Modesto Irrigation District
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July 3, 2008

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
Mail Code: DHAC, PJ-12.3
888 First Street, NE
Washington, D.C. 20426

Re: Don Pedro Project, FERC No. 2299 Fishery Study in July 2008

Dear Secretary Bose:

The Turlock Irrigation District and Modesto Irrigation District (Districts) provide this notification and the attached detailed *O. mykiss* population estimate study plan for monitoring being conducted this month in the Tuolumne River. The study is pursuant to the April 3, 2008 Order (Order) and referenced conceptual study plan submitted by the Districts in July 2007. As described in the attached plan, the field surveys scheduled to begin July 8th will utilize the snorkel methods that are available under the current applicable resource agency scientific sampling permit authorizations for *O. mykiss* and as provided for under the July 2007 study plan.

The April 3, 2008 Order directed the Districts to implement the *O. mykiss* monitoring plan with specific modifications. It also required the Districts, beginning in 2008, to "conduct population estimate surveys using two-phase snorkeling surveys calibrated by electrofishing to determine population abundance by habitat type." (p. 29). While the Order specifies electrofishing in the study description, the July 2007 study plan to be implemented recognized electrofishing permit constraints, and allowed for both snorkeling and electrofishing surveys to be used for calibration purposes. As identified in the attached plan, a request for an amended Section 10 sampling permit has been submitted to National Marine Fisheries Service [NMFS]. If approved, the permit would allow for the electrofishing necessary to conduct calibration sampling in combination with the snorkeling method in future related efforts. Until such time as a permit is issued, calibration efforts will utilize multi-pass snorkeling techniques described in the attached *O. mykiss* population estimate study plan. The results of this and other *O. mykiss* studies will be included by the Districts in the report to be filed by January 15, 2010 as required by the Order.

Respectfully submitted,

MODESTO IRRIGATION DISTRICT

Walter P. Ward
Assistant General Manager
Water Operations

TURLOCK IRRIGATION DISTRICT

Jeffrey T. Barton
Assistant General Manager
Civil Engineering & Water Operations

Enclosure

Study Plan

Population Size Estimates of Resident *O. mykiss* in the lower Tuolumne River

Prepared for
Turlock Irrigation District
333 East Canal Drive
Turlock CA 95380

and

Modesto Irrigation District
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Modesto, California 95354

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3 July 2008

Stillwater Sciences

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1 BACKGROUND AND PURPOSE

Fisheries monitoring for the Don Pedro Project (FERC Project No. 2299) by the Turlock Irrigation District (TID) and Modesto Irrigation District (MID) have long documented the presence of *Oncorhynchus mykiss (O. mykiss)* in the lower Tuolumne River (TID/MID 2005). On March 19, 1998 the National Marine Fisheries Service (NMFS) first listed the Central Valley steelhead as threatened under the Endangered Species Act (ESA). After several court challenges, NMFS issued a new final rule relisting the Central Valley steelhead on January 5, 2006 (71 FR 834). In a separate process regarding terms of the 1996 FERC license amendments for the Project, NMFS staff provided input to a draft limiting factors analysis for Tuolumne River salmonids (Mesick et al 2007) and included recommendations for developing abundance estimates, habitat use surveys and anadromy determination of resident *O. mykiss*. These recommendations were conceptually used to develop the Districts FERC Study Plan (TID/MID 2007) which was the subject of an April 3, 2008 FERC Order. As part of the Order, the Districts are required to conduct population estimate surveys in summer (June/July) and winter (February/March), starting in summer 2008 to determine *O. mykiss* population abundance by habitat type.

The purpose of the proposed *O. mykiss* population surveys is to provide population size estimates over several sampling seasons of differing environmental conditions to determine habitat use and needs within the lower Tuolumne River. The surveys will be used to examine the following hypotheses:

> Hypothesis 1: Summertime distribution of suitable habitat by observed life stages of *O. mykiss* is related to ambient river water temperature.
>
> Hypothesis 2: Habitat use by *O. mykiss* juveniles and adults observed in the Tuolumne River occurs at the same density in both restored and nearby reference sites.

As recommended by Stillwater Sciences (Stillwater), the surveys will employ a two-phase sampling approach for the development of a "bounded count" population estimate (Hankin and Mohr 2001). Habitat units are selected using stratified random sampling where the habitat types possess a pre-determined probability of occurrence within areas where *O. mykiss* have been frequently observed during the summer in the lower Tuolumne River, extending from approximately river mile (RM) 52–40 during summers and potentially extending to about Waterford (RM 30) during colder winter conditions.

The two-phase stratified sampling design involves snorkeling pre-selected habitat units (e.g., riffle, run, pool, etc.) multiple times in order to quantify the variance associated with density and subsequent population estimates. In a typical Phase 1 sampling approach, primary snorkel surveys (Edmundson et al. 1968, Hankin and Reeves 1998, McCain 1992, Dolloff et al. 1996) will be conducted across a subset of the all habitat units. In Phase 2, approximately 20–70% of each habitat type sampled will be randomly selected for replicated surveys by either repeated dive counts or depletion electrofishing (Reynolds 1996).

Although the methodology presented below discusses a combined approach using both repeated dive counts and electrofishing, current ESA permit restrictions for both NMFS Section 10(a)(1)(A) permit No's 1280 (TID) and 1282 (Stillwater) do not allow sufficient incidental take to conduct the second phase surveys at this time using electrofishing. Discussions with NMFS permitting staff and Stillwater have occurred since submittal of the 2007 study plan, resulting in a pending formal request to NMFS by Stillwater for modification of Permit 1282 (see Section 6 below). The Section 10 Permit

1280 issued to TID in 2005 authorized only up to 5 juvenile *O. mykiss* annually by electrofishing that was further restricted to River Mile 25–30 during September to November. Thus that permit is not applicable or adequate to the season, location, and fish numbers needed to conduct the electrofishing for this population estimate study. Consequently, the first survey effort planned for July 2008 will be conducted using snorkel surveys only as provided for in the 2007 study plan. Depending upon the outcome of the pending amendment request for permit No. 1282 with NMFS, subsequent surveys in 2009 may be conducted using the combined methodology presented below.

2 FIELD SAMPLING AND DATA COLLECTION

Although the bounded counts methodology was developed for use in smaller stream systems (Hankin and Mohr 2001), applying the methodology to a larger system such as the Tuolumne River is feasible provided key assumptions are satisfied. A critical assumption of the bounded counts approach is that all individuals have a chance of being observed. This may not be practically attainable due to the depths of some of the in-channel mining pits and also potentially due to low visibility conditions occurring at downstream locations or due to winter-time sediment inputs during rain events. Hankin and Mohr (2001) found that their survey designs were suitable for coho salmon (*O. kisutch*), but they were less confident about applying the methodology to *O. mykiss* juveniles because the fish's furtive nature may violate the assumption that all fish have an observation probability >0. Sampling sites and methodologies may be modified following initial surveys because local conditions cannot be anticipated and may dictate the use of other schedules, locations, or techniques. Stillwater Sciences will notify TID, FERC and permitting authorities if substantive changes in the study design, methods or schedule are anticipated.

2.1 Sample sites

During the 2008 summer survey, 42 sampling units will be selected from representative locations between about RM 52–40 for single-pass snorkel surveys. During subsequent winter and summer surveys, the number of habitat units may be adjusted based on results of the 2008 survey and seasonal differences. Preliminary habitat type mapping was conducted in 2001 (McBain & Trush 2004) and these mapping products are provided as an attachment to this plan. The accompanying GIS will be used to update these maps using field verification of flow, depth and water temperature conditions in the river.

2.2 Sampling Period

For summer 2008, habitat typing of the available habitat within the river into relatively homogeneous sampling units will be conducted in early July by a 2-person field crew to verify the preliminary habitat typing developed from GIS and past surveys (see attached maps). The habitat typing will be followed by single-pass snorkel surveys within pre-selected habitat units, with the second phase calibration surveys within units of each type to develop uncertainty and bias estimates. In July 2008, second phase sampling will be conducted using multi-pass snorkel surveys. In subsequent survey efforts in 2009, both snorkel survey and depletion electrofishing methods will be used as allowed under applicable permits (See Section 6)..

2.3 Field Work Notification

To ensure field staff safety and to satisfy scientific collecting permit requirements, the parties listed in Table 1 will be notified in advance of the proposed sampling in as required to confirm sampling dates.

Table 1. Field Work Notification

Contact	Affiliation	Address	Phone and Email
Tim Ford	TID	333 East Canal Dr. Turlock, CA 95380	209.883.8275 tjford@tid.org
Tim Heyne	CDFG	P.O. Box 10 La Grange, CA 95329	209.853.2533 x1# theyne@dfg.ca.gov
Jeffery Jahn	NMFS	777 Sonoma Ave. Rm 325 Santa Rosa, CA 95404	707.575.6097 Jeffrey.Jahn@noaa.gov

Prior to mobilization, planned river operations by the Districts will be checked to determine if fish sampling would be safe under the anticipated flow and all parties will be notified of any delay or modification to the sampling schedule.

