SWCA
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MIDDLE RIO GRANDE RIVERINE HABITAT RESTORATION FISHERIES MONITORING SPRING 2008 SAMPLING AND DATA ANALYSIS PLAN

Prepared for

NEW MEXICO INTERSTATE STREAM COMMISSION, ALBUQUERQUE OFFICE

Prepared by

SWCA ENVIRONMENTAL CONSULTANTS

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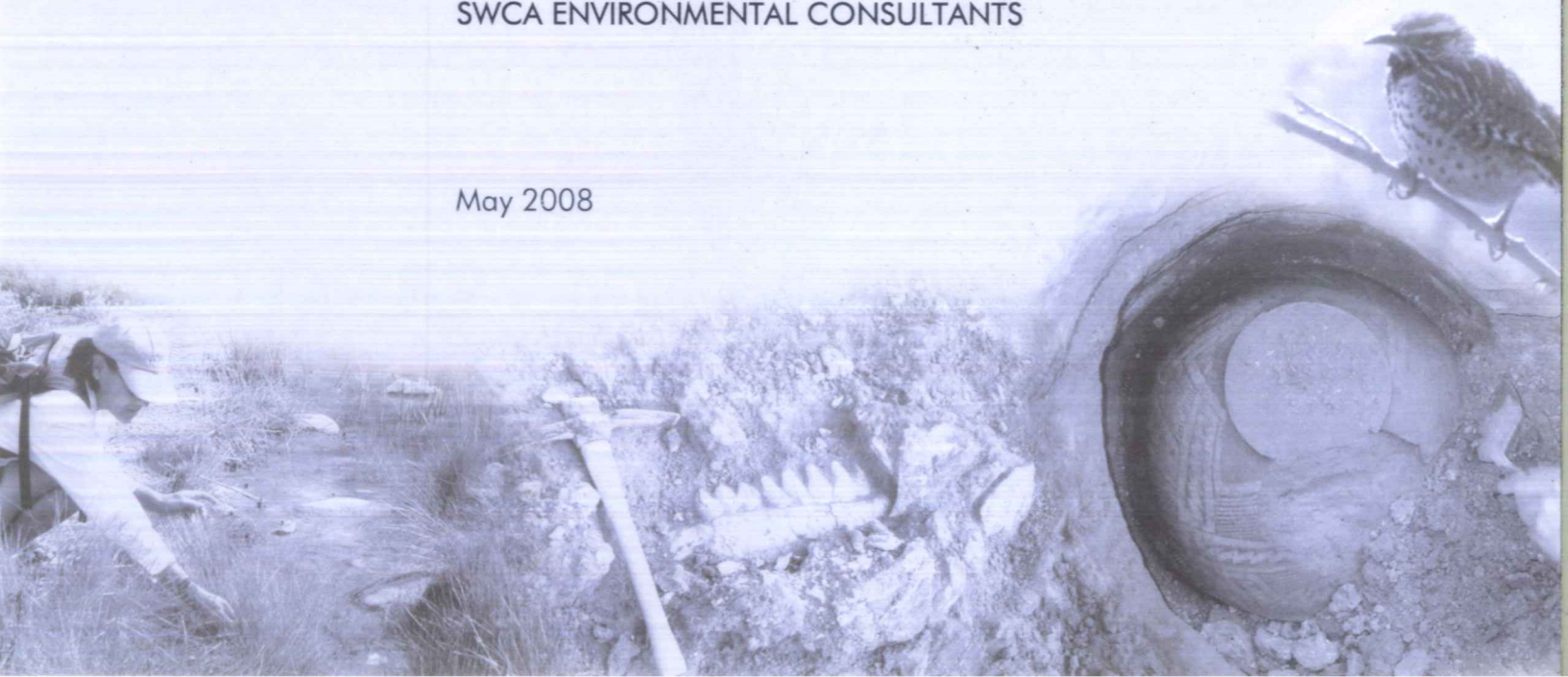

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RIVERINE HABITAT RESTORATION FISHERIES MONITORING
SPRING 2008 SAMPLING AND DATA ANALYSIS PLAN

SWEP3 RG-08-13

Prepared for

NEW MEXICO INTERSTATE STREAM COMMISSION, ALBUQUERQUE OFFICE
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List of Acronyms Used

Acronym	Definition
SWCA	SWCA Environmental Consultants
MRG	Middle Rio Grande
NMISC	New Mexico Interstate Stream Commission
cfs	Cubic feet per second
USGS	United States Geological Survey
m/s	Meters per second
feet/s	Feet per second
PDN	Paseo del Norte subreach
I40	Interstate 40 subreach
SDC	South Diversion Channel subreach
MEC	Moore egg collector
SL	Standard length
mm	millimeter
g	gram
HOBO	Brand name for temperature dataloggers
GPS	Global positioning system
PCA	Principal components analysis
PFD	Personal floatation device
RGSM	Rio Grande silvery minnow

PROJECT OVERVIEW

This Sampling and Analysis Plan for spring 2008 Fisheries Monitoring, under SWCA RG08-13 Task 3, provides field personnel with detailed instructions on sampling locations, field equipment operations, monitoring methodologies, and operating procedures.

PRIMARY HYPOTHESIS

During inundation, river floodplains are known to be highly productive relative to main channel habitats (Junk et al. 1989). In addition, during high flows, river floodplains provide valuable habitat for fish that positively affects population and community dynamics (Schlosser 1991). In the Middle Rio Grande (MRG), the construction of flood control dams on the main stem and it's primary tributaries, result in modified flows (including reductions in some peak flows, increases in base flows, and, on occasion, truncated snowmelt and summer monsoon flows), and the realignment of the river channel including straightening the river, jetty jack installation, and placing spoil embankments. These factors have contributed to a system with modified hydrology and geomorphology, including isolating an incised main channel from the historic floodplain. The realignment of the river channel and associated floodway in combination with the fact the upstream reservoirs capture sediment results in a situation where the water flowing from the flood control dams is sediment starved. Therefore, the sediment starved water picks up finer grained sediment from below the flood control dams moving that sediment downstream and the channel itself degrades locally. That degradation further reduces the potential for flooding in some areas of the MRG by over banking or sloughing of a spoil embankment/levee. Because of these factors, the river within the contemporary MRG floodway through certain reaches, including the Albuquerque Reach, inundates over bank floodplain areas less frequently.

The New Mexico Interstate Stream Commission (NMISC) has been executing a number of river restoration techniques in the MRG in order to reconnect portions of the immediate floodplain with the main channel during periods of moderate and high flows to benefit the federally endangered Rio Grande silvery minnow (*Hybognathus amarus*; silvery minnow). Silvery minnow may use these inundated floodplain habitats to spawn during spring runoff. Multiple life stages of silvery minnow have been found in both naturally-occurring floodplain habitats and features created by the NMISC. This includes areas adjacent to the main river channel and inundated islands within the river channel. Knowledge of life stage use of mesohabitats represents a logical basis for formulating intervention strategies intended to enhance the species' short- and long-term prospects of survival. The 2008 spring runoff fisheries monitoring will allow the NMISC to assess the effectiveness of specific techniques used for the creation of silvery minnow habitat and to observe silvery minnow presence in naturally occurring features. This will allow for informed adaptive management including modifying restoration designs, and conducting high priority maintenance.

SWCA will assist the NMISC in establishing relationships between inundated floodplain habitat and occupancy of spawning silvery minnow. For this study inundated floodplain habitat is defined as habitat that is approximately 600 feet from the active channel that has inundated terrestrial vegetation, slow water velocity, and shallow depth. Based on both literature and field observations conducted over several years, it appears there is a strong correlation between availability of floodplain habitat during spring runoff and the success of silvery minnow

spawning and recruitment. It now appears most likely that silvery minnow utilize inundated floodplain to spawn as well as for 'nursery' habitat for larvae and fry. Such habitats are know to provide increased heterogeneity of habitat and structural refugia for developing stages of fish, including silvery minnow, relative to the active river channel.

It is important to better understand silvery minnow spawning behavior so that opportunities for successful spawning and recruitment are provided through habitat improvements and/or manipulations of flow operations. The NMISC has constructed a number of floodplain habitats within the Albuquerque Reach that were found to have silvery minnow present during the 2007 runoff (maximum flow of 3500 cfs at the Albuquerque gage with flow of 3,000 cfs or greater for 10 days). The monitoring activities described in this work order will provide further information on the spawning behavior and recruitment of the silvery minnow within selected constructed and natural habitat sites. Based on current 2008 spring runoff predictions, it is likely runoff will be at safe channel capacity (6000 to 7000 cfs at the Albuquerque gage) for an extended period of time. Therefore, inundation of floodplain habitat will occur and there should be excellent opportunities to study silvery minnow spawning and recruitment on both naturally occurring and selected constructed habitat sites. Due to the anticipated high flows, a number of the restoration sites constructed to inundate at 1500 to 3000 cfs during the Phase I and Phase II restoration efforts will not be suitable spawning habitat this year. However, a number of the Phase I and Phase II sites were constructed so as to provide inundated floodplain habitat characteristics over a wide range of flows including those anticipated to occur this spring. For this year, sites will be selected that provide the best information possible to test habitat preferences for spawning and nursery habitat. The primary monitoring sites are outlined below in the "Site Selection" section.

PROJECT GOALS AND OBJECTIVES

The study plan implemented for the 2008 spring runoff fisheries monitoring will:

- assess if adult silvery minnow are present on inundated floodplain habitat adjacent to the main river channel during high flows associated with spring runoff;
- assess if silvery minnow spawn on inundated floodplain habitat adjacent to the main river channel during spring runoff;
- assess, by presence or absence, if constructed habitat restoration sites are being utilized by the silvery minnow for spawning.

