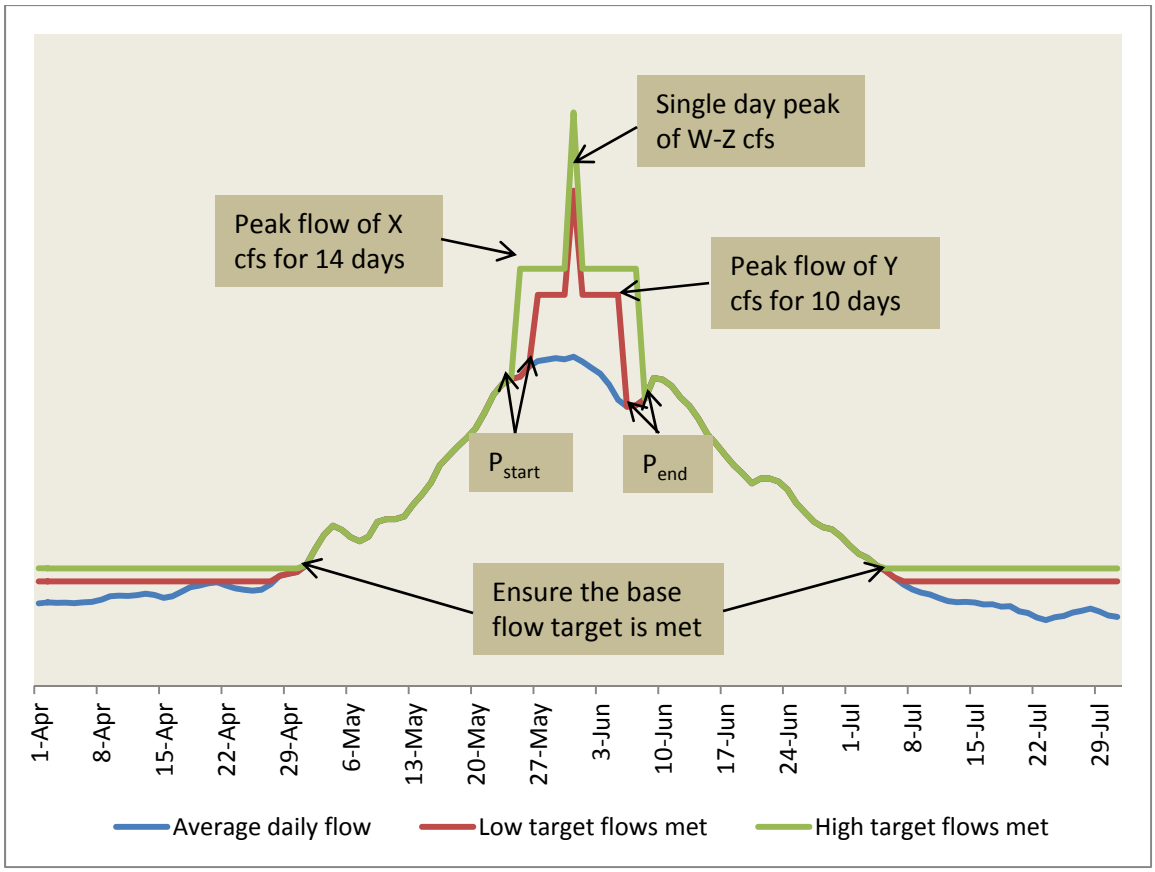
OPTIONS FOR COLORADO RIVER BASIN WATER SUPPLY AND DEMAND STUDY

Date Submitted: January 31, 2012

Option Name: Integrated Options to Maintain and Restore Healthy River Flows

Description of Option: This water management option is to maintain and restore the healthy river flows thought to provide a materially higher degree of river ecosystem and economic benefits. Where such benefits may be provided within current flow regimes, the option is to develop appropriate legal and policy mechanisms that protect enough of the current regimes. Such mechanisms include the continued and adaptive re-operation of major federal reservoirs and other water projects. Where a materially higher degree of river ecosystem and economic benefits depends on the restoration of current flow regimes, this option will again include the continued and adaptive re-operation of water projects, should be integrated with options for water banking and improving irrigation efficiency, and entails protection of restored flows by appropriate mechanisms. The integration of this option with an extensive set of options for demand management should reduce the potential for conflict between meeting such water demands and realizing the river ecosystem and economic benefits from maintaining and restoring more of the targeted flow regimes.

