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August 24, 2006

Mr. David Schiltgen
County of Sonoma
Permit and Resource Management Department
2550 Ventura Avenue
Santa Rosa, CA 95403

RE: Russian River Scientific Review Committee

Dear Mr. Schiltgen:

The Scientific Review Committee (SRC) is pleased to provide its recommendations regarding Syar Industries, Inc. proposed mining for Bars 2 and 13 in the Middle Reach of the Russian River. The SRC recommendations incorporate a number of measures intended to reduce the potential adverse impacts of mining on channel morphology, riparian habitat, and fisheries and aquatic habitat. These measures are suggested in addition to the measures outlined in Syar's Mining and Reclamation plan, their 1997 Supplemental EIR, and NOAA Fisheries Biological Opinion prepared for the US Army Corps of Engineers 404 permit for mining in 2001. The SRC is providing their recommendations to Sonoma County PRMD and to the following resource agencies:

- NOAA Fisheries
- US Army Corps of Engineers
- Regional Water Quality Control Board
- California Department of Fish and Game

Based on our discussion with John Perry, we anticipate that Syar Industries, Inc. will be revising their 2006 mining plan to incorporate the SRC recommendations listed in this report.

We note that in June 2005, the ESA status of Central California Coast coho salmon was changed from threatened to endangered (70 FR 37160, 6/28/05). This change in status may require re-consultation with NOAA Fisheries (Daugherty pers. comm.), but that decision is outside the purview of the SRC. In their 2001 Biological Opinion, NOAA Fisheries indicated that this species was unlikely to occur in the project area at any time. Coho are generally thought to inhabit tributary streams further downstream on the Russian River, although they may use Dry Creek, which is upstream of Bar 13. Few individuals are thought to use the upper portions of the Russian River or its tributaries.

The SRC will be proceeding with its annual review and analysis of the monitoring data, to be prepared as a separate annual monitoring report (AMR), during fall 2006 (Task "B"). The AMR is to include evaluation of the adequacy of the performance criteria and standards, adequacy of the monitoring program, and review of monitoring data to

determine conditions and trends in the Middle Reach and vested mining area. The AMR will review the previous year's decisions regarding gravel production, and provide recommendations regarding the next year's production limits, areas of activity, and any other requirements necessary to more effectively avoid adverse impacts and balance river management goals.

We look forward to discussing our findings with you and the resource agencies. Please call me at (707) 833-2687 with any comments and questions.

Thank you for this opportunity to assist PRMD.

Sincerely,

Mitchell Katzel
Senior Geomorphologist

cc: John Perry, Syar Inc.
Brian Clure, NOAA Fisheries
David Hines, NOAA Fisheries
Tom Daugherty, NOAA Fisheries
Bill Cox, DFG
Mr. Peter Straub, US Army Corps of Engineers
John Short, RWQCB
Steve Bargsten, RWQCB

Scientific Review Committee Responsibilities

The purpose of the SRC was established by the State Mining and Geology Board (SMGB) as lead agency under the California Environmental Quality Act and National Environmental Policy Act to assess the impacts of the mining and reclamation activities proposed by Syar Industries, Inc. (Syar) on its vested instream mining sites in the Middle Reach of the Russian River (State Mine ID# 91-49-0028). The SRC is to provide objective, science-based analysis, recommendations, and peer review of Syar's annual mining and reclamation plans. Syar is to revise the annual mining and reclamation plan, if necessary, to meet the requirements of other agencies and to incorporate the recommendations of the SRC to help assure that adverse environmental impacts are minimized and performance standards are met. Sonoma County Permit and Resource Management Department (PRMD) will allow Syar to implement the mining and reclamation plans once it determines that they are consistent with the SRC recommendations and the SMGB approval and, Syar has satisfied the Conditions of Approval for the project.

The duties of the SRC, identified under the Mitigation Monitoring Plan, include the following:

(1) *Annual review of mining and reclamation plan proposals.* The SRC is to review past monitoring results and current river conditions to determine whether the mining plan conforms with the reclamation plan mining standards, environmental mitigations, and can be expected to meet adopted performance criteria. The SRC is to also work collaboratively with Syar and the other jurisdictional agencies to determine what revisions of the mining plans may be necessary. The SRC shall also determine if the annual mining and reclamation plan submittals include all of the required information set forth in Conditions of Approval No. 16 of the Mitigation Monitoring Plan.

(2) *Annual review, analysis, and reporting on monitoring data.* The SRC is to review the annual site-specific and system wide monitoring data each year and prepare an annual report analyzing the trends in the Middle Reach of the Russian River. The report will analyze the monitoring data in relation to specific performance standards listed in the SMGB Approval. This review is to include the previous year's decisions regarding gravel production, and recommending the next year's production limits, areas of activity, and any other requirements necessary to more effectively avoid adverse impacts, balance river management goals, and meet the performance criteria.

The SRC's recommendations may include, but are not limited to, site-specific revisions to the mining and reclamation plans, modifications of the performance criteria, modification of the mitigation measures, revisions to the riparian vegetation restoration and enhancement requirements.

This report provides the annual review for the 2006 mining and reclamation plan proposal submitted by Syar as described under item (1), above. The SRC will be providing its annual review, analysis, and reporting on the monitoring data, as described in item (2), as a separate report to be prepared during fall 2006.

Data and Information Reviewed

The SRC received the following data from Syar, as required under Condition of Approval No.16:

- Aerial photographs of past years and current year 2006 (obtained from County)
- DTM topographic data and maps of past year and proposed year mining sites
- Proposed mining and reclamation plan for mining sites (Bar 2 and Bar 13, 2006 Existing Conditions and Gravel Harvest Plans)
- Riffle survey data (included as part of thalweg profiles)

The SRC also received from Syar the 1997 EIR/EIS (supplemental draft and final) for the Mining Use Permit Application, Reclamation Plan, and Section 404 Permit Application, the accompanying technical appendices to the EIR/EIS, copies of instream permits, and monitoring cross-section

surveys collected by Syar for the ARM Plan monitoring program. Syar provided for both Bars 2 and 13, a 2003 report on monitoring riparian vegetation, a 2006 botanical survey, and a 2006 survey for osprey, white-tailed kite, yellow-breasted chat, and yellow warbler, and fisheries habitat monitoring reports from 2001, 2003, 2004, and 2005 (Halligan 2003, 2004, 2005, 2006).

In addition to the data and information listed above the SRC reviewed existing data on the Middle Reach available in the 2002 and 2003 Annual Monitoring Program, the most recent years for which monitoring data is available under the Sonoma County Aggregate Resources Management Plan (ARM Plan). Historic orthophotos dating back to 1999 were also reviewed. SRC members conducted a field inspection of Bars 2 and 13 during the summer 2006.

The SRC considered the gravel replenishment rates since the first year of mining in 2002; channel vertical stability as represented by thalweg and riffle crest elevation data; bar area, bar stability, low-flow channel width, and channel pattern based on measurements and interpretations from aerial photos; field observations of geomorphic, riparian, and aquatic habitat conditions; monitoring reports on riparian and aquatic habitat conditions, and recent trends in the Middle Reach from the available 2002 and 2003 ARM data.

Consultations with Resource Agencies

The SRC consulted with resource agency staff to discuss the 2006 mining plan, and to consider potential modifications of the mining plan in order to address protection of environmental resources. The following agency staff were consulted:

Mr. Brian Clure, NOAA Fisheries

Mr. David Hines, NOAA Fisheries

Mr. Tom Daugherty, NOAA Fisheries

Mr. John Short, RWQCB

Mr. Steve Bargsten, RWQCB

Mr. Peter Straub, US Army Corps of Engineers

Mr. Bill Cox, DFG

In addition to the consultations listed above, the SRC met with Mr. John Perry and Mr. Brad Goth at Syar, Inc to discuss their mining plans and available data for the SRC review. The SRC recommendations considered the information and concerns expressed during these consultations, but the recommendations in this report are those of the SRC.

