
REACH: YAKIMA RIVER, KEECHELUS DAM TO LAKE EASTON

REACH FLOW PROBLEM:

Flow is too high in July, August and 1st week of September. Winter flow is lower than desired, pulses are absent.

REACH FLOW OBJECTIVE:

The objective is to improve rearing during July-early September by reducing flows down to 450-550 cfs and increasing winter flow to 120 cfs. Periodic pulses are desired to mimic natural flow conditions.

SPECIES AND LIFE STAGES BENEFITTED:

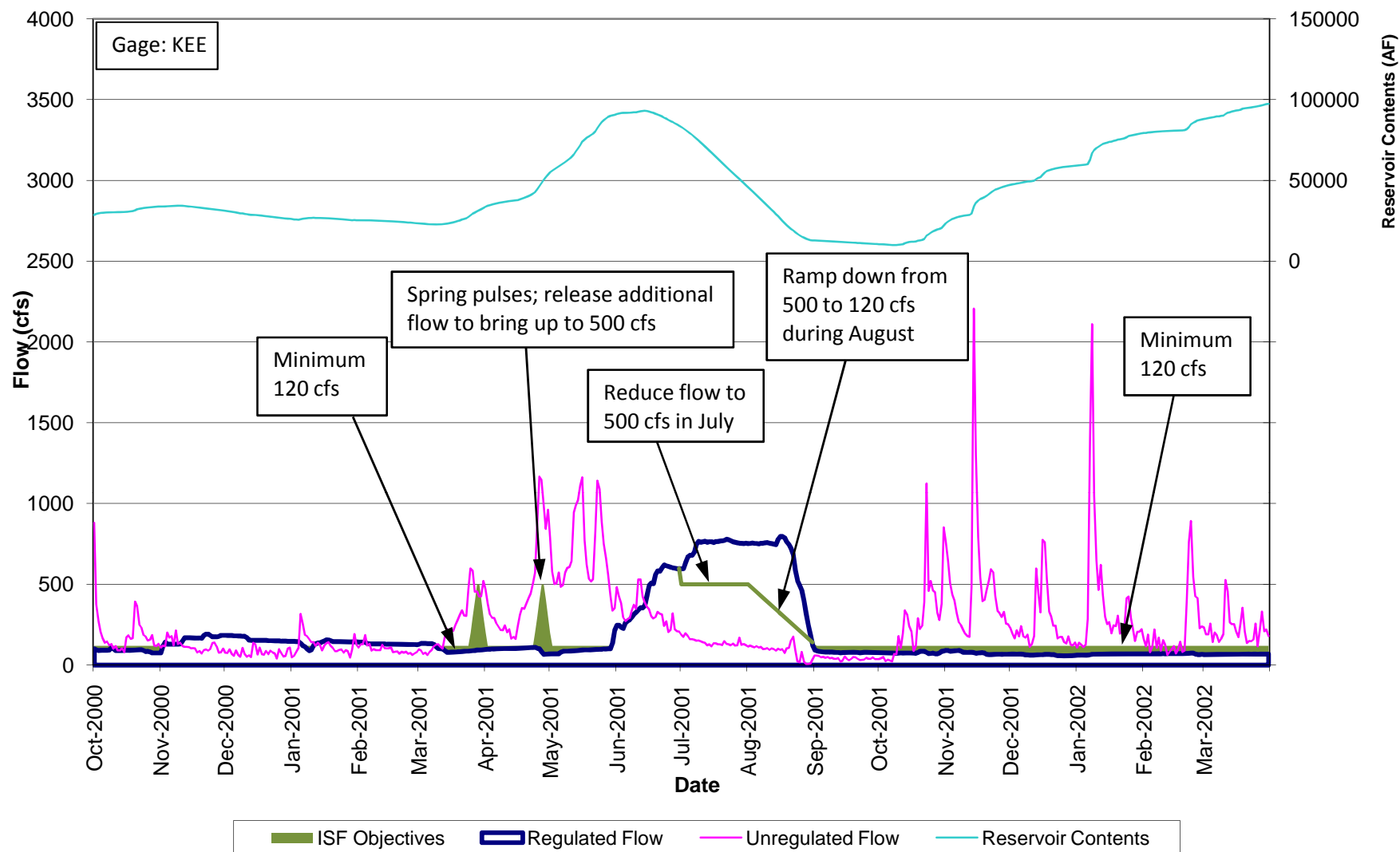
Spring Chinook: juvenile rearing; juvenile overwintering

Steelhead: juvenile rearing; juvenile overwintering

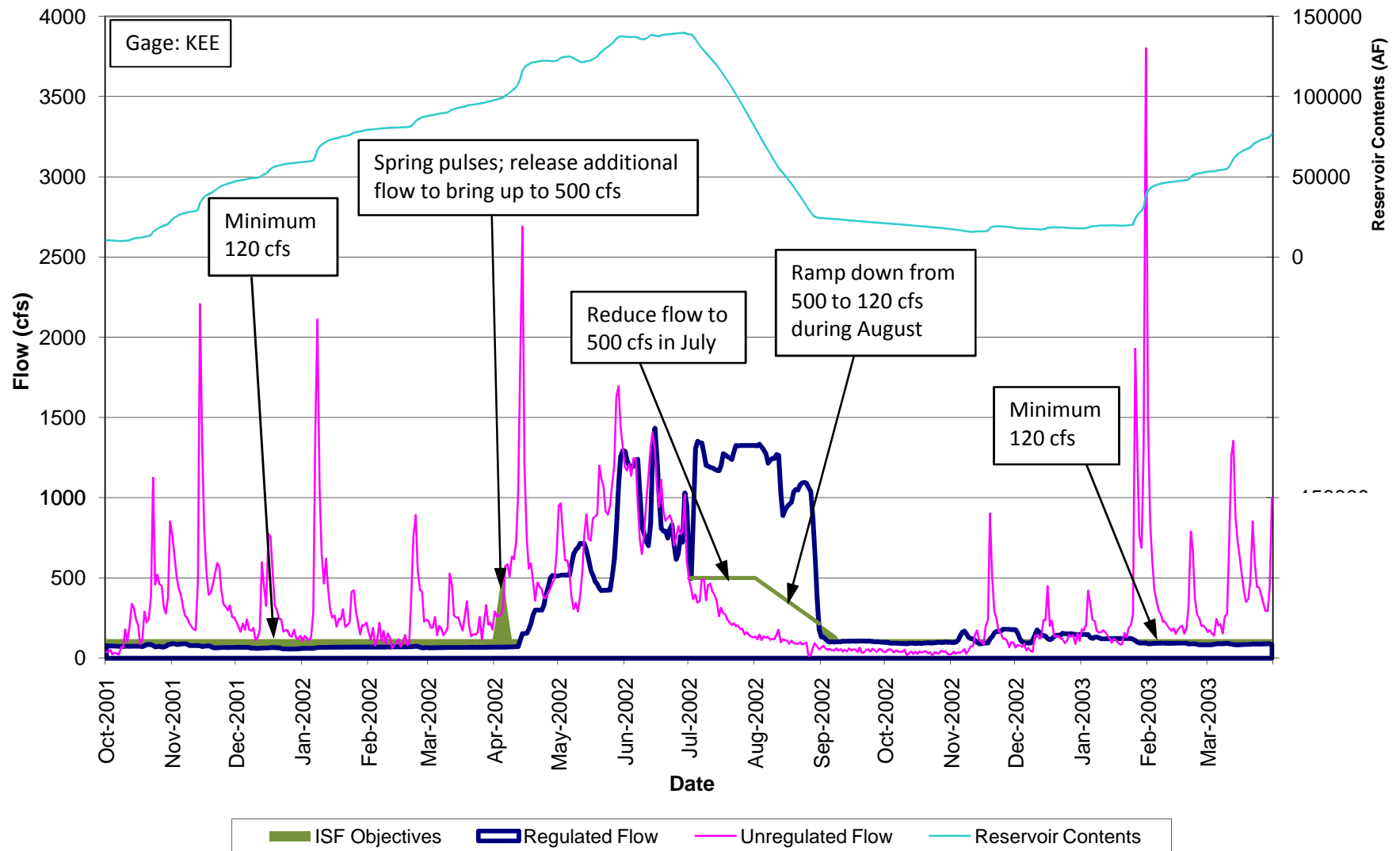
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are the K-K Pipeline, Wymer Reservoir and other possible storage proposals (Kachess Inactive Storage, Bumping, Cle Elum pool raise, etc). The hydrologic model will test the capability of these elements to meet the reach flow objectives. In general, water will be released from Keechelus Dam during winter to provide an average of 120 cfs flow and flow pulses. The water released during wet years may not need to be stored downstream as there would be sufficient runoff to meet entitlements during the irrigation season. During spring operations, additional water would be released to provide a strong pulse in April (up to channel shaping flows perhaps). In summer water would be released through both the K-K pipeline (up to 400 cfs) and the Yakima River but the flow in the Yakima River would be curtailed as much as possible to meet the 450-550 cfs flow objective in July-early September. To accomplish that, water will be conserved in Keechelus Reservoir during summer and that flow demand met through additional storage in Wymer, Cle Elum or Bumping reservoirs (and possibly Kachess). The water can be released the following winter to refill Wymer or Kachess.

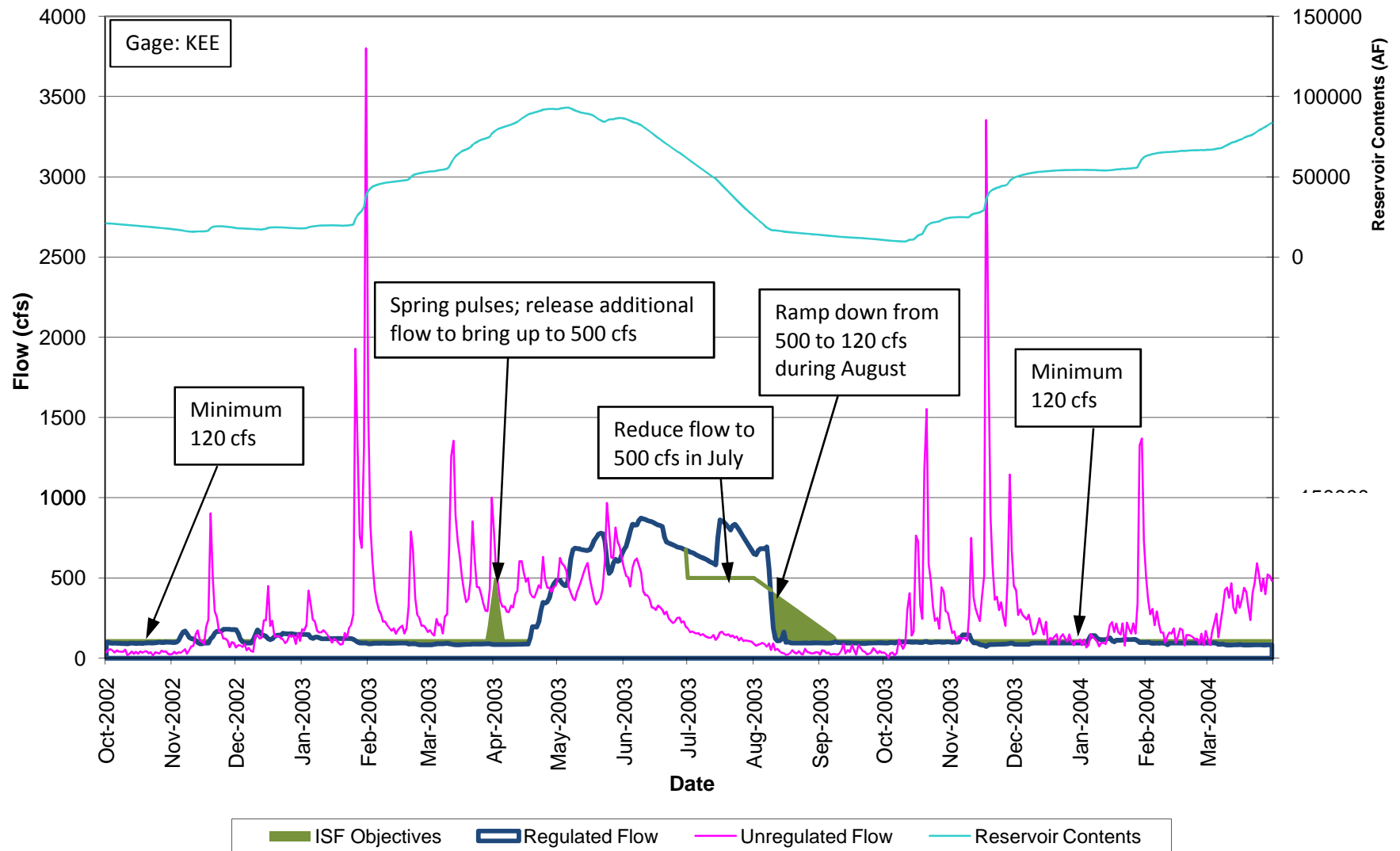
2001 Flow Data (Drought Year) - Yakima River, Keechelus Reservoir to Lake Easton Reach



2002 Flow Data (Wet Year) - Yakima River, Keechelus Reservoir to Lake Easton Reach



2003 Flow Data (Average Year) - Yakima River, Keechelus Reservoir to Lake Easton Reach



REACH: YAKIMA RIVER, EASTON REACH

REACH FLOW PROBLEM:

Need additional flow for spawning and rearing in the fall and winter to increase habitat area, including connecting side channels.

REACH FLOW OBJECTIVE:

The objective is to increase spawning flows to around 220 cfs and then increase flows for rearing to 250-300 cfs in winter. This will provide connection to additional side channels. Periodic pulses are desired to mimic natural flow conditions.