Because these benefits are generated by maintaining or restoring river flows instead of consuming them, the quantity and timing of the target flows for upstream reaches need not be added to the flow targets in downstream reaches and are not necessarily added to consumptive demands when assessing water supply and demand imbalances. An important example is meeting flow targets in the Upper Basin by piggybacking on the flows that should not be depleted to keep from dropping below the flow threshold at Lee Ferry imposed by the 1922 Compact, where the blue line (including when it is under the green line) in the figure below could represent much of the flows that should not be depleted to meet Compact obligations.



Source: Appendix D3, Technical Report D - System Reliability Metrics, Colorado River Basin Water Supply and Demand Study

Locations of Flow or Water Quality Targets and of Flow Protection and Management: See enclosed table on healthy flows, columns 1, 2, and 4.

Quantity and Timing of Flow Target: See enclosed table on healthy flows, column 3.

Technical Feasibility: This option is currently feasible only at coarse temporal and spatial scales. See enclosed table on healthy flows, column 5, issues with the Colorado River Simulation System. Full implementation of this option and its integration with all other water management options requires the basin-wide development and synthesis of finer resolution assessments of ecological and recreational flow needs. Such flow needs then need to be fully incorporated into water budgets at consistent scales. Such basin-wide flow assessments and water budgets have been developed elsewhere at costs ranging from $5 to $15 million. The Focus Study on the Colorado River Basin being undertaken by the USGS could offer some building blocks but is not currently scoped or funded to provide basin-wide assessments of ecological and recreational flow needs and consistent water budgets at sufficiently fine scales.

Costs, Permitting, Legal/Policy Considerations, Implementation Risks/Uncertainty, and Reliability: All of these considerations are highly dependent on the resolution and consistency for the flow assessments

and water budgets. The costs, implementation risks, and uncertainty of this water management option are generally higher with coarse, less than comprehensive flow assessments and with imprecise water budgets. Permitting, legal and policy considerations and water supply reliability are generally more problematic at the coarse scale.

Energy Needs and Impacts on Hydroelectric Generation. This water management option does not have any stand-alone energy needs. It may have both positive and negative impacts on hydroelectric generation that can be quantified at coarse scales.

Water quality, recreational, environmental, and socio-economic impacts. The objective of this option is to maintain or increase the benefits in all of these sectors as supply imbalances in meeting other water demands are addressed.

