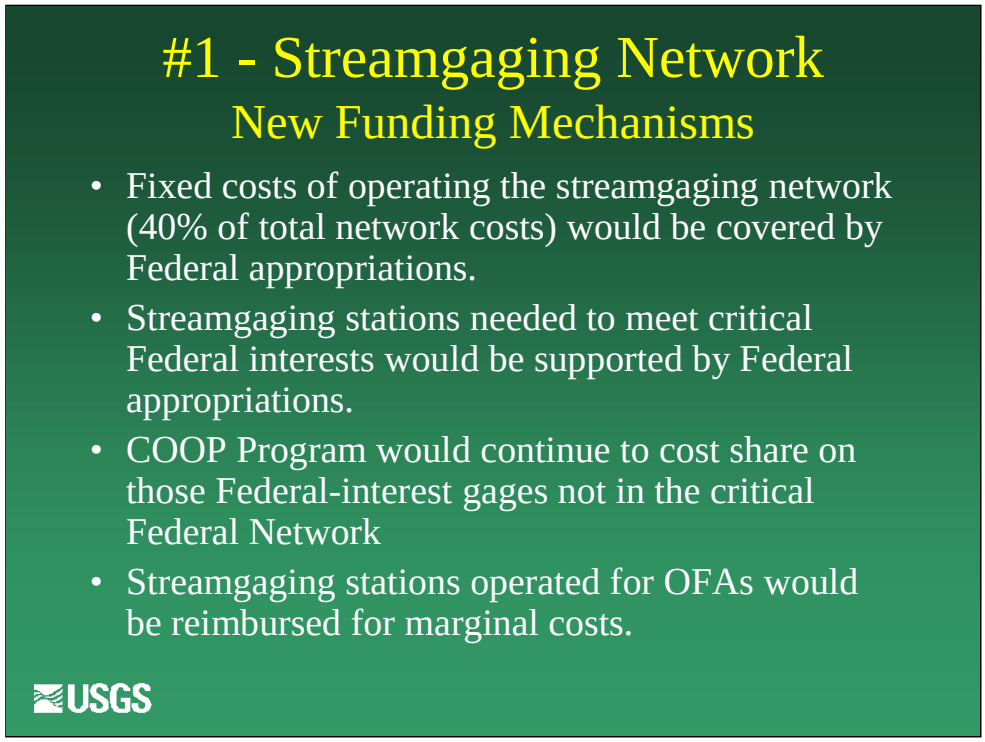
The Federal intersts or Goals shown in the previous table do not represent all the Federal needs for streamflow information, but they represent the interests that we think are most important. Other obvious Federal needs include those listed on this slide. We expect many of these needs to be met through the Cooperative Water Program or with funds from OFAs.



Another aspect of our vision is a new funding mechanism for the USGS streamgaging network.

- We would no longer be riding on the backs of cooperators to cover the fixed costs of the network. Data servers, data processing software, data delivery software, archiving, quality assurance and network management would be supported with USGS Federal appropriations.
- Federal interest stations would be funded with USGS Federal appropriations
- Cooperators would only be responsible for their share of the actual station operating costs (technician salaries, space, vehicles, equipment, and travel expenses).

#2 - Floods and Droughts

- Systematic field surveys of precipitation, river stage and discharge
- Installation of temporary gages during events
- Opportunistic sampling of sediment, nutrients, bacteria, pesticides, and hydrocarbons
- Characterization of changes in geomorphology of river channels and reservoir sedimentation