2.4 Universe Delineation (Habitat Typing)

Because the target *O. mykiss* may likely congregate at transitional locations between major habitat types (Table 2), the overall study reach will be characterized by designating smaller habitat units as pool heads, pool bodies, pool tails, run heads, run bodies, run tails, and riffles. In addition to the preliminary habitat type mapping provided as an attachment to this plan, available orthorectified aerial photographs, and other existing habitat data and stream descriptions completed during past surveys and ongoing restoration projects along the river will also be used to develop aquatic habitat maps for use in survey efforts.

Table 2. Coarse scale habitat types to be used during snorkel surveys

Habitat Type	Description
Riffle	Shallow with swift flowing, turbulent water. Partially exposed substrate dominated by cobble or boulder. Gradient moderate (less than 4%).
Run/Glide	Fairly smooth water surface, low gradient, and few flow obstructions. Mean column velocity generally greater than one foot per second (fts^{-1}).
Pool	Slow flowing, tranquil water with mean column water velocity less than 1 fts^{-1}.

Within each reach, individual habitat units will be digitized as two-dimensional features of varying shapes, or polygons, where each unit is a discrete functional habitat, as defined above. This approach is consistent with the general techniques of McCain (1992), Thomas and Bovee (1993), and Cannon and Kennedy (2003) and allows a flexible approach to evaluating habitat and habitat use patterns at a scale that can be easily delineated given available data, readily depicted, and is ecologically meaningful for aquatic species.

Habitat units will be assigned a natural sequence order (NSO), starting at one which is the first unit at the upstream end of the site, and a habitat type unit number (1…N pools, runs and riffles). The maximum depth, length and width (usually at 1/3 and 2/3 of the units length) will be recorded and flagging tied at both upstream and downstream ends of units to be surveyed. Pertinent information such as date, unit number, and type is included on the flag. Lastly, the upper and lower end of each unit will be located by GPS and mapping from previous efforts will be verified or updated.

2.5 Survey Unit Selection

After all potential habitat units are typed and all pertinent information recorded, a subset of each habitat unit type will be selected for single-pass snorkel surveys. This includes six units of each type for 2008. Selection for sampling proceeds by random selection of the starting sampling unit in the upper survey section, followed by a systematic uniform sampling of the remaining units in the survey reach. For example, every 3rd, 4th or larger selection interval will be used to distribute the selected units uniformly across the survey reach. With the goal of sampling each selected unit, larger pool, run and riffle habitats will be subsampled at a length 100m, extending 50 meters upstream and downstream of their midpoint.

2.6 Measurement Parameters and Sampling Methods

Multiple parameters will be measured in order to meet the objectives for this study (Table 3). Photos and GPS locations will be taken at each site, and site locations identified on GIS maps corresponding to mapped aquatic habitat units. General site information recorded at fish sampling locations will include site name, GPS coordinates, time, date, and crew member names. *In situ* water quality parameters (Temperature, dissolved oxygen, and conductivity) will be collected using a pre-calibrated multi-probe (YSI 85, Yellow Springs Instruments, Yellow Springs, OH). Underwater visibility will also be estimated into the sun and away from the sun using a Secchi disk to monitor any changes in visibility. Dissolved oxygen probes will be recalibrated at each site and checked for accuracy against concentrations measured in Winkler titrations (Grasshoff et al 1983) at the beginning and end of each day using a portable dissolved oxygen test kit.

Table 3. Measurement parameters and methods for snorkel surveys

Parameter	Method	Metric/Descriptor	Method Reporting Limit
Habitat Typing Attributes			
Natural sequence order (Reach ID – Habitat unit #)	N/A	A-1, A-2, A-3, …	N/A
Latitude/Longitude	Handheld GPS receiver	UTM	N/A
Habitat type	Visual estimation	See Table 2	N/A
Average unit width	Horizontal distance	meters (feet) (measured at multiple transects)	0.01 m (0.1 ft)
Average unit length	Horizontal distance	meters (feet)	0.01 m (0.1 ft)
Maximum/minimum depth	Vertical distance	meters (feet)	0.15 m (0.5 ft)
Bed substrate composition	Visual estimation	bedrock, boulder, cobble, gravel, organic, sand, silt	10%
Cover type	Visual estimation	none, boulder, cobble, IWM, bedrock ledges, overhead vegetation, aquatic vegetation	10%
Field Data During Snorkel Surveys			
Temperature	EPA 170.1	°C	0.1 °C
Dissolved Oxygen	SM 4500-O	mg/L	0.0 mg/L
Conductivity	SM 2510A	umhos/cm	1.0 umhos/cm

Parameter	Method	Metric/Descriptor	Method Reporting Limit
Visibility	Secchi depth	meters (feet)	0.01 m (0.1 ft)
Date/Start time/End time	N/A	Day/month/year	N/A
Number of Individuals	Visual estimation	Number	1
Fish length – snorkeling	Visual estimation	millimeter	50 mm
Fish length – electrofishing	Fork length	millimeter	1 mm
Weight - electrofishing	Electronic balance	gram	0.1 g

2.6.1 Snorkel Surveys

Snorkel surveys are planned to be conducted during daylight hours (6:00am–8:00pm). A two phase survey design will be used to survey the seven different riffle, run and pool strata (Table 4). At the first phase, single-pass dive surveys will be conducted by a four to five person crew depending upon river flows and underwater visibility. Sampling units will generally be sampled from downstream to upstream in dive lanes using a zigzag pattern, passing fish and allowing them to escape downstream of the diver. If fish are observed to escape upstream, the diver will take care to avoid counting these fish twice. Divers will record their observations of pertinent attributes (Table 3) and numbers of *O. mykiss* and Chinook salmon (*O. tshawtscha*) observed; with fish lengths to be estimated in 50 mm size ranges using a scale model or markings on the slates to correct for underwater size distortion. After the first dive pass is completed a tab is then pulled to determine if the unit is included in the second phase of sampling.

Table 4. Preliminary sample unit selection and survey count

Habitat	Phase I Dives		Phase II Survey	
	Initial Units	Passes	Repeat Units	Passes
Riffle	6	1	4	3
Pool head	6	1	2	3
Pool body	6	1	2	3
Pool tail	6	1	2	3
Run head	6	1	2	3
Run body	6	1	2	3
Run tail	6	1	2	3
	Total	42	Total	48

The second phase of sampling collects data that will later be used to extrapolate dive counts to total population estimates by three passes of either repeated dive counts or depletion electrofishing. Ideally, if the count of *O. mykiss* from the Phase 1 snorkel survey is less than or equal to 20 individuals then three additional dive passes are made. If electrofishing is permitted, all units with a count of juvenile *O. mykiss* counts greater than 20 individuals will be surveyed by electrofishing. Lastly, occurrence of other native and non-native fish species will be recorded as presence/absence.

2.6.2 Electrofishing at Riverine Sites

When employed, electrofishing will be conducted by a 4 person crew during the daylight hours (6:30am-8pm) following the dive surveys. Ideally, 3-pass electrofishing will be used on all second

phase dive units where the first dive pass exceeded 20 *O. mykiss*. Dive units that require electrofishing for dive calibration will be completed as soon as possible after the dive survey.

Shallow water habitat may be sampled using back pack electrofishing units while deep water habitat may be sampled using a boat electrofishing unit. Back pack electrofishing in shallow waters less than 3–4 ft depth will be conducted using two or more Smith-Root back pack electrofishers (Model LR-24 or Model 12 with 11-inch anode rings and standard "rat-tail" cathodes). Boat electrofishing may be used in deeper riverine habitats using a boat mounted Smith Root 1.5 KVA electrofishing unit. To ensure the health of all fish captured during electrofishing, all electrofishing will be conducted in accordance with NMFS (2000) electrofishing guidelines and an electrofishing logbook will be maintained and updated at each sampling site.

Depending upon river flows and depth, electrofishing will use block nets placed at the upstream and downstream ends of the unit to be fished, taking care to avoid disturbance of the unit during net set-up. Block nets will be set up where possible to prevent fish from moving out of the unit. If block nets are not feasible, then a snorkeler may be stationed at the upstream end of a unit to observe any fish moving out of the unit.

First pass electrofishing will proceed slowly and deliberately upstream from the downstream end of the unit; members of an electrofishing crew will move to the top and back down to the bottom working closely together. To maintain equal effort on subsequent passes, electrofishing time (seconds) will be recorded to allow for any adjustments in sampling effort. A fourth pass will be conducted if one of the following applies:

1. The number of *O. mykiss* caught on the 2nd pass exceeds the number of *O. mykiss* caught on the 1st pass.
2. The number of *O. mykiss* caught on the 3rd pass is greater than or equal to 25 percent of number caught on the 2nd pass.

The procedure may be modified in riffle habitats to facilitate capture of shocked fish in fast water. In the riffle strata, a pass consists of a sweep from the top to the bottom of the unit. Depending on the water velocity, block nets may or may not be set at the upstream end of riffle units.

2.6.3 Fish Handling Protocols

Any fish captured during electrofishing surveys will be processed, and information collected regarding species identification, fork length (FL, mm), weight (g), and, if applicable, notes on general condition. All fish will be rapidly retrieved using dip nets and placed immediately into aerated live wells or buckets with water. Large fish will be kept separate from juvenile fish to avoid confinement predation. Fish will be identified to species and origin (hatchery or wild stock) where possible. Fish that are weighed and measured will be anesthetized using clove oil to minimize handling stress. After all fish are identified, counted, and measured, fish will be held for approximately 10 minutes, until they show signs of "normal" swimming patterns and behavior.