1. Flow/Salinity Target Points	2. Reaches and Values	3. Flow Targets	4. Options for Flow Protection or Management to Meet Flow Targets	5. Issues with Colorado River Simulation System (CRSS)
Upper Colorado River				
Colorado River at Glenwood Springs, CO Map # 1	• River boating reach at Glenwood Playpark and in South Canyon • Salinity loading at and downstream of the flow target point	• River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration that result in target shortages (e.g. Green Mountain pumpback) • Potential upstream water project re-operations, including the Shoshone Power Plant under the Colorado River Cooperative Agreement • Potential water banking (e.g., options for Upper Basin) • Potential improved irrigation efficiencies that reduce consumption (many options including crop shifting) or that improve river flows without reducing consumption (e.g. ditch piping and several institutional strategies) • Demand management that helps meet flow targets (e.g. options for reducing per capita municipal demands by 1% per year)	Elements of flow targets or management that cannot be modeled: • Daily flows (limited disaggregation) • Upstream water project operations • Reach benefits of improved irrigation efficiencies that do not reduce consumption, some reduced consumptive demands, and some flow protection • Sediment transport, water temperature, and other water quality except salinity at selected nodes
Colorado River near Cameo, CO Map #2	• Upstream from target point to terminus of designated critical habitat and downstream to confluence with the Gunnison River • Reaches within critical habitat with cottonwood stands • River boating reach at Big Sur • Salinity loading at and downstream of the flow target point	• Endangered fish recovery: Flows as coarsely indicated in Technical Report D, System Reliability Metrics, Appendix D3, Table 1 • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Water project re-operation: Grand Valley Project, Orchard Mesa Project, Ruedi Reservoir, Shoshone Power Plant, Green Mountain Reservoir, Granby Reservoir, and Coordinated Facilities • Potential water banking (Upper Basin options) • Potential improved irrigation efficiencies (many options and institutional strategies) • Demand management (at least three options)	Elements that cannot be modeled: • Daily flows (monthly targets are coarse) • Upstream water project operations • Flow targets for 15 Mile Reach • Downstream operations of Grand Valley and Orchard Mesa projects • Many significant reach benefits • Water quality except salinity
Colorado River near Colorado-Utah Stateline (not CRSS natural flow node)	• Designated critical habitat from confluence with the Gunnison River downstream to Cisco, UT • Reaches within critical habitat with cottonwood stands • River boating reaches at Ruby, Horsethief and Westwater canyons	• Endangered fish recovery: High range of target flows as coarsely indicated in Technical Report D, System Reliability Metrics, Appendix D3, Table 3 • River boating: Optimal flows for boatable days • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4	• Protect against major, new depletions and flow alteration • Potential upstream water project re-operations • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (monthly targets are coarse) • Aspinall operations to meet flow targets • Other upstream operations • Many significant reach benefits • Water quality except salinity
Colorado River near Cisco, UT Map #3	• Designated critical habitat from stateline downstream to confluence with Green River • Reaches within critical habitat with cottonwood stands • River boating reaches at Hitte Bottom and Moab • Salinity loading at and downstream of the flow target point	• Endangered fish recovery: Flows remaining after depletions covered by Programmatic Biological Opinions • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Potential upstream water project re-operations • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation) • Upstream water project operations • Many significant reach benefits • Water quality except salinity
Colorado River in Cataract Canyon, UT (not CRSS natural flow node)	• Designated critical habitat from the confluence with the Green River downstream to Lake Powell • Reaches within critical habitat with cottonwood stands • River boating reaches in Cataract Canyon • Canyonlands National Park	• Endangered fish recovery: sum of high range of target flows on Green River at Green River, UT and on Colorado River at the Stateline, plus inflows from the Dolores and San Rafael rivers • Boating flows: Optimal flows	• Protect against major, new depletions and flow alteration • Potential water banking • Potential improved irrigation efficiencies • Potential upstream water project re-operation • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation; monthly targets are coarse) • Upstream water project operations • Many significant reach benefits • Water quality except salinity

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Lower Gunnison and Dolores Rivers				
Gunnison River near Grand Junction, CO Map #4	• Upstream from target point to terminus of designated critical habitat and downstream to confluence with the Colorado River • Reaches within critical habitat with cottonwood stands • River boating reaches on the lower Gunnison (Dominquez-Escalante) • Salinity loading at and downstream of the flow target point	• Endangered fish recovery: High range of target flows as coarsely indicated in Technical Report D, System Reliability Metrics, Appendix D3, Table 2 • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration (e.g. Blue Mesa pumpback) • Water project re-operations: Aspinall Unit • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation; monthly targets are coarse) • Aspinall operations to meet flow targets • Other upstream water project operations • Many significant reach benefits • Water quality except salinity Flood control releases and spills from the Aspinall Unit and downstream flooding potential can be modeled
Dolores River near Cisco, UT Map #5	• Upstream from target point to terminus of river habitat occupied by listed fish and downstream to confluence with Colorado River • Reaches within occupied habitat with cottonwood stands • River boating reaches on the lower Dolores River • Salinity loading at and downstream of the flow target point	• Endangered fish recovery: Flows remaining after depletions covered by Programmatic Biological Opinion • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Potential water project re-operations: McPhee Reservoir • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation) • Upstream water project operations • Many significant reach benefits • Water quality except salinity
Lower Yampa and Little Snake Rivers				
Yampa River near Maybell, CO Map #6	• Upstream from target point to terminus of designated critical habitat and downstream to Deerlodge Park • Reaches within critical habitat with cottonwood stands • River boating reaches in Little Yampa/Cross Mountain Canyon • Salinity loading at and downstream of the flow target point	• River ecosystem health, including endangered fish recovery: Whole flow regime with base flow augmentation as indicated in Technical Report D, Appendix D5, Table 2 • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration (e.g. Maybell pumpback) • Water project re-operations: Elkhead Reservoir • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation; monthly targets are coarse) • Elkhead operations to meet flow targets • Other upstream water project operations • Many significant reach benefits • Water quality except salinity
Little Snake River near Lily Park, CO Map #7	• Upstream from target point to terminus of river habitat occupied by listed fish and downstream to Deerlodge Park • Reaches within critical habitat with cottonwood stands • Salinity loading at and downstream of the flow target point	• River ecosystem health, including endangered fish recovery: Whole flow regime as indicated in Appendix D5, Table 3 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Potential water banking and improved irrigation efficiencies	Elements that cannot be modeled: • Daily flows (monthly targets are coarse) • Upstream water project operations • Many significant reach benefits • Water quality except salinity
Yampa River at Deerlodge Park, CO (not CRSS natural flow node)	• Designated critical habitat from Deerlodge Park downstream to Green River • Reaches within critical habitat with cottonwood stands • Dinosaur National Monument • River boating reaches in Yampa Canyon	• River ecosystem health, including endangered fish recovery: Whole flow regime as indicated in Technical Report D, System Reliability Metrics, Appendix D5, Table 4 • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4	• Protect against major, new depletions and flow alteration • Water project re-operations: Elkhead Reservoir • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation; monthly targets are coarse) • Upstream project operations • Many significant reach benefits • Water quality except salinity