2006 Mining Plan

Syar is proposing to mine 59,000 cubic yards from Bar 2 and 63,000 cubic yards from Bar 13 in the Middle Reach of the Russian River according to the 2006 Existing Conditions and Gravel Harvest Plan. Both bars were last mined in 2002 (e.g., first year of mining) under the 1997 EIR/EIS certified by the SMGB. The finished bottom grade along the longitudinal profile on Bar 2 is to be 0.12 percent and on Bar 13 is 0.08 percent. Both bars retain an undisturbed buffer, in accordance with Condition of Approval No. 19, as follows:

- An undisturbed buffer will be maintained at the head of the bar and along its outer edge
- The outer edge buffer is 10-40 ft, and the size of the buffer shall correlate with the importance value of riparian vegetation
- Established vegetation adjacent to the low-flow channel shall have a 10-40 ft buffer zone to protect that vegetation
- Downstream end of the bar shall be day-lighted at 1 ft above the low water stage (200 to 300 cfs).

Recent Historic and Existing Conditions

Bar 2

Bar 2 is located upstream from Healdsburg Dam (RM 33), in the area where the Russian River is backwatered in summer when the Healdsburg dam is installed (July 4th in 2006). Minimal woody riparian vegetation currently exists along the channel margins of the bar. Little vegetation was observed along the channel margins prior to the 2002 mining based on the 1999 aerial orthophoto. Fairly young willows interspersed with cottonwood are established in scattered locations along the channel margin. No woody riparian vegetation is established at the head of the bar. The bar appears to be easily over-topped by moderately high flows. Aerial photography (2003) indicates that the bar disassociated from the bank following the 2002 mining. The bar was reformed by 2004, with a remnant formation of a potential chute channel on the inside of the bar near the head, that progresses into the middle-half of the bar at the downstream outlet along the bar longprofile-axis (2005 photography). Field inspection in 2006 indicates that Bar 2 is intact. Review of aerial photography since 1999 indicates that this bar has reformed every year in the same location, and is a relatively, stable long-term feature of the channel.

The riverbanks are comprised of mature cottonwoods and willows (Fremont Cottonwood series). Scattered cottonwoods and willows established along the margins of the inside chute channel/backwater area following the spring 2006 runoff period. During the July field inspection, water was present within the back channel area on the bar. Based on Syar's observations, this back channel was dry following the recession of the spring runoff. Thus the water in this area appears to be related to the backwater of the river from the Healdsburg Dam. This vegetation is within the proposed area for mining. As this chute channel/backwater area appears to have been formed in response to the 2002 mining and subsequent high flows during 2003, it is possible that this chute channel/backwater area will not be maintained or re-formed following the proposed 2006 mining. As a result, this newly established woody riparian vegetation may not be supported in the future.

Following the 2002 mining, Syar attempted to eradicate the giant reed (*Arundo donax*). Despite this effort, which included chopping down the giant reed and applying herbicide on the stumps for at least two years, giant reed is still present. Syar currently has an agreement with the Sotoyome Resource Conservation District to remove the giant reed, and to re-vegetate with native vegetation, and to maintain the project.

Syar transplanted two rows of 2 to 3-year old willows and 1 to 2-year old cottonwoods at the head of the bar following the mining in 2002. Approximately 4,600 sq. ft of vegetation was initially planted. The vegetation appears to have been planted on the upstream end of existing riparian vegetation directly in the line of the flow. This existing woody riparian vegetation patch is present in all the aerial photographs from 2002 through 2005. By 2003, only 10% of the transplants survived. In addition, the bar surface was scarified after mining was completed, which possibly loosened the underlying substrate such that it was more easily eroded and the transplanted vegetation more easily uprooted. Monitoring was not continued after 2003 (Syar 2003).

In 2006, Syar completed surveys for osprey, white-tailed kite, yellow-breasted chat, and yellow warbler. No nests were observed within the survey area. In addition, Syar completed a botanical survey for special status plant species. None were found. Numerous non-native plant species were identified on the bar (Syar 2006a, 2006b).

Fish species of particular concern in the project area are three salmonids: Central California Coast coho salmon which are listed as endangered, and California Coastal Chinook salmon and Central California Coast steelhead, which are listed as threatened under the federal ESA. Coho and steelhead are considered threatened under the California ESA. Also of concern are Russian River tule perch, a California Species of Concern and hardhead, a California Watchlist Species.

The portion of the Russian River where mining is proposed is primarily a migration corridor for the three salmonid species (ENTRIX 2004). They pass through this area in the fall and winter, on their way to areas further upstream, and in the spring, when fry and juvenile are migrating from spawning and rearing areas upstream and on the tributaries back to the ocean. Very few coho are expected to even pass through this area (NMFS 2001, ENTRIX 2004). A few Chinook salmon redds have been observed near Bar 2 (0 to 8 redds. depending on year), but none have been seen near Bar 13 (Cook 2005, Halligan 2006). Substrate conditions are poor for salmonid spawning in the vicinity of both bars, having high amounts of fine sediment in pool tails and riffles. The SRC team have observed these substrate conditions to be pervasive throughout the Middle Reach. Low numbers of fry and juvenile steelhead have been observed below Dry Creek and near Syar's Russian River crossing just upstream of the Highway 101 bridge (Cook 2003, Halligan 2006), but most rearing occurs in tributaries and portions of the mainstem upstream of Cloverdale (ENTRIX 2004).

Tule perch have been observed in the vicinity of both bars proposed for mining. Tule perch associate with vegetation in slow water in pools, but have also been observed to use riffles (Moyle et al. 1995). They occur under and around riparian vegetation along the banks of the mined areas. Hardhead tend to occupy slow deep pools. They have been reported to be present in this reach (DFG 2003). While they have not been observed in monitoring adjacent to the bars (Halligan 2003, 2004, 2005, 2006), they are presumed to be present.

The 2003 chute channel formation resulted in a relatively substantial change in aquatic habitat configuration in the vicinity of Bar 2. The proportion of different habitats changed substantially. Since 2003, habitat proportions have nearly returned those observed in 2002 (pre-mining). The return of habitats to their historic condition is indicative of the fact that these habitats are relatively long-term features maintained by channel processes. Residual pool depth shallowed in 2004, but then increased in 2005. Qualitative embeddedness estimates have been relatively constant over time, indicating that the mining has likely had little effect on salmonid spawning success.

Bar 13

Located below Healdsburg dam and the mouth of Dry Creek, near RM 29, this bar has an established buffer with woody riparian vegetation well-above the low-flow channel. The vegetation (dominated by willows, with a few cottonwoods) is primarily younger and newly established willows, with a few mature individuals interspersed. The vegetation is structurally diverse and fairly dense. Some scour was observed on the inside of the buffer vegetation zone during the 2006 field inspection. In addition, burial of some willows in the buffer from recent deposition was observed. Low-water discharge cuts (about 40 ft wide openings) were made through the bar in 2002 and are proposed for 2006. These cuts are intended to facilitate the drainage of water off the bar when it is overtopped to minimize the potential for stranding fish. These types of low-water discharge cuts are not proposed for Bar 2. The riverbank vegetation is comprised of mature cottonwoods and willows, with some younger trees and a few California black walnuts interspersed (Fremont Cottonwood series). A short section (approximately 1,000 feet) of the riverbank is rip-rapped near the head of the bar. Minimal woody riparian vegetation occurs in the area of the bar where mining is proposed.

Syar transplanted seven ‘clumps’ of riparian vegetation, comprised of 5 to 7-year old willows and cottonwoods (approximately 6,100 sq. ft) following the 2002 mining. Two clumps were placed at the head of the bar. The remaining five clumps were placed behind the riparian buffer. Twenty percent of the transplanted clumps survived by 2003 (3 clumps). All the surviving clumps were located near the existing buffer. In contrast to the lack of transplant survival on Bar 2, none of the transplants were scoured or uprooted. Rather, the failure of the transplants to survive has been attributed to the transplant methods, which included planting in mid-summer, no pruning of the poles, and minimal to no irrigation (irrigation was not mentioned in the monitoring or summary reports of the revegetation effort), which together likely contributed to the lack of success of the transplants. Monitoring was not continued after 2003 (Syar 2003).