MONITORING DESIGN OVERVIEW

Fyke nets will be deployed at multiple locations within the Albuquerque and Isleta reaches of the MRG in an effort to document floodplain occupancy and spawning of silvery minnow. In the Isleta Reach, fyke nets will be configured into enclosures containing the same number of entrances and exits. Through enumeration and documentation of gravid silvery minnow entering and exiting the enclosure and through egg monitoring within and outside of the enclosure, it is believed that inference regarding occupancy and the magnitude of silvery minnow spawning on the floodplain can be made. Individual fyke nets will be deployed at sites in the Albuquerque Reach in single and "stretch" enclosure configurations to document floodplain occupancy and spawning of silvery minnow. In addition, water quality data will be collected from all sites to

assess if parameters measured are correlated with the initiation and peak of observed silvery minnow occupancy and spawning. Monitoring will occur for a period of 14–21 days after the initial or peak detection of silvery minnow and eggs. The start date of monitoring will be decided jointly by NMISC and SWCA staff, and will be based on observations of silvery minnow at floodplain sites and rates of downstream egg drift. Sites selected for monitoring will include artificially augmented and naturally occurring floodplain habitat within the MRG. These sites were selected to determine the relative benefit of restoration projects and to aid in future habitat enhancement activities.

PROJECT METHODOLOGIES

SITE SELECTION

SWCA and NMISC staff scouted three potential enclosure sites in the Isleta Reach (Bosque Farms) and four potential individual fyke net sites in the Albuquerque Reach on March 13, 2008. Flows during the scouting trip were approximately 1,300 cubic feet per second (cfs) at the U.S. Geological Survey (USGS) Bosque Farms gage and approximately 1,600 cfs at the USGS Albuquerque gage. None of the potential sites were inundated on this date. NMISC and SWCA staff identified suitable locations for enclosures at some sites and acknowledged that other sites may not be large enough to contain an enclosure and would require either stretch configurations or single fyke nets instead (Table 1,

Table 2).

Ideal sites would have low water velocity (<0.20 m/s [0.66 feet/s]) with depth shallower than 0.6 m (2.0 feet) (the height of the fyke nets). Larger (1.2 m [3.9 feet]) fyke nets have been obtained for use at the Old Atrisco Diversion site where water depths are expected to exceed the height of the standard fyke nets. Sites visited on March 13, 2008 are designated primary sites and were identified by both SWCA and NMISC personnel as locations where relatively large numbers of silvery minnow were observed during 2007 monitoring. Additional sites within the Albuquerque Reach that were not visited in March have been selected for monitoring and will be sampled using individual fyke net setups. These sites were visited on April 17 by SWCA personnel and potential net locations were identified. Directions and maps depicting sites selected for the 2008 NMISC spring runoff fisheries monitoring study can be found in Appendix A.

Table 1. Albuquerque Reach Sites Selected for NMISC 2008 Fisheries Monitoring

Site	Project Name	HR Site	Site Visited	Fyke Configuration	Number of Fykes	Notes
PDN-1b	Paseo	Y	N	Single	2	Might not work at highest flows. Located on the East bank. Place fykes at middle or downstream end of bar to avoid debris clogging nets.
I40-1ch	Central Wasteway	Y	Y	Stretch	4	Use fykes and wings to block off both inflow and outflow of the channel. Located on the East bank.
I40-2b	Central Bridge	Y	Y	Stretch	2	Use fykes and wings to block off both inflow and outflow of channel, although they may not hold at higher flows. Located on the East bank
I40-4b	Tingley Lakes	Y	N	Single	2	Large scallop located downstream of Central Bridge on the East bank.
SDC-3b	SDC West	Y	Y	Single	2	At higher flows the excavated shelf at this site will probably not work. Located on the West bank.
SDC-5b	SDC East	Y	N	Single	2	Place fykes at middle or downstream end of bar to avoid debris clogging nets. Located on the East Bank.
Old Atrisco Diversion	Atrisco	N	Y	Stretch	2	Use 1.2-m (4-foot) fykes and nets to block off old diversion channel. Larger nets needed to accommodate deeper water. Located on the West bank.

Table 2. Isleta Reach Sites Selected for NMISC 2008 Fisheries Monitoring

Site	Project Name	HR Site	Site Visited	Fyke Configuration	Number of Fykes	Notes
Bosque Farms (3 sites on one bar)						
Bosque Farms Upper	BF Up	N	Y	Enclosures	6	A large, bank-attached sandbar exists just south of the USGS gage with space for three enclosures and options in the floodplain for relocating to higher ground as water comes up. Gellan beads will be dropped at the USGS gage. All sites are located on the East bank.
Bosque Farms Middle	BF Mid	N	Y	Enclosures	6	
Bosque Farms Downstream	BF Down	N	Y	Enclosures	6	

EQUIPMENT

The 2008 NMISC spring runoff fisheries monitoring study will require a variety of different equipment, and much of it will be custom built for this project. SWCA and NMISC have agreed how the financial responsibility should be split, and SWCA will assume responsibility for acquiring everything necessary. A list of the needed equipment and associated costs can be found in Appendix B.

FYKE NET DEPLOYMENT

ENCLOSURE SETUP (ISLETA REACH)

To quantify the number, species and spawning condition of fish attempting to enter each of the floodplain habitats, fish enclosures will be constructed on natural floodplain habitats within the Isleta Reach, from D-frame fyke nets with wings. Each enclosure will consist of six fyke nets and will have an equal number of nets situated on either end of each enclosure to capture entering and exiting silvery minnow. The fyke net wings will be 15 feet long and 24 inches high with 1/8-inch delta mesh. When nets are placed, they create an enclosure with the same number of fish entry and exit fyke nets. Appendix C-1 illustrates a schematic of the expected enclosure setup in detail while Appendix D-1 provides a detailed outline of the expected fyke net and enclosure setup procedures.

Fyke nets will be secured with T-posts (~five per net) attached to the nets with wire or zip ties. The wings will be overlapped between fykes, attached to T-posts, and secured to the riverbed by double lead lines and concrete blocks. If necessary, a plastic snow fence will be secured to T-posts upstream of the enclosure to help prevent large debris from reaching the site. Enclosures will be checked at least daily to ensure that they are functioning properly.

Within one to two days of notice to proceed, SWCA personnel will visit the sites agreed upon by NMISC and SWCA staff and make final determinations for net placement. At that time the enclosure setup will be tested, and final changes will be made to design and documented. This step will allow technicians to efficiently deploy nets and begin sampling silvery minnow.

FYKE NET SETUP (ALBUQUERQUE REACH)

The set-ups in the Albuquerque reach will consist of single and stretch techniques. Individual fyke nets will be deployed at PDN-1b, I40-4b, SDC-3b, and SDC-5b restoration sites within the Albuquerque Reach. Fyke nets will be secured with T-posts (~five per net) attached to the nets with wire or zip ties. The wings will also be attached to T-posts and secured to the riverbed by double lead lines and concrete blocks. If necessary, a plastic snow fence will be secured to T-posts upstream of the trap site to help prevent large debris from reaching the site. Individual fyke nets will be checked once daily to ensure that they are functioning properly. Appendix C-2 illustrates the expected individual fyke setup in detail while Appendix D-1 and D-2 provide a detailed outline and flow chart of the expected fyke net and enclosure setup procedures.

In addition, "stretch" fyke nets will be set up at I40-1ch, I40-2b and the Old Atrisco Diversion sites. These sites are backwater sites which are bounded laterally by high steep bank lines. Stretch fykes will serve as pseudo-enclosures by stretching the fyke net wings out across the channel, only providing entrance and exits into the site via the fyke net openings. Appendix C-3 illustrates the expected stretch fyke net setup.

PRE-MONITORING SURVEILLANCE

To determine when silvery minnow begin spawning and or occupying the floodplain, crews will monitor for eggs and fish at two sites: one in the Albuquerque Reach, and the other in Isleta Reach. Crews will use Moore Egg Collectors (MEC), kick nets, and individual fyke nets. The site selected from the Albuquerque Reach is the I40-1ch site and the one selected from the Isleta Reach is Bosque Farms Upper site. Numbers of silvery minnow and eggs captured at each site along with river stage height, discharge, water and air temperature, water electrical conductivity, DO and turbidity will be recorded daily. The information collected during pre-monitoring will be plotted and distributed to the project science team daily. When catch rates of either fish or eggs are deemed to be sufficient by the science team, or the anticipated peak in discharge for the season (6000-7000 cfs at the Abq gage) is reached, SWCA crews will begin installing and monitoring enclosures and fyke nets. Crews will monitor the sites for 14–21 days following net installation. Because of the time required to set up and dismantle enclosures and fyke nets, monitoring will not cease after it has started. Ideally, monitoring will coincide with peak flow at the Central Avenue Bridge discharge gauge in the Albuquerque Reach and the Bosque Farms discharge gage in the Isleta Reach.

DATA COLLECTION/FIELD PROCEDURES

EGG AND FRY MONITORING

Upon arrival at a monitoring site, crews will first monitor for eggs and fry within and around enclosures and or individual fyke setups.

Enclosures will be surveyed once daily for silvery minnow eggs and fry using a standardized method. A kick net of standard size will be used to sample along established transects located outside (perpendicular to flow) and within the middle of each enclosure. Samples will also be collected along the fyke nets situated at the downstream end of the center of each enclosure and along fyke nets situated at the upstream side of the outside of each enclosure (Appendix C-3) . Numbers of silvery minnow eggs and fry captured within and outside of each enclosure will be recorded separately. In addition all eggs captured within exit fyke nets will be tallied as part of the number captured within each enclosure on each day. Appendix C-3 depicts transects that will be sampled for eggs at enclosure setups.

In order to determine the potential of silvery minnow eggs drifting into enclosures, a gellan bead experiment will be conducted at the Upper Bosque Farms site in the Isleta Reach. The expected bead release site will be at the USGS Bosque Farms Discharge Gauge which is approximately 150 meters upstream from the enclosure site. The enclosure site will be examined and a complete mock workup of fish will take place to determine if any of the beads enter the enclosure or get trapped on the outside of the enclosure nets and wings. The number of gellan

beads trapped on the outside of the enclosure and the number of gellan beads that enter the enclosure will be recorded separately. Two gellan bead experiments will be conducted, the first 1-2 days after enclosure setup, and the second during peak flow.