SPECIES AND LIFE STAGES BENEFITTED:

Spring Chinook: adult spawners; smolt outmigrants; juvenile overwintering

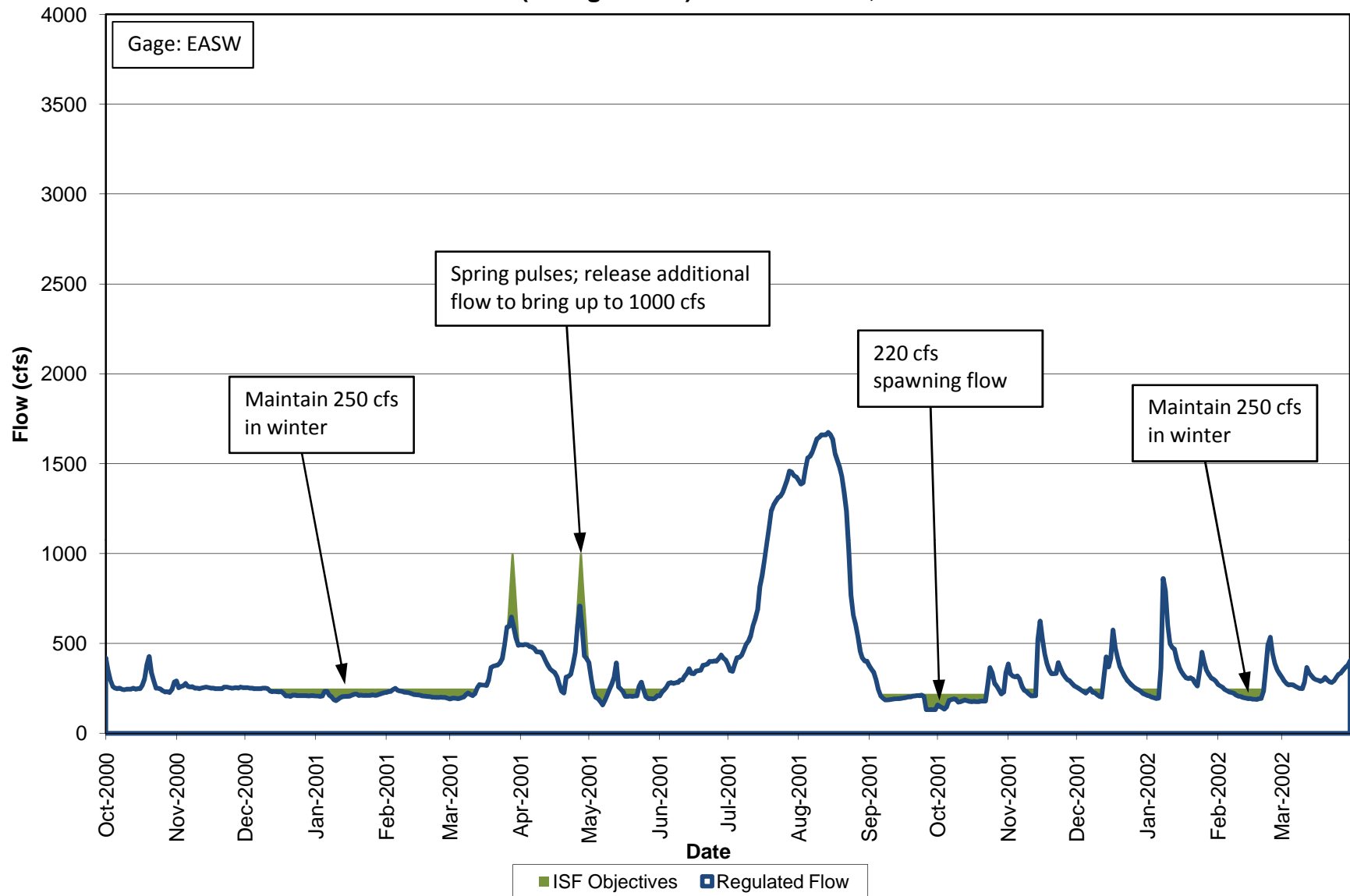
Coho: smolt outmigrants; juvenile overwintering; adult spawners

Steelhead: smolt outmigrants.

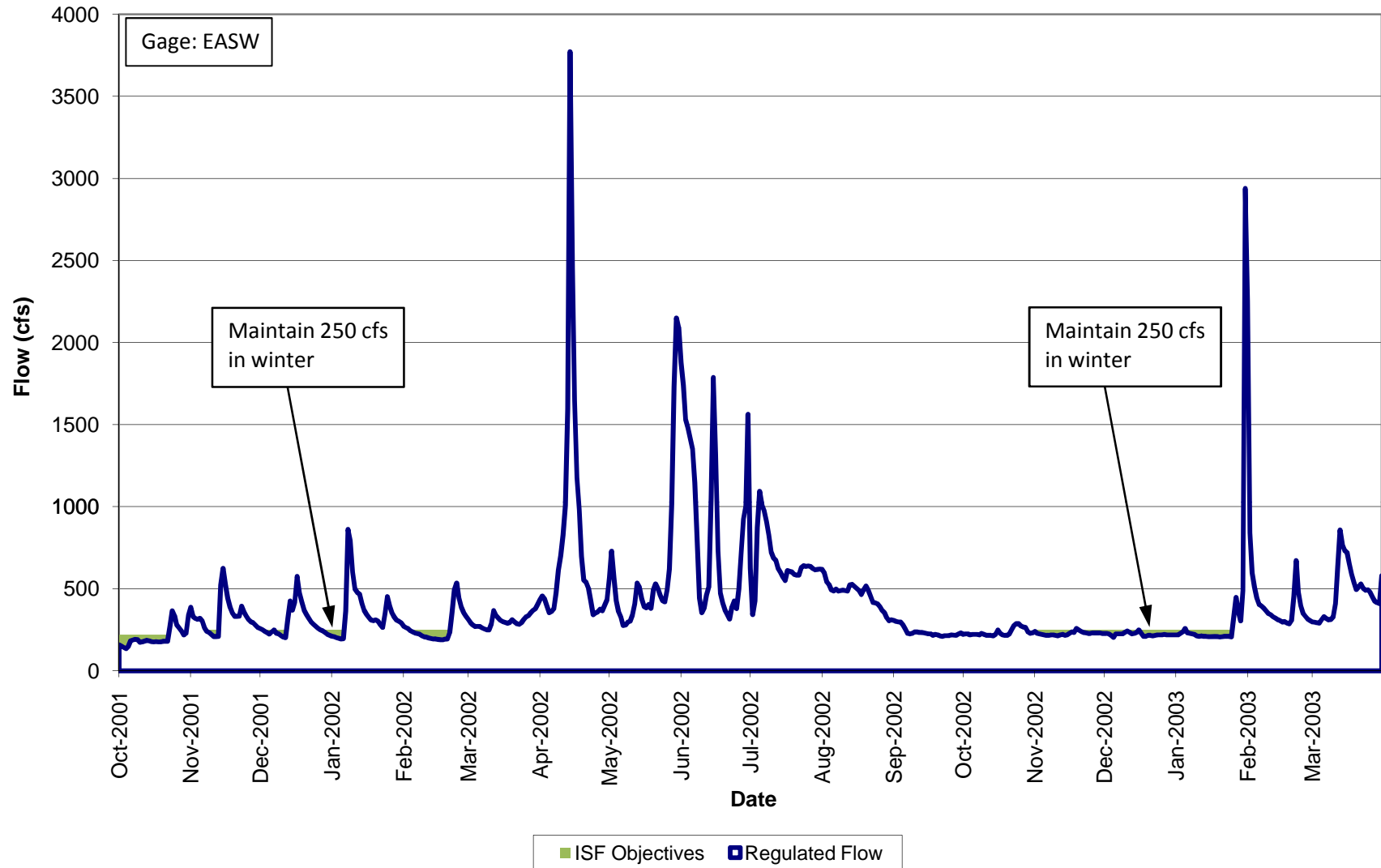
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are Wymer Reservoir and other possible storage proposals (Kachess Inactive Storage, Bumping, Cle Elum pool raise, etc). The hydrologic model will test the capability of these elements meeting the reach flow objectives. In general, water will be released from Keechelus (120 cfs) and Kachess (130 cfs) reservoirs during winter to provide an average of 250 cfs flow and flow pulses. The water released during wet years may not need to be stored downstream as there would be sufficient runoff to meet entitlements during the irrigation season. During spring operations, additional water would be released to provide a strong pulse in April (up to channel shaping flows perhaps). That water would be released to build upon unregulated tributary peaks. The flow in late summer will not be limited for these first hydrologic model runs. Additional water released from Keechelus and Kachess will be picked up in Wymer Reservoir or conserved in Cle Elum reservoir.

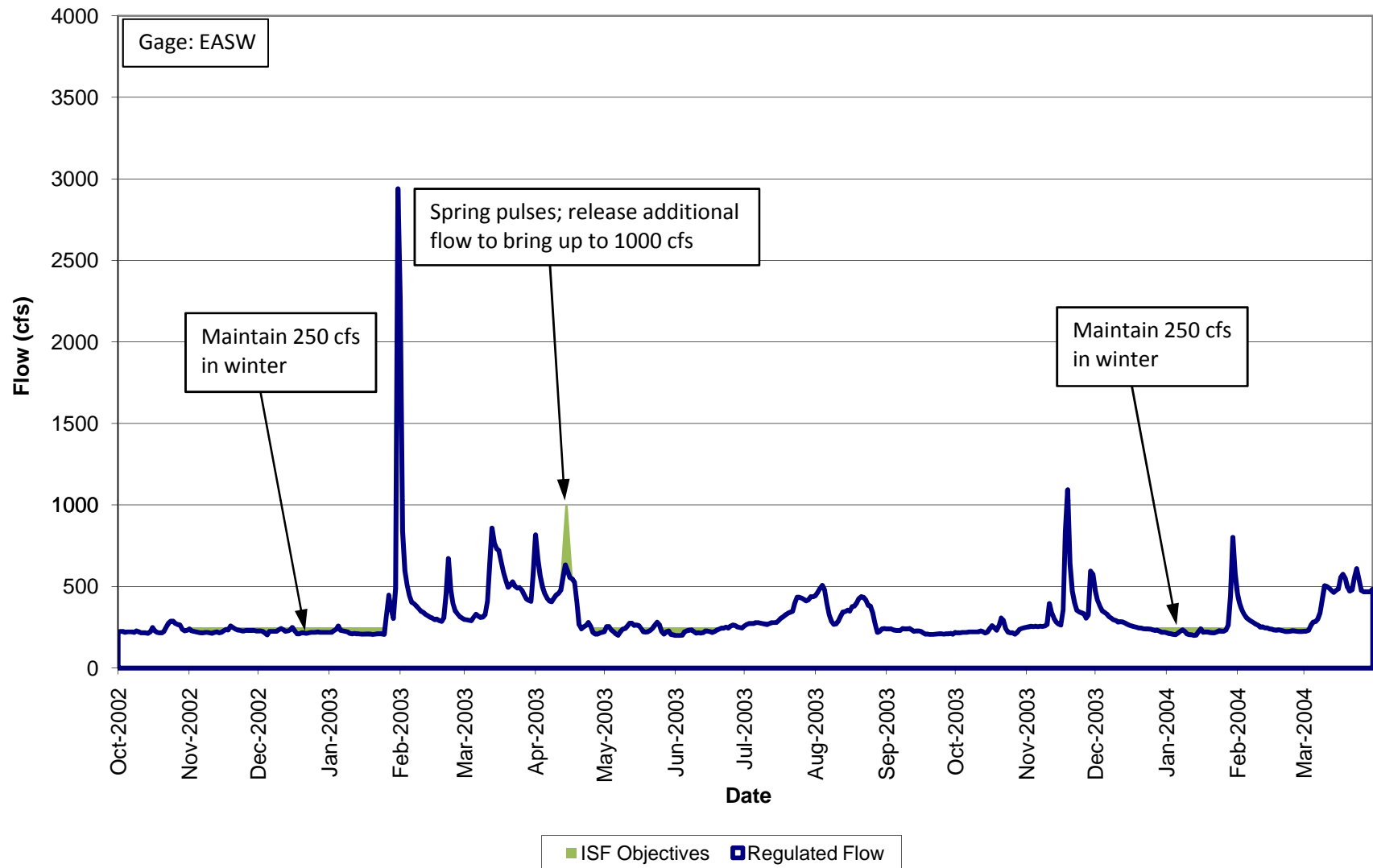
2001 Flow Data (Drought Year) - Yakima River, Easton Reach



2002 Flow Data (Wet Year) - Yakima River, Easton Reach



2003 Flow Data (Average Year) - Yakima River, Easton Reach



REACH: CLE ELUM RIVER

REACH FLOW PROBLEM:

Summer flows are too high in July and August. Lack of flow variation from September 10 through March limits access to side channels. Additional flow is needed from September to March for rearing and access to side channels.

REACH FLOW OBJECTIVE:

The summer objective is to hold water in storage to reduce flows by up to 1000 cfs to give a more gentle change in hydrograph. The fall/winter flows objective is to increase flows starting September 10 through March to as much as 500 cfs. Preliminary modeling performed for the State's EIS indicates that too much storage would be exhausted at this level, so flows in the range of 300 cfs are more achievable. This will provide connection to additional side channels, where recent efforts are connecting side channels at 200 cfs. Periodic pulses are desired to mimic natural flow conditions. Integrate with floodplain restoration efforts.