In 2006, Syar completed surveys for osprey, white-tailed kite, yellow-breasted chat, and yellow warbler. No nests were observed within the survey area. In addition, Syar completed a botanical survey on Bar 13 for special status plant species. None were found. Numerous non-native plant species were identified on the bar.

The fish species of concern adjacent to Bar 13 are the same as those for Bar 2. While changes in habitat sequence near Bar 13 have been noted, aquatic habitat here appears to be more stable than that near Bar 2. Habitat proportions have varied by less than 20%, residual pool depth is nearly constant, as is embeddedness. There were some changes in habitat following the 2002 mining event (2003 was a relatively wet year), but the habitat sequences have returned to approximate their 2002 condition.

Data Analysis and Results

Geomorphology

Quantitative monitoring data was analyzed to determine:

- Sediment replenishment rates on Bar 2 and Bar 13
- Vertical channel stability from thalweg elevation surveys
- Channel pattern
- Low water channel width
- Bar area

Since summer 2002 was the last time that bars in the Middle Reach were skimmed, comparison to monitoring data from 2003, 2004, 2005, and 2006 provides information on how the channel has responded during the intervening non-mining years. This comparison provides a reference on the range of geomorphic changes in the Russian River during a non-mining period, providing information on channel recovery since the first year of mining in 2002. Understanding the type and magnitude of change in channel morphology following a period of mining assists the SRC with interpreting future monitoring data.

Gravel replenishment rates

Digital Terrain Model (DTM) data from 2002 post mining to 2006 was analyzed by the SRC to determine the net replenishment/loss of sediment over the Bar 2 and Bar 13 surface. **Figure 1** shows the change in Bar 2 elevations between 2002 and 2006. There has been a net gain of +79,000 cubic yards, which is a +4.0 ft average gain over the bar surface. **Figure 2** shows the change in Bar 13 elevations between 2002 and 2006. There has been a net gain of +76,000 cubic yards which is a +4.9 ft average gain over the bar surface.

The average annual sediment recharge for the Middle Reach of the Russian River is estimated to be 430,800 tons/yr (Entrix, 2005). Syar plans to harvest 183,000 tons (122,000 cu yds) as a combined total from both bars. This is 42% of the average annual sediment recharge rate of 430,800 tons. The proposed Syar 2006 mining does not exceed the average annual sediment recharge rate, and is therefore within the intent of the ARM Plan which seeks to limit instream extraction so that the average annual extraction rate does not exceed the average annual sediment recharge rate. The amount of recharge for both bars also exceeds the minimum replenishment criteria established by the SMGB under Condition of Approval No. 12:

> ***Minimum Replenishment:*** *Mining in subsequent years on a previously mined barsite shall not be allowed unless at least 1 foot of replenishment, on average, has occurred over the minimum baseline elevation.*

Vertical channel stability

A graphic plot of the Middle Reach thalweg elevations comparing 2002 and 2005 is shown in **Figure 3**. The thalweg data shows a small increase in bed elevation, as indicated by the trendline plot, with no indications of channel incision. This is consistent with data analyzed for the ARM Plan monitoring, which showed a net cumulative increase of 2.0 feet over the Middle Reach since inception of the ARM Plan between 1994 and 2003 (Entrix, 2005). These data indicate that the Middle Reach is stable, and that the channel does not exhibit incision, which is identified in the ARM Plan as a potential cause of bank erosion due to over-steepening of banks as the channel down-cuts.

Riffle crest elevations are also indicated on **Figure 3**, although these are somewhat problematic to interpret. There are 17 riffle crest elevations for 2002 and 12 for 2005, leaving 5 unpaired riffle crests from 2002. There are also three 2005 riffle crests with no apparent proximal pair to the 2002 survey. In total, there are 8 riffle crests that appear to be related pairs (spatially close on the longitudinal profile in Figure 3). Of these 8 riffle crest pairs, all are within the criteria established by the SMGB under Condition of Approval No. 12:

> ***Minimum Riffle Elevations:*** *minimum riffle elevations shall not decrease more than 2 ft in relation to baseline in the first year of monitoring.*

Channel Pattern

The channel pattern within the Bar 2 and Bar 13 vicinity of the Middle Reach are exemplified by bar-pool-riffle sequences. The bar types are point bars and alternate bars. Inspection of the aerial photography and orthophotos from 2002 to 2006 indicates that this type of channel pattern has not changed. This is in conformance with the SGMB performance standard in Condition of Approval No. 12:

> ***Channel Pattern****: Channel pattern shall not change from the current alternate bar pattern to a braided one.*

The SRC notes, however, that in 2003, following the first year of mining (2002) Bar 2 was completely dissected by a chute channel through the longitudinal profile of the bar, and was disconnected from the bank during spring flows (as shown in aerial photography when discharge was 675 cfs). The bar recovered by 2004, aggrading and leaving a remnant trace of the chute channel today. This potential for developing a chute channel is addressed in the Recommendations section. Similar to Bar 2, Bar 13 developed a poorly defined chute channel on the inside of the bar, but it did not completely dissect the bar or cause it to disconnect from the bank during spring runoff.

Bar Area

The SGMB performance standard in Condition of Approval No. 12, states:

> ***Bar Area****: The bar area shall not decrease by more than 30 percent as measured [ideally] between 200 to 350 cfs, but no more than 1,000 cfs.*

Bar surface area was measured from aerial photography taken in 2002 prior to mining, and in 2006. Measurements , indicate that there has been some fluctuations in the total bar area, but well-within the 30 percent standard. Bar 2 had approximately 12.3 acres) in spring 2002, and (12.6 acres) by spring 2006. This is a small increase in area, reflecting aggradation and bar building processes following the first year of mining. Considering that the bar areas are measured under different flow conditions (the 2002 photography was flown when discharge was 273 cfs and the 2006 photography when the discharge was 695 cfs), we would have expected a decrease in area over the Bar 2 surface in 2006 simply due to the higher discharge at that time. Thus, the 12.6 acre bar surface area in 2006 probably under-represents the true area in comparison to the “baseline” measured in 2002. Assuming that the 2006 aerial photography could have been taken, and measurements made, when flow was at a lower discharge closer to

the 273 cfs, the amount of increase in area would be greater. On Bar 13, measurements indicate a decline in the bar surface area between 2002 and 2006, from 11.7 acres in 2002 (prior to mining) to 10.0 acres in 2006, a reduction of 15%. This loss in bar surface area still meets the 30 percent standard. Again, the 15% reduction is likely an artifact of measuring bar surface area at a higher discharge in 2006.

The SRC notes that Bar 2 and Bar 13 surface areas were noticeably smaller in the spring 2003 aerial photography, the year following mining, however, only the current conditions relative to pre-2002 conditions were evalutated. A year by year evaluation will be conducted for the Monitoring Report to be prepared this fall. Both bars were more easily over-topped and have partially submerged areas, a result of the bar-skimming activity which lowers the bar surface and alters the stage-discharge relationship. By 2004 the bar areas increased, and the extent of bar inundation by spring flows decreased, indicating recovery associated with sediment deposition and bar-building processes.

Low Water Channel Width

The SGMB performance standard in Condition of Approval No. 12, states:

> ***Low Water Channel Width****: The low water channel width shall not increase more than 30 percent in surface area along an individual bar at a flow of 200-350 cfs.*

Measurement in low-water channel width between 2002 prior to mining and 2005 indicate that there has been little change, meeting the 30 percent criteria.

On Bar 2, eleven measurements were made of the wetted top-width (i.e., the low-water channel), each spaced approximately 200 feet apart using the aerial photography. Of the eleven measurements, three were unchanged and six showed a decrease in channel width ranging from 5% to 23% more narrow in 2005 compared with 2002. Two measurement points near the upstream portion of the bar showed an increase in low-flow channel width, approximately 50% and 125% wider in 2005. Considering that the 2005 photos were taken when the flow was 700 cfs, and the 2002 photos were taken when the flow was only 270 cfs, the low-flow channel wetted top-width should be wider due to the difference in flow condition alone. The extent of channel widening at these two measurement points is undoubtedly exaggerated because of the difference in flow at the times the aerial photography was taken. Considering that 9 of the 11 measurement points show a decrease in low-flow channel width, (even though the flow was greater in the 2005 photography), the channel width along most of the low-flow channel adjacent to Bar 2 has narrowed due to sediment accretion and bar-building processes, despite bar skimming that occurred in 2002.

