McBain & Trush
FISHERIES
HYDROLOGY
RIPARIAN ECOLOGY
STREAM RESTORATION
FLUVIAL GEOMORPHOLOGY
P.O. Box 663, Arcata, CA 95518 • 980 7th Street, Arcata, CA 95521
Phone: (707)826-7794 • Fax: (707)826-7795

Memorandum

December 21, 2006

Ms. Victoria Whitney, Chief
Division of Water Rights
State Water Resources Control Board
1001 I Street
Sacramento, California 95812

Subject: Status and Recommended Revisions to the State Water Resources Control Board Order Nos. 98-05 and 98-07 Riparian Vegetation and Geomorphic Termination Criteria

Dear Ms. Whitney

The purpose of this memo is to report on the status of geomorphic and riparian vegetation termination criteria specified in State Water Resources Control Board (SWRCB) Order Nos. 98-05 and 98-07 and to recommend changes to the SWRCB regarding these criteria.

Woody Riparian Vegetation Termination Criteria

SWRCB Order Nos. 98-05 and 98-07 established termination criteria for restoring pre-diversion riparian vegetation conditions. The 1929 aerial photographs archived in the Fairchild collection have been the primary pre-diversion baseline from which riparian vegetation has been quantified. Jones and Stokes Associates (JSA) evaluated 1929 and 1940 aerial photographs to estimate pre-diversion riparian vegetation in the Mono Basin Environmental Impact Report. Technologies for directly overlapping original pre-diversion estimates from the 1929 aerial photographs onto contemporary estimates from recent aerial photographs have improved considerably since the early-1990s.

McBain and Trush re-evaluated pre-1941 woody riparian acreages by re-mapping riparian vegetation on the highest quality digital images of the 1929 aerial photos obtainable. For our evaluation, the 1940 aerial photos were not used because they were of poor quality. Film diapositives of the original 1929 aerial photo negatives were obtained, scanned at high resolution (1200 dpi), and color corrected in Adobe Photoshop to improve contrast and interpretability. Using AutoCAD Map, the photos were rubbersheeted from 1996 USGS Digital Orthorectified Quarter Quadrangles (DOQQs) to locate coincident ground control points (typically road intersections). The photos were then printed at 1:1800 scale (1 inch = 150 feet). These spatially accurate photographs were used to categorize and quantify 1929 woody riparian acreages for Rush, Lee Vining, Parker, and Walker creeks from vegetation classes consistent with vegetation mapped in 1999 by McBain and Trush. The original film diapositives were viewed concurrently through an enlarging "photo loop" on a light table for additional accuracy of patch determination. After delineating the patches on the laminated photo set, the 1929 aerial photos were orthorectified using ERDAS Imagine software with OrthoBASE module. The images were rectified using horizontal control points located on the 1996 USGS DOQQs, automatic tie points using the spectral characteristics of the overlapping imagery, and Digital Elevation Models (DEMs) to correct for topographic relief distortion produced from the relations between the topography and the flat photographic film. Because there was no camera calibration report available for the 1929 photos, interior parameters of the camera were estimated using the flight scale and measurements of the fiducial marks in the photos. The root mean square error (the degree of correspondence between the control points on the resulting 1929 orthophotos and the 1996 DOQQ basephotos) was less than one meter for the Lee Vining Creek block and less than 3 meters for the Rush/Walker/Parker creek block.

By spatially correcting the 1929 aerial photos and mapping vegetation patches directly onto those photos, we produced a more accurate and reproducible inventory of the 1929 woody and herbaceous riparian vegetation than was possible 15 years ago. Table 1 provides the present SWRCB termination criteria (Column 2), which are the 1929 acreages traced back to JSA's efforts, and revised 1929 acreages from our re-assessment.