3 QUALITY ASSURANCE

The objective of data collection for this Project is to produce data that represent as closely as possible, *in situ* conditions of the Tuolumne River with respect to river flow conditions, water quality, abundance and habitat use by *O. mykiss*. To meet this objective, field sampling, sample preparation, and analysis will follow general guidelines outlined in USEPA (2002) by ensuring that:

- the project's objectives, hypotheses and data quality objectives are identified and agreed upon,
- the intended measurements and methods are consistent with project objectives,
- the assessment procedures are sufficient for determining if data of the type and quality needed and expected are obtained, and
- any potential limitations on the use of the data can be identified and documented.

Aquatic environments are inherently variable, but management decisions must be based on a data from a limited number of locations and often collected in short time periods. How well the information collected represent the reach or river-wide fish population depends upon a systematic approach to quality assurance.

3.1 Data Quality Objectives for Measurement Data

The data quality parameters used to assess the acceptability of the data are precision, accuracy, representativeness, comparability, and completeness. Precision measures the reproducibility of measurements under a given set of conditions. Analytical precision is limited to water quality and physical habitat characteristics (Table 5). Accuracy is an expression of the degree to which a measured or computed value represents the true value. Field accuracy is controlled by adherence to sample collection procedures.

Table 5. Data quality objectives for field parameters

Parameter	Units	Accuracy	Precision	Completeness
Dissolved Oxygen	mg/L	± 0.5	10%	90%
Temperature	^{o}C	± 0.5	5%	90%
Conductivity	umhos/cm	± 5%	± 5%	90%
Depth	meters	± 0.2	N/A	N/A
Visibility (Secchi)	meters	± 0.05	N/A	N/A

- Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For this study, monitoring site selection will be conducted based on physical habitat attributes. Additionally, specific measurement parameters have been identified as relevant based on numerous studies indicating factors associated with species distribution.

- Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this biological assessment, comparability of data will be established through the use of standard analytical methodologies and reporting formats.

- The project goal for completeness, a measure of the amount of data that is determined to be valid in proportion to the amount of data collected, will be 90% for analytical water quality parameters. The data quality objective for completeness for all components of this study is 90%.

3.2 Training Requirements/Certification

Specialized training is required for the proposed sampling activities, however none of the sampling activities require outside certification from an agency or another entity. Required permits for biological sampling are discussed in Section 5. Field crews will be staffed by a variety of qualified personnel, which due to the nature of extended field activities, will necessarily be rotated in and out of the field.

3.3 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

To ensure proper equipment performance in the field, maintenance and operational procedures, including preventative maintenance, will be performed on all YSI multiprobes (temperature, dissolved oxygen, and conductivity). YSI maintenance will be recorded in a logbook with the date the maintenance was performed and the initials of the technician. When the instruments are not deployed, the calibration or storage cup will be used to protect sensors from damage and desiccation.

3.4 Instrument Calibration and Frequency

Field probes used for field sampling will be calibrated prior to use, midway through each sampling event, and at the end of each sampling event. Measurement devices for conductivity will be checked against a standard whose source is different than that selected for calibration. Dissolved oxygen will be checked against aerated water whose oxygen content is established by the Winkler method (Grashoff et al 1983). Temperature does not require calibration because of the unvarying nature of the temperature sensor and its conditioning circuitry.

3.5 Reconciliation with Data Quality Objectives

If data do not meet the project's specifications, the following actions will be taken. First, the task leaders working with the field crew leaders (in some cases they will be the same person) will review the errors and determine if the problem is equipment failure, calibration/maintenance techniques, or monitoring/sampling techniques. They will suggest corrective action. If the problem cannot be corrected by training, revision of techniques, or replacement of supplies/equipment, then the task leaders will review the data quality objectives (DQOs) and determine if the DQOs are feasible. If the specific DQOs are not achievable, they will determine whether the specific DQO can be relaxed, or if the parameter should be eliminated from the monitoring program.

3.6 Data Management

All field data will be amassed in a quality-checked database and summarized. QA checks will be applied to all data before data entry and data will be stored on Stillwater Sciences servers. Full backup of data from all offices is done on a weekly basis, while differential backup (files that have changed since the last full backup) is done on a nightly basis. The backup process is accomplished with a Fast Tape Library and backup processes are completed during off-peak hours. Two sets of tapes are taken offsite by two Information Technology (IT) staff members on a weekly basis to ensure recovery in case of failure or catastrophe.

4 DATA ANALYSIS

Data analysis will be conducted to summarize *in situ* water quality and fish counts in each sampling strata. Bounded counts or depletion estimators will be used to determine populations and linear density for each sampled unit, together with estimates of uncertainty. In addition to comparisons of fish density between sampling strata, the density estimates and uncertainties will be propagated across the unsampled areas for an overall population estimate. Exploratory multiple regression analysis will also be used to determine relationships between fish density and recorded habitat variables.

5 REPORTING

A data report will be prepared for use with permitting authorities that includes: date, time, and location of sampling activities; species and number of species collected; and a copy of field data sheets. A draft technical report will be submitted to TID by November 17, 2008. Assuming review

comments are received within two weeks, an Agency review draft will be available by December 20, 2008 and final report will be complete by February 2009.

6 PERMITTING REQUIREMENTS

Stillwater Sciences will maintain the following permits to sample fish populations that may be present:

- NMFS Section 10(a)(1)(A) permit 1282
- California Department of Fish and Game individual Scientific Collection Permits.

A NMFS Section 10(a)(1)(A) permit 1282 has been obtained and all NMFS guidelines (e.g., notification, data gathering, preservation) will be followed if any Central Valley steelhead are captured. Under that existing NMFS permit, electrofishing is limited to an authorized incidental take of 40 juvenile *O. mykiss* and the <5% unintentional mortality limit, and no adults. An amendment to the sampling description was submitted to NMFS on June 2, 2008 with increased take limits for handling electrofishing of 100 adults and 200 juveniles at an unintentional mortality rate of <10%. Mr. Jeffrey Jahn of NMFS will be notified at least two weeks prior to applicable sampling to confirm sampling dates and locations. Electrofishing under an amended permit will be suspended in the event that the authorized incidental take limits were exceeded and all subsequent calibration surveys would be made by repeat dive surveys. Annual reporting will be provided to Mr. Jeffrey Jahn of NMFS by March 1, of each year.

CDFG Scientific Collecting Permits (SCPs) will be maintained for species potentially present in the project area. CDFG guidelines (e.g., notification, data gathering, and preservation) will be followed if special-status species are captured and the CDFG 24-hr dispatch (916.446.0045) will be notified should unrelated events result in fish kills.

No intentional mortality or removal of special-status species from the wild is included in this study plan. In the event unintentional mortality occurs beyond the take permit limits, NMFS staff will be contacted within 24 hrs and a fin-clip will be provided to the Salmonid Genetic Repository. CDFG will also be contacted to determine the disposition of the individual specimen and whether the individual may be retained for otolith analysis.

7 REFERENCES

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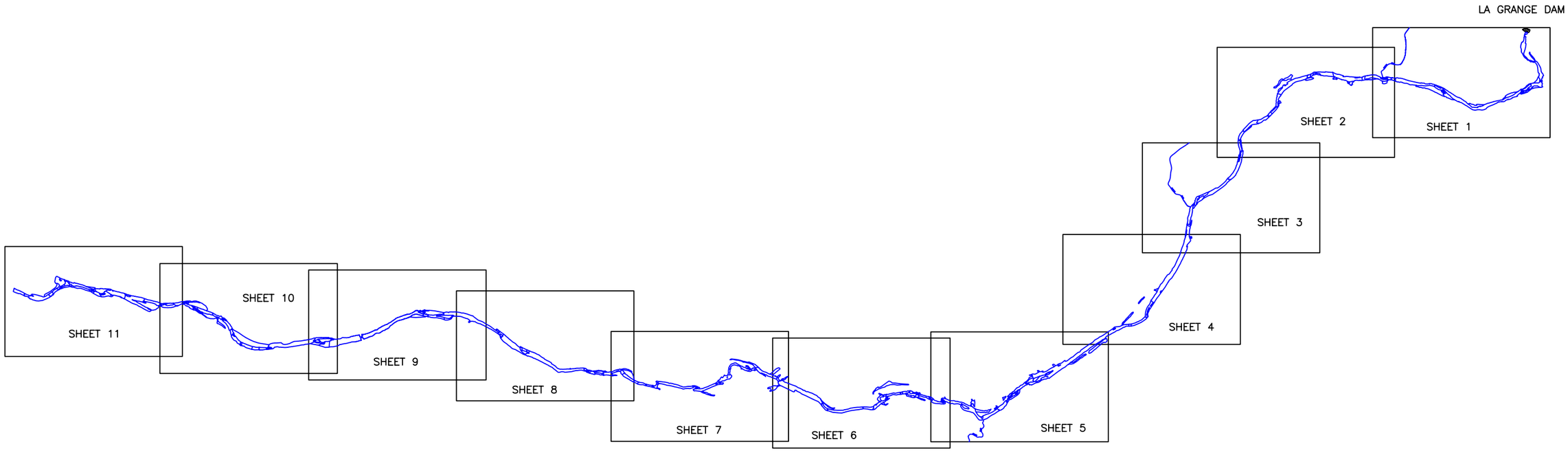
Attachment A - Habitat Mapping