Egg and fry monitoring at individual fyke net sites (Albuquerque Reach) will consists of sampling along two established transects situated adjacent to the net and along the upstream facing side of wings of the fyke net. Eggs will be sampled using a kick net of standardized size. Eggs collected along each transect and along the wings of each fyke net will be recorded separately. All eggs collected from within the fyke nets will be tallied as part of the number of eggs collected at each net on each day. Appendix C-2 depicts transects that will be sampled for eggs at individual fyke net setups.

To better understand the relationship between spawning dynamics within the floodplain and spawning dynamics in the active river channel, MECs will be used to estimate egg densities within the main river channel (or as close to the active channel that crews can safely access) at each of the monitoring times and locations within the Isleta Reach and at pre-selected monitoring sites within the Albuquerque Reach (Table 3). The number of eggs collected during a single, 15-minute period and the total amount of water filtered will be recorded. This data will then be used to extrapolate egg densities. Appendix D-3 and D-4 include an outline and flow chart of the daily standard operating procedure that explain in detail the expected field procedures for egg and fish collections.

Table 3. Albuquerque Reach Sites Selected for MEC Sampling during each Day of Monitoring.

Day of Monitoring	Sites within the Albuquerque Reach Selected for MEC Monitoring (one 15 minute set for each site)		
1-21	SDC-5b	I40-2b	PDN-1b

Note: One 15 minute MEC set will be collected from the main channel adjacent to each site.

FISH MONITORING

Enclosures (Isleta Reach)

Upon completion of egg monitoring, crews will begin removal, identification, and enumeration of fish from fyke nets. Entry and exit fyke nets will be inspected once per day unless it is determined by SWCA and NMISC staff that increased sampling frequency is justified. Time of day, net orientation, depth, and velocity at the mouth of each fyke will be recorded in the field log. A block screen constructed of 1/4-inch plastic mesh screening attached to two 8-foot T-posts will be placed in front of the mouth of each fyke net prior to inspection. The block net screen is intended to prevent enclosure breach and subsequent loss of silvery minnow and eggs residing within. Exit fyke nets will be checked for fish first. Silvery minnow captured in exit nets will be recorded separately and will be counted, measured (standard length (SL) +/- mm), weighed (+/- 0.1g), gravidity noted if possible, and returned to the floodplain habitat outside and away from the enclosure. Entrance fyke nets will be checked after all exit nets have been checked for fish. Silvery minnow captured in entrance nets will be counted, gravidity noted if possible, and placed within the enclosure. Other species of fish will be identified, counted, and returned to the water outside and away from the enclosure regardless of whether they were captured in exit or entrance nets. Appendix D-3 and D-4 include an outline and flow chart of the

daily standard operating procedure that explain in detail the expected field operating procedures for egg and fish collections.

Individual Fyke Nets and Stretch Configurations (Albuquerque Reach)

Fish handling procedures for fish collected from individually deployed fyke nets will be similar to those described for fish collected from enclosure sites. Time, net orientation, depth, and velocity at the mouth of each fyke will be recorded in the field log. Silvery minnow captured in fyke nets will be counted, measured (standard length (SL) +/- mm), weighed (+/- 0.1g), gravidity noted, and returned to the floodplain habitat away from the trap. At stretch sites, silvery minnows captured in entrance nets will be released to the interior of the enclosed channel, those captured in exit nets will be released to the river. Other fish species will be identified, counted, and returned to the main channel away from the trap. Appendix D-3 and D-4 include an outline and flow chart of the daily standard operating procedure that explain in detail the expected field procedures for egg and fish collections.

Fish and Egg Identification

Fish identification will be facilitated through the use dichotomous taxonomic keys using characteristics presented by Sublette et al. (1990). Egg identification will be based on characteristics and photos included in the fish key. Nomenclature will follow Nelson et al. (2004). Taxonomic keys printed on water proof paper will be available for reference during all sampling events.

WATER QUALITY MONITORING

Upon completion of fish monitoring, water quality measurements will be recorded at a point established inside and outside of each enclosure, at individual fyke nets, and at locations selected for MEC egg monitoring at each site on each day. Temperature, turbidity, conductivity, salinity, pH, and dissolved oxygen will be recorded each time individual fyke nets and enclosures are checked for fish. In addition, 16 HOBO Pendant temperature data loggers (Onset Computer Corporation) will be deployed at enclosure and individual fyke net sites, and if possible in the main river channel (or as close to the main channel as possible) prior to monitoring. The data loggers will record temperature at specified intervals (e.g., every hour) for the duration of nursery habitat monitoring. The temperature loggers will be attached to T-posts within the water column with light gauge wire or zip ties. Global positioning system (GPS) coordinates of the temperature logger will be recorded and used as a standardized point to take daily water quality measurements. Appendix C depicts locations where water quality measurements will be taken.

Data Sheets and Database Structure

Individual data sheets have been constructed to collect pertinent site physical characteristics, water quality, general fish, egg, and silvery minnow information described in this sampling and analysis plan. Data sheets are based on the anticipated database hierarchical structure and may need to be modified as sampling protocols are modified during monitoring. Appendix E-1 through E-5 depicts draft datasheets and database structure.

Field Safety Plan

A general field safety plan depicting potential hazards that may be encountered while in the field has been attached to the end of this document (Appendix F). The field supervisor will host an internal field safety kickoff meeting prior to beginning field work. A second safety meeting will be conducted in the field. Additional field safety meetings will be conducted as necessary with such meetings to be determined by the project manager and field supervisor. All SWCA employees need to review the safety plan, make any necessary inquiries to the field supervisor and/or project manager, and sign the form found at the end of the document acknowledging that they have reviewed and understand the document. The field safety plan may be modified for this specific project.

ANALYSIS AND DATA PRESENTATION

ANALYSIS AND DATA PRESENTATION IN SUPPORT OF PROJECT OBJECTIVES

Various types of analysis and data presentation will be conducted to determine the extent that project objectives\hypotheses were fulfilled using the current study design. A general overview of analysis designed to address each objective as stated within the scope of work follows.

Objective 1

- Assess if adult silvery minnow are present on inundated floodplain habitat adjacent to the main river channel during high flows associated with spring runoff.

Analysis to be conducted in support of Objective 1 will include a summary of absolute counts of silvery minnow captured by site and for all sample sites combined. The data will be expressed by date, stage height, and flow to determine relative changes in floodplain utilization over the range of dates and flows encountered during the study period.

Objective 2

- Assess if silvery minnow spawn on inundated floodplain habitat adjacent to the main river channel during spring runoff.

If silvery minnow are spawning within enclosures, then a correlation should exist between absolute numbers of silvery minnow entering enclosures and the number of eggs captured within enclosures. Linear regression models will be constructed for all sites combined by regressing absolute numbers of silvery minnow (e.g. gravid in gravid out, total gravid in, total gravid out etc.) against the number of eggs captured within enclosure sites. If the slope between the two variables is positive and significant, then one could statistically infer that spawning on the inundated floodplain by silvery minnow is occurring. In addition, it is reasonable to expect that the occurrence of silvery minnow at an individual trap site might be related to the absolute numbers of eggs captured on or around that site.

Objective 3

- Assess, by presence or absence, if constructed habitat restoration sites are being utilized by the silvery minnow for spawning.

Count data of silvery minnow and eggs will suffice in determining presence or absence of the fish on the floodplain. In addition, analysis will be conducted to contrast between sites selected for monitoring, and in particular the performance of NMISC habitat enhancement sites (Albuquerque Reach sites) relative to naturally occurring floodplain habitat sites (Isleta Reach sites).

Additional Analysis

Additional analysis may be completed to further support study objectives, assess the adequacy of the current sampling strategy, and determine if correlations exist between water quality measurements and observed peaks in fish and egg capture rates.

Relationships between silvery minnow egg occurrences (frequencies) will be compared between transects, single enclosure fykes, enclosure fykes, and mean MEC egg captures. Floodplain spawning can be inferred if increased numbers of eggs are captured on the floodplain relative to the main channel (MEC captures) density estimates.

The study design will enable the distinction of "actively" captured silvery minnow and "passively" captured silvery minnow. Actively captured silvery minnow would be those captured in fyke nets whose openings are oriented away from flow. These silvery minnow would have had to actively swim into the fyke net to be captured. Passively captured silvery minnow would be those captured in fyke nets whose openings are facing into flow, and whose mode of capture is unknown but could be both passive (i.e. incidentally drifting into the net with flow) or active (i.e. actively swimming into the net). Actively captured silvery minnow would indicate floodplain utilization and active use of the habitat. To that end, absolute counts of silvery minnow will be compared between actively and passively captured fish.

Relationships between silvery minnow captures will be examined by site, gear (individual fykes vs. enclosure setups), fyke orientation, water depth at the hoop mouth, and water quality parameters to determine if optimal sampling configurations and environmental cues can be used to direct future sampling efforts. Principal components analysis (PCA) can be used to examine patterns in physical habitat data and determine what effect they may have on the distribution and abundance of silvery minnow, eggs, and other fish. PCA is useful to reduce the dimensionality of multivariate data by creating a few key variables that characterize variation in capture rates as fully as possible (Gotelli and Ellison 2004), guiding variable specific analysis.

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APPENDIX A
MAPS DEPICTING STUDY SITE LOCATIONS

Appendix A-1. Site names and driving directions to sites selected for monitoring during the 2008 fisheries monitoring study.

Habitat Restoration Sites	**2008 NMISC Fisheries Monitoring Name**
PDN 1b	Paseo
I-40 1ch	Central Wasteway
I-40 2b	Central Bridge
I-40 4b	Tingley Lakes
SDC 3b	SDC West
SDC 5b	SDC East
Non-HR Sites	**2008 NMISC Fisheries Monitoring Name**
Old Atrisco Diversion	Atrisco
Bosque Farms Upstream	BF Up
Bosque Farms Middle	BF Mid
Bosque Farms Downstream	BF Down

Driving Directions to 2008 Fisheries Monitoring Sites
Call ABQ Open Space for all Albuquerque Reach Sites

Paseo

Take Rio Grande Blvd north. Just before you pass over Paseo del Norte, turn west into an Open Space parking lot. There is an Open Space gate at the west end of the parking lot, pass through the gate and follow the road to the levee. Turn south on the levee road and go approximately 0.7 miles. Park off the levee road and walk through the bosque to the site.