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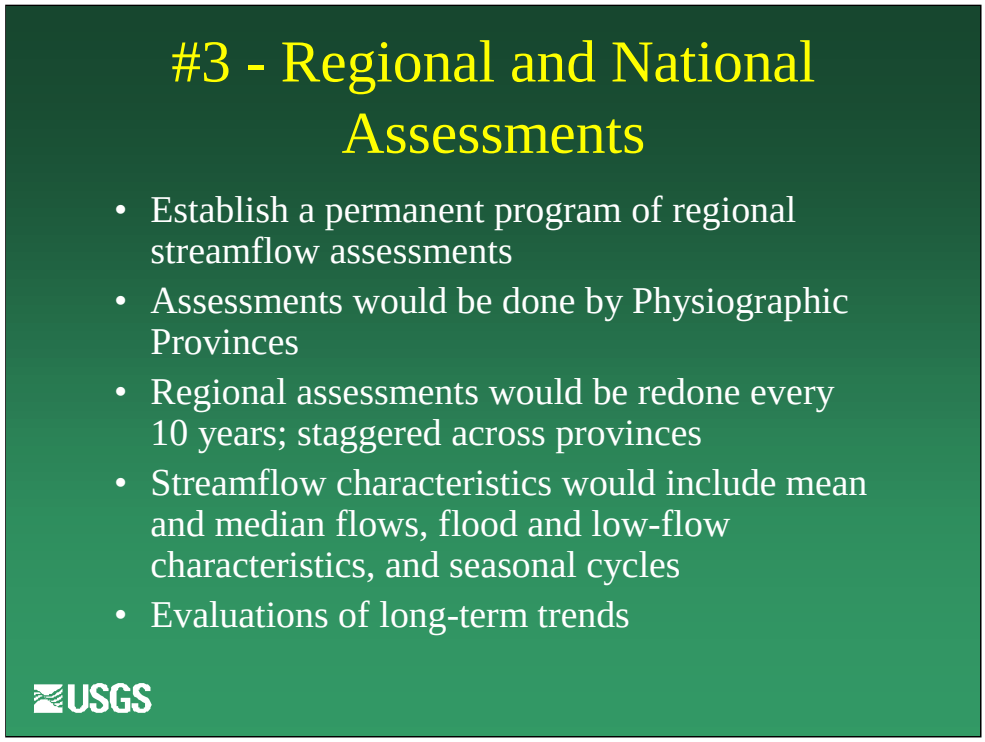
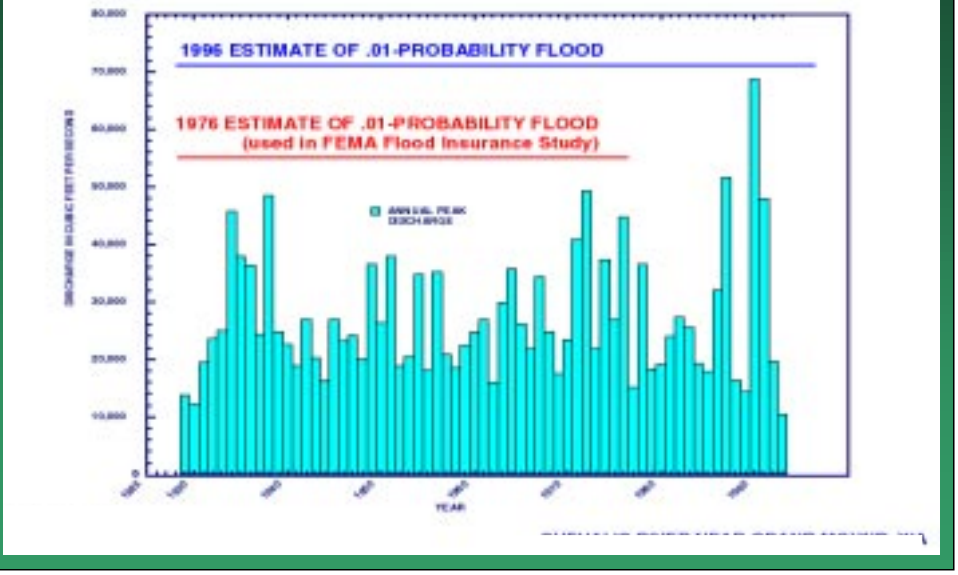
An obvious shortcoming of our current surface-water programs is our inability to respond effectively during major floods and droughts. We need to have a reserve of funds available to accomplish the tasks in this slide.



The third component of NSIP is an ongoing program to analyze the data produced by the streamgaging network and produce a series of regional and national assessments of stream flow characteristics and trends.