Application of the Rush Creek and Lee Vining Creek termination criteria as standards by which to document/verify recovery assumes today's stream corridor has the same potential to grow and sustain woody riparian vegetation as the 1929 stream corridor. Unfortunately, some acreages within Rush Creek and Lee Vining Creek corridors that were woody riparian in 1929 cannot be restored to woody riparian vegetation, either through natural processes by the year 2100 or by planting cottonwoods/Jeffrey pine. Extensive channel downcutting, being more pronounced closer to the Mono Lake shoreline, has isolated many former floodplain and terrace surfaces from the mainstems' influence by peak flow releases on surface inundation/saturation and shallow groundwater dynamics. In other valley bottom locations, burial of former floodplain surfaces by 3 ft to 6 ft of coarse bedload material has made woody riparian initiation difficult, if not highly improbable, by distancing pioneer seedlings from a reliable water source.

Are Rush Creek and Lee Vining Creek stream corridors in 2006 capable of recovering and ecologically sustaining the same acreages of woody riparian vegetation revealed on the 1929 aerial photographs? If the answer is no, then the termination criteria should be revised downward. If the answer is yes, the termination criteria should be revised upward. To answer this question, our assessment charted two pathways that initially diverged yet ultimately converged.

The first pathway was to use the 1929 woody riparian acreages (proposed for revision by McBain and Trush above) within the administrative framework of termination criteria and with the following overall perspective: wherever an acre of 1929 woody riparian vegetation acreage was lost post-1941, LADWP would restore that acre. Restoration could be through natural ecological processes, promoted by the SRFs, and through planting. Natural processes are highly preferred, but the timeframe within which natural processes were expected to accomplish restoration was never stated explicitly. There are three timeframes adopted in our assessment: short-term (by 2025), long-term (by 2100), and beyond 2100. SWRCB Order No. 98-07 adopted a wait-and-see perspective, allowing for 8 to 10 years of SRF streamflow releases before determining if, and to what extent, woody riparian recovery was possible without intervention (e.g., planting).

We have monitored and assessed, and have ascertained that the prognosis (i.e., recovery by 2100) is good for many 1929 riparian areas, fair for others, and poor or futile for some. Perhaps the epitome of bad (the far end of futile) is the young RB (right bank looking downstream) willow stand below the Rush Creek ford. Though part of an actively depositing emergent floodplain prior to 1941, the now dead willow stand is perched many feet above the present floodplain. No planting of cottonwoods or Jeffrey pine would succeed here. Nor is this perched floodplain, due to pervasive mainstem downcutting (extensive and deep close to Mono Lake and tapering-off approaching the Narrows), likely to be eroded away in the short-term or long-term to be converted to floodplain. This patch of former 1929 woody riparian habitat cannot be accommodated ecologically to satisfy the termination criteria. For another example, the 1929 woody riparian vegetation in Rush Creek Segment 3A and Segment 3B consisted of extensive aspen, cottonwood, and willow stands. There was very little riparian herbaceous or desert vegetation within the riparian corridor in 1929 in these segments. As a result of land management activities since 1929 much of the riparian woody vegetation was converted to riparian herbaceous vegetation, desert vegetation, or human disturbance. Much of the unrecoverable (defined in next paragraph) acreage in Segment 3A is currently riparian herbaceous vegetation which was 1929 woody riparian vegetation; in Segment 3B much of the unrecoverable woody acreage has been converted to human disturbance (e.g., expansion of Hwy. 395) or riparian herbaceous vegetation. Of the total 239.5 acres of original 1929 woody riparian acres in Rush Creek (Column 3, Table 1), approximately 55 acres are not recoverable to woody riparian vegetation by 2100.