For Bar 13, thirteen measurements were made of the wetted top-width (i.e., the low-water channel), each spaced approximately 200 feet apart using the aerial photography. Of the thirteen measurements, three were unchanged and six showed a decrease in channel width ranging from 17% to 25% (more narrow in 2005 compared with 2002). Four of the thirteen measurements indicated an increase in low-flow channel width, ranging from 25% to 40% wider in 2005. Considering that the 2005 photos were taken when the flow was 700 cfs, and the 2002 photos were taken when the flow was only 270 cfs, the four measurements indicating an increase in the low-flow channel wetted top-width is probably an artifact of the difference in flow conditions. The low-flow channel adjacent to Bar 2 has overall narrowed due to sediment accretion and bar-building processes despite bar skimming that occurred in 2002.

Fish and Aquatic Habitat

Bar skimming operations have the potential to adversely affect fish and aquatic habitat. This could occur through changes in habitat that are associated with changes in geomorphology, changes in riparian vegetation, which contributes to aquatic habitat, and changes in water quality, specifically temperature and turbidity. Principal concerns regarding bar skimming are:

- Direct impacts to fish could result from construction of the bridge to access Bar 2

- Changes in channel morphology that would result in changes in habitat structure, especially changes such as braiding or head cutting that might impede migration or create areas where predation potential was increased.
- Stranding of fish on mined bar surfaces
- Increased fine sediment in areas downstream of the bar after the bar is inundated during subsequent high flows

To evaluate these concerns, the SRC reviewed all of the relevant information available and consulted with the agency representatives listed above, as well as Dennis Halligan of NRMC, who has conducted the habitat and fisheries surveys for Syar since 2001. In addition to the documents previously cited, the following were also reviewed.

- Final EIR/EIS for Syar Industries, Inc. Mining Use Permit Application, Reclamation Plan and Section 404 Permit Application (EIP 1997),
- the Sonoma County Aggregate Resources Management Plan EIR (Sonoma County, 1994),
- the USACE 404 permit,
- the Biological Opinion for the USACE 404 permit for the project (NMFS 2001), and
- NMFS Guidelines for Sediment Removal (NMFS 2004).

Direct impacts from construction of bridge to Bar 2

The construction of the bridge to allow Syar to access Bar 2 could result in fish being injured or killed when equipment is moved across the channel to construct the abutment on the far bank or by fill placed in the water, displaced from their normal habitat by these activities, or affected by turbidity created during the above activities.

These impacts are expected to be small. Syar's mining plan follows all recommendations for placement of such bridges identified in the ARM plan, Syar's EIR for this project, and the Biological Opinion issued by NOAA Fisheries for this project. Chief among these are:

- Avoiding the season of peak usage by salmonids. As a result very few salmonids are expected to be present when the bridge is constructed.
- Limiting equipment crossings to the maximum extent practical (one during placement and one during removal of the bridge)
- Placing fill for the bridge abutments slowly so fish have time to move out of the way
- Employing best management practices to minimize turbidity

NMFS found that some incidental take would likely occur as a result of construction of the temporary bridge to Bar 2, but that this take would not result in jeopardy. The construction of the bridge may bury or displace some juvenile steelhead, but their numbers are expected to be very low. This has been confirmed in the monitoring conducted by NRMC (Halligan 2003, 2004, 2005, and 2006). As noted above, NMFS established a number of "Reasonable and Prudent Measures" to minimize impacts. Syar's proposed operation complies with these measures. The SRC concurs with NOAA Fisheries that the impacts are likely to be smalls and recommends that Syar's proposed bridge placement be approved as drafted, with all mitigation measures employed.

Changes in channel morphology

The approach to mining is expected to minimize changes in channel morphology and habitat structure. Additional recommendations are made below to further reduce the likelihood of such changes. Changes in channel morphology may occur in the future during substantial high flow events, although such changes can potentially occur even without mining. The changes in channel morphology and habitat structure observed between 1998 and 2006 indicate that Bars 2

and 13 are stable features within the river and that these areas will return to their pre-mining configuration over time, as do the aquatic habitats associated with them.

Stranding of fish on mined bar surfaces

Bar skimming will change the topography of the surface of the bar. Syar proposes to grade the finished bar surface to approximately 0.1 percent. This grade is intended to guide any fish present down toward the water at the downstream end of the bar as flows recede off of the bar following higher flow events. Syar also will fill all depressions where fish may tend to be trapped as water recedes. Syar proposes a flat profile across the bar between the lateral buffer zones (no transverse grade).

No information has been provided to the SRC regarding the effect of mining on fish stranding within the mined area. The proposed finished grade will be a minimum of 0.12 percent on Bar 2 and 0.08 percent on Bar 13. The SRC recommends that the grade at Bar 13 be no less than 0.1 percent, as indicated in the Syar SEIR and the NOAA Fisheries Biological Opinion. The grade at un-mined bars in the river is reported to be 0.1 to 0.5 percent (NOAA Fisheries 2001). The proposed grade is within the normal range of variation, and should result in a similar amount of stranding as occurs on natural bars. However, the extent of stranding on mined vs. un-mined bars has not been documented. It is also possible that the flat surface of the bar after mining may reduce the amount of stranding in comparison to a natural bar, which would likely contain depressions and other features that might hold fish. The fisheries literature indicates that higher gradients across the bar surface are considered to provide more protection against stranding (Envirosphere 1998). This report states that stranding risk decreases as the transverse grade increases from 4 to 10 percent. The NOAA Fisheries Biological Opinion (2001) for this project did not conclude that stranding might be increased to such an extent that it would cause jeopardy to salmonid populations.

In the ARM Plan (Sonoma County, 1994) a 2 percent transverse grade was prescribed to reduce stranding risk. This requirement has been eliminated in the Syar SEIR, the NOAA Fisheries Biological Opinion, and NOAA Fisheries Guidelines for Sediment Removal (NOAA Fisheries 2004). Discussions with David Hines of NOAA Fisheries indicates that the ARM plan was unclear about the purpose of this transverse grade requirement. The possibility of instituting a transverse grade requirement was discussed with Bill Cox of DFG.

The SRC considered whether prescribing a transverse grade was advisable at this time. However, providing a transverse grade may cause scour on the landward side of the riparian buffer strip and destabilize the buffer area. The riparian buffer strip along the low flow channel was not included in the ARM plan recommendations and therefore provided no conflict with the 2 percent transverse grade requirement. Scour has been observed on Bar 13, even without the presence of a transverse bar grade. An increase in scour could either cause the riparian buffer strip to fail and be washed away, or cause the channel to split around the riparian buffer. The SRC considers either case to be an undesirable result.

Because of the uncertainty relating to the effects associated with establishing a transverse grade behind the riparian buffer strip, as well as the uncertainty of the effects of mining on fish stranding, the SRC does not recommend adoption of a transverse grade at this time. Rather, the SRC finds that further study of the effects of mining on stranding potential are warranted. The SRC recommends that a stranding monitoring study be developed and implemented in February through May 2007, as high winter flows recede off the bars following mining. The monitoring should consider mined and un-mined bars for evidence of stranding. It is recommended that Syar develop a detailed monitoring plan for review by the SRC prior to the commencement of 2007 runoff period. Should the monitoring find that stranding potential on mined bar surfaces is greater than that on un-mined bar surfaces, the SRC would consider additional measures in the future to reduce stranding potential.