Changes in Flood-frequency Estimates



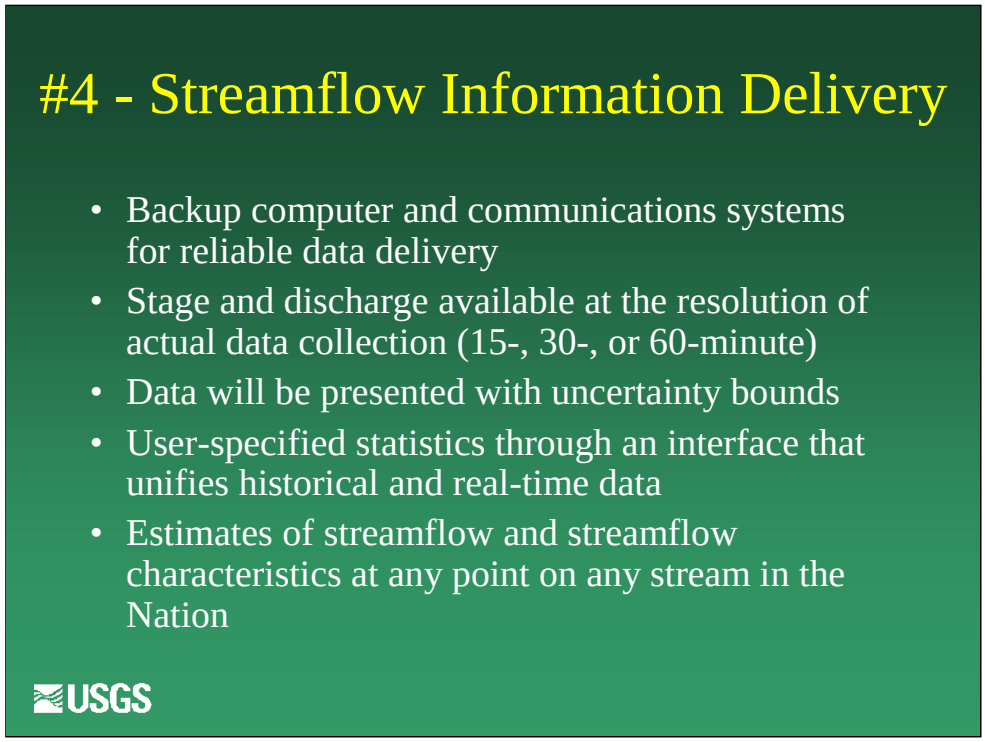
This slide is a perfect example of why we need an ongoing assessment program. The Flood Insurance Study done for the Chehalis River in 1976 determined that the 100-year flood was 55,000 cfs based on 47 years of record. A restudy in 1996 determined that the 100-year flood was 72,000 cfs, These changes and updates are to be expected because our systematic record of stream flows only represents a small portion of the streamflow continuum.

#3 - Regional and National Assessments

- Regionalization errors identified by assessments will be fed back into network design process
- National scale assessment will be built from regional assessments
- Goal will be to estimate flow characteristics anywhere on any stream with a low standard error

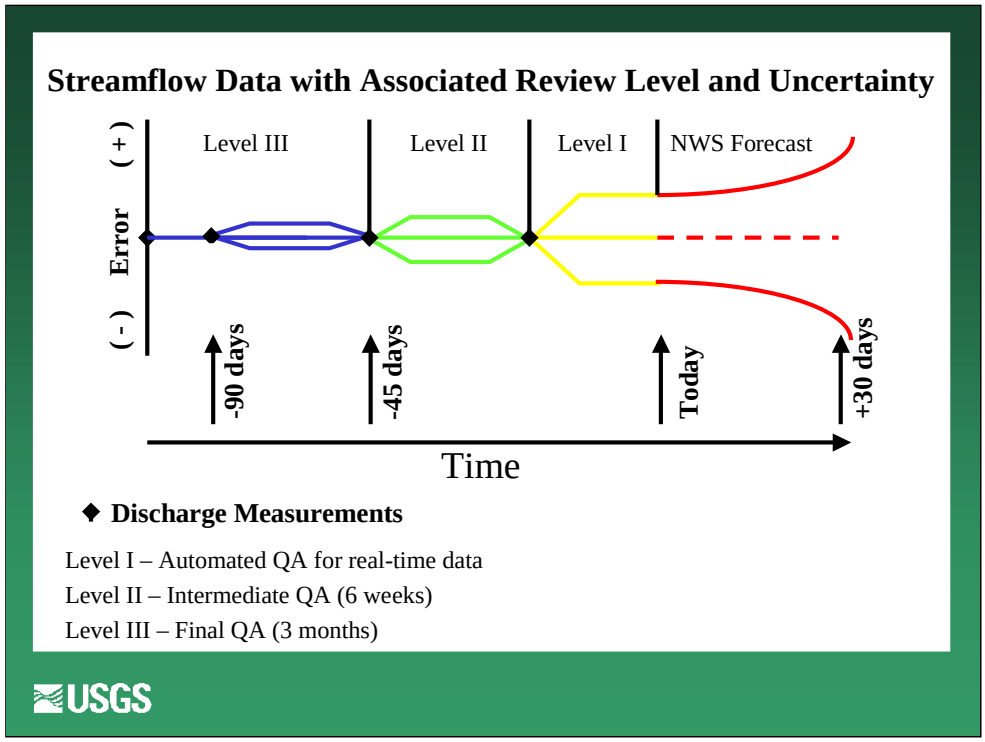
USGS

An important aspect of the regional and National assessments is the feed back that will be used to enhance the design of the network. The goal will be to estimate streamflow characteristics with a low standard error.