Central Bridge

Take Central Avenue west towards the river. Go through the light at Tingley Dr. and turn north into the Open Space parking lot adjacent to the river. Go through the gate at the north end of the parking lot and make an immediate right into the bosque. This is a picnic area and you need to drive to the south of the wooden fence. At the river, turn north and follow the river about 100 meters.

Central Wasteway

From the Central Bridge site, follow the levee road north approximately 0.7 miles. You will pass by a small building on the right side of the road and then cross over the Central wasteway. Immediately after that there is a road going west into the bosque that takes you right to the habitat restoration site.

Tingley Lakes

From Central Avenue, turn south on Tingley Dr. and follow it approximately 0.9 miles. There is an Open Space access gate to the bosque on the west side of the road. Go through the gate and follow the road through the bosque as it bends north approximately 1.5 miles. Park at the northernmost pond and walk through the bosque to the river.

Atrisco

Cross Central Avenue and turn north, going through Open Space gate and following levee road. Follow north approximately 0.7 miles. Park on road and walk through bosque to site.

SDC West

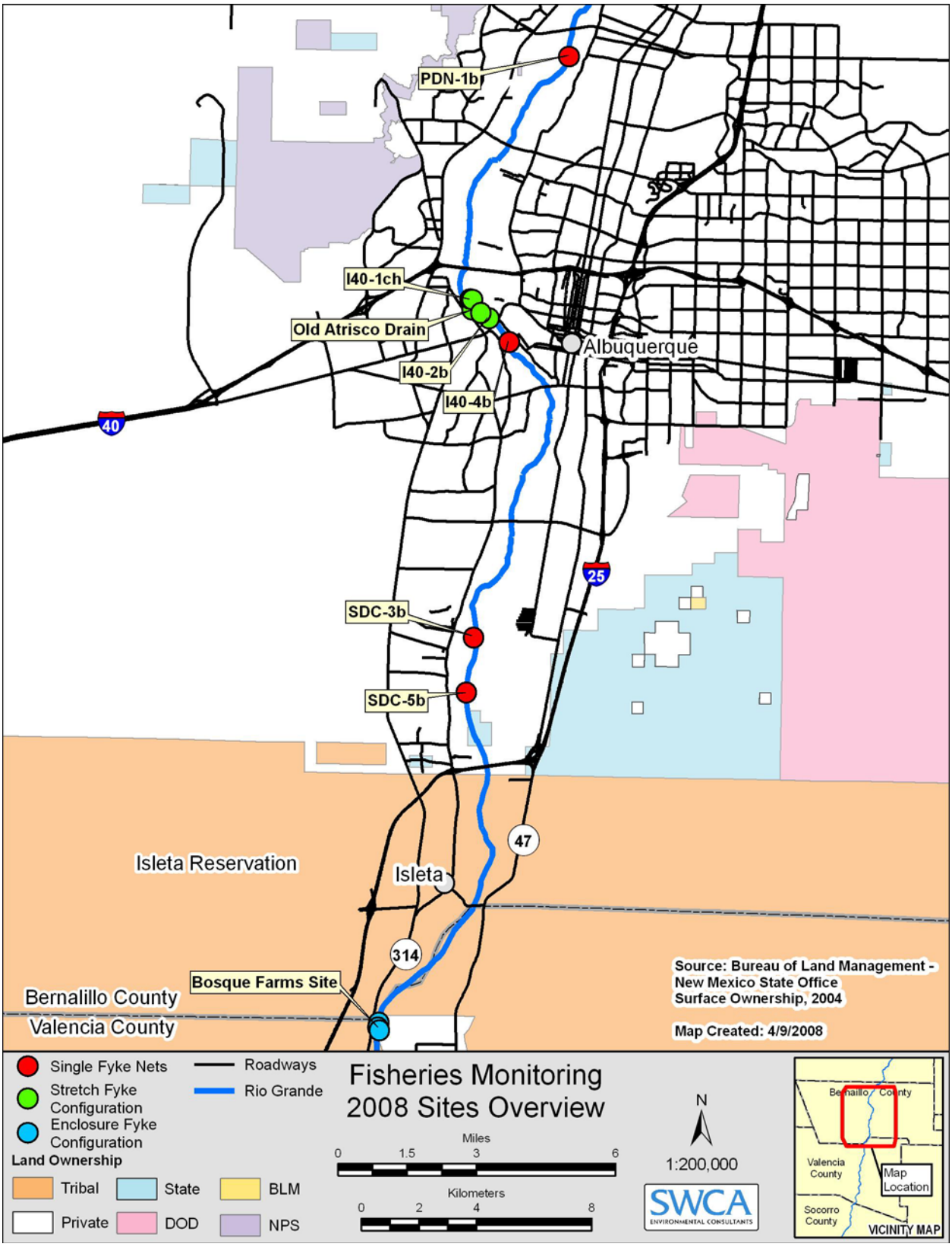
Take I-25 south and exit at Rio Bravo. Follow Rio Bravo west as it crosses the river and turn south at Isleta Blvd. Follow Isleta Blvd approximately 3 miles and turn east on Louise Ave. Follow to the end, cross the ditch and pass through the Open Space gate.

SDC East

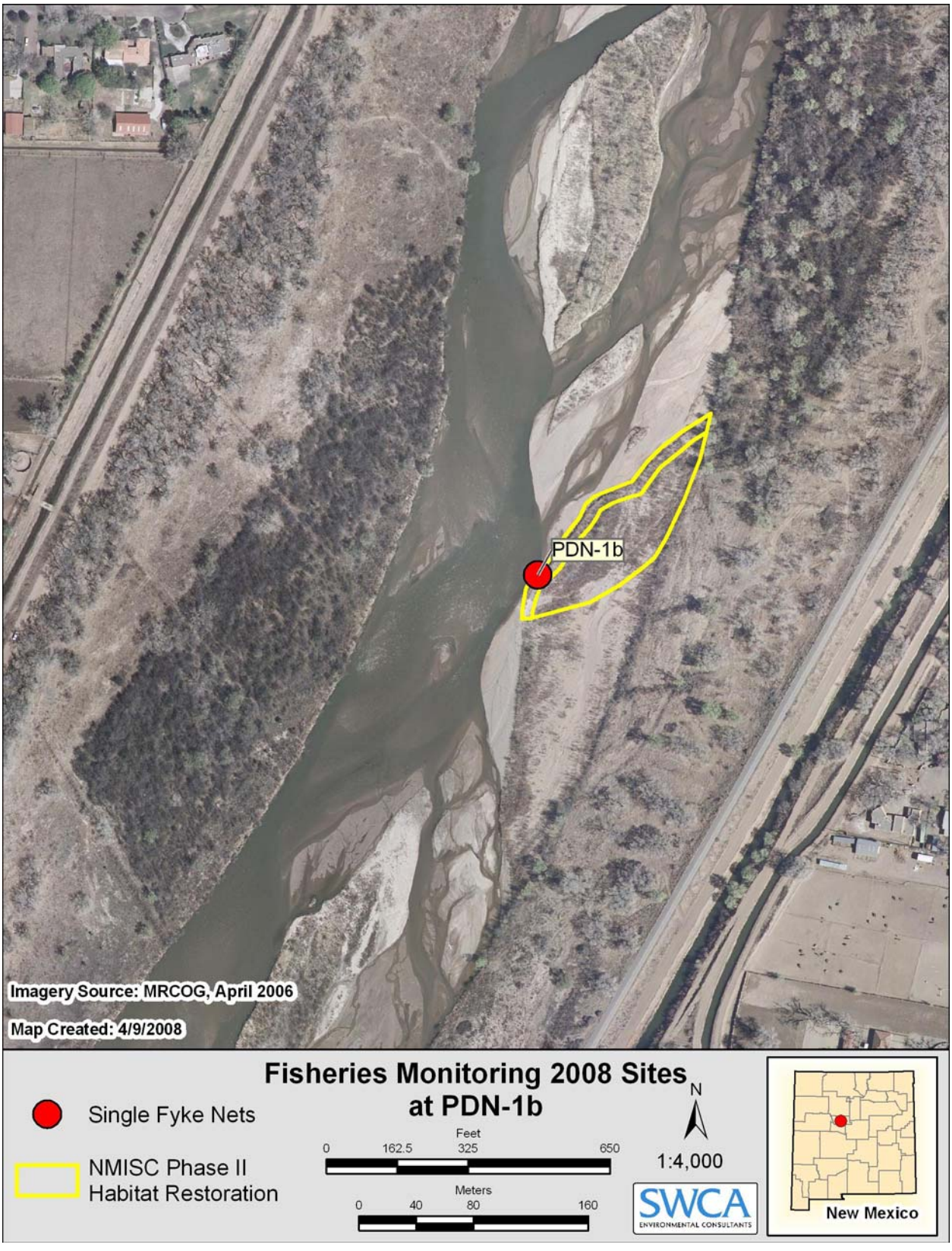
Take I-25 south and exit at Rio Bravo. Turn south on Second Street and go approximately 2 miles to Shirk Ln. Turn west on Shirk Ln. and go approximately 0.3 miles. Cross the irrigation ditch and go north on the access road. There is a gate but it has been standing open for several weeks. Follow this road for approximately 3.5 miles. Look for the green 8 ¾ mile sign and park about a quarter mile past that. Walk through the bosque to the site.