Mapping and Habitat Types from 2001 Surveys by McBain & Trush (2004)



NORTH

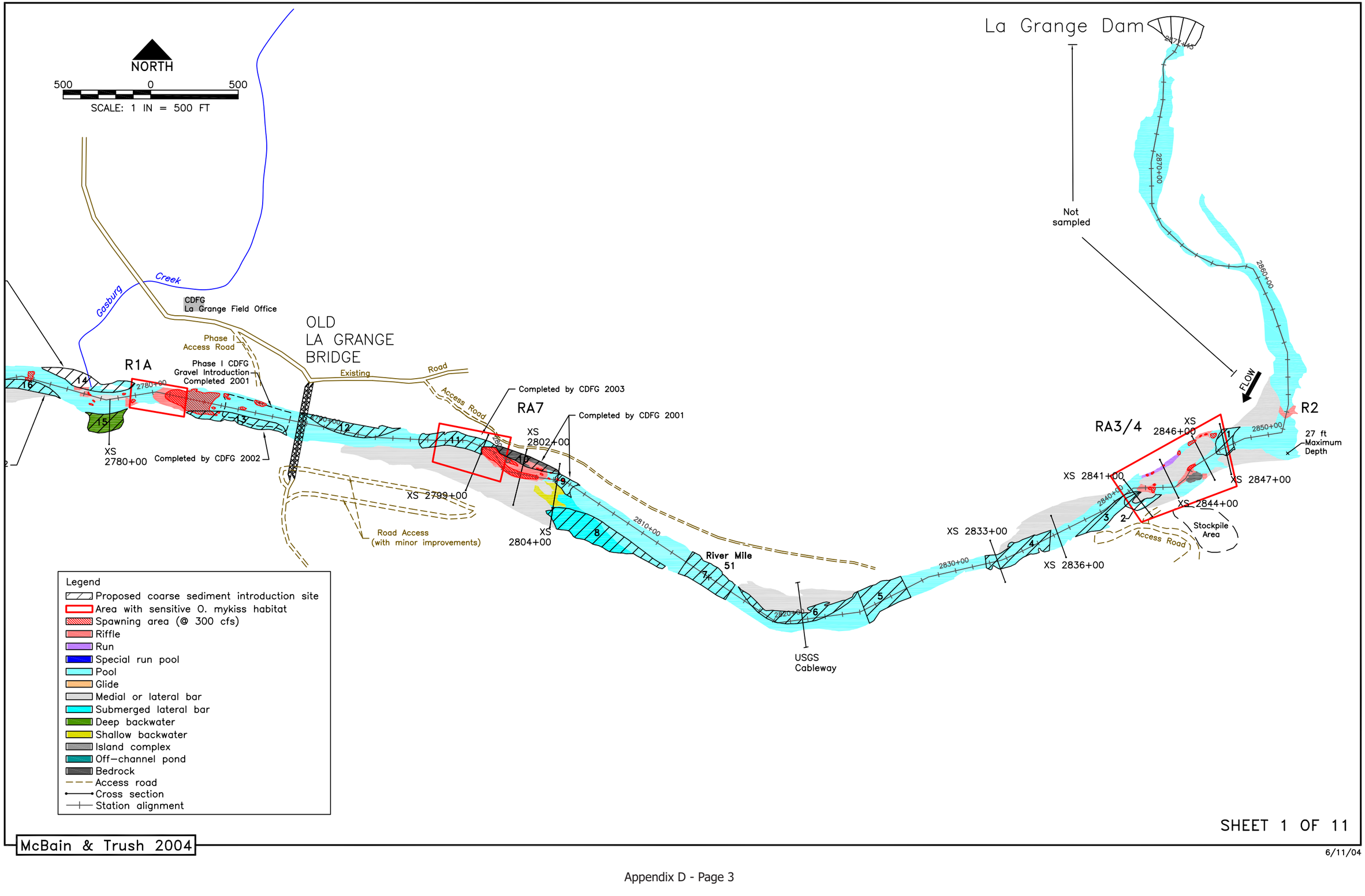
4500 2250 0 4500

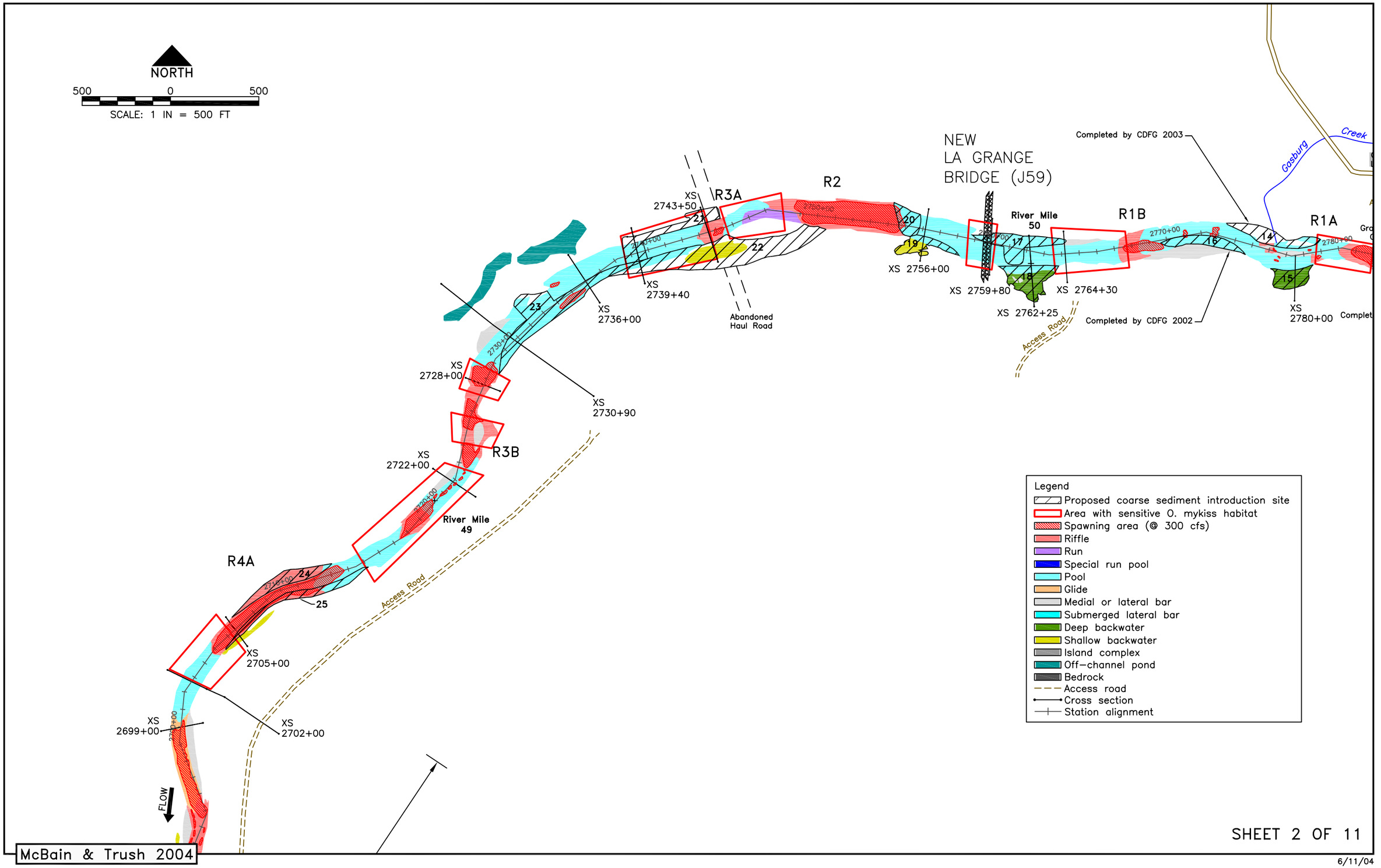
SCALE: 1 IN = 4500 FT

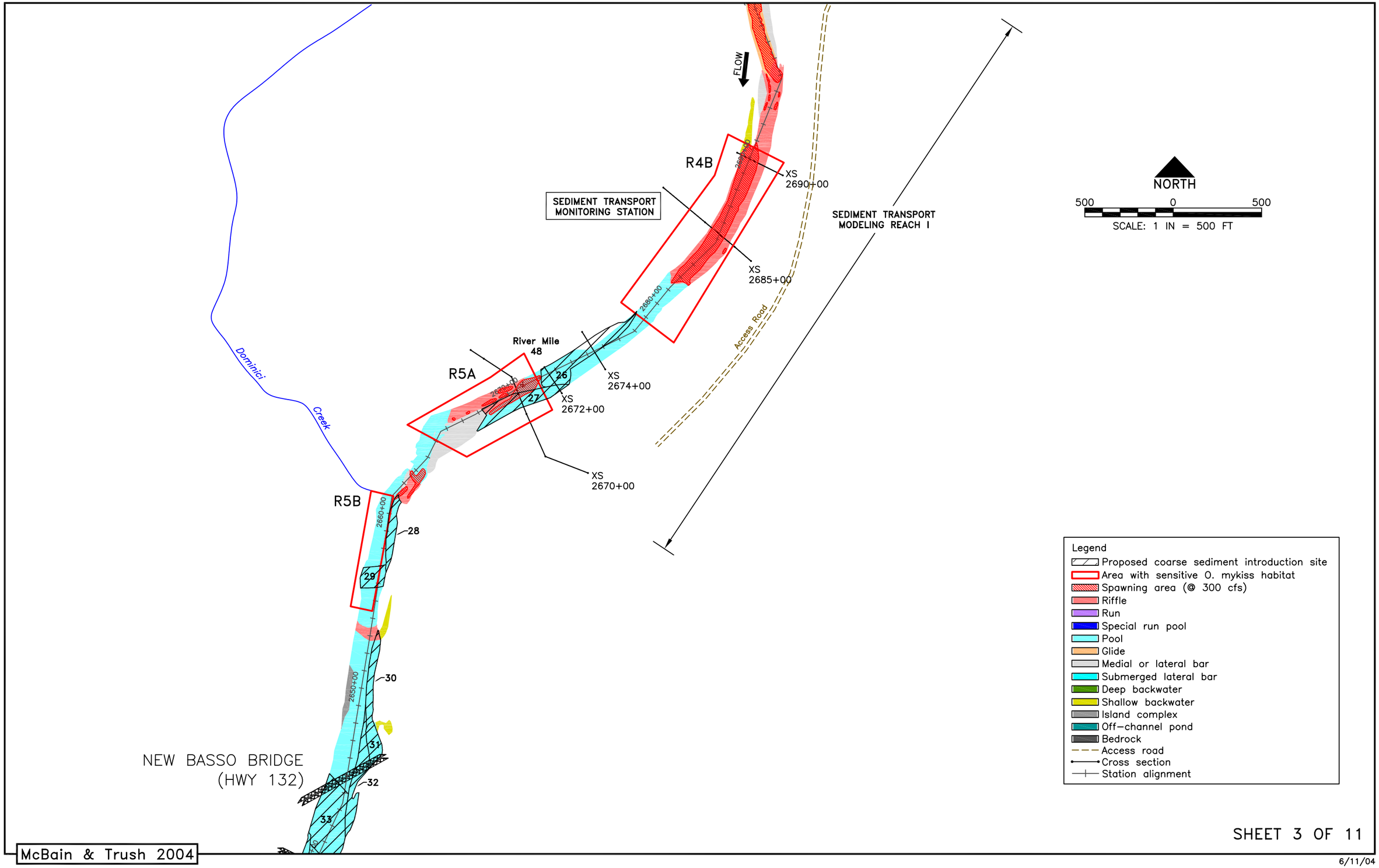
TUOLUMNE RIVER HABITAT MAP SHEET INDEX

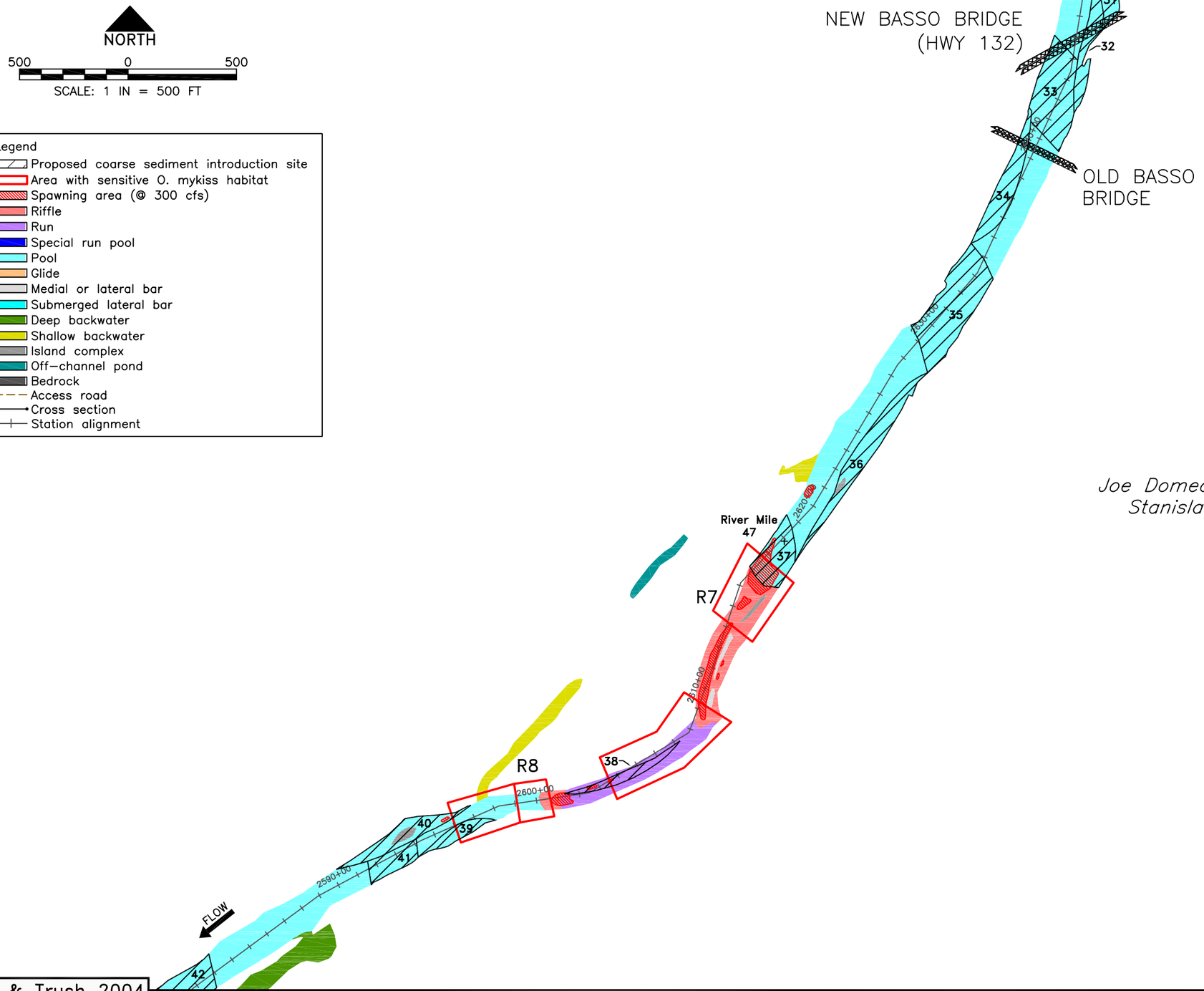
McBain & Trush 2004

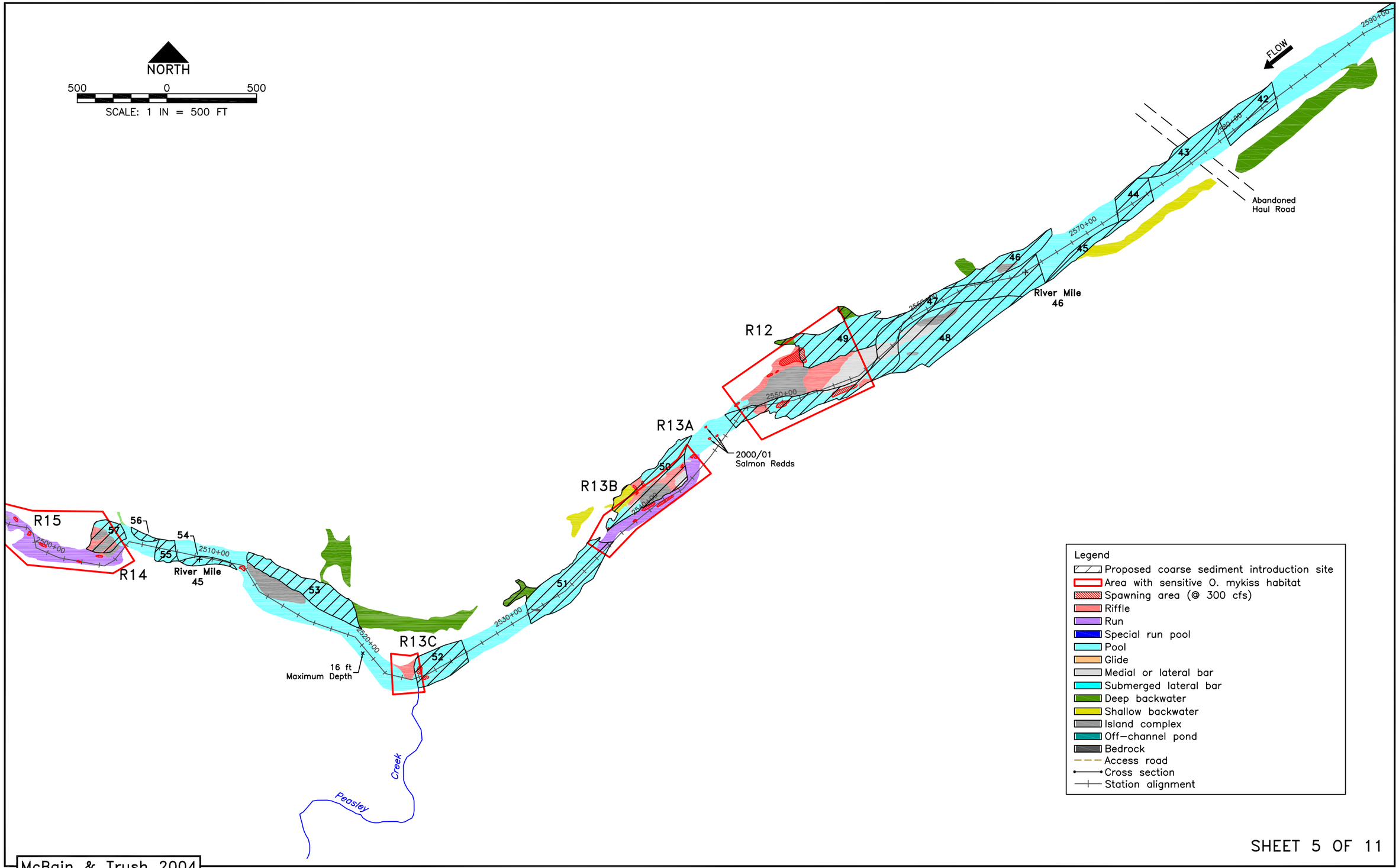
6/11/04

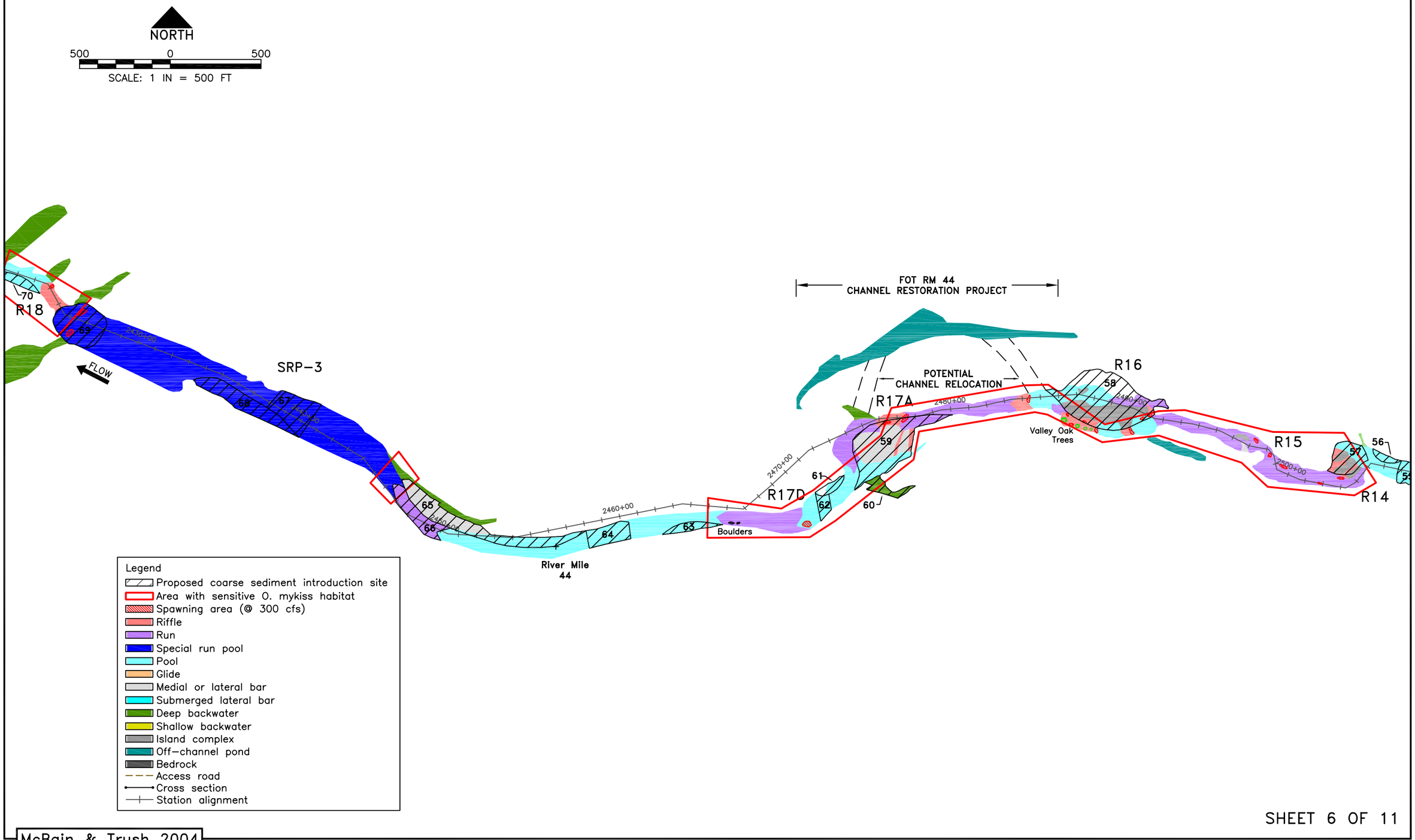

NORTH
500 0 500
SCALE: 1 IN = 500 FT
La Grange Dam
Not sampled
FLOW
Gasburg Creek
CDFG La Grange Field Office
Phase I Access Road
OLD LA GRANGE BRIDGE
Existing Road
Access Road
R1A
Phase I CDFG Gravel Introduction Completed 2001
2780+00
XS 2780+00
Completed by CDFG 2002
2790+00
RA7
Completed by CDFG 2003
Completed by CDFG 2001
XS 2802+00
XS 2799+00
XS 2804+00
2810+00
Road Access (with minor improvements)
River Mile 51
2820+00
USGS Cableway
2830+00
