Hydrology Science Plan – prioritization process and potential future directions

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25 November 2020

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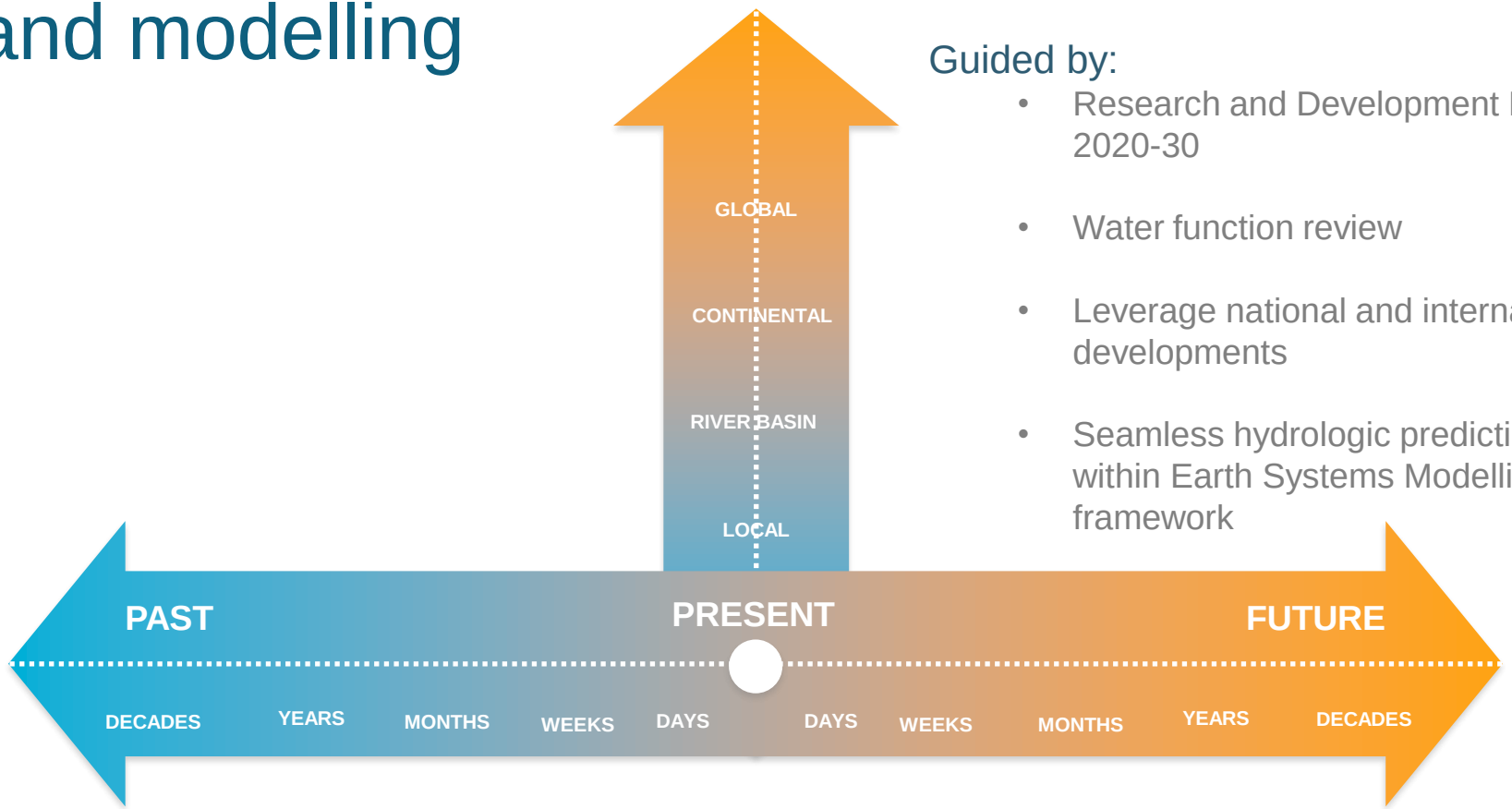
Acknowledgement