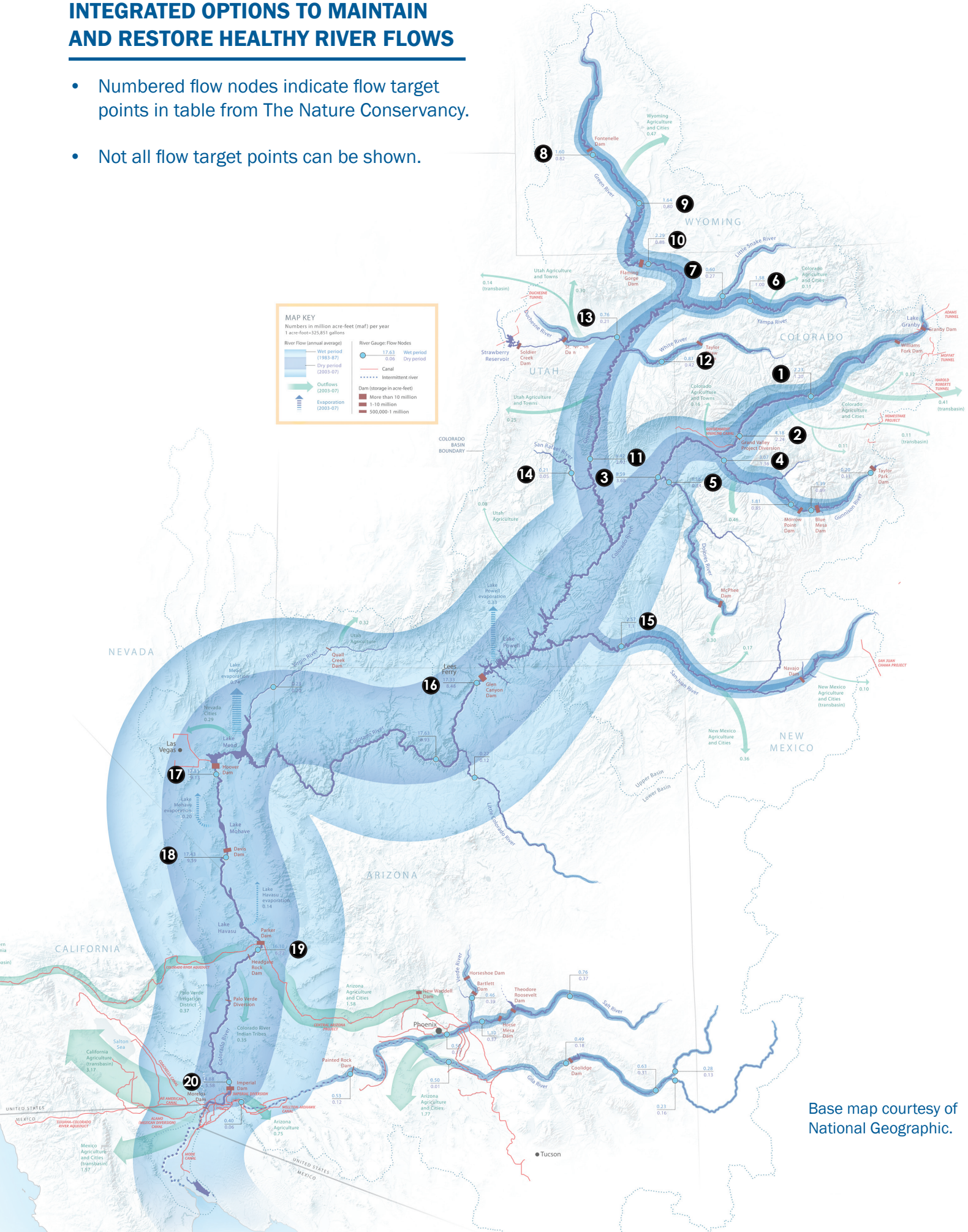
Green River				
Green River below Fontenelle Reservoir, WY Map #8	• Reaches below Fontenelle dam with cottonwood stands downstream to Green River, UT • Seedskadee National Refuge • Salinity loading at and downstream of the flow target point	• Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Flows for Seedskadee National Refuge: Technical Report D, System Reliability Metrics, Appendix D6, Table 1 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Potential water project re-operations: Fontenelle Reservoir • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation) • Upstream water project operations except possibly Fontenelle Reservoir • Many significant reach benefits • Water quality except salinity Flood control releases and spills from Fontenelle Reservoir can be modeled
Green River near Green River, WY Map #9	• Reaches with cottonwood stands from target point downstream to Flaming Gorge Reservoir • River boating reach at Green River, WY Whitewater Park • Salinity loading at and downstream of the flow target point	• River boating: Optimal flows for boatable days • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration (e.g. Million pipeline) • Potential water project re-operations: Fontenelle Reservoir • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation) • Upstream water project operations except possibly Fontenelle Reservoir • Many significant reach benefits • Water quality except salinity
Green River near Greendale, UT Map #10	• Designated critical habitat from Flaming Gorge dam downstream to Jensen, UT • Reaches within critical habitat with cottonwood stands • Browns Park National Refuge • Dinosaur National Monument • River boating reaches in Lodore Canyon • Salinity loading at and downstream of the flow target point	• Endangered fish recovery: High range of target flows as indicated in Technical Report D, System Reliability Metrics, Appendix D3, Table 6 • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Flows for Browns Park National Refuge: Technical Report D, System Reliability Metrics, Appendix D6, Table 2 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration (e.g. Million pipeline) • Water