XS 2833+00
XS 2836+00
RA3/4
XS 2846+00
2850+00
R2
27 ft Maximum Depth
XS 2841+00
XS 2847+00
XS 2844+00
2840+00
Stockpile Area
Access Road
2860+00
2870+00
Legend
Proposed coarse sediment introduction site
Area with sensitive O. mykiss habitat
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
McBain & Trush 2004
SHEET 1 OF 11
6/11/04


NORTH
500 0 500
SCALE: 1 IN = 500 FT
NEW
LA GRANGE
BRIDGE (J59)
Completed by CDFG 2003
Completed by CDFG 2002
Gasburg Creek
River Mile
50
River Mile
49
R1A
R1B
R2
R3A
R3B
R4A
XS 2743+50
XS 2739+40
XS 2736+00
XS 2730+90
XS 2728+00
XS 2722+00
XS 2705+00
XS 2702+00
XS 2699+00
XS 2756+00
XS 2759+80
XS 2762+25
XS 2764+30
XS 2780+00
Abandoned Haul Road
Access Road
Access Road
FLOW
McBain & Trush 2004
Legend
Proposed coarse sediment introduction site
Area with sensitive O. mykiss habitat
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
SHEET 2 OF 11
6/11/04


FLOW
R4B
XS 2690+00
SEDIMENT TRANSPORT MONITORING STATION
XS 2685+00
2680+00
SEDIMENT TRANSPORT MODELING REACH 1
Access Road
River Mile 48
R5A
26
XS 2674+00
27
XS 2672+00
XS 2670+00
Dominici Creek
R5B
2660+00
28
29
30
2650+00
31
32
33
NEW BASSO BRIDGE (HWY 132)
NORTH
500 0 500
SCALE: 1 IN = 500 FT
Legend
Proposed coarse sediment introduction site
Area with sensitive O. mykiss habitat
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
McBain & Trush 2004
SHEET 3 OF 11
6/11/04


NORTH
500 0 500
SCALE: 1 IN = 500 FT
Legend
Proposed coarse sediment introduction site
Area with sensitive O. mykiss habitat
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
NEW BASSO BRIDGE
(HWY 132)
OLD BASSO
BRIDGE
River Mile
47
R7
R8
FLOW
31
32
33
34
35
36
37
38
39
40
41
42
2620+00
2610+00
2600+00
2590+00
Joe Domecq Wilderness
Stanislaus County
McBain & Trush 2004
SHEET 4 OF 11
6/11/04