All Bosque Farms

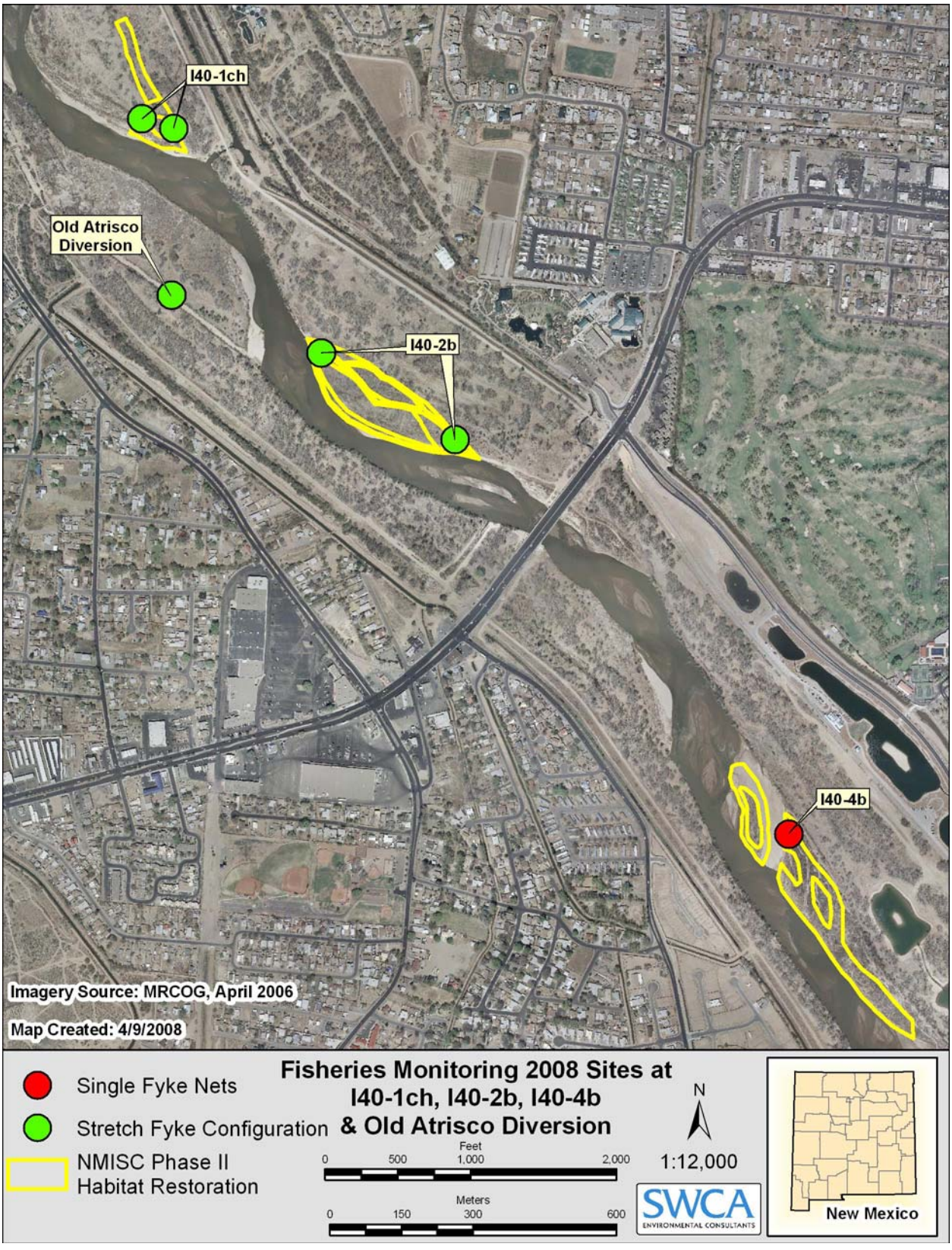
Take I-25 south to Los Lunas. Go east along NM 6 and cross the river. Follow NM 6 approximately 3.5 miles and turn west on South Bosque Loop. Follow this road around the 90º bend and turn west on Cottonwood Dr. Go through the MRGCD gate and follow the levee road north approximately 1.5 miles. Park on the levee road and walk through the bosque. All three sites are on this bar.



Appendix A-2. Overview of sites selected for the 2008 NMISC fisheries monitoring study.



Appendix A-3. Site location PDN-1b selected for monitoring during the 2008 NMISC fisheries study.



Appendix A-4. Site locations at I40-1ch, I40-2b, I40-4b and, the Old Atrisco Diversion, which were selected for monitoring during the 2008 NMISC fisheries study.

Appendix A-5. Site locations at SDC-3b and SDC-5b, which were selected for monitoring during the 2008 NMISC fisheries study.

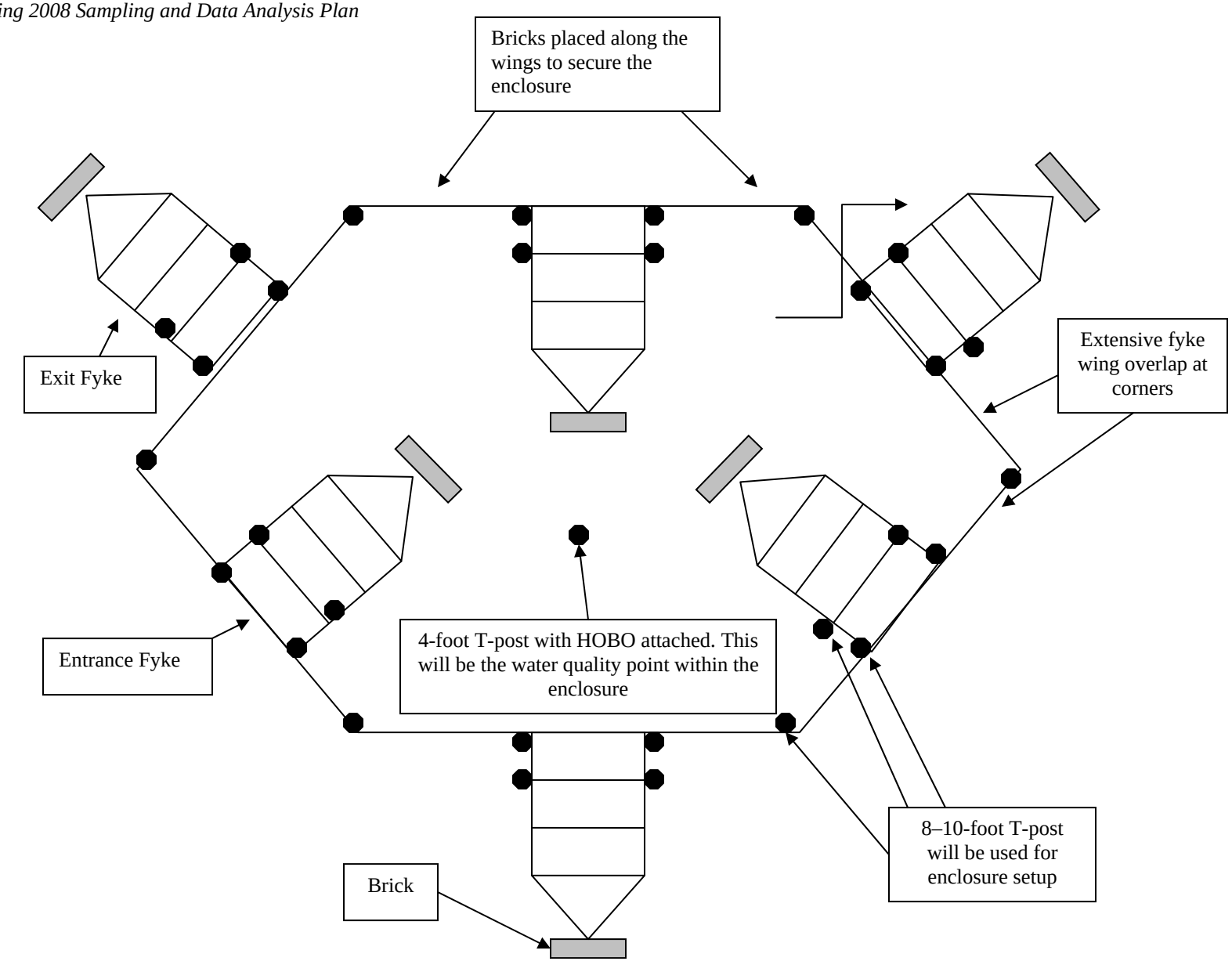
Appendix A-6. Bosque Farms locations that were selected for monitoring during the 2008 NMISC Fisheries study.