SPECIES AND LIFE STAGES BENEFITTED:

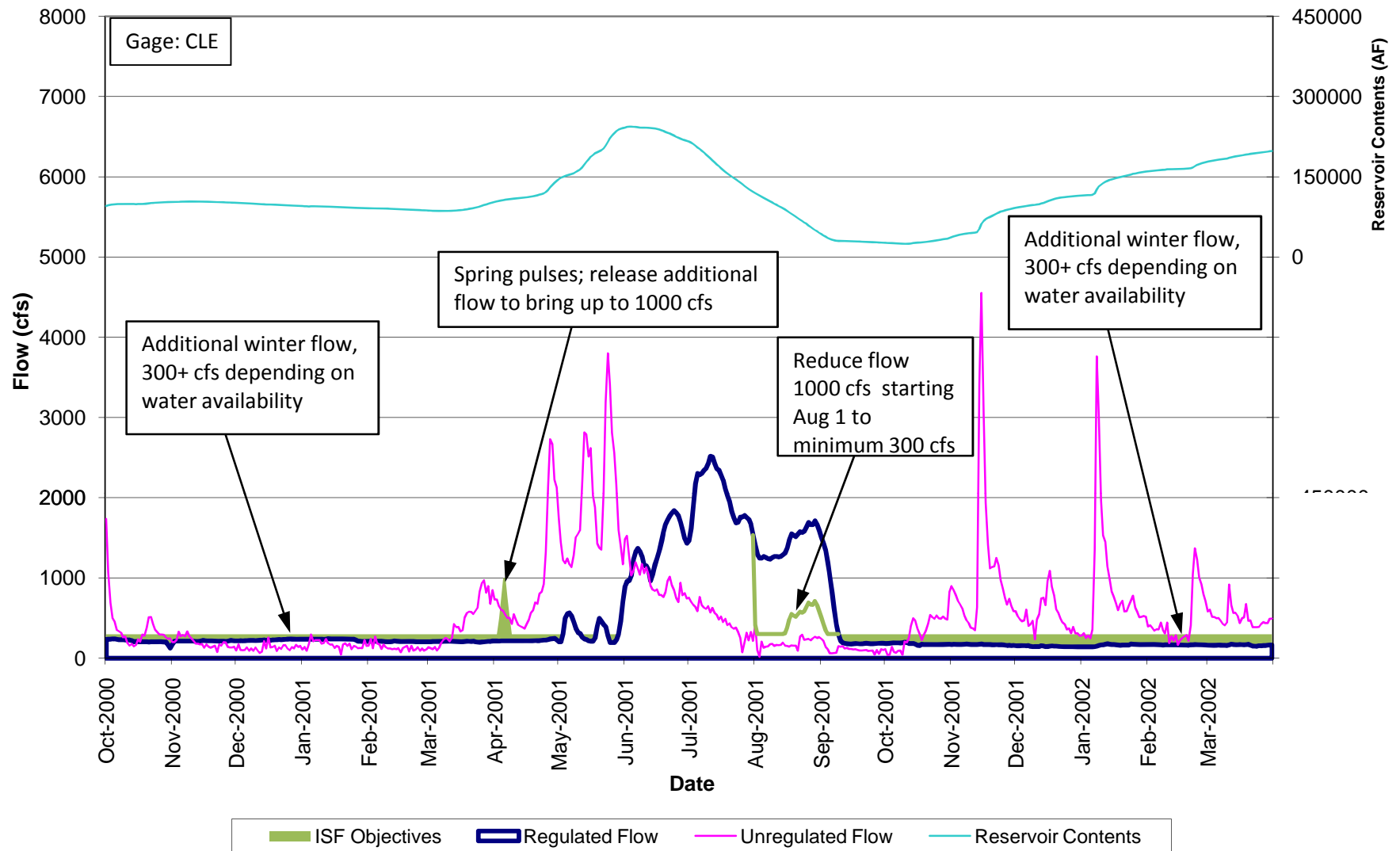
Spring Chinook: juvenile rearing; juvenile overwintering

Steelhead: juvenile rearing; juvenile overwintering

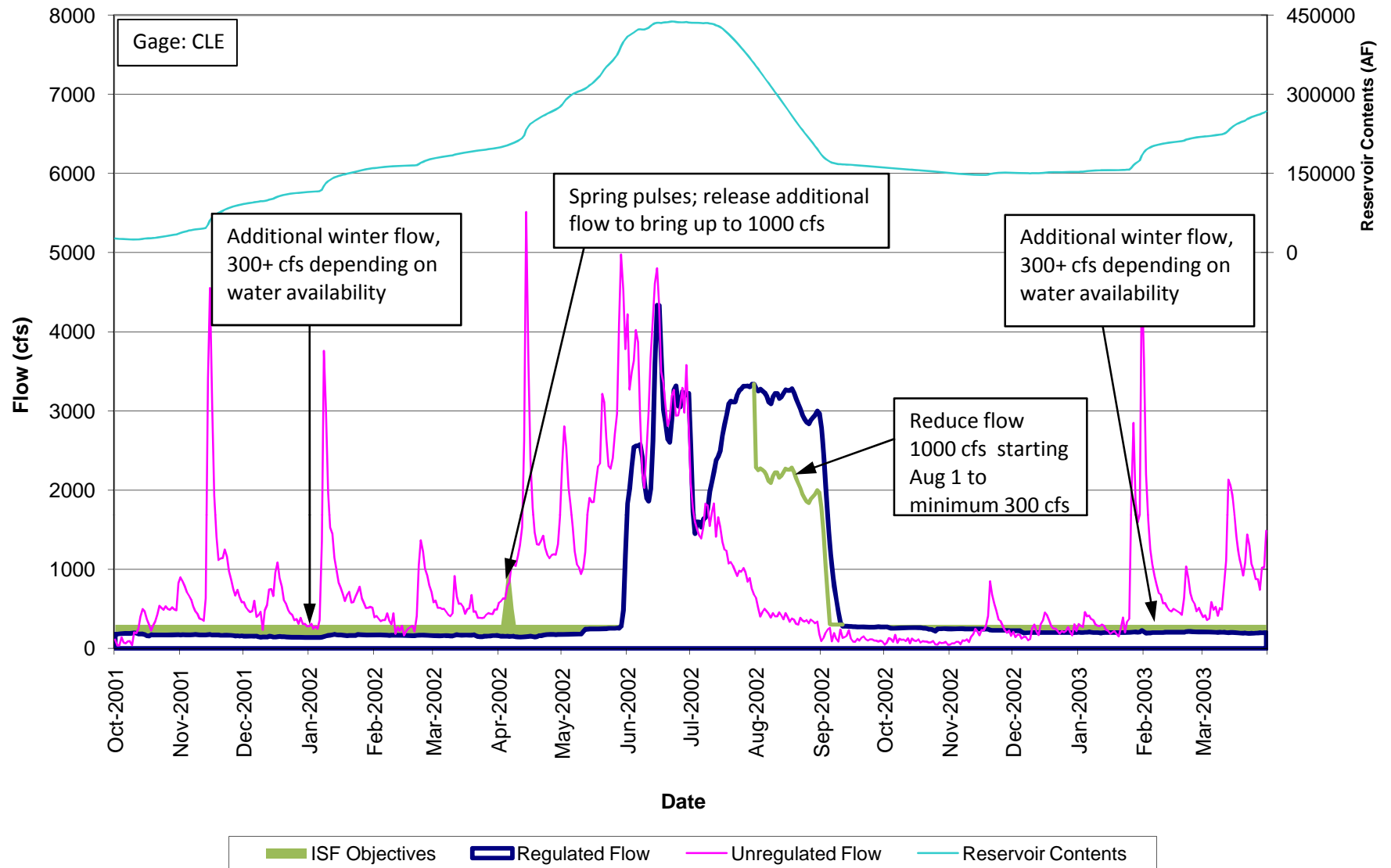
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are the Wymer Reservoir and other possible storage proposals (Kachess Inactive Storage, Bumping, Cle Elum pool raise, etc). The hydrologic model will test the capability of these elements to meet the reach flow objectives. In general, water will be released from Cle Elum Dam during fall and winter to provide additional instream flow. A flow objective of 500 cfs was stated; however the storage volume required to meet that objective is probably greater than available. The modeling will test a flow objective of 300 cfs at first. The released flow will need to be pumped back into Wymer Reservoir. During summer, storage will need to be conserved in Cle Elum reservoir to reduce flow by 1000 cfs in August. That flow will need to be released in fall and winter and stored in Wymer as described above. Pulse flows and flow variability are also desired. At least one pulse with a peak of 1000 cfs will be provided in April and the winter flow should be viewed as an average with variability around the mean flow.

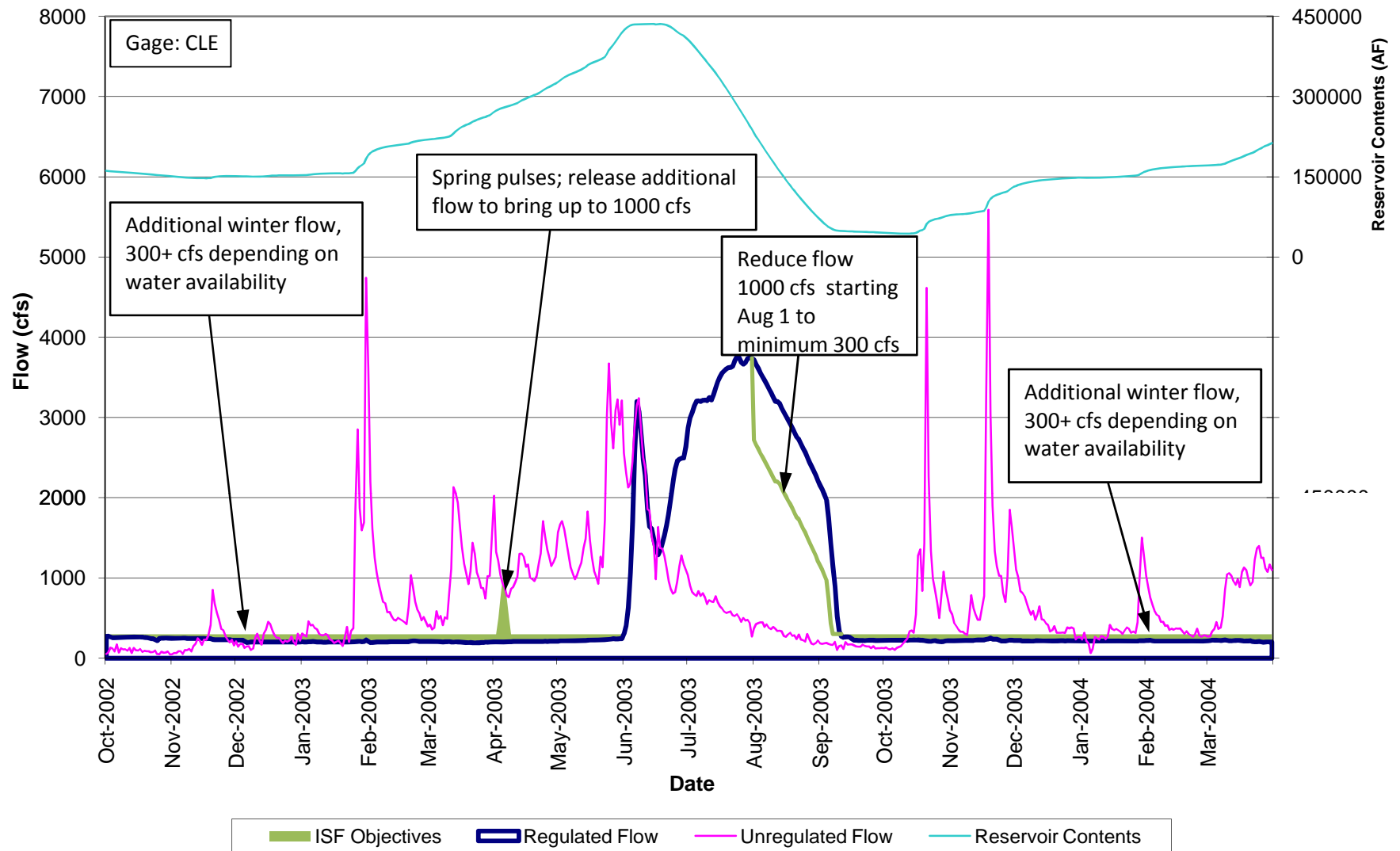
2001 Flow Data (Drought Year) - Cle Elum River



2002 Flow Data (Wet Year) - Cle Elum River



2003 Flow Data (Average Year) - Cle Elum River



REACH: YAKIMA RIVER, CLE ELUM TO TEANAWAY RIVER

REACH FLOW PROBLEM:

Summer flows are too high in August by as much as 3000 cfs. Lack of flow variation from September 10 through March limits access to side channels. This reach needs more periodic channel shaping flows (e.g., every five years or so).

REACH FLOW OBJECTIVE:

The summer objective and highest priority is to reduce flows from 4000 to 1000 cfs by late August to more closely mimic the unregulated hydrograph. Medium priorities include periodic pulses in winter to mimic natural flow conditions and channel shaping flow approximately every five years.

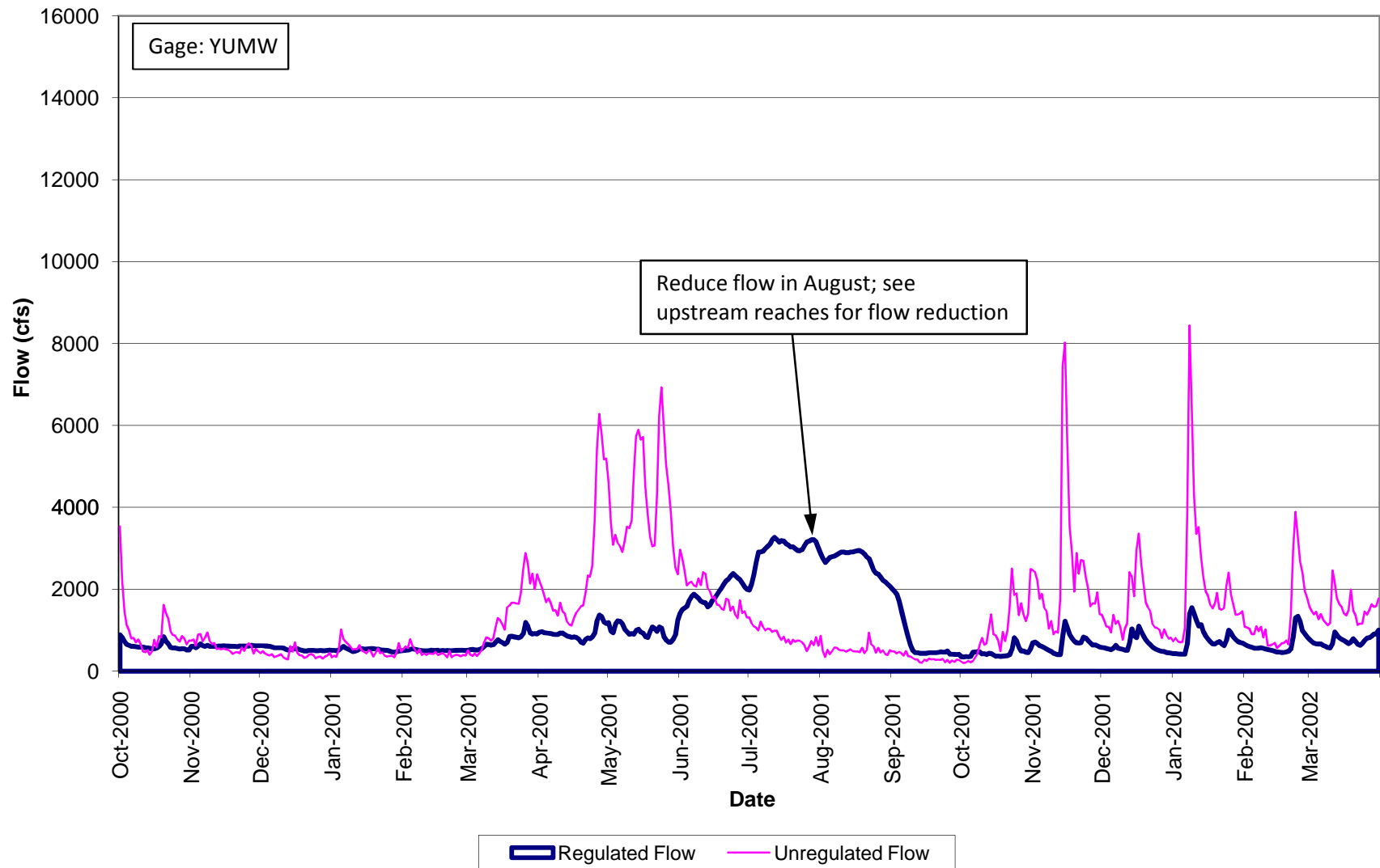
SPECIES AND LIFE STAGES BENEFITTED:

Spring Chinook: juvenile rearing; juvenile overwintering

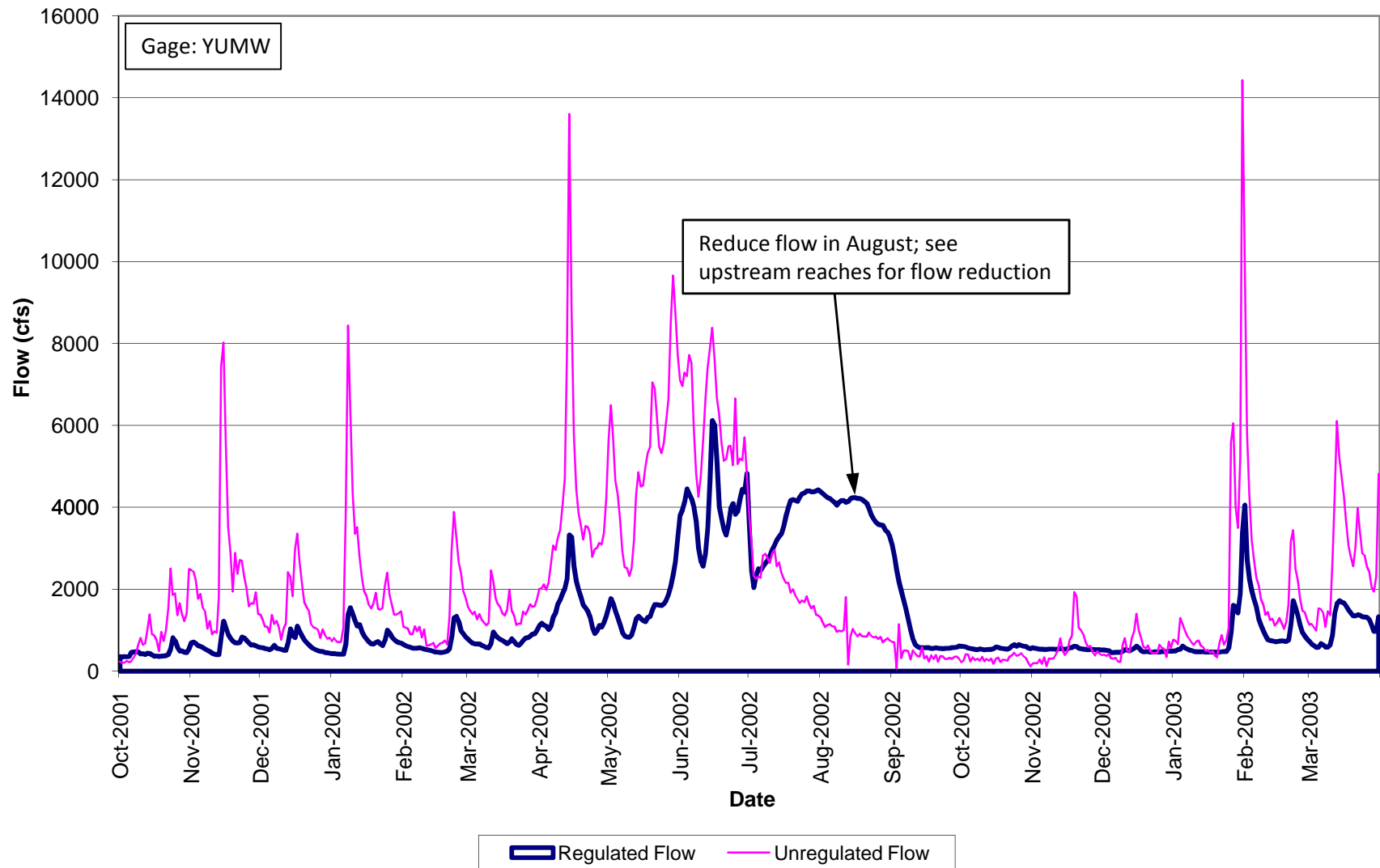
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are the Wymer Reservoir and other possible storage proposals downstream of this reach (Bumping, etc). Downstream reservoirs can release water to make up for desired flow reductions in August. New upstream reservoir projects such as Kachess Inactive Storage are important to allow earlier release of water and balance releases from the reservoir system. The hydrologic model will test the capability of these elements meeting the reach flow objectives. In summer, water releases would be reduced as much as possible during August to meet lower flow objectives. At first, the effect of reducing flow in the upper Yakima River and Cle Elum River will be reviewed to determine if those flow reductions result in a satisfactory flow in August in this reach. The flow will be decreased if possible (given the limits of storage and releases). To accomplish that, water will be conserved in Keechelus Reservoir during summer and that flow demand met through additional storage in Wymer or Bumping reservoirs. The water can be released the following winter to refill Wymer or Kachess.

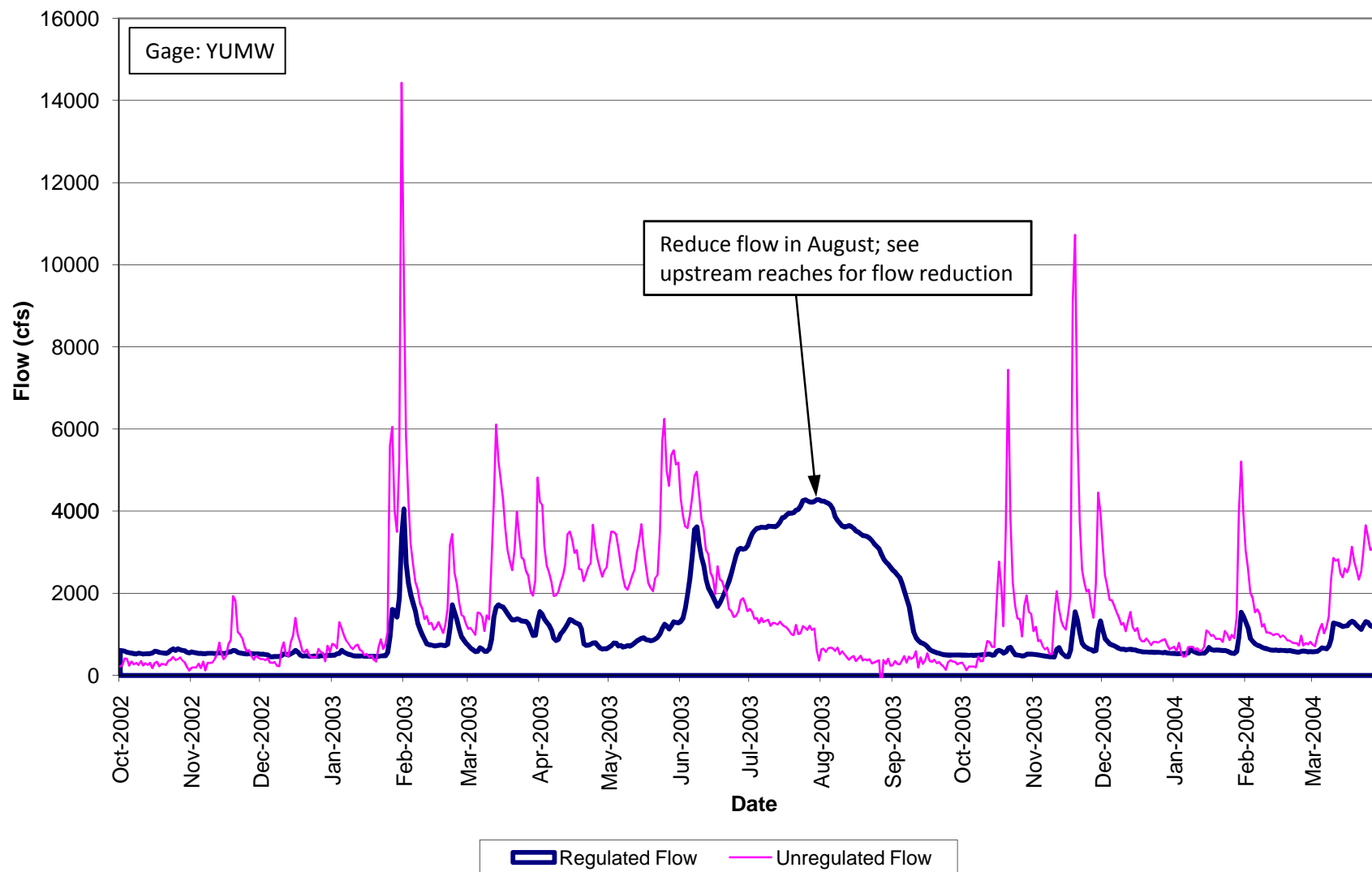
2001 Flow Data (Drought Year) - Yakima River, Cle Elum to Teanaway River Reach



2002 Flow Data (Wet Year) - Yakima River, Cle Elum to Teanaway River Reach



2003 Flow Data (Average Year) - Yakima River, Cle Elum to Teanaway River Reach



REACH: YAKIMA RIVER, TEANAWAY RIVER TO ROZA DAM

REACH FLOW PROBLEM:

Summer flows are too high in July and August. Tributary inflows help with flow variation and channel shaping flows but additional improvement is desired.

REACH FLOW OBJECTIVE:

The summer objective and highest priority is to reduce flows to more closely mimic the unregulated hydrograph. Periodic pulses in winter are desired to mimic natural flow conditions, along with channel shaping flows.

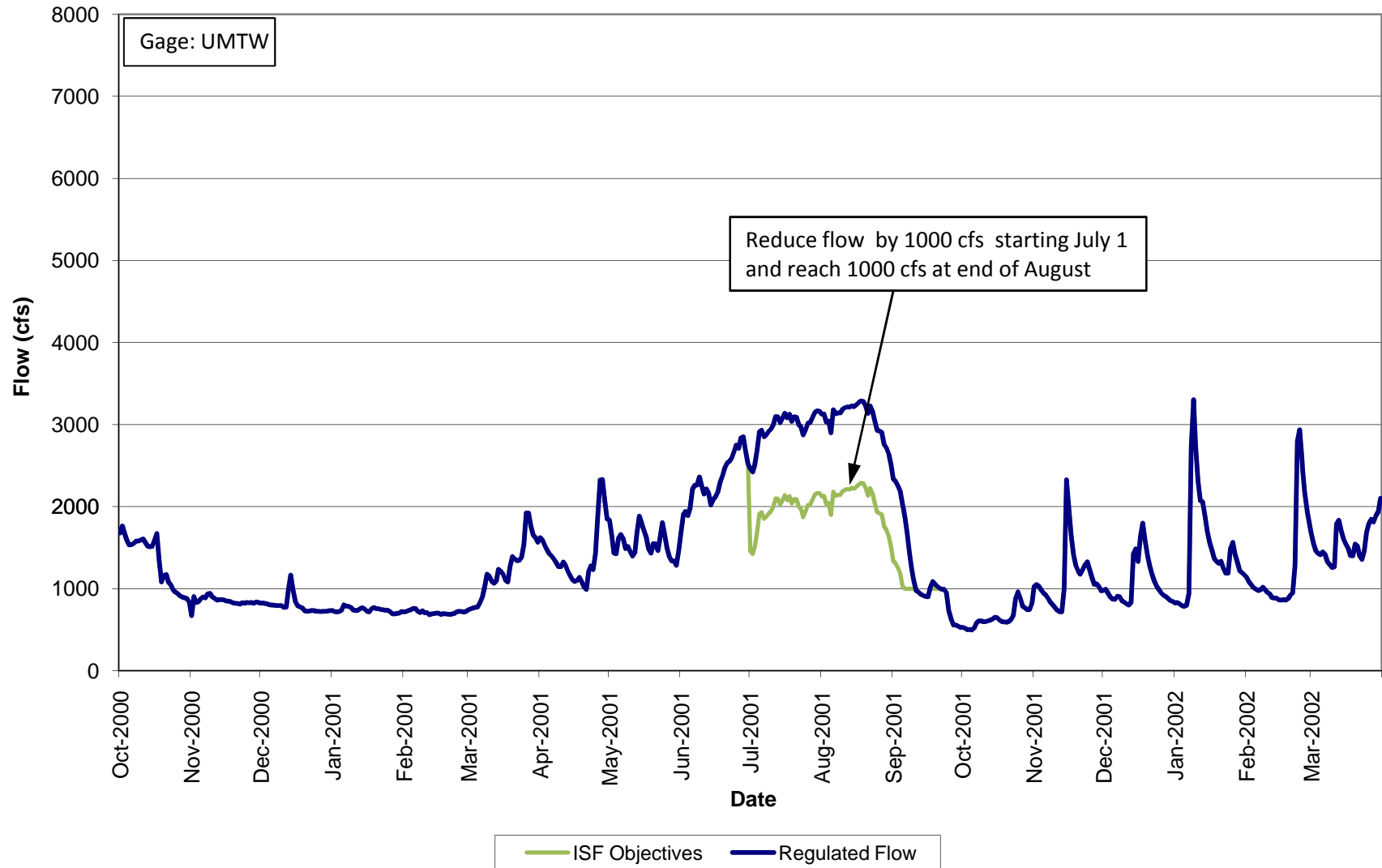
SPECIES AND LIFE STAGES BENEFITTED:

Spring Chinook: juvenile rearing

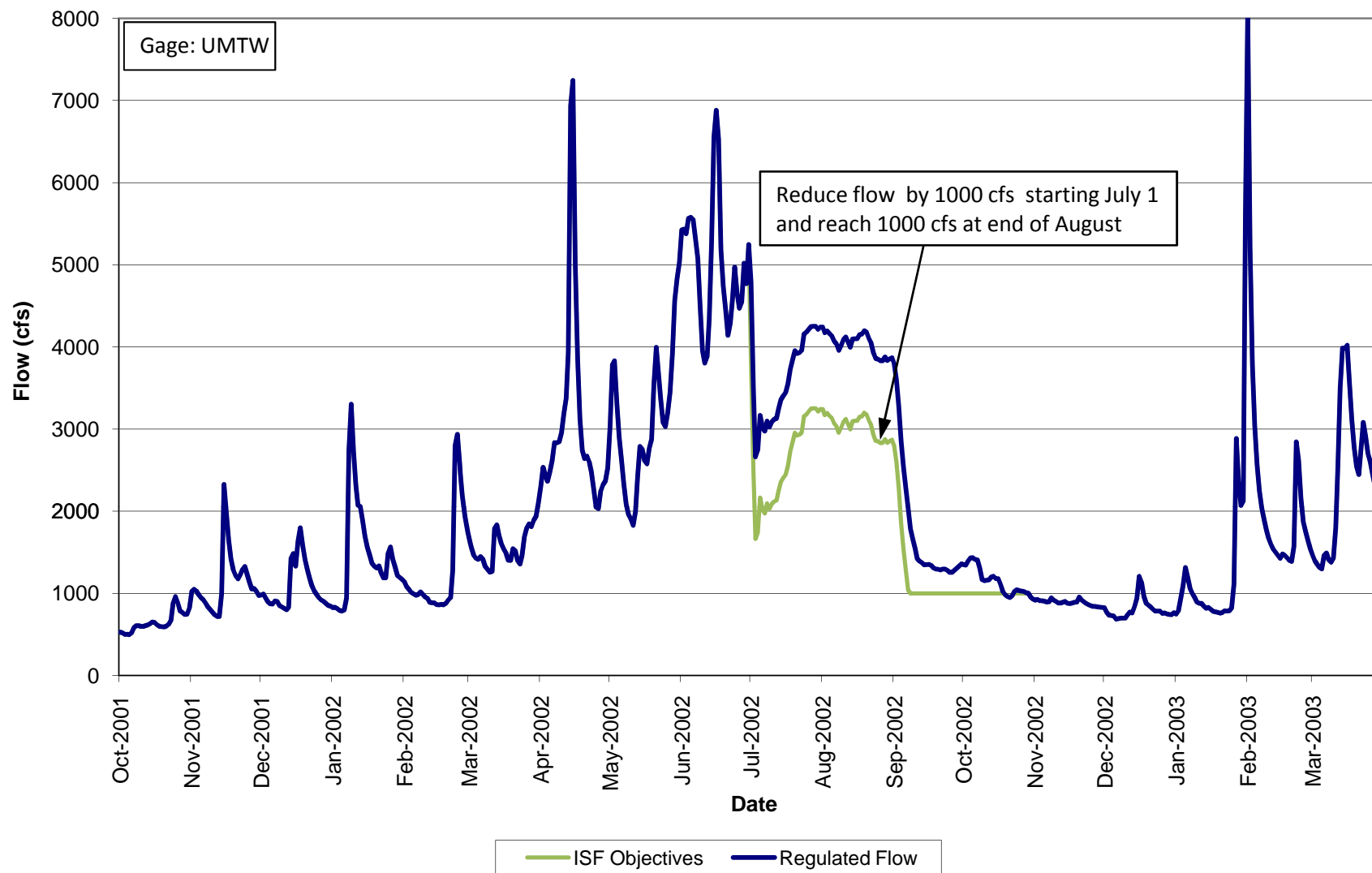
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are the Thorp Pump Station and feed to Wymer Reservoir, and other possible storage proposals downstream of this reach (Bumping, etc). Downstream reservoirs can release water to make up for desired flow reductions in August. New upstream reservoir projects such as Kachess Inactive Storage are important to allow earlier release of water and balance releases from the reservoir system. The hydrologic model will test the capability of these elements meeting the reach flow objectives. In summer water releases would be reduced as much as possible during August to meet lower flow objectives. A flow reduction will be obtained by other August flow reduction efforts performed for upstream reaches combined with pumping 1000 cfs at Thorp into the KRD North Branch Canal and Wymer Reservoir. The August flow in this reach will be decreased as much as possible (given the limits of storage and releases and the capacity of the Thorp Pump Station). To accomplish that, water will be conserved in Keechelus, Kachess and Cle Elum reservoirs during summer and that flow demand met through additional storage in Wymer or Bumping reservoirs. The water can be released the following winter to refill Wymer or Kachess.

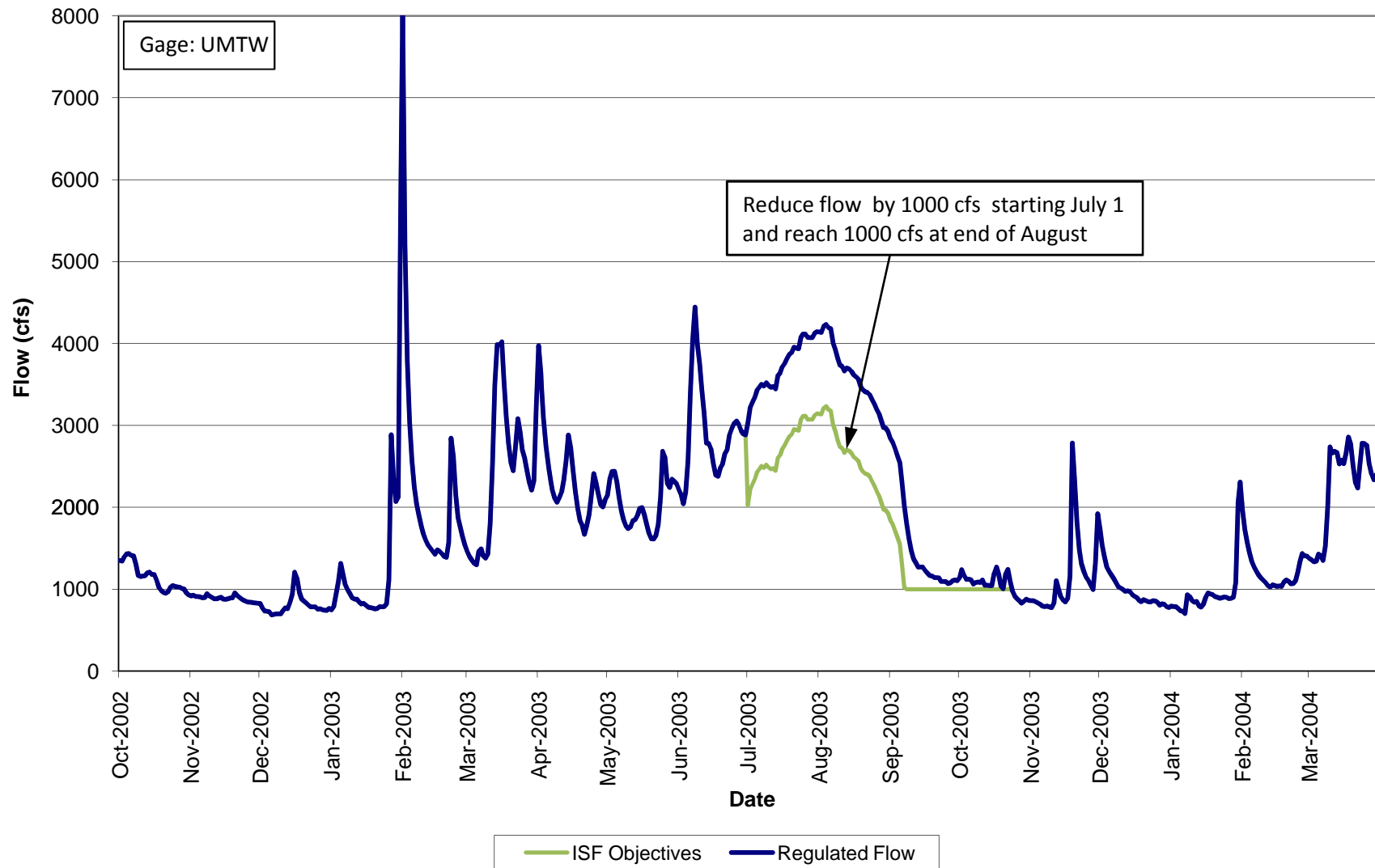
2001 Flow Data (Drought Year) - Yakima River, Ellensburg Reach



2002 Flow Data (Wet Year) - Yakima River, Ellensburg Reach



2003 Flow Data (Average Year) - Yakima River, Ellensburg Reach



REACH: YAKIMA RIVER, ROZA DAM TO NACHES RIVER

REACH FLOW PROBLEM:

Need additional spring outmigration flow (March to May). In fall and winter, sufficient flow needed to support fish movement to lower river, and for spawning and rearing.

REACH FLOW OBJECTIVE:

The spring objective is to increase flows to approximately 1400 cfs, and in the fall and winter increase flows to between 1000 and 1400 cfs. Both are high priority. The choice of flows needs to be coordinated with floodplain restoration efforts.

SPECIES AND LIFE STAGES BENEFITTED:

Spring Chinook: smolt outmigrants; juvenile overwintering

Coho: smolt outmigrants

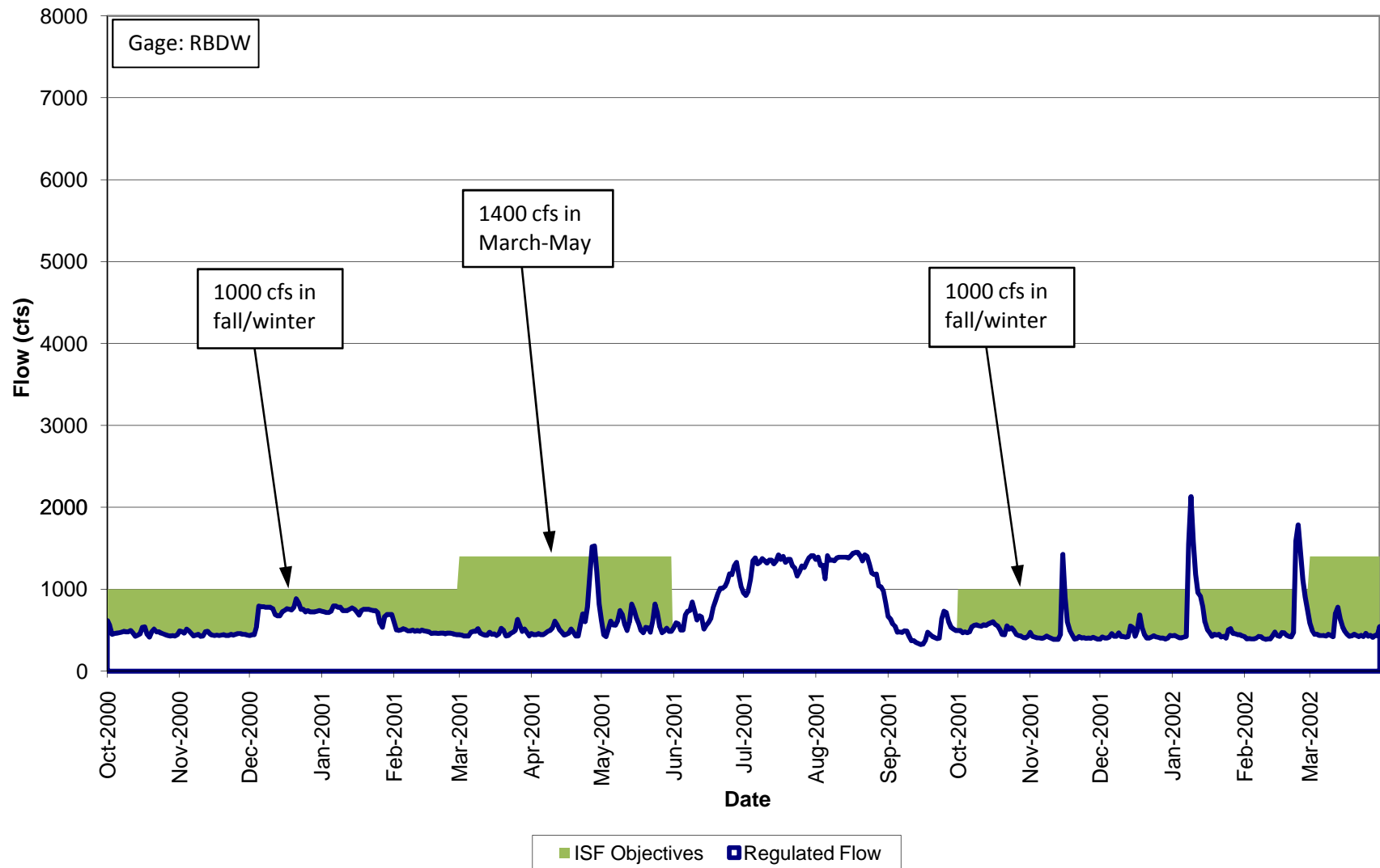
Steelhead: smolt outmigrants.

HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

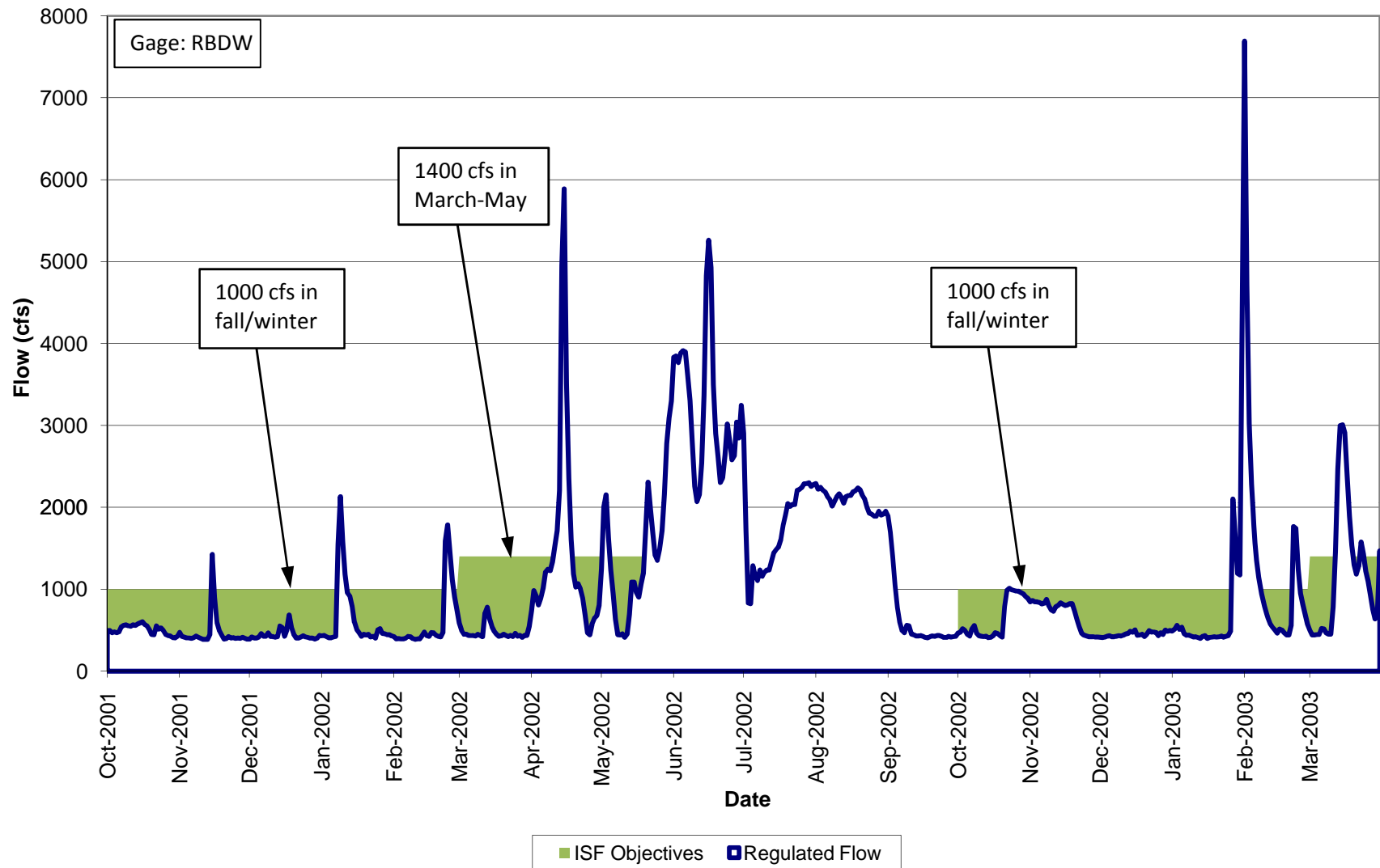
With the Integrated Plan, the projects that would help achieve the reach flow objectives are the Wymer Reservoir and other possible storage proposals (Kachess Inactive Storage, Cle Elum pool raise, etc), Roza hydropower subordination, and even Roza dam removal if an alternate supply source is developed.

In general, water will be released from upper Yakima River basin reservoirs to increase instream flow. However it is likely a conflict between storing winter flow releases in Wymer and increasing instream flow in this reach will occur and the hydrologic modeling will likely determine that Wymer Reservoir would not fill with increased flow bypassing the reservoir through this reach.

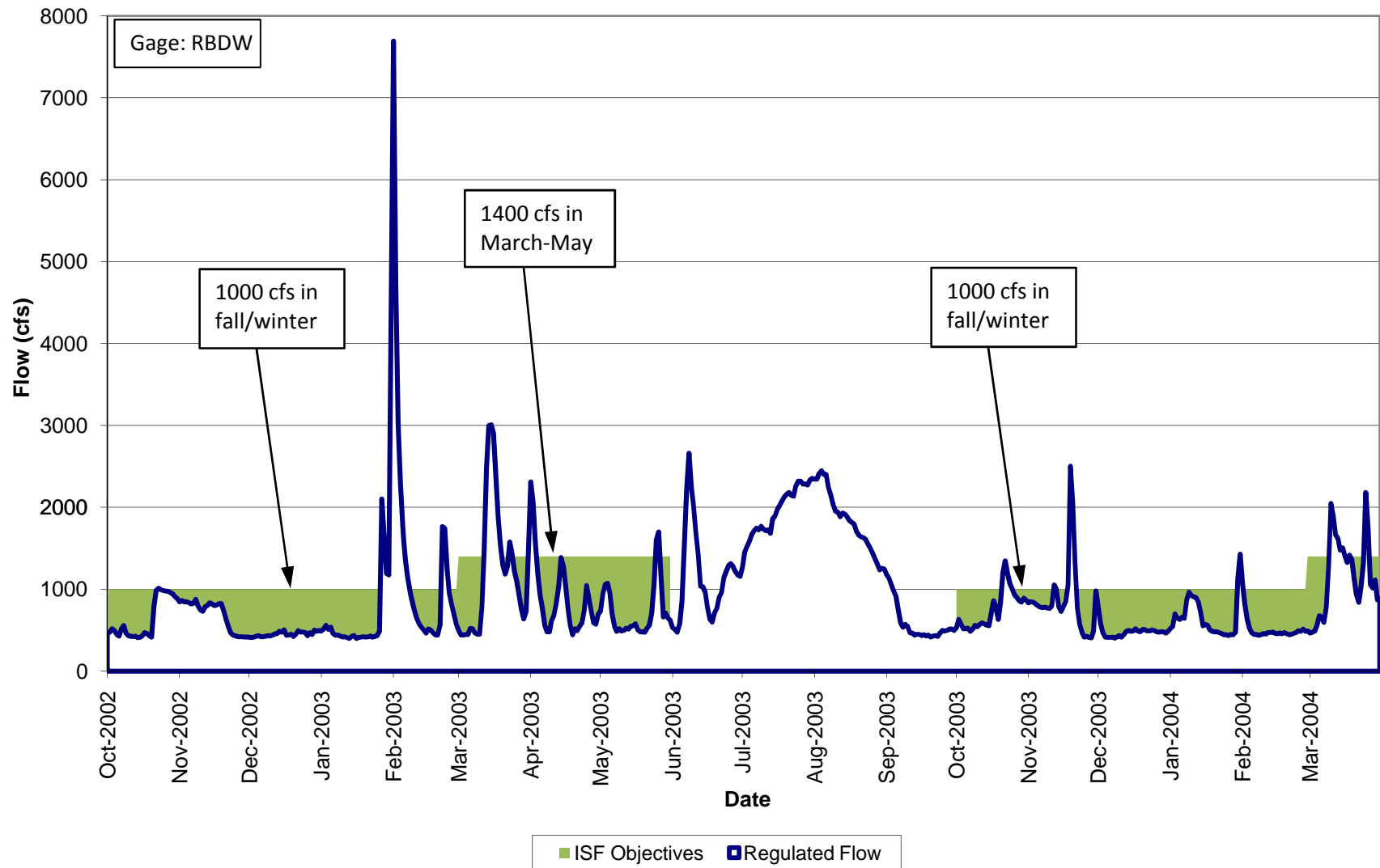
2001 Flow Data (Drought Year) - Yakima River, Roza to Naches Reach



2002 Flow Data (Wet Year) - Yakima River, Roza to Naches Reach



2003 Flow Data (Average Year) - Yakima River, Roza to Naches Reach



REACH: TIETON RIVER

REACH FLOW PROBLEM:

Low winter flows (75 – 120 cfs) and limited variation November to March. Also have high flows in September due to flip-flop operations

REACH FLOW OBJECTIVE:

The winter objective, and high priority, is to increase flows to approximately 125 cfs. In September at the beginning and end of flip-flop operations, reduce flows as much as possible.

SPECIES AND LIFE STAGES BENEFITTED:

Spring Chinook: juvenile rearing; juvenile overwintering

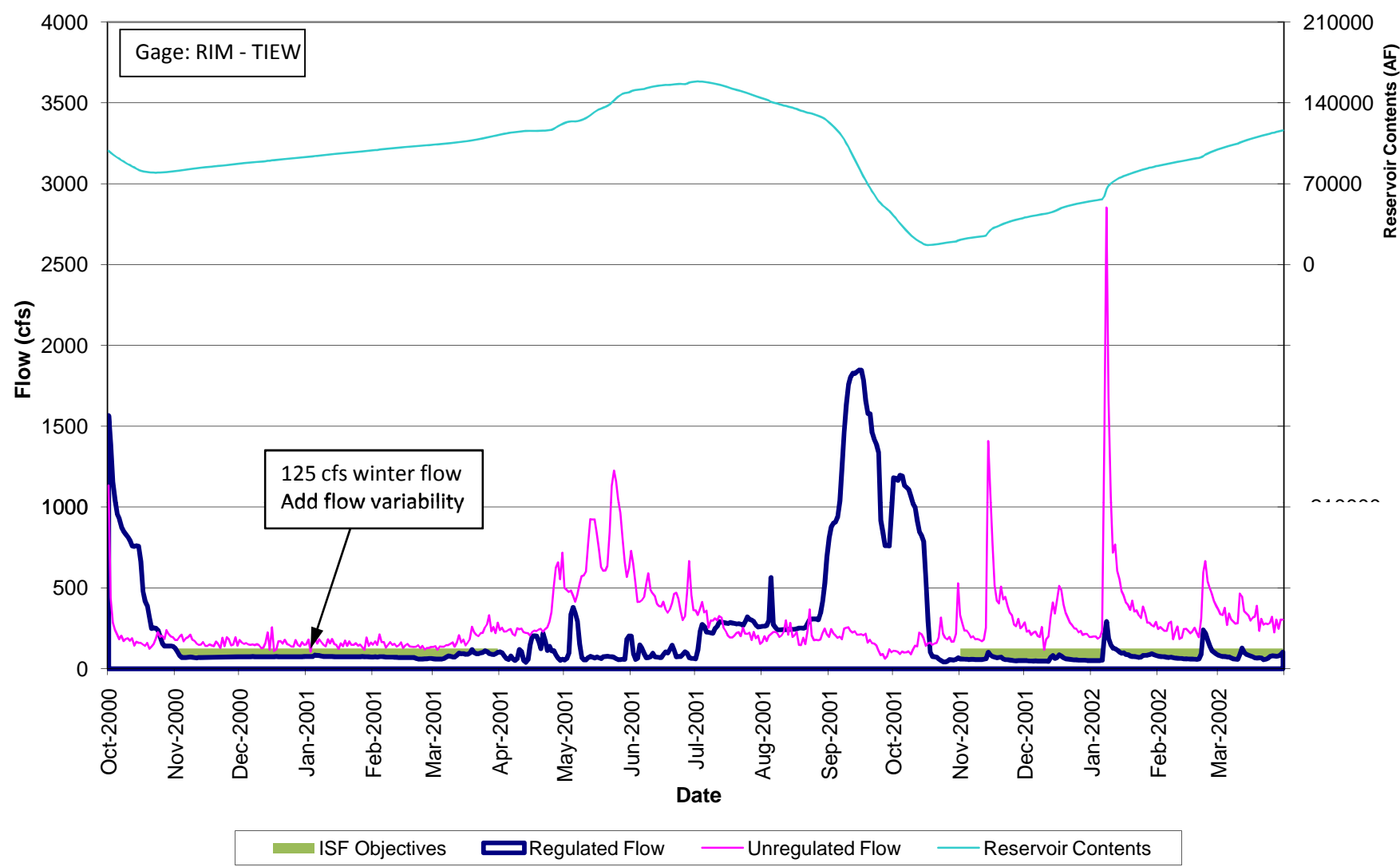
Steelhead: juvenile rearing; juvenile overwintering