- Business Solutions Group:
  - (Water) Matthew Coulton, Vjekoslav Matic, Habibur Rahman, Sigrid Tijs, Daniel Burton + other sectors
- Research Program Leads
- CSG GMs and Team Leads
- R2O GM and experts
- UK Met Office and CEH
- Notable contributions to-date from:
  - CSIRO (WIRADA)
  - University of Adelaide/Newcastle
  - University of Melbourne
  - UNSW
  - ANU
- MDBA
- WMO – global hydrology initiatives

Establish priorities for hydrological science and modelling



Guided by:

- Research and Development Plan 2020-30
- Water function review
- Leverage national and international developments
- Seamless hydrologic predictions within Earth Systems Modelling framework

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Wide ranging operational water products (25)

Products in blue font require modelling effort

Water information standards: 3 products

- Australian water accounting standards, National industry guidelines for hydrometric modelling, and Water Transfer Data Format

Water data: 10 products

- National Groundwater Information System, Climate Resilient Water Sources, Design Rainfalls, Environmental Monitoring Sites, Groundwater Dependant Ecosystems, Groundwater Explorer, Water Data Online, Water Markets Information, Australian Hydrological Geospatial Fabric, and Hydrologic Reference Stations

Water Status: 9 products

- National Water Account, Urban National Performance Report, Australian Groundwater Insight, Regional Water Information, Water in Australia, Monthly water update, Water Restrictions, Water Storages, and Landscape Water Balance

Water Forecasts: 3 products

- Flood Forecasting and Warning, 7-day Streamflow Forecasts, and Seasonal Streamflow Forecasts

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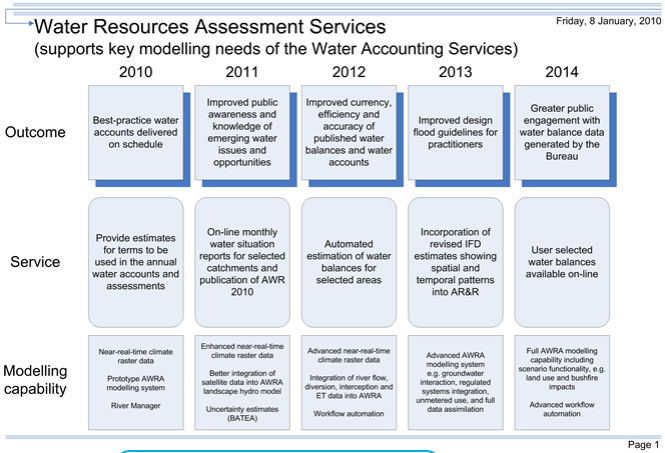
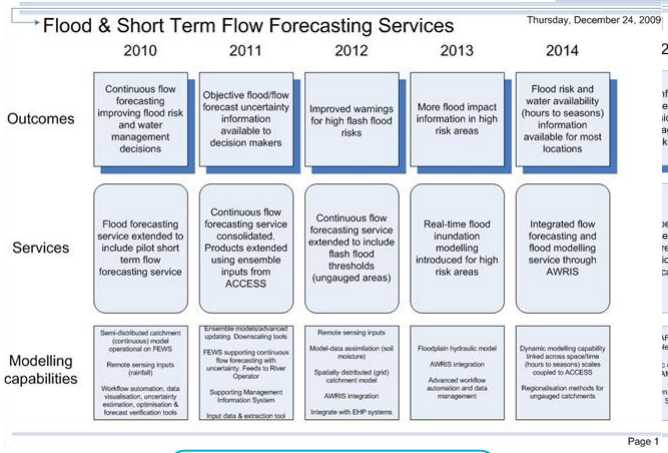
Legacy parallel developments in water prediction systems