Table 1 uses the modifier ‘recoverable’ woody riparian acreage for 1929 and non-1929 woody riparian patches. There are two kinds of ‘recoverable.’ Short-term recoverable (up to 2025) woody riparian acreage will result from these natural processes created by SRF releases and encouraged by removal of domestic grazing: (1) the stream channel migrating into a high terrace and depositing a floodplain in its wake, (2) natural seeding and/or suckering during shallow groundwater saturation in late-spring on low terraces, and (3) seasonal and perennial side-channel surface flows accessing previously inaccessible terrace surfaces. Long-term recoverable acreage (to the year 2100) will result from: (1) changing shallow groundwater dynamics as increasing channel roughness increases flood stage and increases the extent and duration of floodplain saturation, (2) better seedling success as adjacent areas already with maturing woody riparian vegetation favorably change the microclimate, (3) main channel avulsions, and (4) slow cottonwood and willow suckering that will require infrequent wetter years combined with other favorable factors (e.g., no late-season cold snap that can kill catkins). Long-term recovery also can be promoted by selectively planting to jump-start these processes, particularly where a terrace surface approaches a 6 ft elevation above the stream channel (declining success with greater elevation) and where mainstem migration may eventually topple matured trees directly into the channel as LWD (thereby providing a positive feedback loop to channel roughness). In a few instances a short-term prognosis could be transformed to a long-term one if rapid local mainstem downcutting occurred, particularly at side-channel entrances. The use of 'non-recoverable' means woody riparian recovery not expected by 2100.

Our second assessment pathway was more ecological rather than administrative: estimate acreages of woody riparian vegetation that both future stream corridors are capable of recovering, and not base/measure performance by the 1929 acreages. Although not all 1929 woody riparian acreages can be returned to a similar status, some acreages that were not woody riparian in 1929 have been converted. In 2004, woody riparian vegetation has become established in 60.4 acres of Rush Creek that were not woody riparian habitat in 1929 (Column 7, Table 1). As the SRF's are released, side-channels are re-watered, and time marches on (thus encountering more favorable hydrologic years for establishing seedlings), other portions of both valley corridors presently not supporting woody riparian vegetation will recover or be transformed into woody riparian habitat. Patches in 2004 inventoried as herbaceous riparian habitat were not included in the woody riparian acreage totals.

Table 2 presents a similar woody riparian acreage analysis for Lee Vining Creek in Segments 2B, 3A, 3B, and 3C. Segments 1 and 2A are above Hwy. 395 and no future restoration actions are being considered. Differences between McBain and Trush's revised 1929 acreages (Column 3, Table 2) and the 2004 acreage plus recoverable acreage (Column 9, Table 2) for Segments 3A and 3B are relatively large (8.1 acres and 13.7 acres respectively) compared to Rush Creek. In current Lee Vining Creek, over 60% of the 1929 woody riparian vegetation is unrecoverable in Segment 3A and Segment 3B. In 1954 a catastrophic fire destroyed much of the pre-diversion woody riparian vegetation. Furthermore, there is considerable anecdotal evidence to suggest that, before diversion, well developed soils existed in the riparian corridor but were washed away in the 1960 floods. Today, many locations where 1929 woody riparian grew are now much higher in elevation from the stream channel, having deeply incised through areas that were frequently inundated or were close to the shallow groundwater table. The combination of much less fines in the soil, the groundwater dropping away quickly within short distance from the channel, and many surfaces being no longer inundated greatly inhibits/prevents recovery of the 1929 woody riparian vegetation where it once historically existed. In 2004, woody riparian vegetation has become established in 10.4 acres on Lee Vining Creek that were not woody riparian vegetation in 1929 (Column 7, Table 2).

Woody Riparian Termination Criteria Recommendation

Recovery of all woody riparian vegetation acreages by designated stream reaches in the SWRCB termination criteria cannot be accomplished through natural processes and/or intervention solely on former 1929 woody riparian acreages. Some 1929 floodplain and low terrace surfaces that once supported woody riparian vegetation are now too high relative to the shallow groundwater dynamics within both valley corridors due primarily to progressive channel downcutting instigated by lowering Mono Lake. As of 2004 (the latest woody riparian inventory), woody riparian vegetation throughout Rush Creek is established on 123.1 acres of former 1929 riparian surfaces and on an additional 60.5 acres where woody riparian vegetation did not exist in 1929. This Rush Creek total, 183.6 acres, is 55.9 acres short of our revised 1929 acreage total (239.5 acres) and 56.2 acres short of the SWRCB termination criteria.