The Streamflow Information Delivery component of NSIP integrates the data and assessment components and defines the future standard for information delivery. Streamflow data will be delivered reliably 99 percent of the time. Instead of daily-mean streamflow being the primary product, the 15-, 30-, or 60-minute stage and discharge will be the primary product. Real-time and historical data will be delivered as user-specified products. All data will include error bounds.

Through a combination of statistical and dynamic models, we will provide estimates of streamflow and streamflow characteristics for any point on any stream in the Nation.



This slide is a schematic diagram of the timing of data delivery and the relative uncertainty of the data. The highest error will be associated with forecasts. The next level of uncertainty will be observed values that are not verified by inspections and discharge measurements. The lowest level of uncertainty will be those data that have been reviewed and finalized within 3 months of observation.

Long-Term Daily Flow Statistics Little Pee Dee River, SC

Mean daily flow in relation to Q_{5-95} Q_{25-75}, and Q_{50}.

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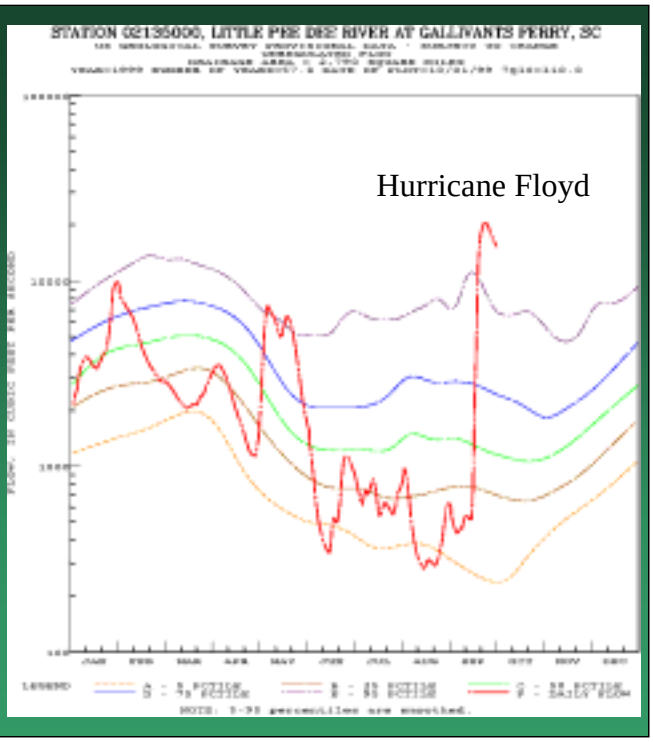
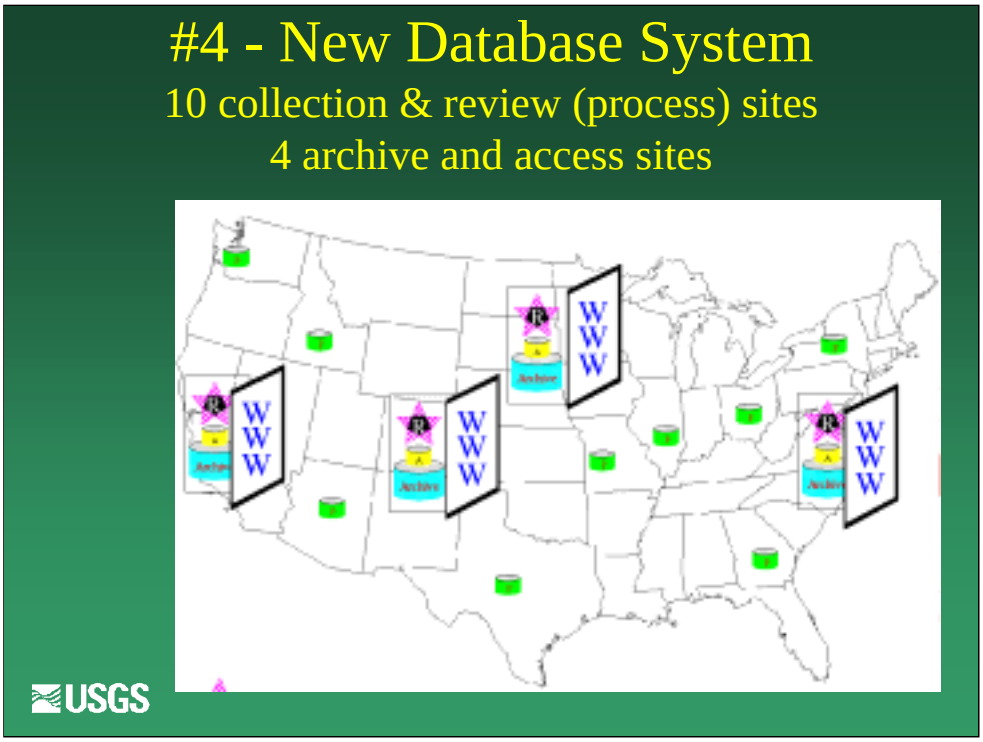