project re-operations: Flaming Gorge Reservoir • Potential water banking and improved irrigation efficiencies • Demand management	• Under revision: Flaming Gorge modeling to meet flow targets • Elements that cannot be modeled: Many significant reach benefits and water quality except salinity • Flood control releases and spills from Flaming Gorge Reservoir can be modeled
Green River at Jensen, UT (not CRSS natural flow node)	• Designated critical habitat from Jensen, UT downstream to Green River, UT • Reaches within critical habitat with cottonwood stands • Ouray National Refuge • Upstream river boating reach in Split Mountain Canyon	• Endangered fish recovery: High range of target flows as indicated in Technical Report D, System Reliability Metrics, Appendix D3, Table 7 • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Flows for Ouray National Refuge: Technical Report D, System Reliability Metrics, Appendix D6, Table 3	• Protect against major, new depletions and flow alteration • Water project re-operations: Flaming Gorge Reservoir • Potential water banking and improved irrigation efficiencies • Demand management	• Under revision: Flaming Gorge modeling to meet flow targets • Elements that cannot be modeled: Many significant reach benefits and water quality except salinity • Flood control releases and spills from Flaming Gorge Reservoir can be modeled
Green River near Green River, UT Map #11	• Designated critical habitat from Jensen, UT downstream to the confluence with the Colorado River • Reaches within critical habitat with cottonwood stands • Canyonlands National Park • River boating reaches in Gray, Desolation, Labyrinth, Stillwater canyons • Salinity loading at and downstream of the flow target point	• Endangered fish recovery: High range of target flows as coarsely indicated in Technical Report D, System Reliability Metrics, Appendix D3, Table 4 • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Water project re-operations: Flaming Gorge Reservoir • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (limited disaggregation; monthly targets are coarse) • Upstream project operations • Many significant reach benefits and water quality except salinity