Application of the Rush Creek termination criteria, using either the present criteria or McBain and Trush's 1929 revisions, as standards by which to document/verify recovery assumes today's and future stream corridor has/will have the same capacity to grow and sustain woody riparian vegetation as the 1929 stream corridor. Assuming all 2004 woody riparian vegetation persists, we predict an additional 48.0 acres are recoverable over the short-term (by 2025) and long-term (by 2100). While adoption of the 1929 acreages was an excellent strategy in drafting the Orders, our research subsequently indicates that the short- and long-term outlook is for a Rush Creek stream corridor with slightly less capacity. Our basic guiding principle has been to promote an ecologically sustainable restoration program and to make ecologically defensible recommendations. Mathematically, the difference between 239.5 acres (1929 total acreage) (Column 3, Table 1) and 231.5 acres (2004 acreage + 48.0 recoverable acres) (Column 9, Table 1) seems small (8.0 acres). On a reach-by-reach basis, however, some reaches will be above the revised McBain and Trush 1929 acreages and others will be below (contrast Column 3 with Column 9, Table 1 and Table 2).

We recommend that the ecological capacities for creating and sustaining woody riparian vegetation (i.e., 2004 woody riparian acreage and recoverable woody riparian acreage) (Column 9, Table 1 for Rush Creek and Column 9, Table 2 for Lee Vining Creek) be adopted by SWRCB as the termination criteria.

Following the 2009 woody riparian inventory, acreages identified as 'recoverable' (i.e., short-term and long-term, as defined) will be re-assessed. Those patches still with evident recovery trajectories (short-term or long-term) will be tallied and left alone. Other patches still considered 'recoverable' will be tallied and evaluated for planting, but only where long-term recovery was suspect and where accelerated long-term, or possibly short-term, recovery would substantially benefit channel hydraulics (e.g., providing LWD). Patches of riparian woody vegetation recovered by 2009 and recoverable through stream migration and channel re-opening will be re-assessed. Planting Jeffrey pine or a cottonwood/willow mix would be recommended on a site-by-site basis. Documentation of planting success will require two monitoring periods at 5-yr intervals as stipulated by the SWRCB. For planting performed in 2010, monitoring in 2014 and 2019 should establish whether intervention did remove the doubt of ecological recovery. If the 2009 re-assessment unveils more 'recoverable' acreages than predicted by McBain and Trush, LADWP would be required to address acreages up to those specified in McBain and Trush's revised 1929 woody riparian acreages.

Geomorphic Termination Criteria

SWRCB Order No. 98-07 established three geomorphic termination criteria: main channel length, gradient, and sinuosity. All have numeric targets for each stream reach in Rush Creek and Lee Vining Creek intended to represent pre-diversion conditions. Specific stream reaches were established by Woody Trihey in the early-1990s based on contour breaks in the May 1991 aerial survey. The 2003 low-altitude aerial photographs were orthorectified with photogrammetry developed at a contour accuracy of ±1 ft. This digital terrain model was ideally suited to quantify the geomorphic termination criteria. Values for main channel length, gradient, and sinuosity were replicated from the 2003 aerial photogrammetry and compared to the SWRCB Order No. 98-07 termination criteria values.

Geomorphic criteria were calculated as follows:

- Main Channel Length: The main channel for each reach of Rush and Lee Vining creeks was identified on the 2003 aerial photographs, the left and right edges of water were digitized in AutoCAD, and a centerline was established in the middle of the low-flow channel. Length of the main channel centerline was then measured in AutoCAD.