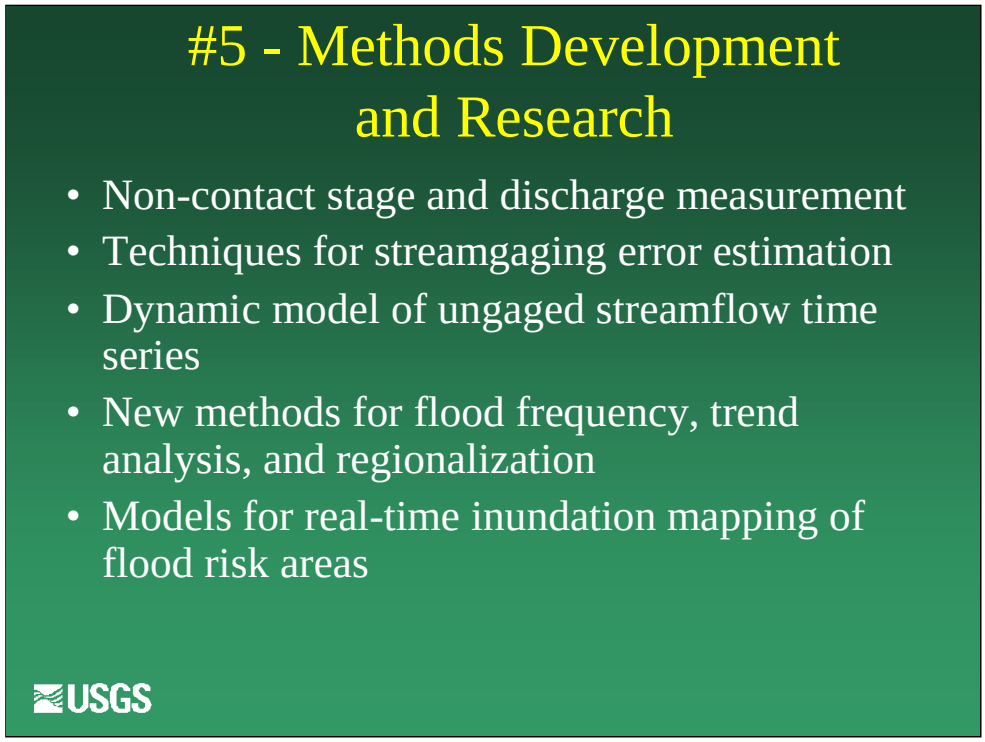
This slide is an example of how real-time and historical data will be integrated with user-specified criteria. This example includes the 5th, 25th, 50th, 75th, and 95th percentile flows for the Little Pee Dee River plotted with the observed streamflows.