Lower White, Duchesne, and San Rafael Rivers				
White River near Watson, UT Map #12	• Upstream from target point to terminus of designated critical habitat and downstream to confluence with Green River • Reaches within critical habitat with cottonwood stands • River boating reaches below Taylor Draw Reservoir • Salinity loading at and downstream of the flow target point	• River ecosystem health, including endangered fish recovery: Whole flow regime as coarsely indicated in Technical Report D, System Reliability Metrics, Appendix D5, Table 5 • River boating: Optimal flows for boatable days • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (monthly targets are coarse) • Upstream project operations • Many significant reach benefits and water quality except salinity
Duchesne River near Randlett, UT Map #13	• Upstream from target point to terminus of designated critical habitat and downstream to confluence with Green River • Reaches within critical habitat with cottonwood stands • Salinity loading at and downstream of the flow target point	• Endangered fish recovery: Flows as coarsely indicated in Technical Report D, System Reliability Metrics, Appendix D3, Table 5 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (monthly targets are coarse) • Upstream project operations except possibly Starvation Reservoir • Many significant reach benefits and water quality except salinity
San Rafael River near Green River, UT Map #14	• Lower reaches with cottonwood stands • Salinity loading at and downstream of the flow target point	• Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Potential water banking and improved irrigation efficiencies • Demand management	Elements that cannot be modeled: • Daily flows (monthly targets are coarse) • Upstream project operations • Many significant reach benefits and water quality except salinity
San Juan River				
San Juan River near Archuleta, NM	• Reaches below Navajo Dam with cottonwood stands downstream to Bluff, UT • Salinity loading at and downstream of the flow target point	• Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Potential water project re-operations: Navajo Reservoir • Demand management	• Navajo operations can only be modeled to meet flow targets downstream at Bluff • Flood control releases and spills from Navajo Reservoir and downstream flooding potential can be modeled • Elements that cannot be modeled: Many significant reach benefits and water quality except salinity
San Jan River near Bluff, UT Map #15	• Upstream from target point to terminus of designated critical habitat and downstream to Lake Powell • Reaches within critical habitat with cottonwood stands • River boating reaches on the lower San Juan River • Salinity loading at and downstream of the flow target point	• Endangered fish recovery: Peak target flows as indicated in Technical Report D, System Reliability Metrics, Appendix D3, Table 8 and target base flows as indicated in Section 3.3 • River boating: Optimal flows for boatable days as indicated in Technical Report D, System Reliability Metrics, Appendix D2, Table 1 • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Water project re-operations: Navajo Reservoir • Potential water banking and improved irrigation efficiencies • Demand management	• Navajo operations can only be modeled to meet flow targets downstream at Bluff • Elements that cannot be modeled: Many significant reach benefits and water quality except salinity
Lower Colorado River				
Colorado River Lees Ferry, AZ Map #16 Colorado River near Grand Canyon, AZ	• Designated critical habitat from Glen Canyon Dam to Lake Mead • Reaches within critical habitat with cottonwood stands • Grand Canyon National Park • River boating reaches in the Grand Canyon • Salinity loading at and downstream of the flow target points	• River ecosystem health, including endangered fish recovery: Whole flow regime as indicated by regular high sediment flows and seasonally adjusted steady flows • River boating: Optimal flows for boatable days • Cottonwood stands: Flows that increase recruitment when applying the metric in Technical Report D, System Reliability Metrics, Appendix D4 • Salinity: Flows that reduce loading or concentrations	• Protect against major, new depletions and flow alteration • Water project re-operations: Glen Canyon Reservoir • Demand management	• Elements that cannot be modeled: Most sub-monthly flow needs, many significant reach benefits and water quality except salinity • Flood control releases and spills from Lake Powell can be modeled
Colorado River below Hoover Dam, AZ-NV;	• River reaches for flow protection and potential management: • Designated critical habitat from Lake Mead	• Endangered fish compliance: Flows remaining after large depletion allowances under Multi-Species Conservation Program (845 KAF from Hoover to Davis dams, 860 KAF from Davis to Parker dams, 1,574 KAF	• Potential water project re-operations: Lake Mead • Potential water banking (e.g. options for Lower Basin in U.S.)	• Salinity compliance can be modeled below Hoover, below Parker, and at Imperial dams • Flood control releases and spills from Lake