Increased fine sediment in areas downstream of bar

Bar skimming operations have the potential to increase the amount of fine sediment in spawning areas downstream of the bar. An increase in fine sediment would have a deleterious effect on spawning success of listed salmonids. The SRC believes this effect is likely to be quite small or perhaps non-existent. The vicinity of the proposed mining areas is not generally utilized for spawning. (Cook 2005, Halligan 2003, 2004, 2005, 2006, Cox, pers. comm.). Personal observations and discussions with people knowledgeable about the reach indicate that the entire reach has a large proportion of fine sediments, even in areas where mining has not occurred. Fine sediments may be mobilized and transported from the bar surface during the first storms following mining. The SRC anticipates that during these storms, large amounts of fine sediment would be mobilized throughout the watershed and turbidity would be high, even without mining. As the bars are depositional areas within the river, sediments would be deposited on the bar at the same time other sediments wash from the bar. The additional sediment produced from the mined surface would most likely be indistinguishable from the fine sediments and turbidity generated throughout the watershed.

Syar's habitat monitoring surveys did not detect an increase in embeddedness (a measure of the accumulation of fines in spawning areas) above and below mined areas following 2002 monitoring. Nor have changes in embeddedness been observed in entire period of monitoring. These observations, while qualitative, provide some evidence that there has not been an increase in fine sediments as a result of bar skimming. The SRC believes the current mining practices are sufficient to minimize impacts relating to fine sediments in downstream spawning habitat, however, little empirical data is available to support this finding. To validate this finding, the SRC recommends that a turbidity monitoring study be conducted to evaluate whether turbidity downstream of the mined bars is greater than that above the bars. The SRC recommends that Syar continue to monitor turbidity and/or suspended solids, as described in the Summary of Recommendations section of this report.

Summary of SRC Recommendations

The SRC recommends that Sonoma County and jurisdictional agencies approve the 2006 mining plans as depicted in the Syar 2006 Existing Conditions and Gravel Harvest Plans for Bar 2 and Bar 13, with the additional recommendations for revisions to the Plans as described below. The SRC supports all other aspects of the 2006 proposed mining plans, including the lateral setbacks from the low-flow channel for both bars, and the low-water discharge openings as proposed for Bar 13.

It is additionally recommended that Syar prepare revised 2006 mining plans that reflect the SRC recommendations, and submit the revised plans to Sonoma County PRMD, jurisdictional agencies, and the SRC.

1. Improve Buffer at head of Bar 2

Based on a review of the aerial photography and field inspection, Bar 2 shows some potential for forming a cut-off chute channel (secondary high flow channel) along the inside of the bar by dissection and disassociation from the bank during high flows. This occurred following the 2002 mining season as visible in the 2003 spring season aerial photography. Although Bar 2 reformed and aggraded by 2004, and is connected to the bank today, the field inspection still shows remnants of a potential chute channel. Complete disassociation from the bank could result in the formation of a mid-channel bar, which is an alteration of the channel morphology. This could adversely affect migratory anadromous fish by making it more difficult for them to find a route upstream. It could also adversely affect outmigrant fish, in that they could become stranded in the secondary channel.

The existing head of bar buffer area ranges from approximately 80 to 160 feet wide and is approximately 2-3 feet above the edge of water during the May 2006 flow of 700 cfs. The head of bar has been well-scoured and has only one clump of vegetation. It appears that head of Bar

2 could be easily overtopped by commonly recurring annual peak flows. The effective discharge (flow that transports the most sediment over the long-term) for the Middle Reach has been estimated by other studies of the Russian River to be 16,000 cfs at Healdsburg, which corresponds to a 1.25 year flow event. Although the SRC does not have specific stage-discharge data to review at this time, it is clear that flows equaling or exceeding the effective discharge would over-top the bar head.

The SRC recommends that the buffer area at the head of Bar 2 be improved as part of the 2006 mining plan by increasing the average elevation by 2 feet over existing conditions. We have made a rough calculation that this would require approximately 5,500 cubic yards of material. The increased height of the bar buffer should extend from the upstream most point of the bar to approximately where a vertical line through station 14+50 intersects the proposed 2006 harvest line (as shown on the Syar 2006 Existing Conditions and Gravel Harvest Plan plan view map). This is approximately a 640 ft linear distance. The additional material can be obtained from the proposed 59,000 cubic yards to be taken from Bar 2. The SRC further recommends that willow wattles collected from on-site or nearby sites be buried in the bar head fill material, and that the new material be compacted in place by track-walking the mining equipment over this added buffer material. Willow wattles are bundles of live willow cuttings with the branches and stems trimmed off, that are tied together and are inserted into a shallow trench that is dug into the stream bank or, in this case, the head of the bar. A second bundle can be placed up on the bank behind the first bundle. The trench should be excavated to about the low-flow line, such that the lowest bundle is just at the low flow line. These willows should sprout and take root, aiding in the stabilization of the sediment at the head of the bar. Willow wattle planting methods are also described in detail in 'The Practical Streambank Bioengineering Guide' (USDA Natural Resources Conservation Service Plant Materials Center, Aberdeen, Idaho), which is available to download at: http://plant-materials.nrcs.usda.gov/idpmc/streambank.html. Planting should also follow the guidelines outlined in Appendix F of the Supplemental Draft EIR/EIS and recommended in Syar 2003 (Monitoring of Riparian Vegetation by Natural Resources Management Corporation) with regard to maintenance and monitoring of plantings. The intent is to establish a bar head buffer that is higher and more stable as the vegetation takes root and grows, reducing scour across the bar and reducing the risk of forming an inside chute channel or dissection that results in a mid-channel bar.

2. Transplanting of Important Vegetation on Bar 2

Following the Spring 2006 flows, cottonwood and willows have established along the low-elevation area created by the remnants of the inside chute channel (**Figure 4**). Although this vegetation does not meet the criteria of a 'significant stand' of riparian vegetation, regeneration is important for natural successional processes on the bar and for maintaining riparian structural and compositional diversity and complexity along the river. The SRC recommends that the newly established cottonwoods and willows along this remnant channel be transplanted rather than removed under the 2006 Syar mining plan. The transplant location can be in the same general area from where they are removed, but at a higher elevation, closer to the riverbanks (i.e., on the inside of the bar) or adjacent to an existing patch of buffer vegetation. The specific locations for placement of the vegetation should consider future fluvial geomorphic and flow conditions across the bar based on the as-built topography. The material should be planted and irrigated (as needed) following the methods outlined in Appendix F of the Supplemental Draft EIR/EIS and recommended in Syar 2003 (Monitoring of Riparian Vegetation by Natural Resources Management Corporation). In addition, an as-built map and summary of the methods employed should be included in a post-transplant summary report. Monitoring for at least 5 years is also recommended, following the methods outlined in Appendix F of the Supplemental Draft (EIR/EIS).

3. Revise Finished Grade of the Bar 13

Bar 13 currently contains areas where stranding may occur. These areas should be corrected as part of the proposed mining. The 2006 Existing Conditions and Gravel Harvest Plan indicates a proposed bar grade of 0.08 percent. To minimize the potential for fish stranding, the finished grade of Bar 13 after mining should slope toward the downstream end of the bar or toward low water discharge exits at a gradient of not less than 0.1 percent. Additionally, the finished mined

surface should be left without depressions that could hold water as the bar drains following subsequent inundation events. This includes the inside of the riparian buffer zone adjacent to the low-flow channel and along the base of high bank on the inside of the bar. These are areas where fish could be trapped as flows recede. The first recommended measure will encourage fish to move toward the main channel as flows inundating the bar decline toward baseflow levels. The second recommendation will eliminate deeper pockets of water on the bar where fish may hold as the water level declines.

4. Improve Buffer at Head of Bar 13

Similar to Bar 2, the head of the Bar 13 is relatively flat and easily inundated by relatively low magnitude annual flood flows. The bar head was clearly inundated by recent high flows, probably contributing to the scour areas noted in item 3, above. Bar 13 was nearly completely inundated in 2003 following mining in 2002, and this caused some changes in channel and habitat structure. These changes in habitat could adversely affect upstream migrant anadromous fish by making it more difficult for them to find a route upstream, and could adversely affect outmigrant fish through increased risk of stranding on the bar. To help reduce the risk of scour on Bar 13 and minimize these effects, the SRC recommends improving the buffer at the head of the bar pursuant to the 2006 mining. This improvement should be accomplished by increasing the size of the head of bar buffer, by excluding from the proposed 2006 harvest area a triangular shaped section that is approximately 1/4-acre (10,000 sq ft) in size at the very upstream end of the bar. The boundary of this recommended buffer area is formed by drawing a vertical line through the point where station 18+00 intersects the proposed 2006 harvest line (this is the base of the triangular shaped section to be excluded from harvest and put into the buffer zone). By including this buffer area, proposed mining cuts 3-4 feet in depth will be eliminated at the bar head, effectively maintaining existing elevations.