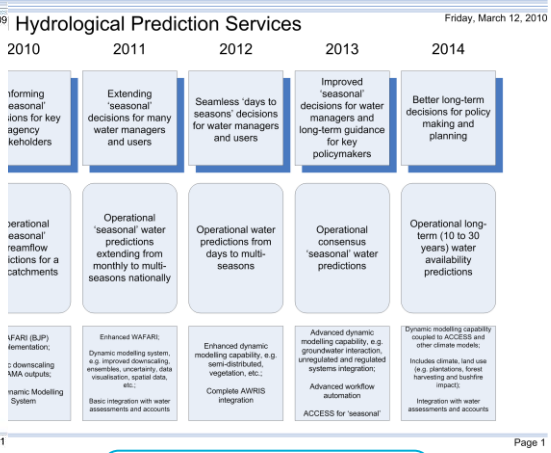
Water Resource Assessments



Flood Forecasting



Extended Hydrological Predictions



Bureau team	Bureau team	Bureau team
↕	↕	↕
CSIRO team	CSIRO team	CSIRO team University sector

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The need for rationalising models and modelling systems

- Water status:
  - Australian Water Resource Assessment modelling system AWRA CMS (AWRA-L & -R)
- Flood Forecasting:
  - Hydrological Forecasting System HyFS (URBS)
- 7-day Streamflow Forecasting:
  - Development system PySWIFT, operational system HyFS (SWIFT, CHyPPS)
- Seasonal Streamflow Forecasting:
  - WAFARi modelling system (BJP, BATEA, FoGGS, GR4J)
- Hydrologic Reference Stations:
  - HRS Toolkit (lightweight modelling toolkit with trends)
- Bespoke modelling systems

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PST: Water Function Review 2020

Recommendation 11: Consolidate Bureau hydrological models into two systems to address:

i. distributed landscape water balance and hydrological modelling at a nationwide and river basin scale using a Numerical Weather Prediction with coupled river and land-surface modelling approach; and

ii. semi-distributed catchment modelling for flood and short-term streamflow forecasting

Recommendation 12: Establish an independently-chaired, cross-disciplinary team (BSG Water, Research, Research to Operations and Environmental Prediction Services Programs) to:

i. evaluate the potential for JULES to deliver the distributed landscape water balance and hydrological modelling at a nationwide and river basin scale and

ii. for SWIFT to provide the capability for semi-distributed catchment modelling for flood and short-term streamflow forecasting.

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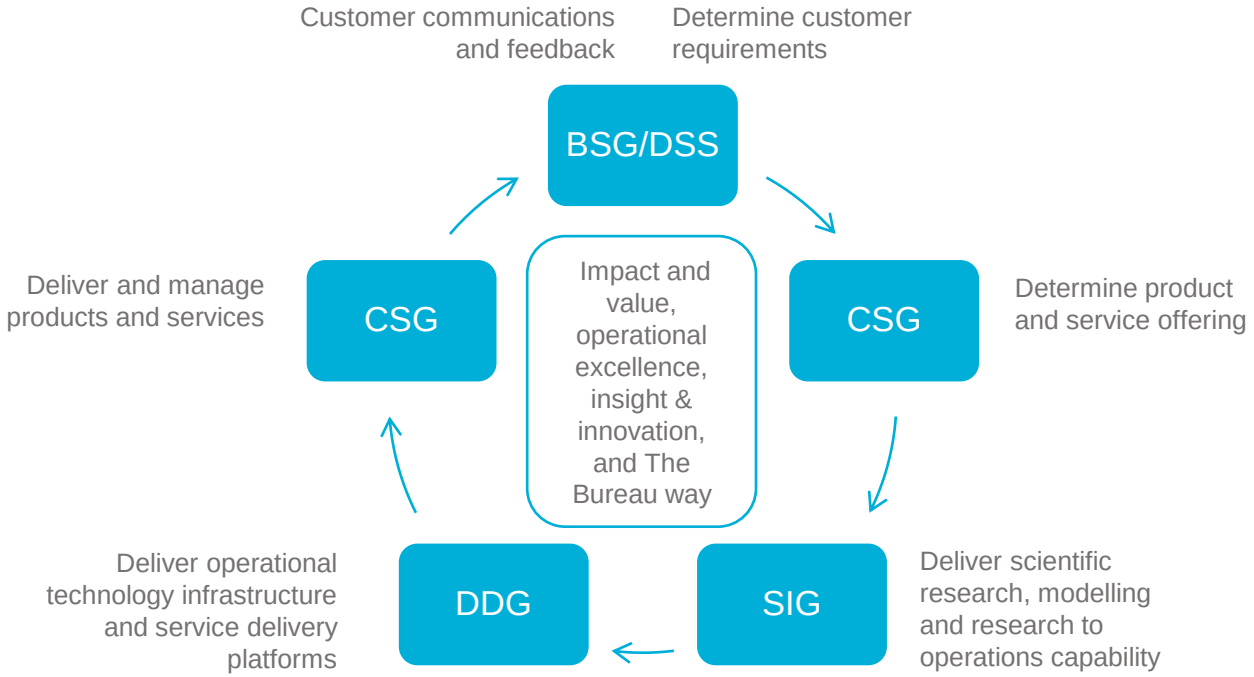
Research and development, product management and customer engagement value chain