APPENDIX B
LIST OF EQUIPMENT AND ASSOCIATED COSTS

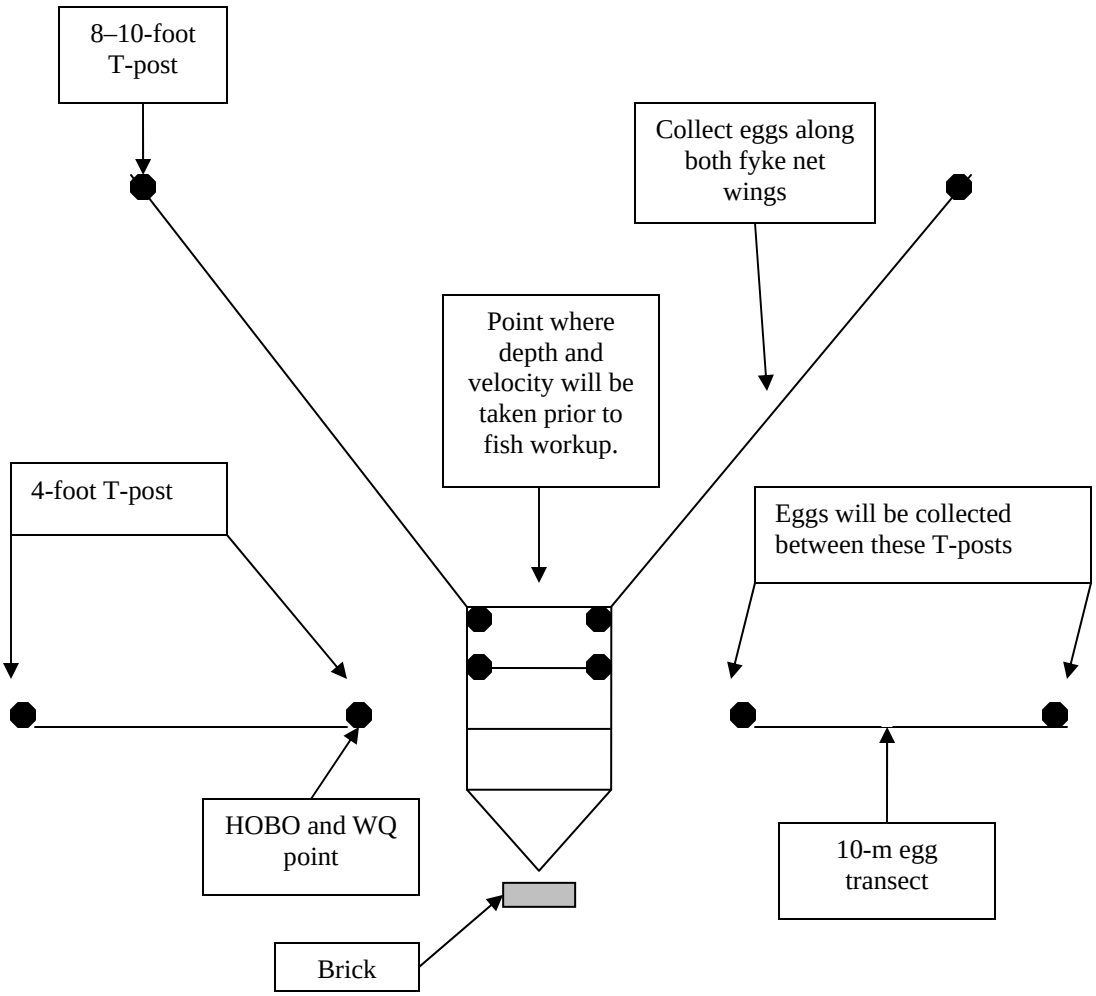
Appendix B-1. Equipment Inventory, Cost, Purchase Responsibility, and Status.

Equipment Item	Cost	NMISC Number	ISC Total	SWCA Number	SWCA Total	Status as of 4/23/08	Notes
Custom made 2-ft fyke nets	$357.00	30	$10,710.00	8	$2,856.00	Scheduled to arrive 4/25	
Custom made 4-ft fyke nets	$540.00	2	$1,080.00			Scheduled to arrive 4/25	
25-ft extra wings	$65.00			4	$260.00	Scheduled to arrive 4/25	
Estimated fyke net shipping	$210.00	1	$210.00	1	$210.00	Scheduled to arrive 4/25	
HOBO Pendant temp loggers	$50.00	6	$300.00			In possession	
6- or 8-ft metal T-posts for fyke net set-up	$6.00	40	$240.00	40		In possession	
4-ft metal U-posts for transect demarcation				40		In possession	SWCA already has these, no cost
Moore Egg Collectors	$0.00	6		5		In possession	SWCA already has these, no cost
Extra screens for MEC	$0.00			12		In possession	SWCA already has these, no cost
D-frame invertebrate kick nets	$0.00			2		In possession	SWCA already has these, no cost
100-ft length 1/4-inch plastic mesh	$250.00	1	$250.00			In possession	Used to create temporary enclosure barricades while checking hoop nets for fish
Metal staples for securing enclosure to substrate	$0.00	1000				Outstanding	Available from NMISC refugium, no cost
Flagging and tags to mark transects and identify sites						In possession	SWCA already has these, no cost
Water quality meter rental/day	$25.00	21	$525.00			In possession	In addition to NMISC's meter

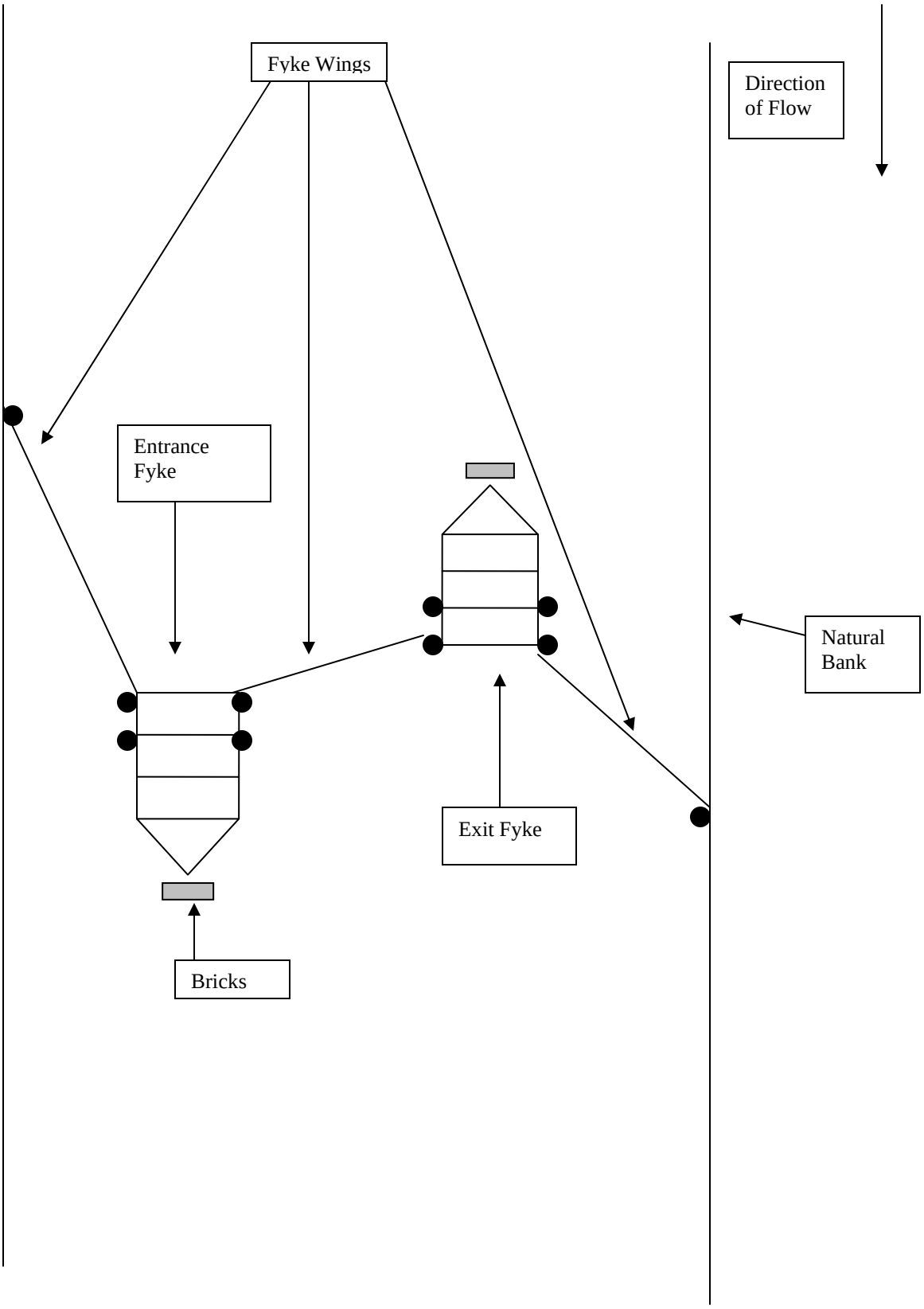
APPENDIX C
FIGURES OF ENCLOSURE AND INDIVIDUAL FYKE NET SETUPS



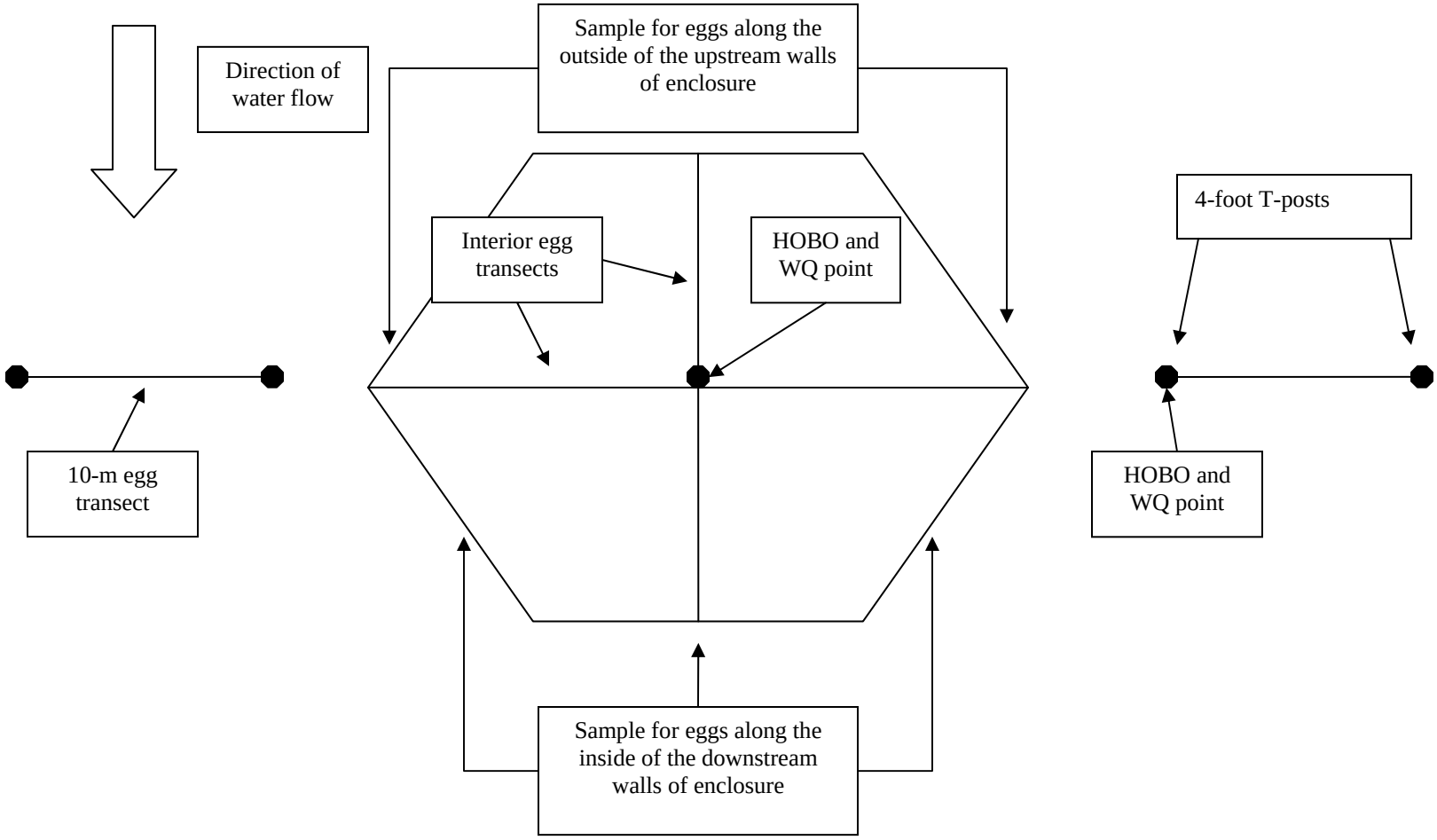
Appendix C-1. General overview of an expected fyke enclosure setup.