5. Compliance with Mitigation Requirements for Revegetation of Bar 2 and Bar 13

Following the 2002 mining Syar conducted a revegetation effort on both Bars 2 and 13 to promote good stewardship. The State Mining and Geology Board approved the bar skimming plan (Appendix C, Reclamation Plan for Syar Middle Reach Vested Rights Gravel Bars Limited Bar Skimming and Adaptive Management State Mine I.D. #91-49-0028), stating :'*… that the mitigation measures presented in the EIR/EIS have been adopted as conditions of approval of the Project. These mitigation measures will reduce all significant and potentially significant impacts (those not identified as significant and avoidable) to a less-than-significant level.'* Also, the State Mining and Geology Board states in the Notice of Determination that the mitigation measures were made a condition of the approval of the project. The revegetation that was conducted on Bars 2 and 13 were proposed mitigation measures. Based on the Mitigation Monitoring Program, any plans for riparian revegetation or restoration were supposed to incorporate the guidelines in Appendix F of the Supplemental Draft EIR/EIS. This plan outlines specific information on site preparation, planting methods, and criteria for success. If plant survival drops below 75% during the first or second year, the contractor is required to re-plant to provide 100% survival and the potential causes for failure were to be investigated. Syar did monitor the vegetation following the planting; which largely failed on both bars with survival rates well below the criteria levels for re-planting. Possible reasons for failure were discussed in the reports; however, re-planting has not occurred to date. Re-planting was identified as a possibility in subsequent monitoring reports, awaiting the formation of the SRC. Therefore, the SRC recommends that Syar implement revegetation following the 2006 mining on both Bar 2 and Bar 13, as the past revegetation efforts failed. The locations for placement of the vegetation should consider future fluvial geomorphic and flow conditions across the bar based on the as-built topography. The SRC recommends that the re-vegetation be implemented either towards the inside of the bars near the river banks or adjacent to existing woody riparian vegetation within the riparian buffer. The material should be planted and irrigated (as needed) following the methods outlined in Appendix F of the Supplemental Draft EIR/EIS and recommended in Syar 2003. In addition, an as-built map and summary of the methods employed should be included in a post-transplant summary report. Monitoring for at least 5 years is also recommended, following the methods outlined in Appendix F of the Supplemental Draft EIR/EIS. It is recommended that Syar submit the mitigation plans prior to the 2006 or 2007 re-planting for review and comment by the SRC.

6. Compliance with Riparian Vegetation Documentation and Data Collection for "Important Stands of Riparian Vegetation"

During year 1 of mining (i.e., 2002) 'Significant stands' of riparian vegetation was defined in the Supplemental Draft EIR/EIS as any riparian vegetation within 25 feet of the low flow channel, on the flood channel banks, floodplain, and terraces areas, or in excess of 1.0 acre within an active gravel bar and normal gravel mining area. These criteria were developed to protect riparian habitat for wildlife species along the riverbanks, to protect aquatic habitat associated with these riparian habitats, and to provide bank stability along the stream margins. The criteria for riparian vegetation and mining, however, are different for year 2 mining (Mitigation Monitoring Plan, page 5-12 in Final Environmental Impacts Statement Syar Industries, Inc. Mining Use Permit Application, Reclamation Plan, and Section 404 Permit Application), as follows:

> '*In the second year and subsequent years, mining might occur on bars with "important" stands of riparian vegetation to meet river management goals. The SRC shall adopt criteria to define the importance of stands of riparian vegetation prior to the initiation of year 2 and subsequent year mining and reclamation. Using these criteria, the committee will assign an "importance" value to stands of riparian vegetation, as well as determine impacts on riparian habitat on a system-wide basis. The criteria should include:*
>
> - *The level of stratification within a stand and measurement of heights of different canopy layers;*
> - *The degree of canopy closure;*
> - *The density and species composition of each of the canopy and understory layers; the degree of wildlife utilization (nesting, perching, vocalization, foraging, etc) by target species;*
> - *The percentage of each type of riparian vegetation within a specified reach of the river; and*
> - *The degree of connection between the stands of vegetation (i.e. continuous/discontinuous spatial arrangement'*

Syar is not taking any significant stands of riparian vegetation according to the proposed 2006 annual gravel harvest plan (other than what the SRC is recommending to transplant on Bar 2), so that they are not removing vegetation at any other location under any criteria for "significance" that was established for year 1 mining or of "importance" that might be established for year 2 mining and in the future. However, even though no 'significant or important stands' of riparian vegetation occur within the proposed mining areas, the riparian vegetation was not mapped to support or document this conclusion for the record. Therefore, the SRC recommends that following 2006 mining, Syar maps from the 2006 aerial photography the locations of existing vegetation and identify the community types present, with field verification, as necessary. In addition, the SRC recommends that the field verification should include the data needed to develop the importance values, as outlined above. If any vegetation is present in the aerial photography or known to have established in the spring or summer of 2006 (e.g. vegetation on Bar 2) that is not present after the mining, this vegetation should be clearly identified. This information should be presented in a summary report to assist the SRC with determining that no significant/important stands of vegetation were disturbed or removed. All subsequent riparian monitoring should include the data outlined above that is required for the evaluation of the importance value of the riparian habitat. The SRC will develop and adopt criteria, in consultation with the County, resource agencies, and Syar, to define the importance of stands of riparian vegetation under its Task B contractual requirements, in the fall 2006 Annual Monitoring Report.

7. Turbidity Monitoring following the "first-flush" high flow events post-mining

The SRC recommends that Syar conduct monitoring of turbidity and/or suspended sediment concentrations, similar to that described in the RWQCB Clean Water Act, Section 401 Water Quality Certification issued on June 25, 2001. The SRC recommends that turbidity monitoring take place during the first two high flow events that inundate the Bar 2 and Bar 13 surfaces. This

monitoring will provide evidence as to whether these bar skimming operations are contributing appreciably to turbidity and fine sediment loads within the Russian River. It is further recommended that Syar provide a turbidity monitoring plan for review by the SRC by no later than October 1

8. Stranding Monitoring Study

The SRC recommends that a stranding monitoring study be developed and implemented in February through May 2007, as high winter flows recede off the bars following mining. It is recommended that Syar develop a detailed monitoring plan for review by the SRC by no later than November 1. The study should include monitoring of mined and un-mined bars for evidence of stranding. The SRC is available to consult with Syar on the elements of a stranding monitoring program that would be desirable.

9. Modification of current habitat monitoring program.

The current habitat monitoring program extends from the downstream end of Bar 3 to the upstream end of Bar 2 and from the downstream of Bar 13 to approximately the confluence of Dry Creek. This extent is based on changes in habitat that occur upstream of Bar 2 and downstream of Bar 13 (Halligan pers. comm.). Regrettably, the areas surveyed do not provide sufficient information to evaluate how mining might affect habitat structure adjacent to and below mined bars, relative to the changes in habitat structure that occur in un-mined reaches. The SRC will discuss this limitation with Syar and evaluate possible avenues to obtain the information necessary to evaluate whether habitat changes are occurring as a result of mining, as opposed to changes resulting from other causes. Recommendations in this regard will be presented in the fall Annual Monitoring Report.