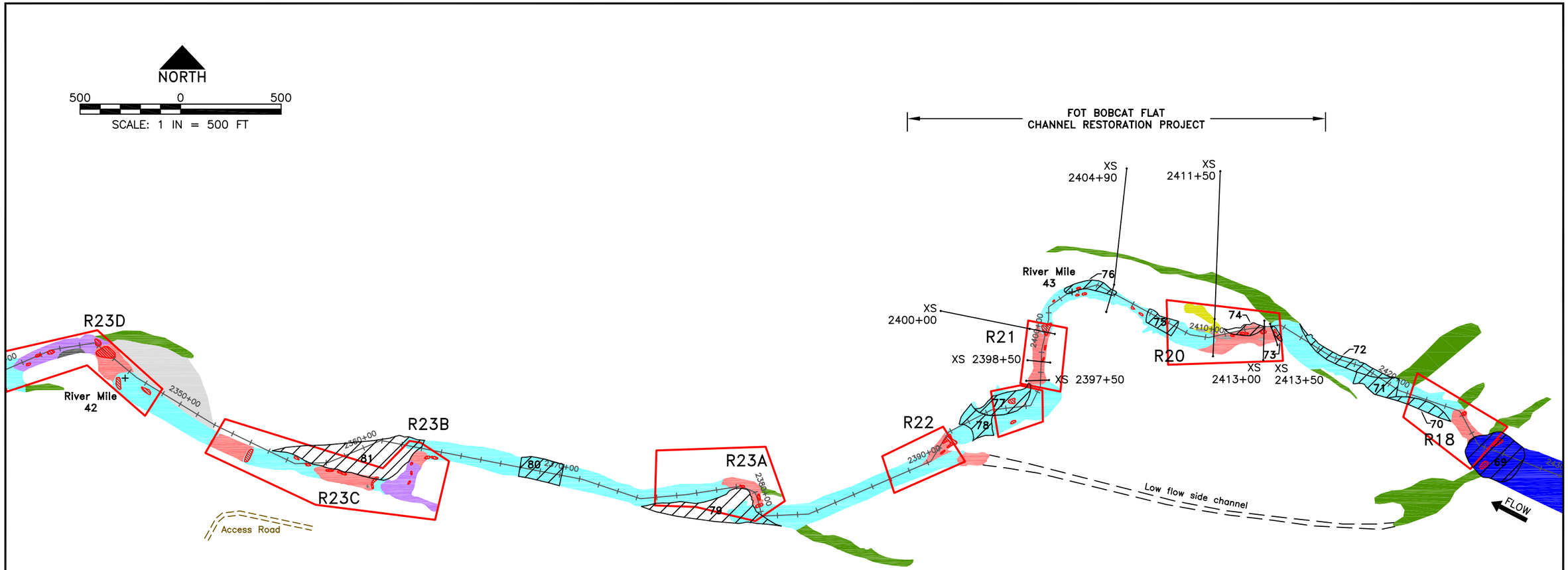

NORTH
500 0 500
SCALE: 1 IN = 500 FT
FLOW
2590+00
42
43
44
45
46
47
48
49
2570+00
2550+00
Abandoned Haul Road
River Mile 46
R12
R13A
R13B
R13C
2000/01 Salmon Redds
50
51
52
53
54
55
56
57
R14
R15
River Mile 45
2510+00
2530+00
2520+00
16 ft Maximum Depth
Peasley Creek
Legend
Proposed coarse sediment introduction site
Area with sensitive O. mykiss habitat
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
McBain & Trush 2004
SHEET 5 OF 11
6/11/04



SHEET 6 OF 11

McBain & Trush 2004

6/11/04



Legend

- Proposed coarse sediment introduction site
- Area with sensitive O. mykiss habitat
- Spawning area (@ 300 cfs)
- Riffle
- Run
- Special run pool
- Pool
- Glide
- Medial or lateral bar
- Submerged lateral bar
- Deep backwater
- Shallow backwater
- Island complex
- Off-channel pond
- Bedrock
- Access road
- Cross section
- Station alignment

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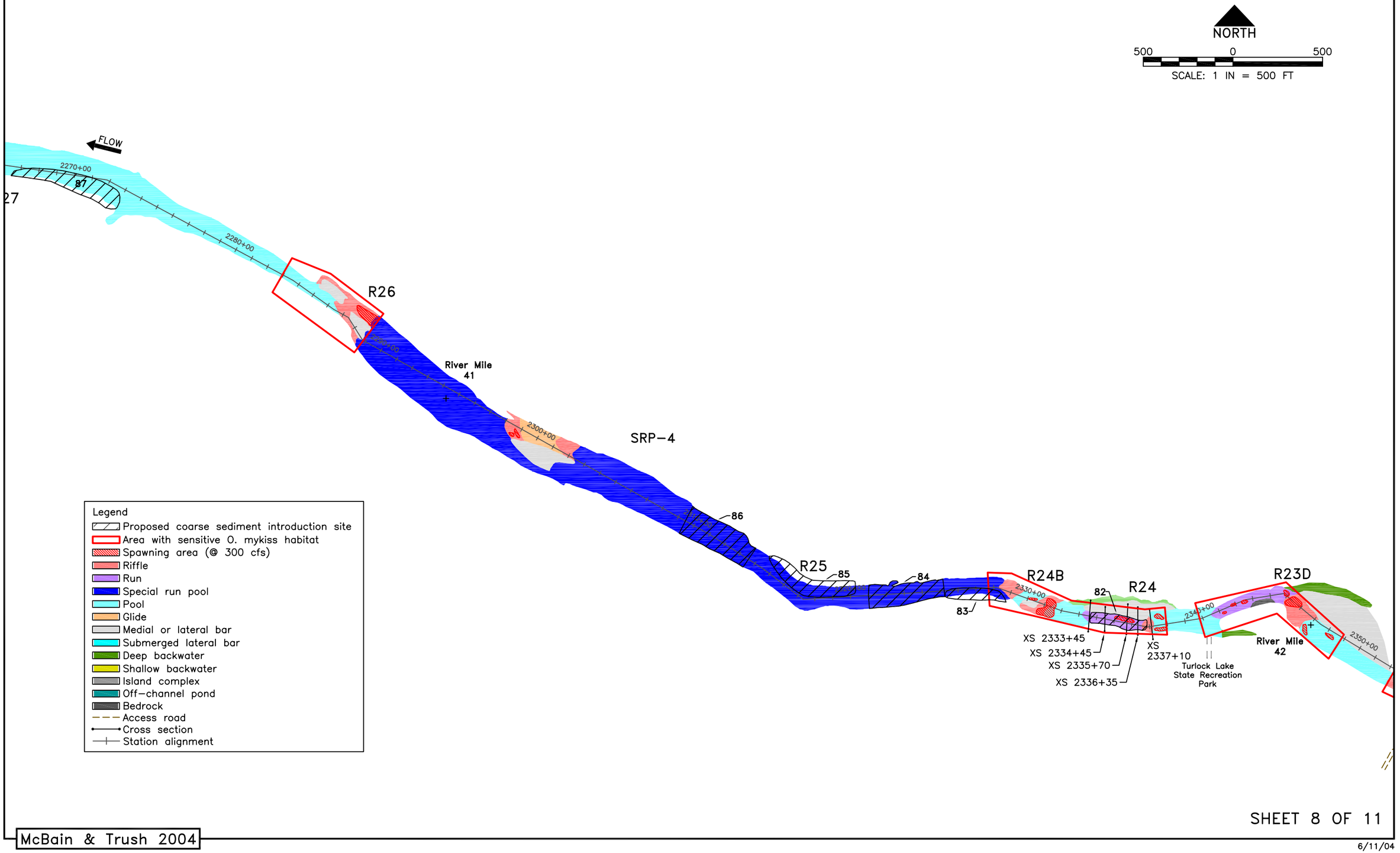
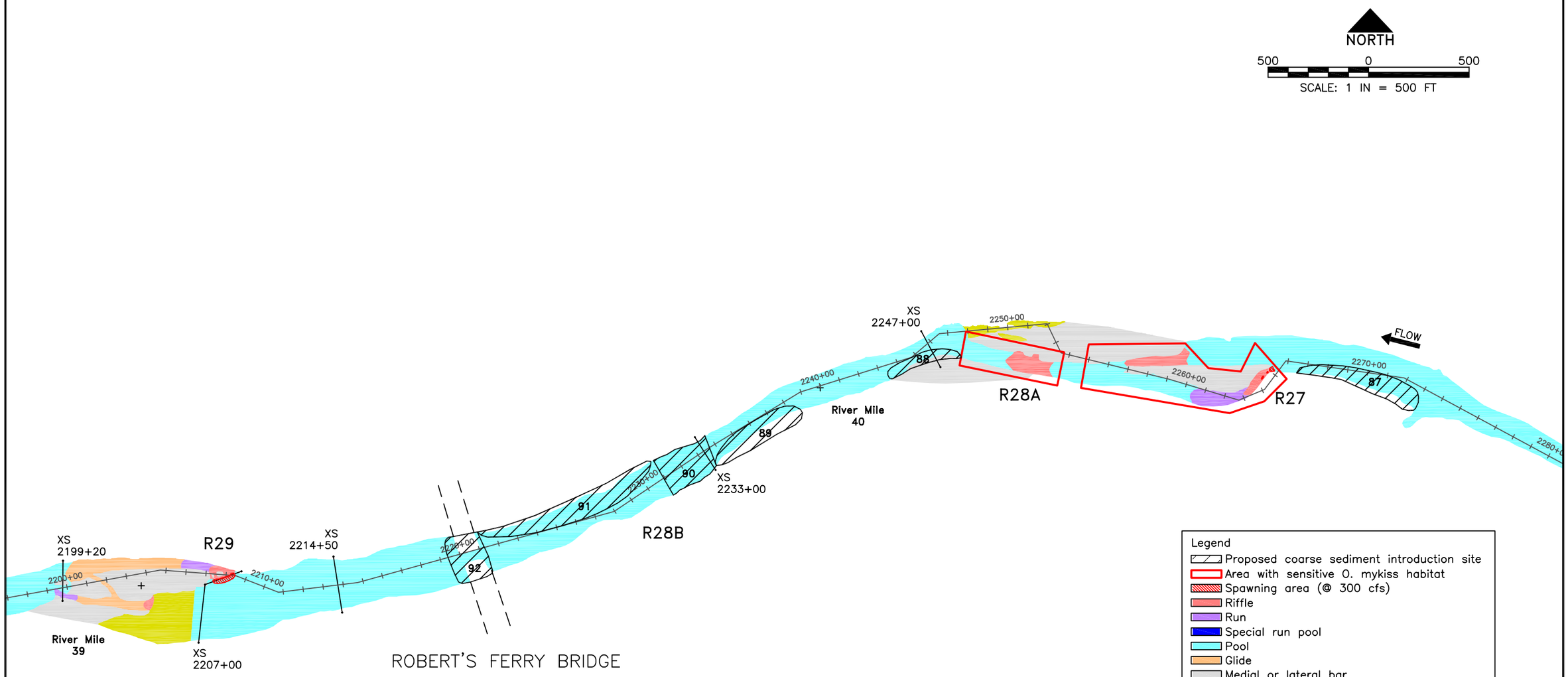
McBain & Trush 2004