  = CHANNEL LENGTH (L)

- Channel Gradient: The channel gradient for each reach of Rush and Lee Vining creeks was calculated using elevations from the 2004 aerial photogrammetry at the Trihey (1993) reach boundary locations, calculating the change in elevation from top to bottom of each reach, and dividing elevation change by the reach length.

  = ∆ ELEVATION / CHANNEL LENGTH (∆EL/L)

- Channel Sinuosity: Channel sinuosity for each reach of Rush and Lee Vining creeks was calculated as the ratio of main channel length to valley length. Valley length was estimated by establishing a valley longitudinal profile line running mid-way between the riparian corridor boundary lines.

  = CHANNEL LENGTH / VALLEY LENGTH (L/VL)

The primary geomorphic termination criterion is main channel length. A comparison of the 2003 main channel lengths for each stream reach in Rush Creek to the SWRCB length criteria (refer to Rush Creek termination criteria, Table 3) shows the following shortfalls:

(1) The Stream Scientists are not recommending any change to the Rush Creek Reach 1 termination criterion at this time.
(2) Stream Reach 3B is shorter than the SWRCB length by 144 ft. This shortfall is real. Upstream of the old Hwy. 395 bridge the decision was made to split the mainstem baseflow at an ‘island’ immediately downstream of the planmapping/fish survey study reach. Streamflows to the right (looking downstream) were directed down the present main channel and streamflows to the left were directed toward the former channel to re-water the floodplain. This previous main channel was more sinuous than the present main channel;
(3) Stream Reach 3D is shorter than the SWRCB length by 135 ft. The RTC scientists originally planned to re-direct the entire main channel toward the right valley wall, to reoccupy its pre-diversion location. However, when the 3D floodplain project was designed, the decision was made to keep the mainstem in its present location, but direct some flow onto the evolving floodplain (with no intention of permanently maintaining a side-channel

against the right valley wall, i.e., on the backside of the evolving floodplain);

(4) Stream Reach 4C is shorter than the SWRCB length by 967 ft. Mainstem channel downcutting, due to declining Mono Lake water levels (post-diversion) and channel realignment associated with the culvert at the Ford, has headcut and abandoned the 14 Channel. In 2006, the decision was made not to re-water the abandoned 14 Channel segment. The portion of the 14 Channel cutoff was 2006 ft long and the 2003 main channel (i.e., the cutoff channel) is 476 ft;

(5) Stream Reach 5A is shorter than the SWRCB length by 247 ft. This reach of main channel has undergone many feet of downcutting (due to lake lowering) through highly erosive volcanic bed and bank material. A planmapping and fish survey study site was selected here to document the main channel's evolution as lake levels rise. We anticipate the evolution of a more sinuous channel, and therefore anticipate increasing main channel length. Re-mapping in 2005 documented an additional 69 ft of main channel length (i.e., in addition to the length of 7320 ft inventoried in 2003). Projections of how the main channel might migrate in the next 15 to 20 years indicate the SWRCB length could be achieved.

A comparison of the 2003 main channel lengths to the SWRCB length criteria (refer to Lee Vining Creek termination criteria, Table 4) for stream reaches in Lee Vining Creek, beginning slightly downstream from Hwy. 395 and ending at the 1941 Mono Lake shoreline, shows the following shortfalls: Stream Reach 2B is shorter than the 1929 reach length by 38 ft (the Termination Criterion is lumped together as Reach 2, but was divided into Reaches 2A and 2B based on 1929 lengths), Stream Reach 3A is shorter than the SWRCB length by 361 ft, Stream Reach 3B is shorter by 405 ft, and Stream Reach 3C is shorter by 150 ft. Lee Vining Creek has undergone significantly greater change than Rush Creek and its recovery will take much longer. While the termination criteria accurately represent pre-1941 main channel lengths, their use as tangible restoration goals is highly questionable. This is especially true for Stream Reach 3B. The present-day, main channel flows close to the right valley wall, while the historic main channel flowed close to the left valley wall and is now considered a secondary channel (e.g., the A4 and B1 channels). The present-day main channel is showing signs of returning to a single thread and asserting a prominent thalweg, rather than being widely braided. Eventually main channel length will increase.