Appendix C-2. General overview of an individual fyke net setup indicating egg transects and water quality point locations.



Appendix C-3. General overview of a "stretch" fyke net setup.

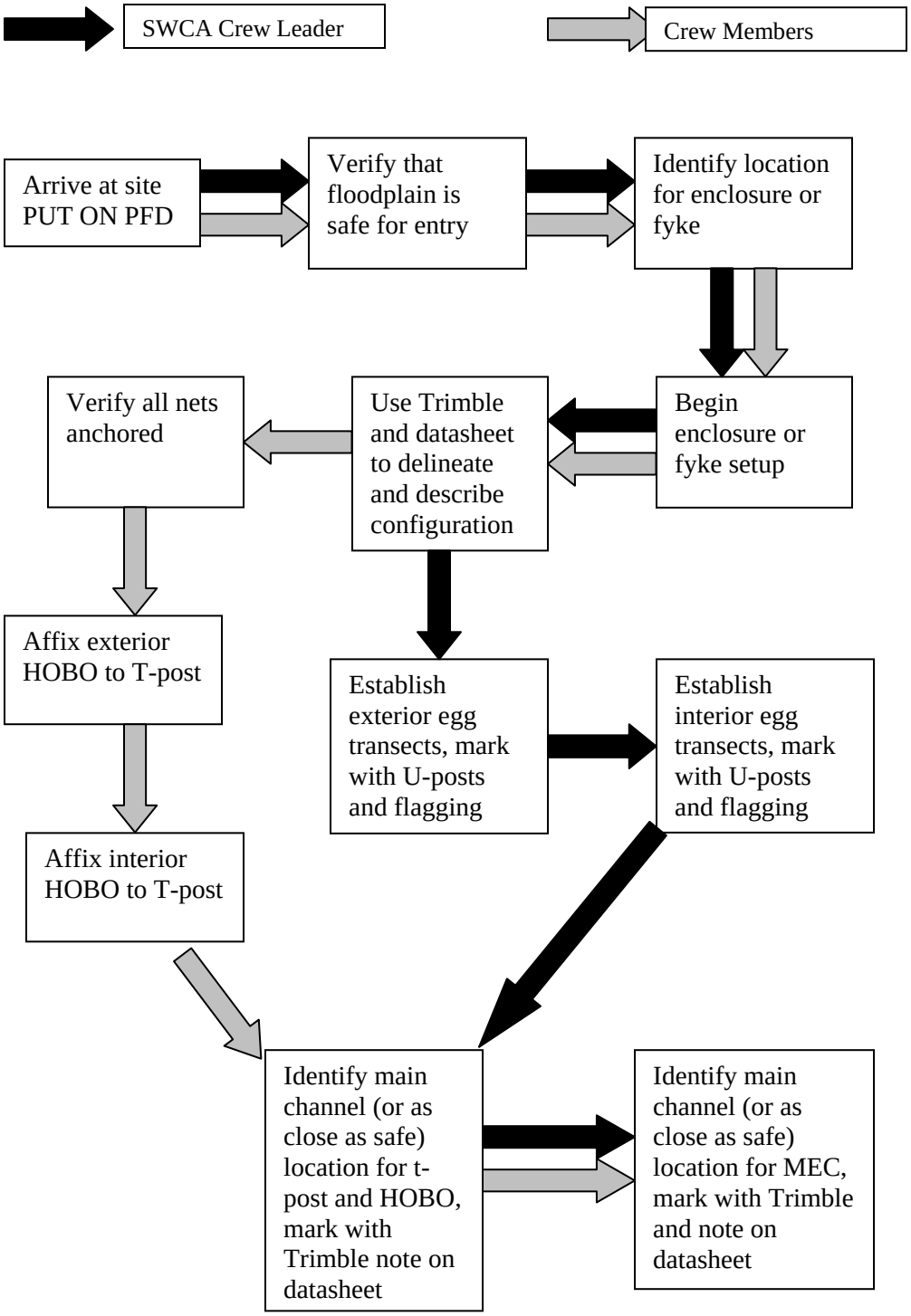


Appendix C-4. Details expected placement of egg transects and water quality points.

APPENDIX D
STANDARD OPERATING PROCEDURES

Appendix D-1. Standard Operating Procedures for Enclosures and Individual Fyke Installation

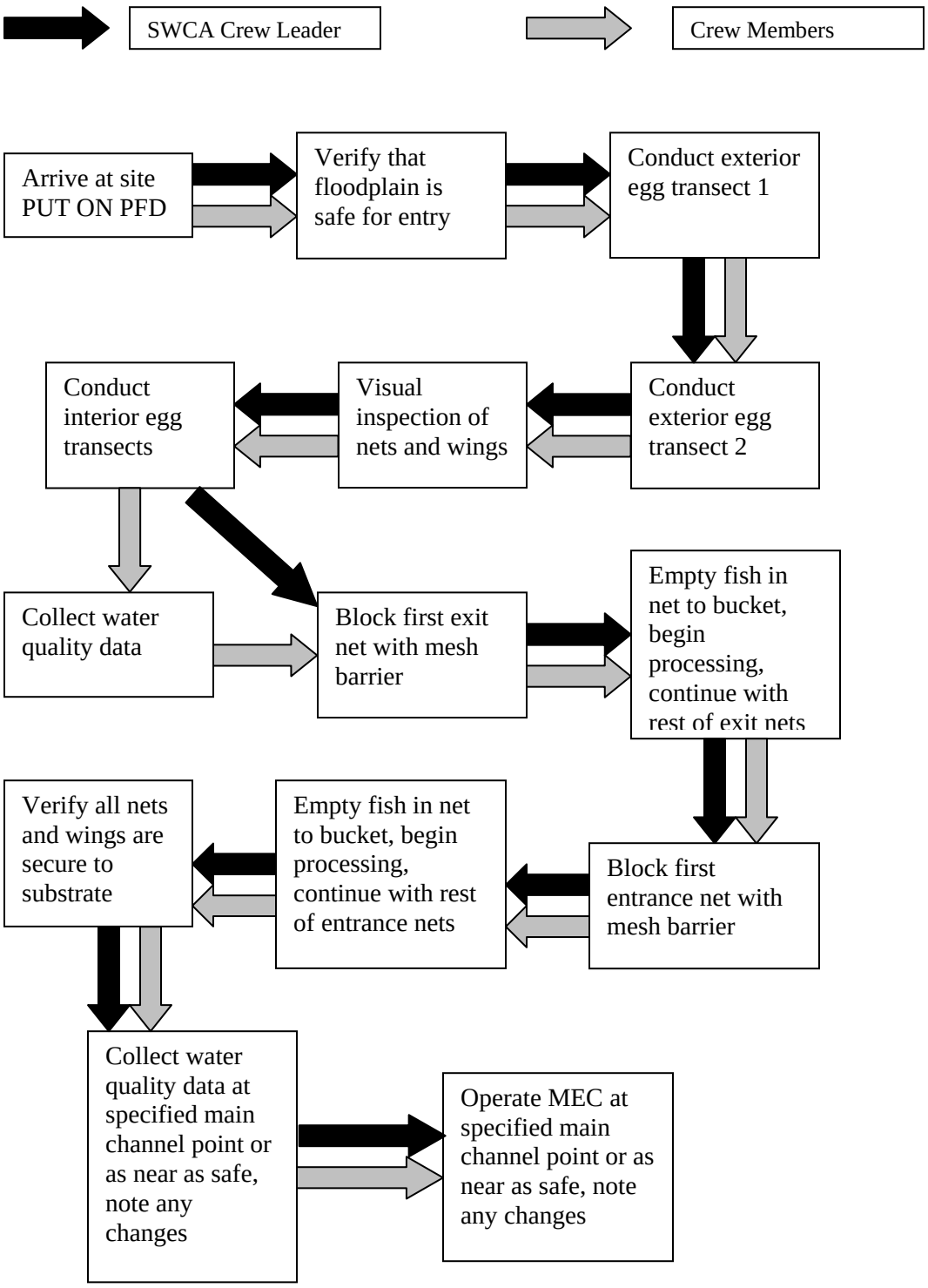
I. Arrive at site
II. Put on personal flotation devices (PFDs) and discuss field and river safety
III. Verify floodplain is safe for entry
IV. Identify location for enclosure/single fyke
V. Begin installation of enclosure/fyke
    a. Install T-posts
        i. Place T-posts in appropriate locations
        ii. Attach net to T-post with zip ties or light gauge wire
    b. Verify that all nets are secured to substrate
    c. Use Trimble and data sheet to delineate and describe enclosure configuration and location
    d. If necessary install garbage catch upstream of site
VI. Establish interior egg transect (Appendix C1-C3)
    a. Transects should cross enclosure as well as include downstream wings
    b. Mark ends of transect with flagging
    c. Affix HOBO within enclosure
VII. Establish exterior egg transects (2)
    a. Transects should be 10 m
    b. Mark each end with T-posts and flagging
    c. Affix HOBO to crew-leader–selected T-post
VIII. Identify main channel (or as close as safe) location for T-post and HOBO
IX. Identify main channel (or as close as safe) location for MEC



Appendix D-2. Flow chart of procedures for enclosure and individual fyke net setups.