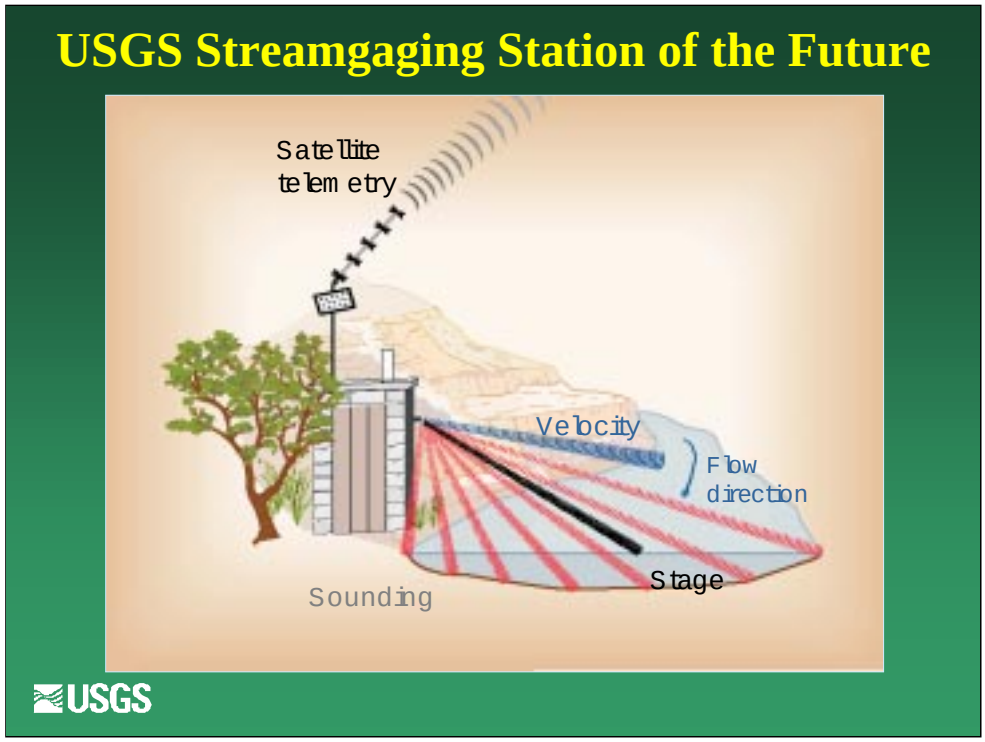
The slide is a schematic of the data processing, archiving, and dissemination system of NSIP. Data will be processed at 10 centers instead of the current network of 44 centers. The data bases and processing software will be fully redundant and which servers are being used will be transparent to the field personnel.

Data archiving and delivery servers will be located away from the data processing centers to shield data processing for internet traffic. The archiving and delivery servers also will be fully redundant.

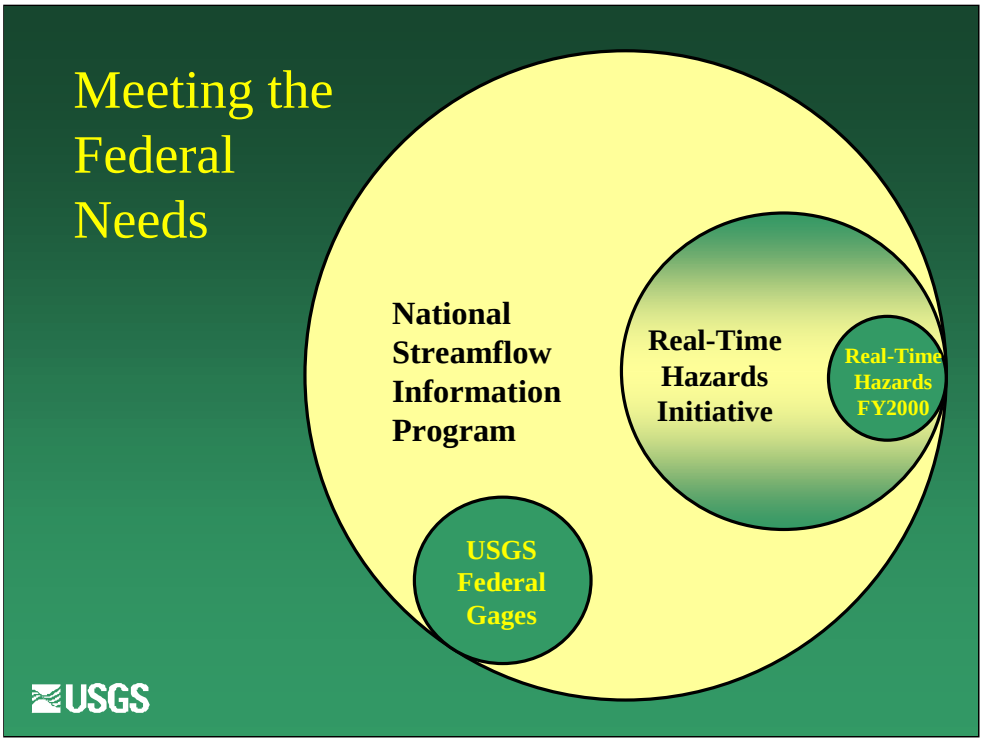
The redundancy in both the data processing and data delivery systems will ensure that we do not have another Hurricane Fran situation, when we were not able to serve real-time streamflow data because we lost power to the North Carolina District office. We may lose individual stations, but we will not lose an entire statewide network.