But a forecast for when this new main channel will increase by 405 ft is not possible at this time. There are just too many interacting variables, including very active channel headcutting and patchy maturing woody riparian stands, that will determine which braided channel in the present-day main channel may become the future single thread main channel. The main channel length termination criteria for Lee Vining Creek are feasible, but so are many other main channel lengths feasible (and desirable) for a restored condition. SWRCB Order No. 98-05 considers these two primary factors for restoration: (1) whether fish are in good condition and (2) whether the stream restoration and recovery process has resulted in functional and self-sustaining systems with healthy riparian ecosystem components for which no extensive physical manipulation is required on an ongoing basis. Meeting the termination criteria for main channel length guarantees neither.

Main channel gradient and main channel sinuosity require estimates of main channel length. Both also require other estimates: channel bed elevation at the top and bottom of each reach (to calculate Main Channel Gradient) and valley length for each reach (to calculate main channel sinuosity). Because gradient and sinuosity are a function of channel length, the only way to attain these other two criteria is to increase channel length. Past estimates of channel bed elevation and valley length have introduced additional error. In some cases, the error creates the need for channel lengths longer than prescribed in the termination criteria. For example in Rush Creek Stream Segment 2A, an additional 159 ft would be needed above the historic 4820 ft to meet the gradient termination criteria. The 2003 estimates, derived from more accurate maps, could be used to replace the present termination criteria for gradient. But neither termination criteria offers a better performance measure or practical restoration guidance than main channel length: measure main channel length, and functionally you are accounting for main channel gradient and main channel sinuosity. We recommend removing main channel gradient and main channel sinuosity as termination criteria for Rush Creek and Lee Vining Creek.

As a footnote, the RTC scientists considered monitoring main channel curvature by measuring the radius of curvature of individual channel bends. The thinking at the time was that the main channel would become more sinuous as confinement improved. The measurement for main channel curvature was the radius of curvature (r_C), the radius of a circle fit to the curvature of an individual channel bend (i.e., a straight section of river would have an infinite r_C). Calculation of r_C (ft) does not require an estimate of valley length, but does require professional judgment in fitting a circle to each channel bend. This measure is independent of main channel length, and would have been more sensitive to change than Main Channel Sinuosity. Since the mid-1990s our research indicated that the pre-diversion main channel was not as sinuous as 'typical' alluvial channels, the RTC scientists' original hypothesis. Alluvial channels have values around a ratio of $r_C / w_{bf} = 1.5$, where w_{bf} is bankfull width (ft). Estimation of a pre-diversion mean r_C ratio as a geomorphic goal or termination criteria, was possible (using the few abandoned pre-diversion main channel segments still reasonably intact) but would have required a wide margin of error, greatly reducing its effectiveness as a performance measure for recovery.

SWRCB Order 98-07 stipulates that two other geomorphic characteristics of the main channel be considered candidate termination criteria, thalweg diversity and channel confinement, as a way to address the physical quality of the mainstem channels rather than length of main channel. The RTC scientists' original hypotheses were that increasing channel complexity could be measured by the variability of the thalweg's longitudinal profile and that increasing channel confinement could be measured by increases in bed averaged shear stress. In the 2000 Annual Report, both were presented, quantified, and evaluated as termination criteria. While thalweg diversity and bed averaged shear stress could serve as termination criteria, the physical processes necessary to achieve confinement and a dynamic channelbed are being specifically targeted in the SRFs. Floodplain deposition, creating the main channel confinement by building the floodplain, will take longer than 2025, the projected date for filling Mono Lake. An extended time period will be needed for two primary reasons. Much of the thalweg diversity will depend on the time necessary to have cottonwoods and Jeffrey pines grow sufficiently big, topple into the channel (many by a migrating channel), and affect/direct physical channel processes. Second, each episode of floodplain deposition will subsequently require an even larger, and less frequent, higher flood to deposit even more fine bed material in the floodplain. The first foot of floodplain deposition will take much less time, and be more predictable, than the second foot (refer to McBain and Trush Annual Report 2000). Lee Vining Creek is a distant second to Rush Creek to reaching either confinement or channel complexity. I recommend not considering thalweg diversity or bed averaged shear stress as termination criteria. The success of creating a physically complex and confined main channel in Rush Creek and Lee Vining Creek (and the geomorphic setting for side-channel formation and maintenance) will greatly depend on maximizing the magnitude of peak flow releases in wetter SRF annual flow regimes.