Bull trout: juvenile rearing

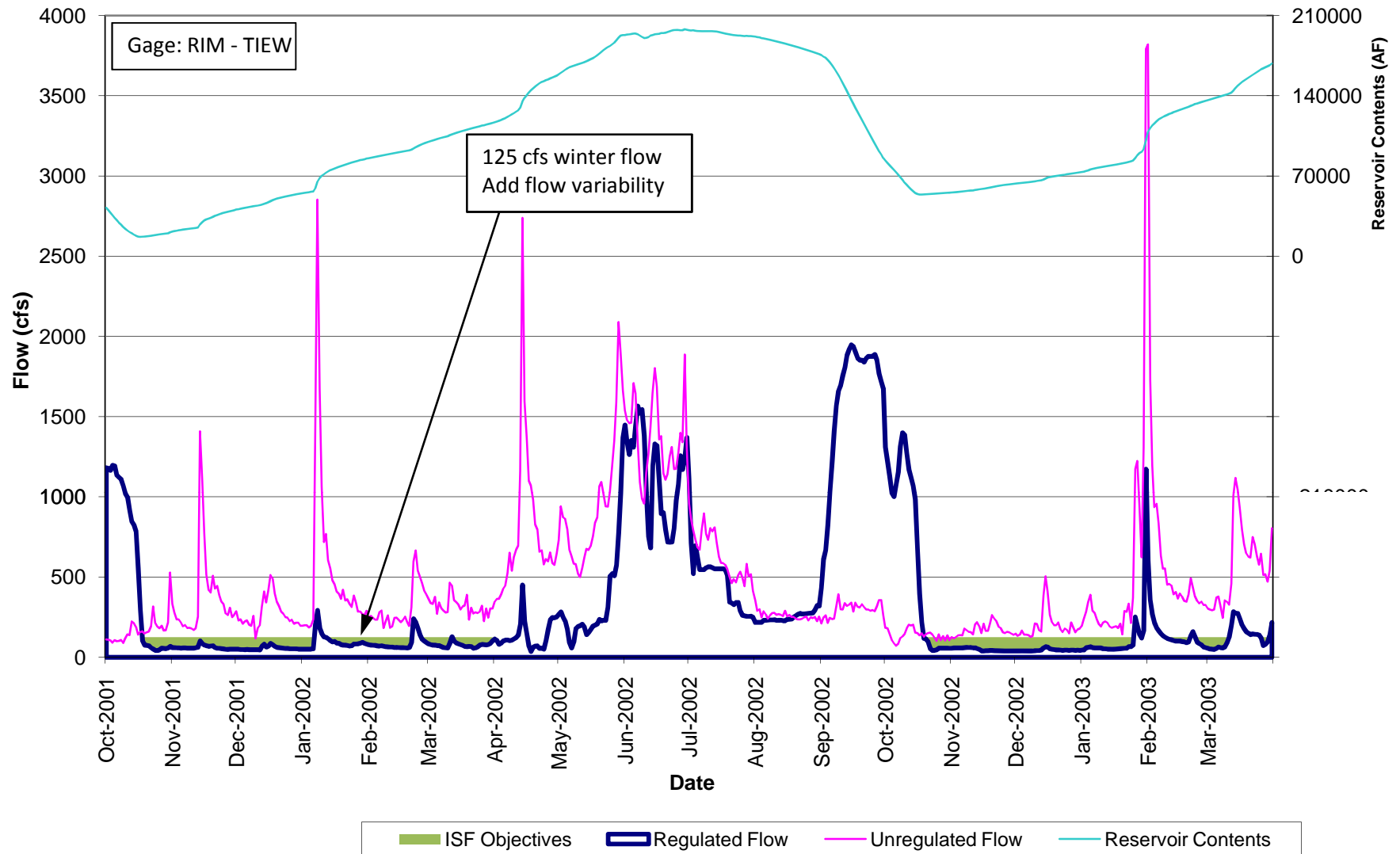
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are additional storage at Bumping Dam to allow additional flow to be released from Rimrock Reservoir in winter and operational improvements to adjust the rate of flow change. The South Fork fish passage project is also needed to allow flexibility in Rimrock reservoir operations.

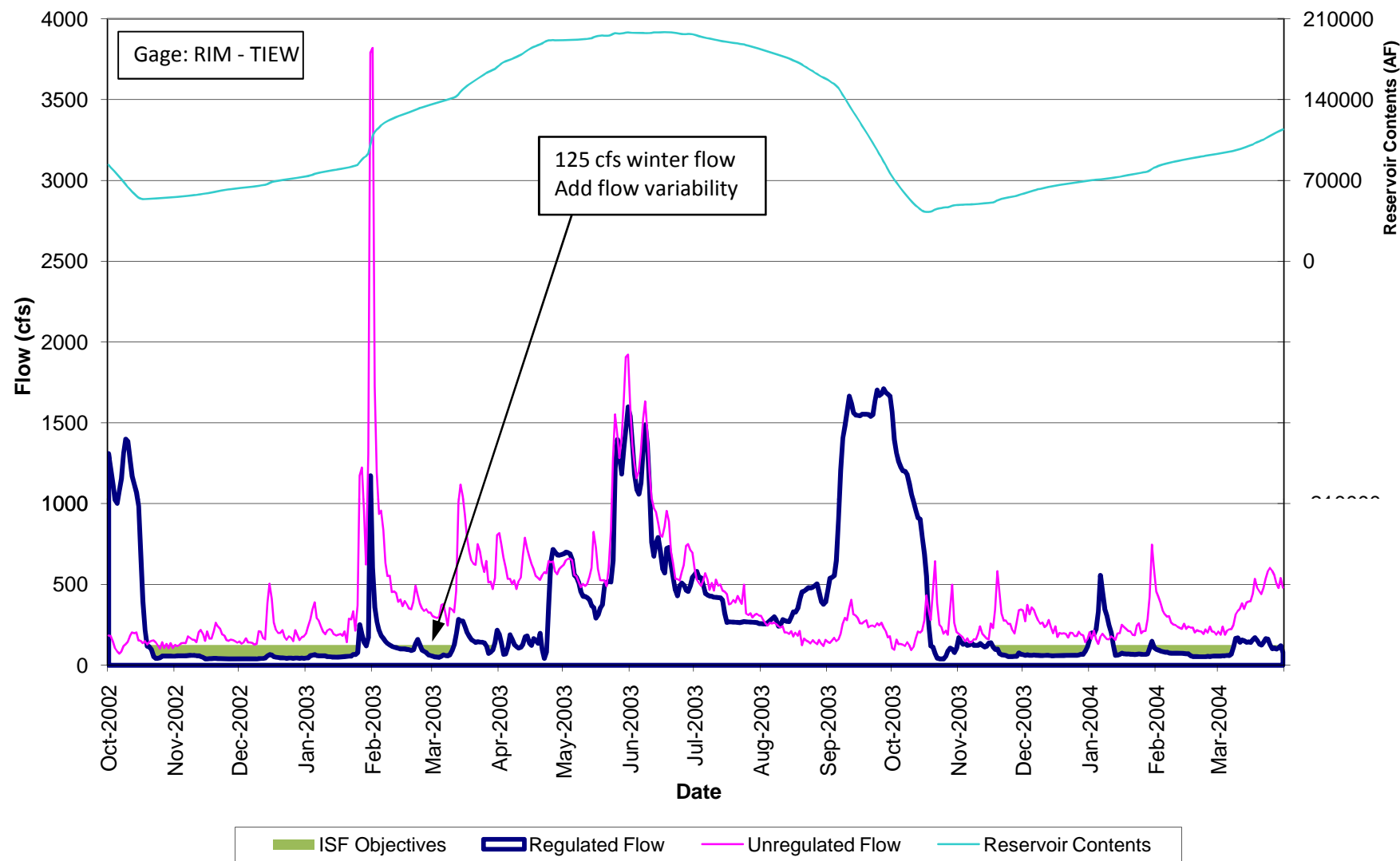
2001 Flow Data (Drought Year) - Tieton River Reach



2002 Flow Data (Wet Year) - Tieton River Reach



2003 Flow Data (Average Year) - Tieton River Reach



REACH: LOWER NACHES RIVER

REACH FLOW PROBLEM:

Summer flows are low. Ramping rate from high spring flows to summer flows is abrupt, affecting rearing for steelhead, coho and spring Chinook. Up to 50% of flow in river is lost to groundwater in lower parts of this reach.

REACH FLOW OBJECTIVE:

Change to more graduated ramping rate from spring to summer. Increase summer low flow to 550 cfs. Reduce fall flows as much as possible, look at releasing more in summer and reducing flip flop. Integrate habitat needs with flow management regime. All those flow objectives are high priority.

SPECIES AND LIFE STAGES BENEFITTED:

Spring Chinook: juvenile rearing

Steelhead: juvenile rearing

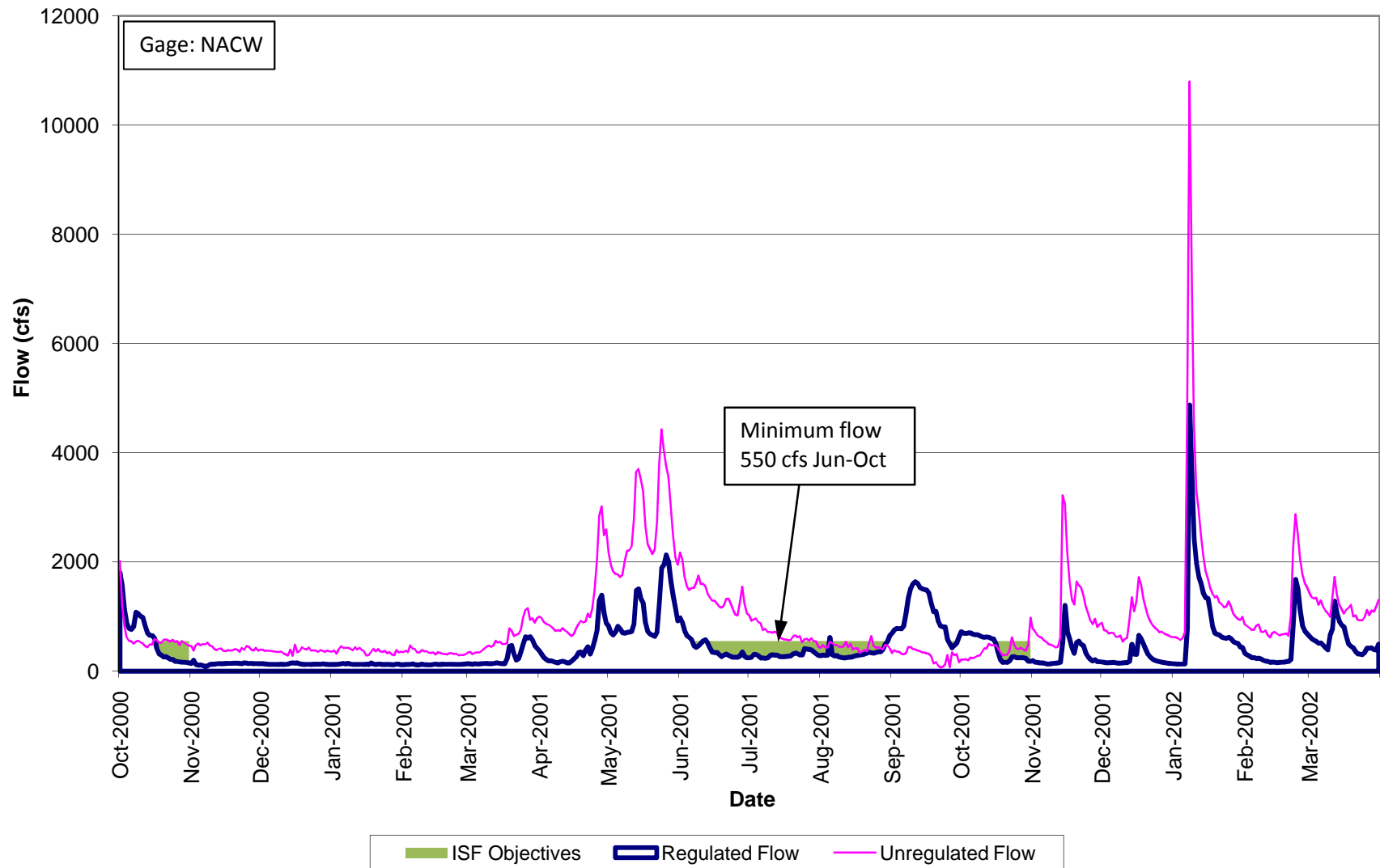
Coho: juvenile rearing

HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

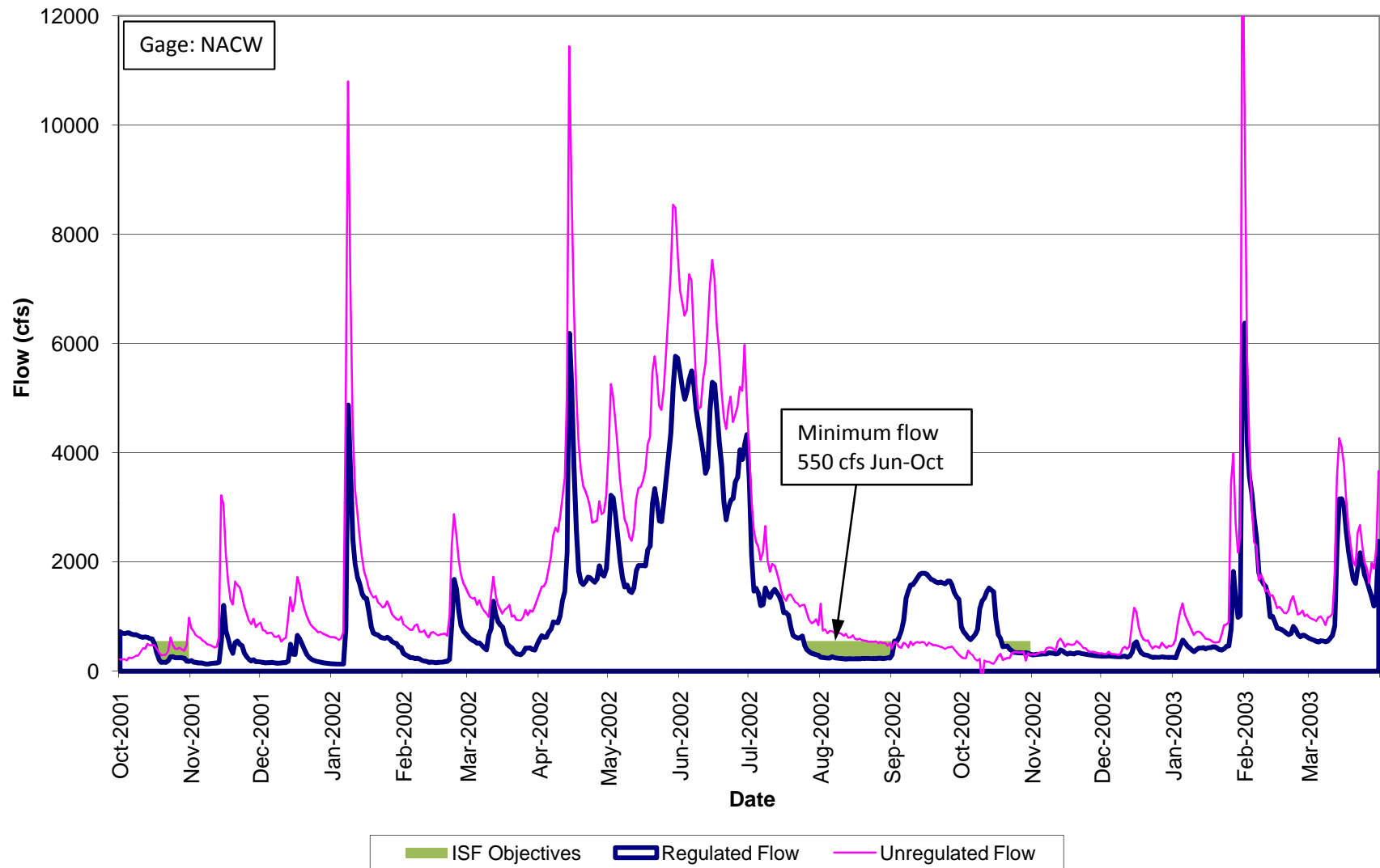
With the Integrated Plan, the projects that would help achieve the reach flow objectives are additional storage in Bumping Reservoir, water conservation and operational improvements.