SRC Annual Monitoring Report – Next Steps

The SRC will be proceeding with its annual review and analysis of the monitoring data, to be prepared as a separate annual monitoring report (AMR), during fall 2006 (Task "B"). The AMR is to include evaluation of the adequacy of the performance criteria and standards, adequacy of the monitoring program, and review of monitoring data to determine conditions and trends in the Middle Reach and vested mining area. The AMR will review the previous year's decisions regarding gravel production, and provide recommendations regarding the next year's production limits, areas of activity, and any other requirements necessary to more effectively avoid adverse impacts and balance river management goals. The SRC's AMR will consider and may include recommendations for modification of the SMGB performance criteria, modification and recommendations regarding cross-section, DTM, and other monitoring data collection that are submitted by Syar for use by the SRC and for the County's annual ARM monitoring report. The SRC will also develop and adopt criteria, in consultation with the County, resource agencies, and Syar, to define the importance of stands of riparian vegetation.

References

California Department of Fish and Game (DFG) 2003. 1603 Lake and Streambed Alteration Agreement. February 10, 2003 letter to Talbot Bailey Jr. of Syar Industries. Notification Number R3-2002-0996.

Cook, D. 2003. Upper Russian River steelhead distribution study. Sonoma County Water Agency, Santa Rosa, CA.

Cook, D. 2005. Chinook salmon spawning study. Russian River Fall 2002-2004. Sonoma County Water Agency, Santa Rosa, CA.

Sonoma County, 1994. Aggregate Resources Management Plan and Environmental Impact Report. November 1994

EIP 1997. Final EIR/EIS for Syar Industries, Inc. Mining Use Permit Application, Reclamation Plan and Section 404 Permit Application. Prepared for the State Mining and Geology Board, US Army Corps of Engineers, and the City of Healdsburg.

ENTRIX 2004. Russian River Biological Assessment. Prepared for the U.S. Army Corps of Engineers, San Francisco, CA and Sonoma County Water Agency, Santa Rosa, CA.

ENTRIX, 2005. Sonoma County Aggregate Resources Management Plan. 2002 and 2003 Annual Monitoring Program Results, Russian River, California.

Envirosphere Co. 1988. Lower Mokelumne River fisheries study. Draft. Prepared for the California Dept. of Fish and Game, Region 2. Rancho Cordoba CA.

Halligan, D., 2003. Stream Inventory and Monitoring Report for the Middle Reach Russian River, California. Prepared by Natural Resources Management Corporation for Syar Industries, Inc., Napa, CA.

Halligan, D., 2004. 2003 Stream Inventory and Monitoring Report for the Middle Reach Russian River, California. Prepared by Natural Resources Management Corporation for Syar Industries, Inc., Napa, CA.

Halligan, D., 2005. 2004 Stream Inventory and Monitoring Report for the Middle Reach Russian River, California. Prepared by Natural Resources Management Corporation for Syar Industries, Inc., Napa, CA.

Halligan, D., 2006. 2005 Stream Inventory and Monitoring Report for the Middle Reach Russian River, California. Prepared by Natural Resources Management Corporation for Syar Industries, Inc., Napa, CA.

Moyle, P.B., R. Yoshiyama, J. Williams, and Wikramanayake 1995. Fish species of special concern in California. 2nd Edition. Prepared for the California Department of Fish and Game, Rancho Cordova, CA.

NOAA Fisheries 2001. Biological Opinion for Syar's Middle Reach Vested Rights Mining and Reclamation Plan.

NOAA Fisheries 2004. Sediment Removal from Freshwater Salmonid Habitat: Guidelines to NOAA Fisheries Staff for the Evaluation of Sediment Removal Actions from California Streams. NOAA Fisheries - Southwest Region

Syar Industries, Inc. 2003. 2003 Monitoring of Riparian Vegetation on Bars 2 and 13 along the Middle Reach of the Russian River. Prepared by Natural Resources Management Corporation.

Syar Industries, Inc. 2006. Middle Reach Russian River Osprey, White-Tailed Kite, Yellow-Breasted Chat, and Yellow Warbler Survey Syar Industries Bars 2 and 13. Prepared by Natural Resources Management Corporation.

Syar Industries, Inc. 2006. Botanical Survey on Bars 2 and 13 for Syar Industries, Inc., Russian River, Sonoma County, California. Prepared by Natural Resources Management Corporation.

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Figures

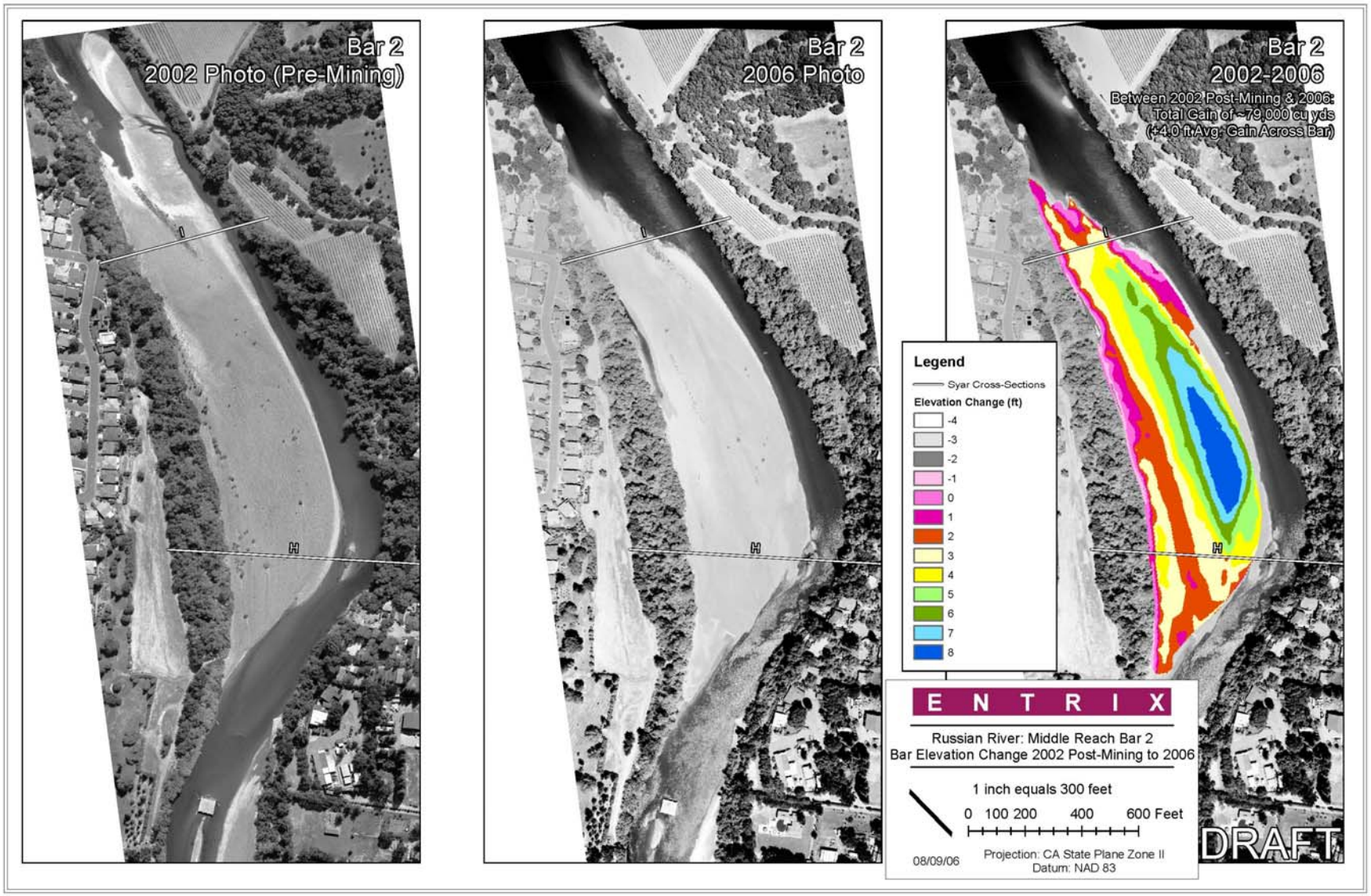

Figure 1. Bar 2 elevation change between 2002 post-mining and 2006.