6/11/04

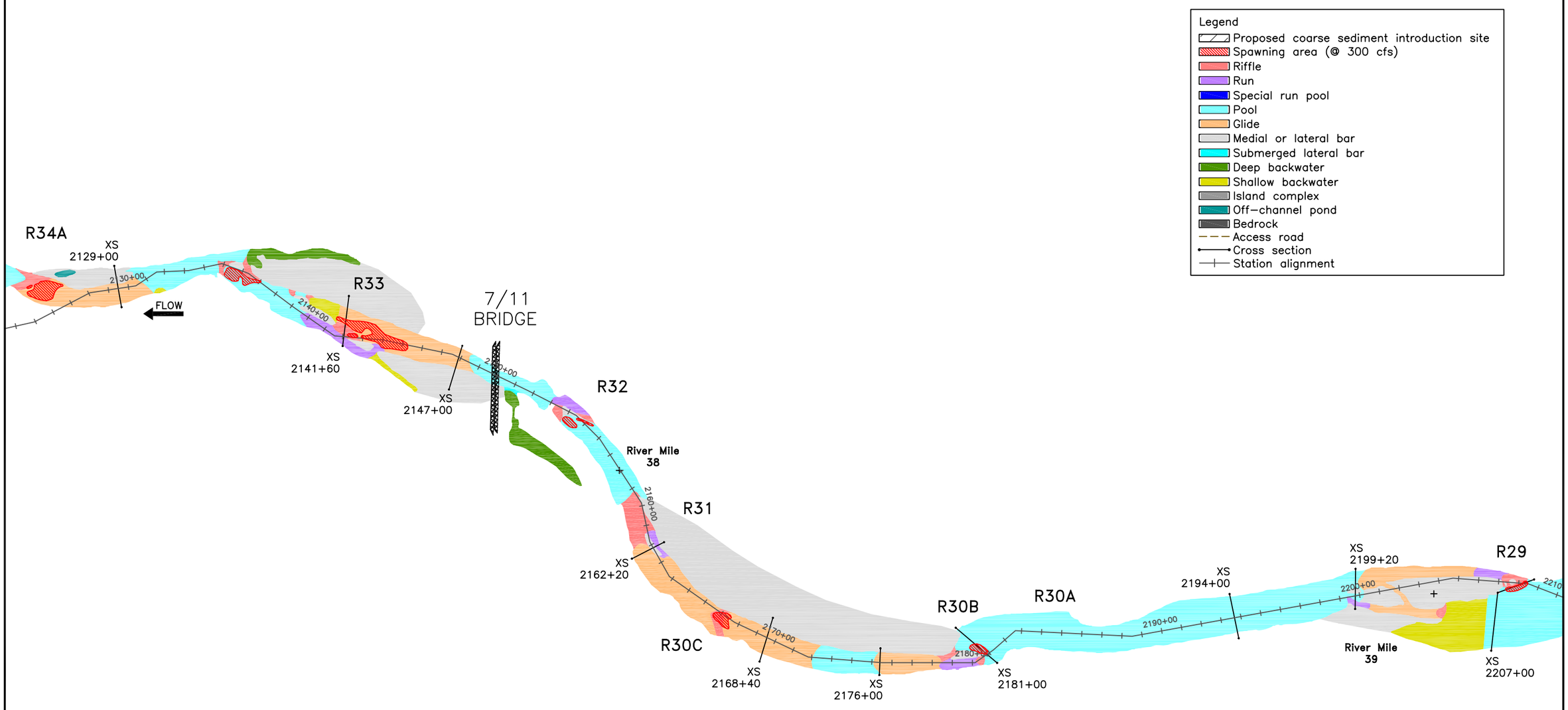

NORTH
500 0 500
SCALE: 1 IN = 500 FT
FLOW
2270+00
81
27
2280+00
R26
River Mile
41
SRP-4
2300+00
86
R25
85
84
83
R24B
2330+00
82
R24
XS 2333+45
XS 2334+45
XS 2335+70
XS 2336+35
XS
2337+10
2340+00
Turlock Lake
State Recreation
Park
R23D
River Mile
42
2350+00
Legend
Proposed coarse sediment introduction site
Area with sensitive O. mykiss habitat
Spawning area (@ 300 cfs)
Riffle
Run
Special run pool
Pool
Glide
Medial or lateral bar
Submerged lateral bar
Deep backwater
Shallow backwater
Island complex
Off-channel pond
Bedrock
Access road
Cross section
Station alignment
SHEET 8 OF 11
McBain & Trush 2004
6/11/04



SHEET 9 OF 11

McBain & Trush 2004

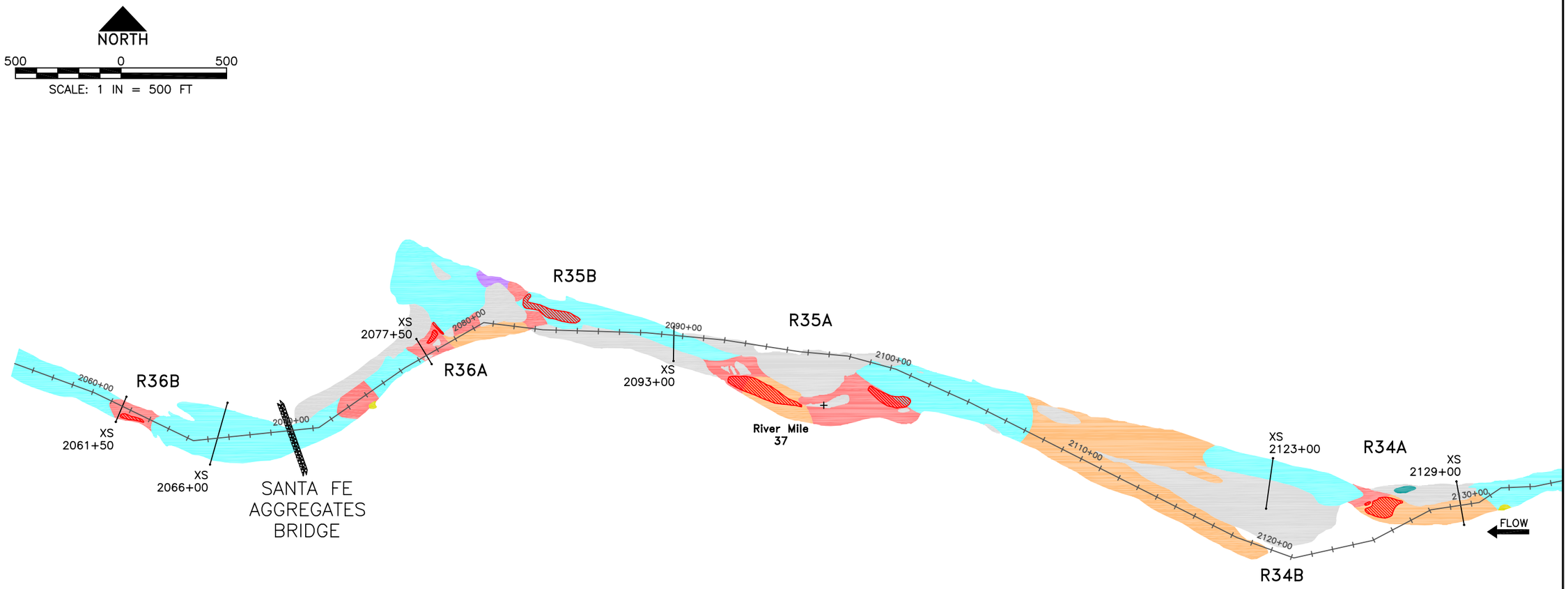
6/11/04



SHEET 10 OF 11

McBain & Trush 2004

6/11/04



Legend
- Proposed coarse sediment introduction site
- Spawning area (@ 300 cfs)
- Riffle
- Run
- Special run pool
- Pool
- Glide
- Medial or lateral bar
- Submerged lateral bar
- Deep backwater
- Shallow backwater
- Island complex
- Off-channel pond
- Bedrock
- Access road
- Cross section
- Station alignment

McBain & Trush 2004

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6/11/04