At the same time summer flows are being reduced in the Upper Yakima River reaches, summer flows will be increased in the Naches River through releases from Bumping Reservoir. Wymer Reservoir releases will need to make up the difference in flow between reductions in upper Yakima River reaches and increased flow in the Naches River. Water conservation projects in the Naches River basin and in the Yakima River basin below Parker will also increase instream flow.

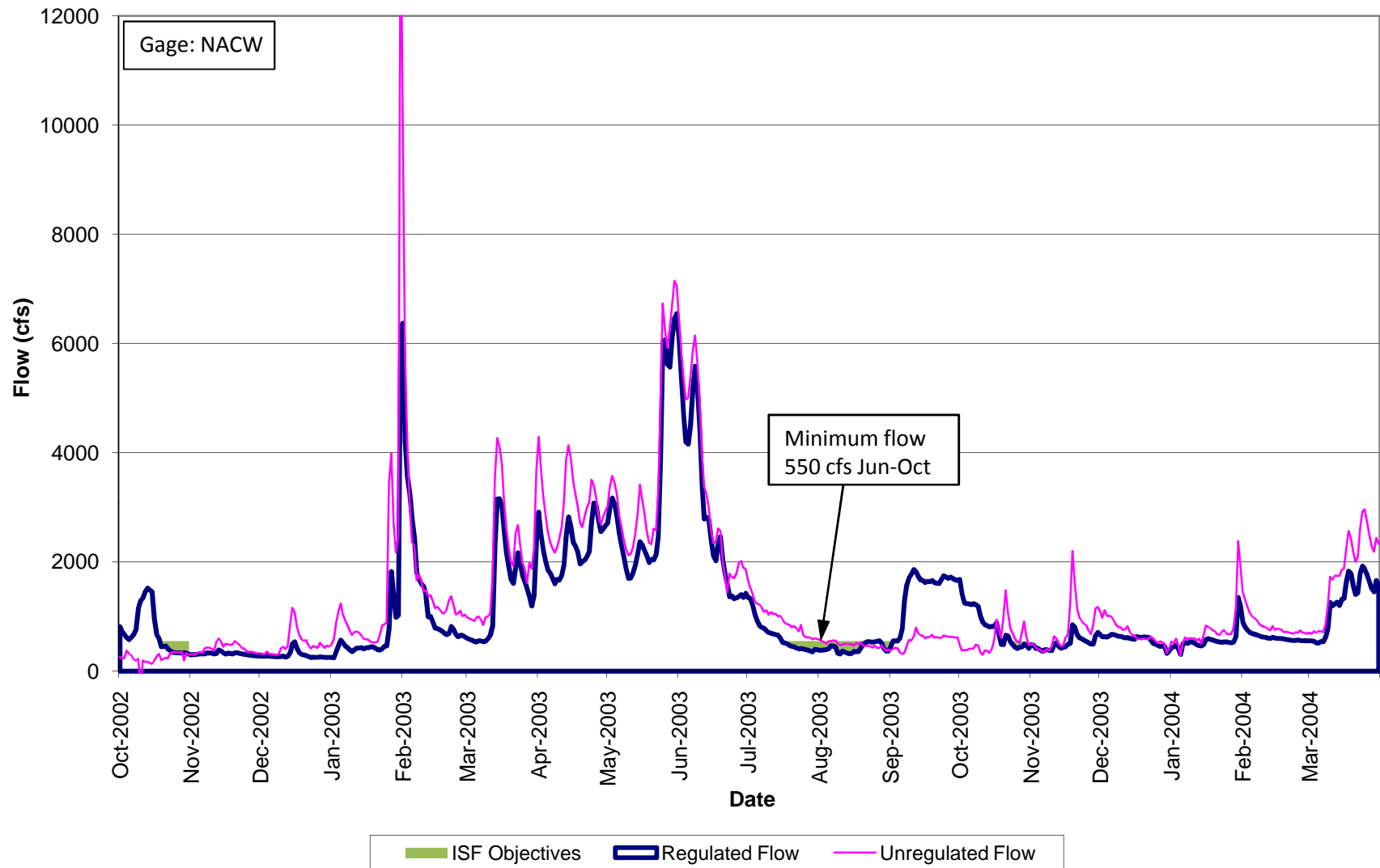
2001 Flow Data (Drought Year) - Lower Naches River Reach



2002 Flow Data (Wet Year) - Lower Naches River Reach



2003 Flow Data (Average Year) - Lower Naches River Reach



REACH: YAKIMA RIVER, FROM PARKER TO TOPPENISH CREEK (WAPATO REACH)

REACH FLOW PROBLEM:

Need additional spring outmigration flow, particularly during dry years.

REACH FLOW OBJECTIVE:

The spring objective is to increase available water to support outmigration (15,000 – 20,000 acre-feet). A pulse flow with a 2-day peak of 1,200 cfs additional flow in the Yakima River would use about 15,000 acre-feet, including the flow required to ramp up and ramp down from the peak.

SPECIES AND LIFE STAGES BENEFITTED:

Fall Chinook: juvenile rearing; smolt outmigration

Spring Chinook: smolt outmigration;

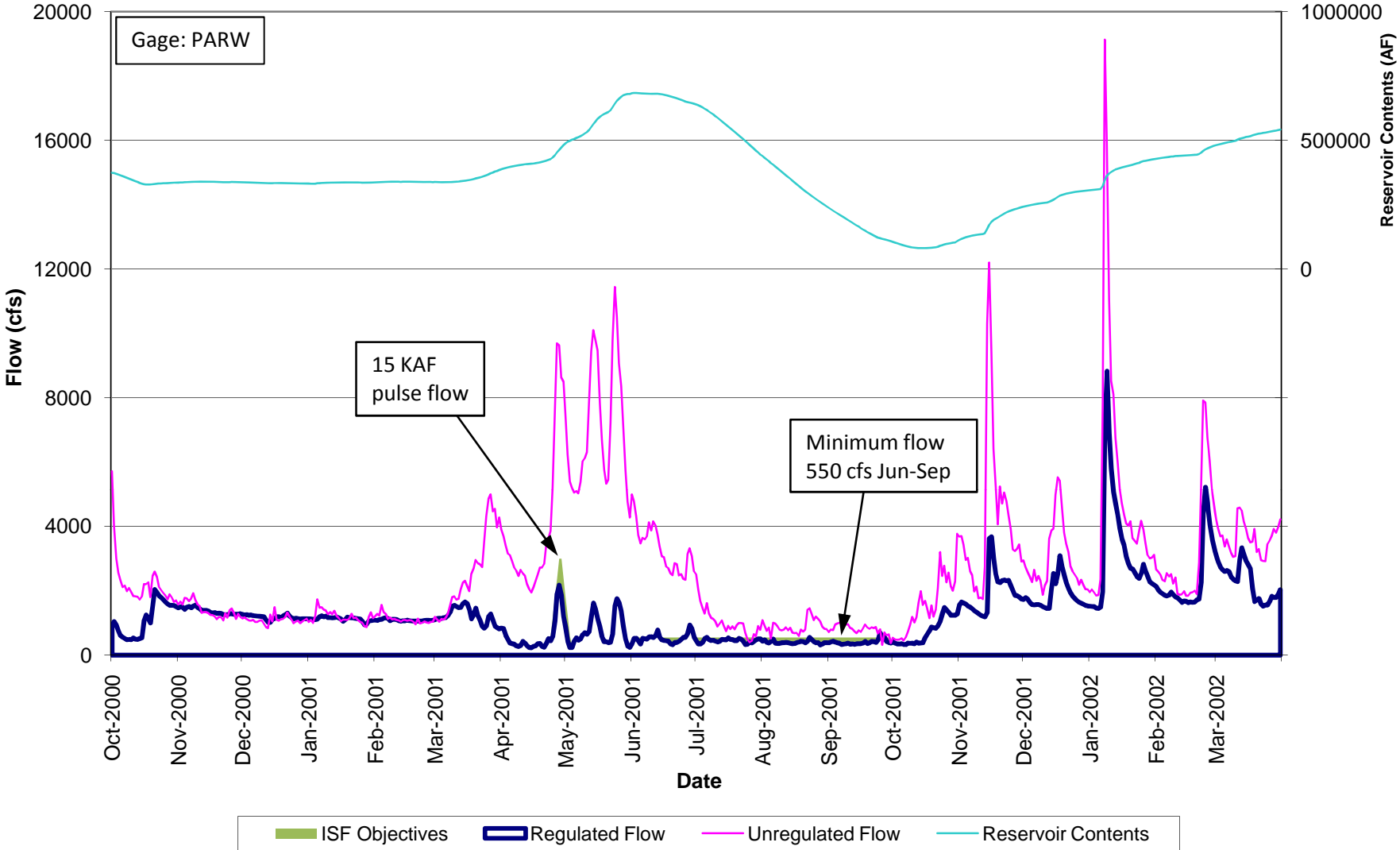
Steelhead: smolt outmigration

Coho: juvenile rearing; smolt outmigration

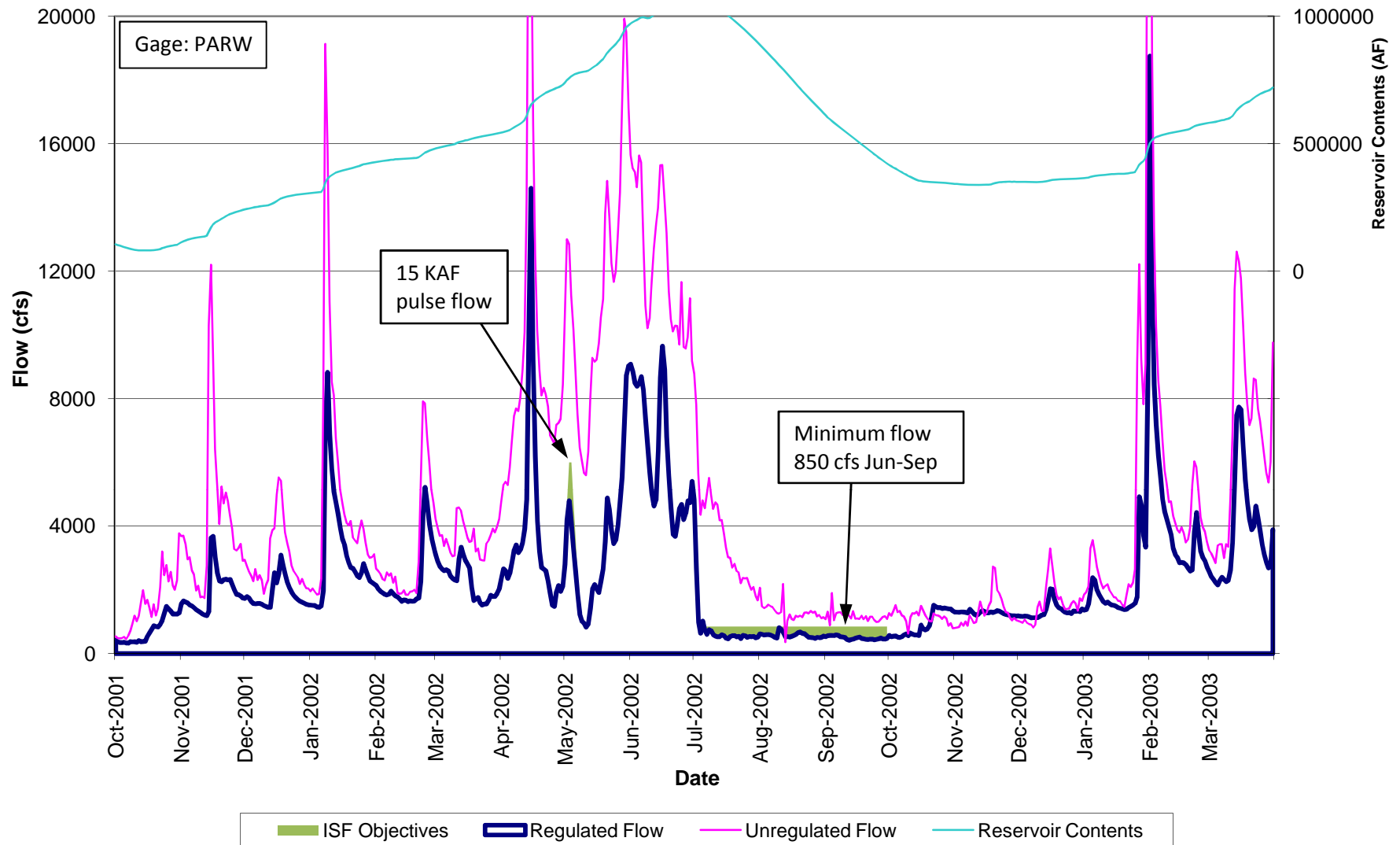
HOW WILL YAKIMA PROJECT BE OPERATED TO ACHIEVE FLOW OBJECTIVE?

With the Integrated Plan, the projects that would help achieve the reach flow objectives are primarily water conservation, with Wymer Reservoir, Kachess Inactive Storage, Bumping Reservoir and Cle Elum pool raise also possibly providing flow.

2001 Flow Data (Drought Year) - Yakima River, Parker to Toppenish Reach



2002 Flow Data (Wet Year) - Yakima River, Parker to Toppenish Reach



2003 Flow Data (Average Year) - Yakima River, Parker to Toppenish Reach