BSG: Business Solutions (public, emergency services, water, agriculture, energy and resources, maritime and transport, and national security)

CSG: Community Services

SIG: Science and Innovation

DDG: Data and Digital

DSS: Decision Support Services (Emergency sector)

Water research priorities

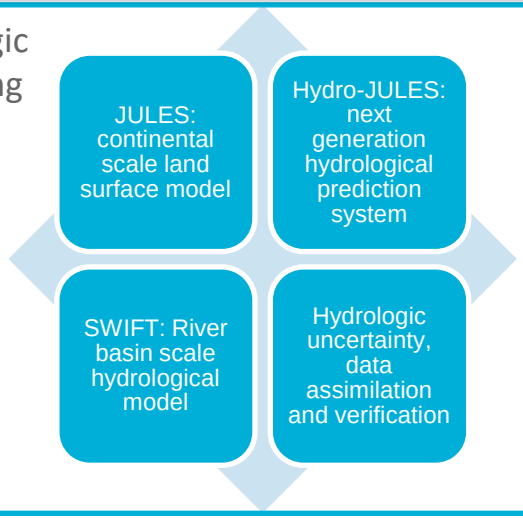
- Riverine floods
- Flood inundation & coastal hydrology
- Water availability/ demand (0-6 mth)
- Bushfire and vegetation impacts
- Water quality
- Hydrologic projections
- Surface water – groundwater links

Drivers

Research and Development Plan 2020-30

Public Services Transformation (Water Function Review)