Parker Creek and Walker Creek
Woody Riparian and Geomorphic Termination Criteria

Parker and Walker creeks do not require geomorphic termination criteria because no mitigative actions are contemplated. Under the current SWRCB Orders, streamflows will be mostly unimpaired and sediment will be routed past the existing diversion structures. We anticipate conversion of the riparian corridor along Walker and Parker creeks to a narrower riparian corridor with more dry riparian vegetation patch types, given the recent cessation of irrigation practices. However once this conversion occurs, the riparian boundary will then more closely track with the stream as the groundwater table sharply tapers-off from the stream. Termination criteria for riparian vegetation along Walker and Parker creeks would be difficult to formulate under these conditions and unnecessary.

If streamflow diversions increase, grazing is re-instated, and/or bedload passage not restored soon, then monitoring tied to mitigation requirements should be considered. Simple trend monitoring would be helpful for documenting the anticipated riparian corridor conversion. Both creeks should be included in all future aerial photography conducted for Rush Creek and Lee Vining Creek mainstems.

Summary of Termination Criteria Recommendations

SWRCB Order 98-07 states: "*This order provides for revising the quantified "termination criteria" when existing conditions make it infeasible to restore a pre-project condition or when new information provides a better understanding of how to evaluate stream restoration progress*." Recommended changes in SWRCB Order No. 98-07 regarding geomorphic and woody riparian vegetation termination criteria are:

(1) adopt the McBain and Trush ecologically based woody riparian acreages as the termination criteria for Rush Creek (Column 9 in Table 1) and Lee Vining Creek (Column 9 in Table 2),

(2) remove main channel gradient and main channel sinuosity as termination criteria for Rush Creek and Lee Vining Creek, but retain main channel length,

(3) adopt the following revisions to the Rush Creek termination criteria for main channel lengths (Table 3): adjust Stream Reach 3B to account for decisions to split the mainstem baseflow to rewater the left bank floodplain (i.e., 2,956 ft rather than 3,100 ft); adjust Stream Reach 3D to account for decisions to not move the main channel when re-constructing the floodplain (i.e., 3,032 ft rather than 3,370 ft); and adjust Stream Reach 4C by removing the length of the 14 Channel and replacing it with the length of its cutoff channel (i.e., 2,830 ft rather than 4,360 ft),

(4) adopt the following revisions to the Lee Vining Creek termination criteria for main channel lengths (Table 4): eliminate termination criteria for Stream Reaches 1 and 2A because no future restoration actions are being considered, and retain the 1929 reach length for Reach 2B,

(5) eliminate thalweg diversity and channel confinement from further consideration as candidate termination criteria, and

(6) do not consider geomorphic or riparian vegetation termination criteria for Parker Creek or Walker Creek.

Thank you for carefully considering our recommendations,

Sincerely,

Bill Trush,
Stream Scientist

Table 1. Riparian vegetation acreages and termination criteria for Rush Creek.