below Davis Dam, AZ-NV; below Parker Dam, AZ-CA; and at Imperial Dam, AZ-CA Map #s17-20	downstream to Imperial Dam • Salinity loading and compliance under Clean Water Act • Havasu, Cibola, and Imperial National Refuges	from Parker to Imperial dams) • Flows for Havasu, Cibola, and Imperial National Refuges • Salinity: flows that meet salinity standards	• Potential improved irrigation efficiencies • All upstream salinity control • Demand management	Mead and downstream flooding potential can be modeled • MSCP depletion compliance and refuge water right entitlements can be tracked • Cottonwood recruitment can be tracked for selected, historic flows • Elements that cannot be modeled: Many significant reach benefits and water quality except salinity
International Borders (northern and southern borders, Cienega, not CRSS natural flow nodes)	• Downstream riparian corridor and Cienega de Santa Clara • Salinity loading for Treaty compliance and Cienega viability	• Pulse flow every 4 years • Restore base flows • Salinity at northern border: flows that meet Treaty standard • Sustain most return flows to Cienega and do not substantially increase salinity concentrations	• Protect against major, new depletions and flow alteration • Potential water banking at Lake Mead including improved irrigation efficiencies to create and manage Intentionally Created Mexican Allocations • All upstream salinity control • Demand management	• Only flows beyond Treaty deliveries can be tracked at Morelos dam • May not include delivery of return flows to Cienega.
All Other Rivers				
Medium Rivers above Target Points (not CRSS natural flow nodes)	a. Henry's Fork of the upper Green River b. Gunnison River above its North Fork, including the Black Canyon National Park, Gunnison Gorge National Conservation Area, boating reaches above and below the Aspinall Unit, and salinity loading below Blue Mesa and Crystal reservoirs c. Taylor River downstream of Taylor Park Reservoir, including boating reaches and salinity loading d. Upper Colorado River above Glenwood Canyon, including boating reaches e. White River above Taylor Draw Reservoir including boating reaches from Meeker to Rangely and on the South Fork f. San Miguel River g. Escalante River h. Virgin River through Zion National Park, its East Fork, and its mainstream to the UT/AZ state line, including numerous boating reaches i. Lower Muddy River j. Bill Williams River above and below Alamo Reservoir, including the Bill Williams National Refuge k. Verde River above Horseshoe Reservoir l. Salt River, including numerous boating reaches m. Upper Gila River in AZ and NM n. San Pedro River in US and MX	•	• Protect against major, new depletions and flow alteration • Water project re-operation (e.g., Alamo for lower Bill Williams River) • Potential water banking and improved irrigation efficiencies • Groundwater management (e.g., San Pedro, Verde, and Muddy Rivers rivers) • Floodplain and channel restoration • Watershed and demand management	• Flow targets and management generally cannot be modeled, including: a. Alamo dam and other upstream water project operations except possibly Taylor Park Reservoir b. Many significant reach benefits and water quality except salinity c. Compliance with the federal reserved water right for the Black Canyon National Park d. Groundwater impacts • Salinity loading can be modeled at Littlefield on lower Virgin river and at three points on the Gunnison River above the Black Canyon • Cottonwood recruitment (e.g. on the lower Virgin and Bill Williams rivers) can be tracked for selected, historic flows by applying the metric in Technical Report D, System Reliability Metrics, Appendix D4
Headwaters in Upper and Lower Basins above Target Points (not CRSS natural flow nodes)	• Reaches with higher quality habitat occupied by ecologically and economically important fish • Rocky Mountain and Arches National Parks	•	• Protect against major, new depletions and flow alteration • Potential water banking and improved irrigation efficiencies • Groundwater management (Arches National Park) • Floodplain and channel restoration • Watershed and demand management	• Flow targets and management generally cannot be modeled

INTEGRATED OPTIONS TO MAINTAIN AND RESTORE HEALTHY RIVER FLOWS

- Numbered flow nodes indicate flow target points in table from The Nature Conservancy.
- Not all flow target points can be shown.



Base map courtesy of National Geographic.