Hydrologic modelling toolkit



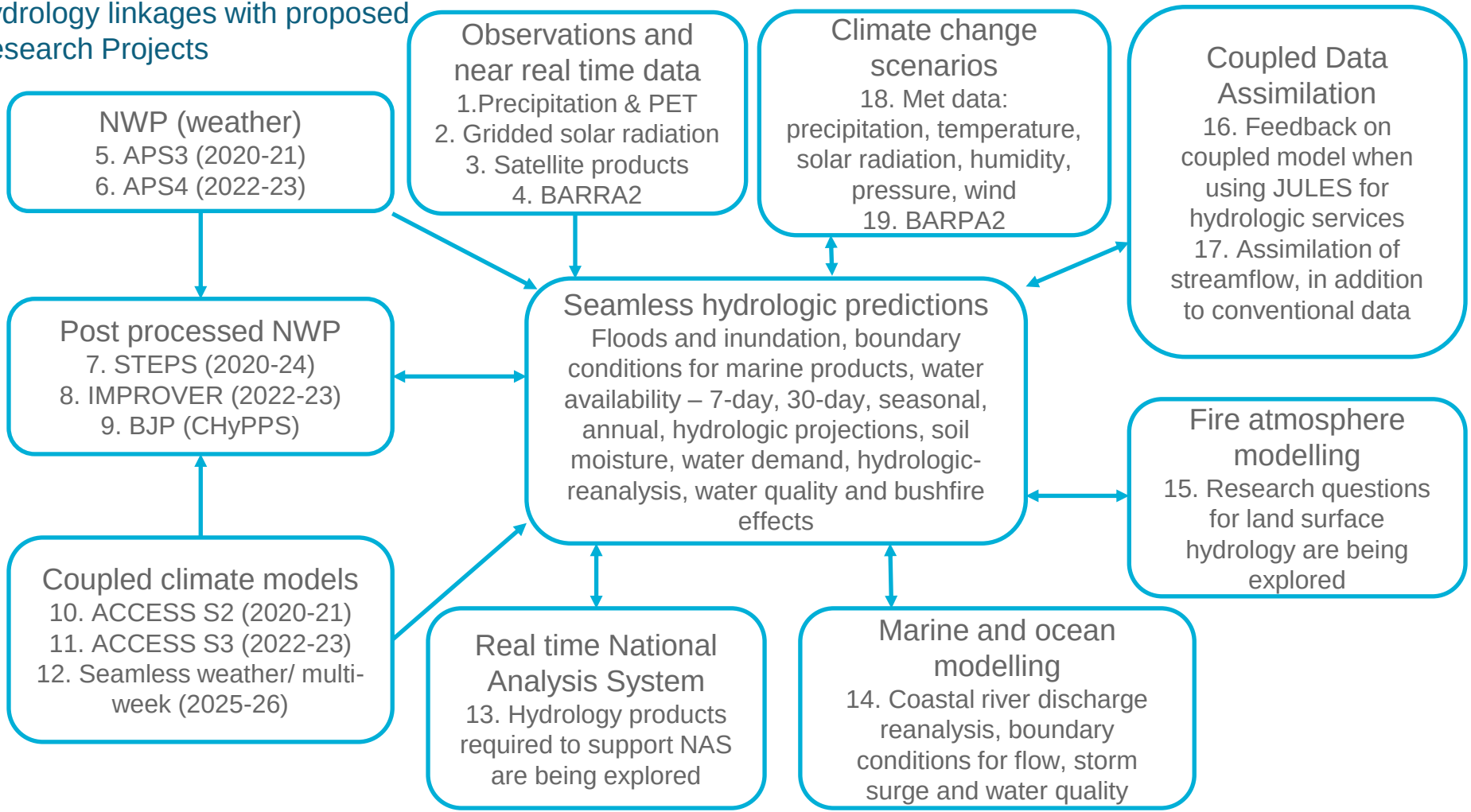
Observations, meteorology research and tech. advances

- Satellite data, meteorology and hydrology data, analysis and post-processing
- NWP, sub-seasonal and seasonal forecasts, and climate change projections
- Next generation modelling systems, data science and cloud computing

Benefits and impact

- Seamless hydrological and land surface prediction capability
- Improved water services – accurate, reliable and automated
- Enhanced public safety from floods
- Increased resilience from drought and water scarcity
- Better preparedness from bushfire hazards
- Practical solutions for environment sustainability
- Hydrologic research inputs to water and climate policy
- Valued outcomes for agriculture, transport, energy and marine sectors