RUSH CREEK			(ACRES)					
Segment	***SWRCB Termination Criteria***	***M&T revised 1929 Woody Riparian***	***2004 Woody Riparian in 1929 Woody Riparian***	***2004 Herbaceous Riparian in 1929 Woody Riparian***	***Recoverable Woody Riparian in 1929 Woody Riparian***	***2004 Woody Riparian in non-1929 Woody Riparian***	***Recoverable Woody Riparian in non-1929 Woody Riparian***	***2004 Woody Riparian plus Recoverable Woody Acres***
1	6.2	6.2	0.2	0.1	4.3	1.7	0.0	6.2
2	5	5.0	3.5	0.0	0.1	3.1	0.0	6.7
3A	21.5	25.7	10.5	2.6	4.0	3.1	2.2	19.9
3B	2.9	3.8	0.6	0.0	1.2	2.2	3.1	7.1
3C	11.2	17.4	6.4	0.2	1.8	3.1	2.4	13.7
3D	10	9.9	2.1	0.0	1.5	3.1	1.4	8.0
4A	26.3	37.3	20.5	0.8	5.1	4.7	1.3	31.6
4B	80.2	72.5	42.9	8.3	10.3	19.7	3.3	76.2
4C	38.7	28.3	22.2	1.6	0.7	7.7	0.7	31.2
5A	37.8	33.4	14.2	0.0	2.7	12.1	2.0	31.0
5B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	239.8	239.5	123.1	13.7	31.6	60.4	16.4	231.5

Table 2. Riparian vegetation acreages and termination criteria for Lee Vining Creek.

LEE VINING CREEK			(ACRES)					
Segment	***SWRCB Termination Criteria***	***M&T revised 1929 Woody Riparian***	***2004 Woody Riparian in 1929 Woody Riparian***	***2004 Herbaceous Riparian in 1929 Woody Riparian***	***Recoverable Woody Riparian in 1929 Woody Riparian***	***2004 Woody Riparian in non-1929 Woody Riparian***	***2004 Recoverable Woody Riparian in non-1929 Woody Riparian***	***2004 Woody Riparian plus Recoverable Woody Acres***
1	20	0	0	0	0	0	0	0
2A	30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2B	Combined with 2A	9.0	7.9	0.1	0.1	2.2	0.3	10.4
3A	22.2	18.5	4.4	0.6	2.6	2.3	1.1	10.5
3B	32.9	36.5	14.9	1.4	3.5	3.1	1.3	22.8
3C	4.0	4.0	2.1	0.2	0.3	2.8	0.2	5.4
3D	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	59.1 Total for Segements 3A-3C	68.0 Total for Segements 2B-3C	29.3 Total for Segements 2B-3C	2.3 Total for Segements 2B-3C	6.5 Total for Segements 2B-3C	10.4 Total for Segements 2B-3C	2.9 Total for Segements 2B-3C	49.1 Total for Segements 2B-3C

Table 3. Geomorphic termination criteria for Rush Creek

RUSH CREEK	MAIN CHANNEL LENGTH (FT)			
Segment	***SWRCB Termination Criteria***	***2004 Lengths***	***M&T Revised Termination Criteria***	***Length Deficit***
1	4,100			4,100
2	4,820	4,820	4,820	0
3A	3,800	3,800	3,800	0
3B	3,100	2,956	2,956	0
3C	6,940	6,964	6,940	0
3D	3,370	3,235	3,032	0
4A	3,070	3,078	3,070	0
4B	7,810	8,071	7,810	0
4C	4,360	3,393	2,830	0
5A	7,320	7,073	7,320	247
5B	N/A			
Total	48,690	43,388	42,578	4,347

Table 4. Geomorphic termination criteria for Lee Vining Creek

LEE VINING CREEK	MAIN CHANNEL LENGTH (FT)			
Segment	***SWRCB Termination Criteria***	***2003 Lengths***	***M&T Revised Termination Criteria***	***Length Deficit***
1	4,500			
2A	7,400			
2B	Combined with 2A	2,112	2,150	38
3A	3,500	3,139	3,500	361
3B	4,200	3,795	4,200	405
3C	1,360	1,210	1,360	150
3D		1,880		
Total	20,960	12,137	11,210	953