The sixth component of NSIP is methods development and research, which is important for meeting our streamflow information delivery goals. The NSIP committee identified many areas of research, but those listed in this slide are most critical. We need to develop non-contact stage and discharge capabilities to improve the reliability of our data. We also need to improve our streamflow estimation techniques and models so we can define the uncertainty of the data.



This is the type of streamgaging station that we need to develop. Instruments that will sense the stage, sound the river bottom, and sense the velocity will allow us to compute streamflow directly and thus improve the reliability and reduce the uncertainty of the data.

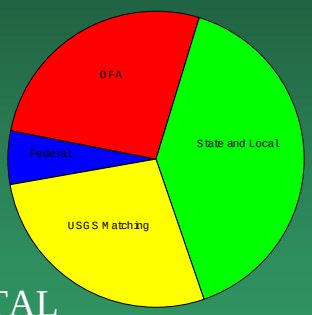


NSIP is a program for the next century, but we already have a start. We have been proposing a real-time hazards initiative for the past three years. The initiative will provide much of the Federal-interest network that supports National Weather Service forecast locations. The FY2000 budget includes $2 million. The proposed FY2001 budget includes $19.3 million.

This diagram shows the relative contribution of the current Federal program (CBR) and the real-time hazards initiative in meeting the NSIP vision.

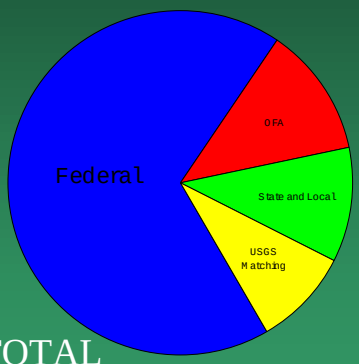
Streamgaging Network FUNDING

Current



TOTAL
$91 million

Future



TOTAL
$130 million

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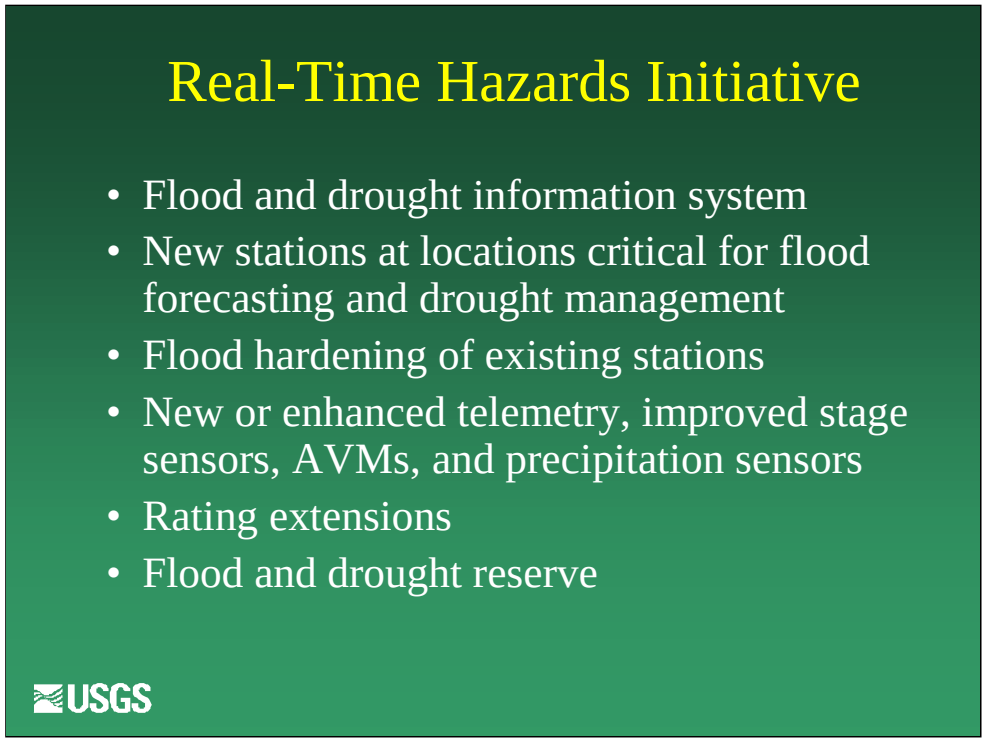