Hydrology linkages with proposed Research Projects



WORLD METEOROLOGICAL ORGANIZATION

HydroSOS Demonstration Portal

WMO Hydrological Status and Outlook System

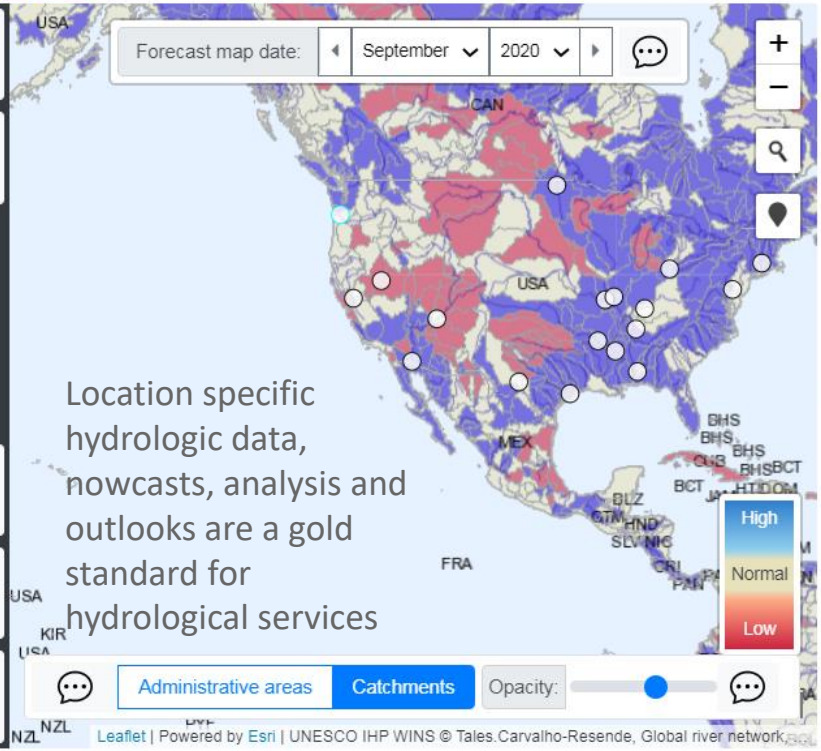
View

Products

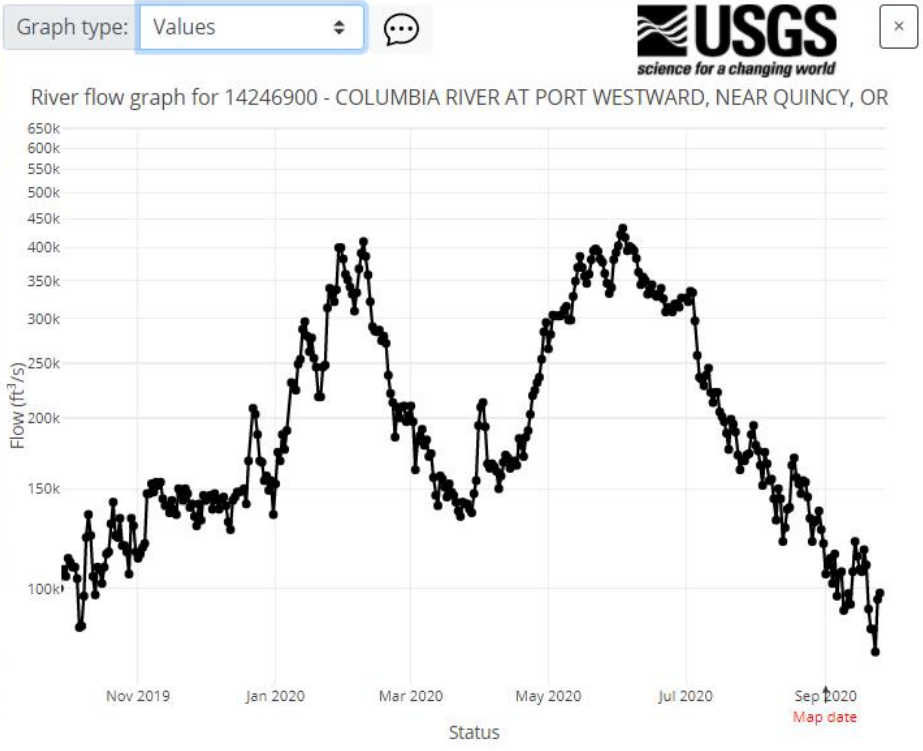
About

Help

Feedback



Location specific hydrologic data, nowcasts, analysis and outlooks are a gold standard for hydrological services



This demonstration portal was developed by: UK Centre for Ecology & Hydrology NCAR

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Strategic partnerships

- UK agencies – Met Office, Centre for Ecology and Hydrology and Flood Forecasting Centre
- CSIRO leveraging developments from 10+ years of research in hydrology
- Australian university sector
- MDBA
- eWater Ltd. (SOURCE)
- WMO hydrology initiatives
- ECMWF hydrologic modelling group

Thank you

Questions?

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