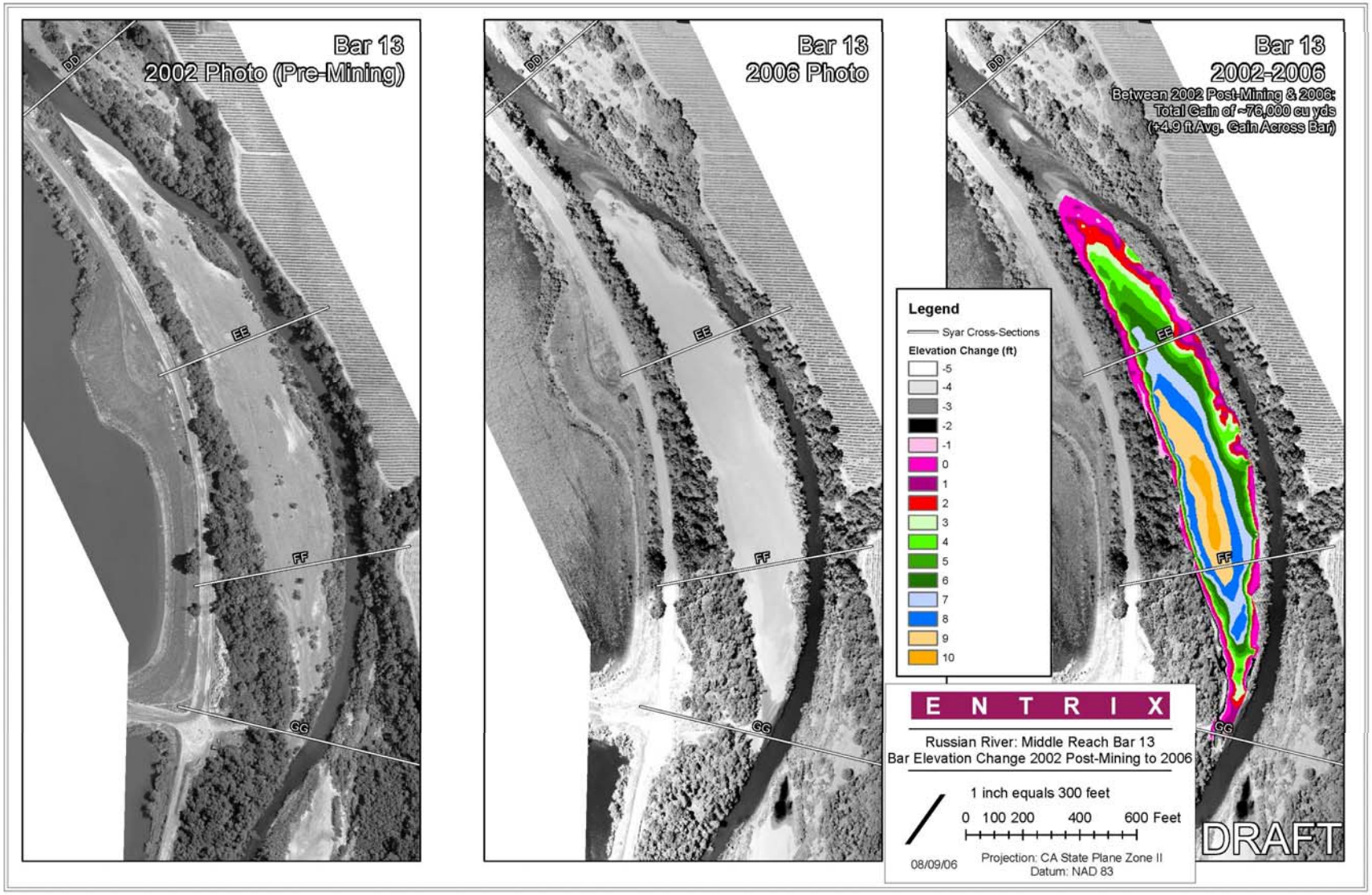

Figure 2. Bar 13 elevation change between 2002 post-mining and 2006.

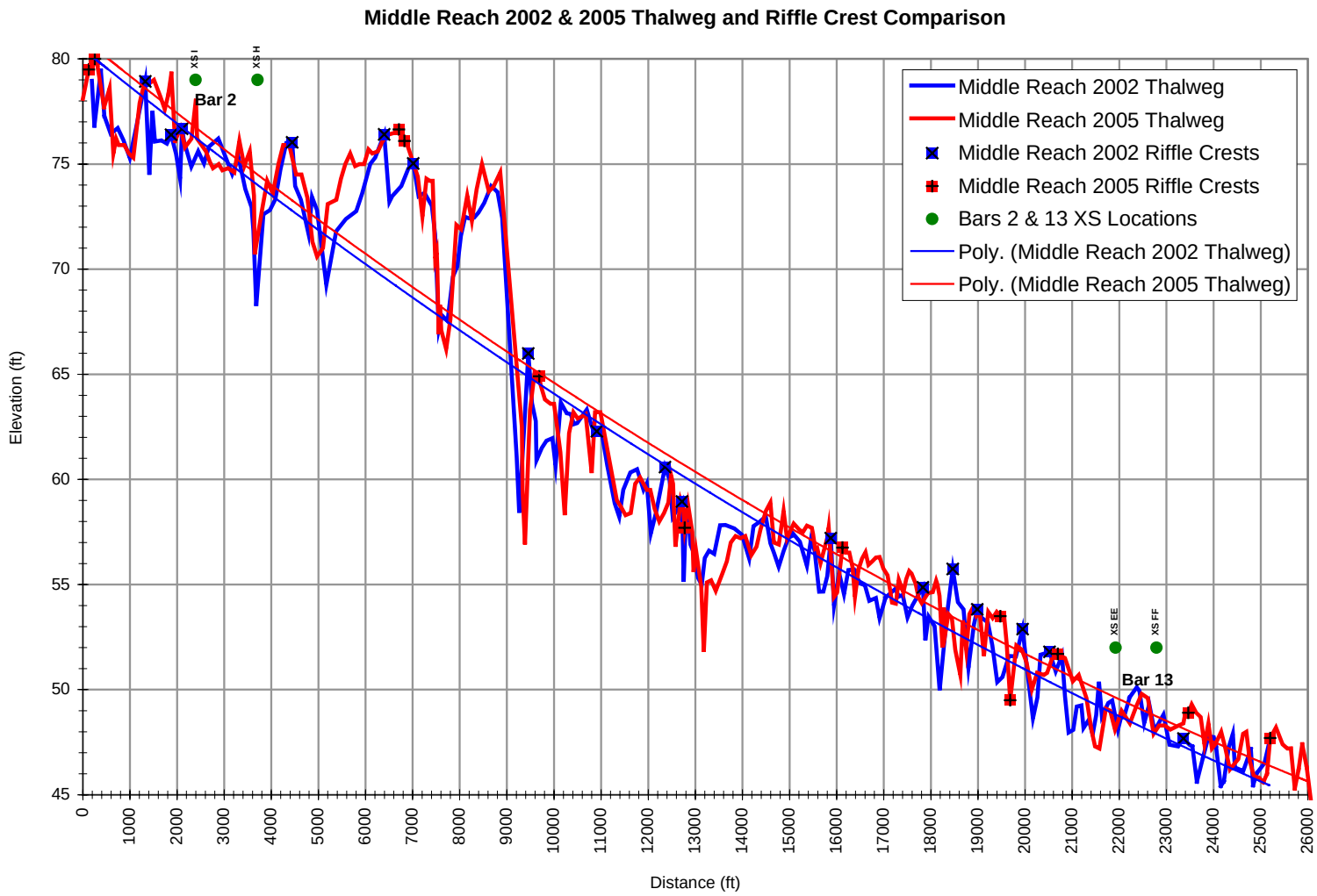

Figure 3. Middle Reach 2002 & 2005 Thalweg and Riffle Crest Comparison.

Figure 4. Willows and cottonwoods newly established as of 2006 along the remnant chute channel on Bar 2. The SRC recommends that these willows and cottonwoods be transplanted rather than removed.