This slide shows the components of the real-time hazards initiative. We have requested the River Forecast Centers of the National Weather Service to help us establish priorities for the new or reactivated stations, flood hardening, enhanced telemetry and other sensors, and stage-discharge rating extensions. We also have requested our District offices to review the priorities with the streamgaging network cooperators. We expect to meet some of the immediate needs with the small budget increase in FY 2000, but we are really depending on the FY2001 budget for real-time hazards ($19.3 million) to get our NSIP vision off the ground.

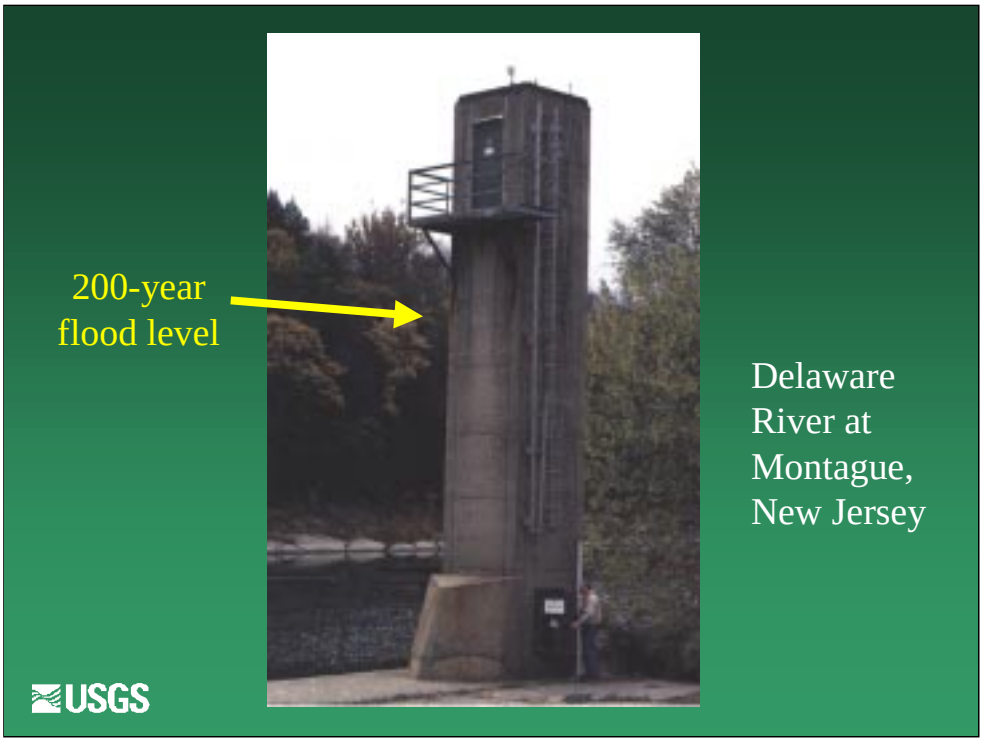
Streamgaging Stations Inoperative during July 1994 Flood

Ocmulgee River at Macon, GA

Falling Creek at Juliette, GA

USGS

A very important part of both NSIP and the real-time hazards initiative is the flood hardening of existing streamgaging stations. Because the budget constraints and other intended uses of data, many of the stations used by the National Weather Service for flood forecasting were not designed to withstand a 200-year flood. Thus when the data are most needed, the stations are likely to be inoperative. These two stations in Georgia are examples of stations that would be flood hardened as part of the real-time hazards initiative and NSIP.



The station in this slide, the Delaware River at Montague, New Jersey will be transmitting data during large floods.

Summarize by stating that an effective NSIP will still require the on-going partnerships with many Federal and State agencies. We also encourage our cooperators to review the NSIP plan and provide us with comments and suggestions.