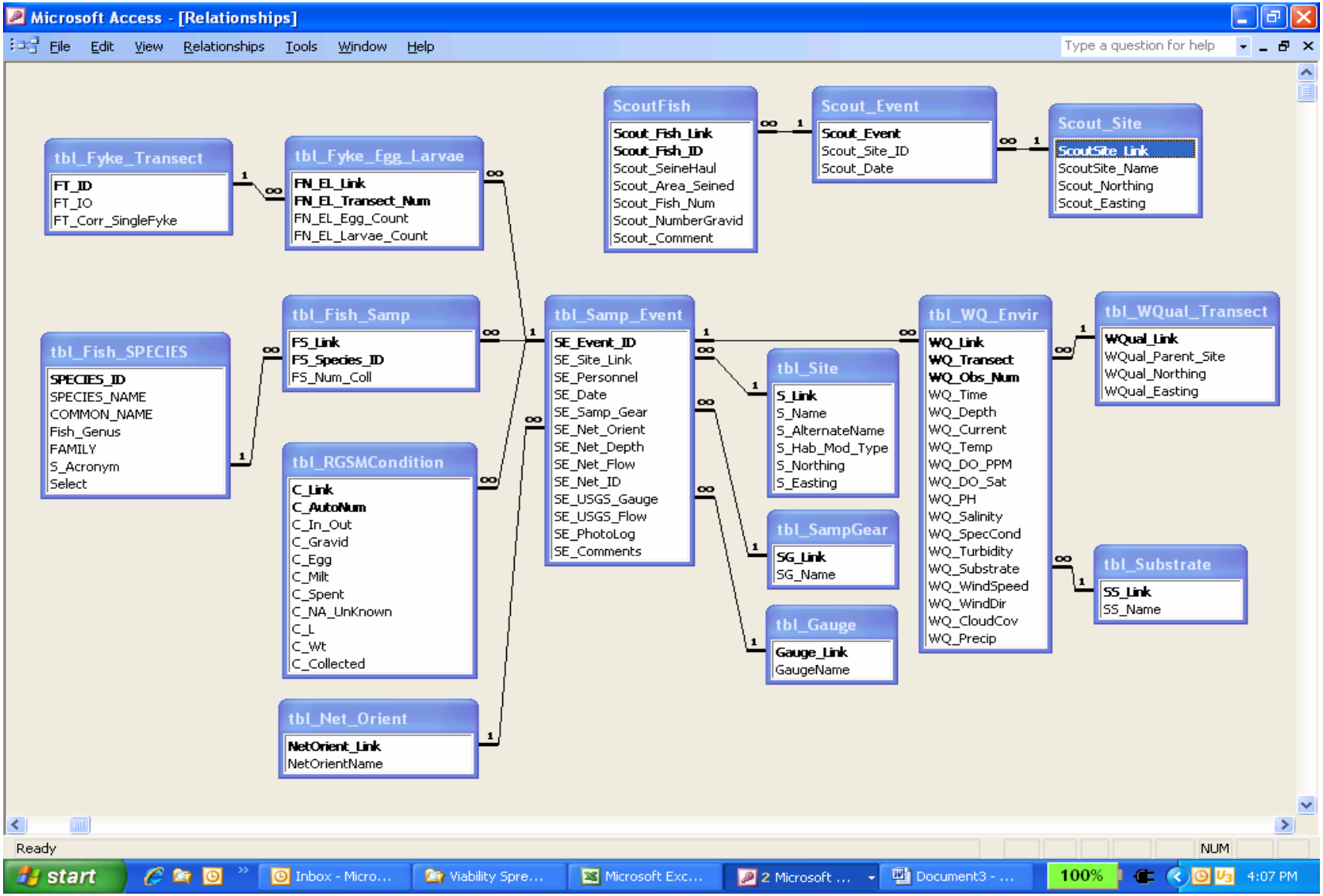
Appendix D-3. Outline of the Daily Standard Operating Procedures for Fish and Egg Monitoring

I. Arrive at site
II. Put on PFDs and discuss field and river safety
III. Verify floodplain is safe for entry
IV. Site is approached and sampled for eggs from the first encountered transect outside of the individual fyke or enclosure setups
    a. For both fyke and enclosure setups the surveyor will next proceed around the downstream side of the structure, and sample the next established transect for eggs
V. Before entering enclosure, conduct visual inspection of nets and wings to determine if any obvious breaches exist. If breaches do exist document them on the data sheet
    a. Next the fyke net wings or downstream nets on the inside of the enclosure will be sampled for eggs
        i. For enclosures, established transects are next sampled for eggs
VI. Collect water quality data
    a. Point inside enclosure
    b. Point outside enclosure
VII. Check fykes for fish
    a. First, check exit nets (or single fyke)
    b. Record time, depth, velocity, and net orientation
        i. Block net opening with mesh barrier
        ii. Open net, remove fish to bucket
        iii. Identify to species
        iv. Count and release all fish except silvery minnow to exterior and away from enclosure
        v. Weigh and measure silvery minnow
        vi. Note spawning condition
        vii. Release silvery minnow to exterior and away from enclosure
    c. Second, check entrance nets
        i. Block net opening with mesh barrier
        ii. Open net, remove fish to bucket
        iii. Identify to species
            1. release fish all except silvery minnow to exterior and away from enclosure
        iv. Note spawning condition of silvery minnow
            1. release silvery minnow to interior of enclosure
    d. Conduct complete inspection of enclosure to verify that all nets are secure to each other and the substrate
VIII. Collect water quality at or as near as safe to main channel or at specified point.
IX. Operate MEC at or as near as safe to main channel



Appendix D-4. Flow chart of the daily standard operating procedures for fish and egg monitoring.

APPENDIX E
DATA SHEETS AND DATABASE STRUCTURE



Appendix E-1. Schematic of 2008 NMISC fisheries monitoring study database.

Physical / Chemical – Daily Field Form

Date: _____ Personnel: _____ Percent Cloud Cover: _____ **Wind Speed and Direction**:_____

Main Site: Atrisco BFarm Up BFarm Mid BFarm Down Central Br Central Wasteway Paseo SDC East SDC West Tingley

Comments_____

WQ Point ID	Time	Depth (ft)	Current Velocity (m/sec)	Water Temp (ºC)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% sat)	pH	Salinity (ppt)	Spec Cond (µS/cm)	Turbidity	Substrate Code

Time: Use time on YSI. Weather: Note approximate wind speed and percent cloud cover. Depth: Note that depth on staff is in decimal feet. Substrate code: SA=sand, SI=silt, TV=terrestrial vegetation, GR=gravel

Appendix E-2. Data sheet for physical and chemical (water quality) data.

Daily Fish Community Collection Field Form

Date: _____ **Personnel:** _____

Main Site: Atrisco BFarm Up BFarm Mid BFarm Down Central Br Central Wasteway Paseo SDC East SDC West Tingley

Gear: Single Fyke Corral Fyke **Net ID:** _____ **Single Net Orientation:** Upstream  Downstream  Perpendicular 

Diagonal Up  Diagonal Down 

Water Depth at Hoop Mouth (ft): _____ **Water Velocity at Hoop Mouth (m/s):** _____**Photo Log:** _____

FAMILY	SPECIES	COMMON NAME	Number In	Number Out
CATOSTOMIDAE	*Carpiodes carpio*	river carpsucker		
	Catostomus (Catostomus) commersonii	white sucker		
	Ictiobus bubalus (n)	smallmouth buffalo		
CENTRARCHIDAE	*Lepomis (Chaenobryttus) cyanellus*	green sunfish		
	Lepomis (Lepomis) macrochirus	bluegill		
	Micropterus punctulatus	spotted bass		
	Micropterus salmoides salmoides	largemouth bass		
	Pomoxis annularis	white crappie		
	Pomoxis nigromaculatus	black crappie		
CLUPEIDAE	*Dorosoma cepedianum*	gizzard shad		
CYPRINIDAE	*Carassius auratus*	goldfish		
	Cyprinella lutrensis	red shiner		
	Cyprinus carpio	common carp		
	Hybognathus amarus	**Rio Grande silvery minnow**		
	Notemigonus crysoleucas	golden shiner		
	Pimephales promelas	fathead minnow		
	Pimephales vigilax	bullhead minnow		
	Platygobio gracilis	flathead chub		
	Rhinichthys cataractae	longnose dace		
ICTALURIDAE	*Ameiurus melas*	black bullhead		
	Ictalurus punctatus	channel catfish		
	Ictalurus furcatus	blue catfish		
	Pylodictis olivaris	flathead catfish		
PERCICHTHYIDAE	*Morone chrysops*	white bass		
PERCIDAE	*Perca flavescens*	yellow perch		
	Sander vitreum	walleye		
POECILIIDAE	*Gambusia affinis*	western mosquitofish		

Appendix E-3. Daily fish community collection form.

2008
RGSM Reproductive Condition / Length / Weight Data Collection Field Form

Date: _____ **Personnel:** _____

Main Site: Atrisco BFarm Up BFarm Mid BFarm Down Central Br Central Wasteway Paseo SDC East SDC West Tingley

Gear: Single Fyke Corral Fyke **Net ID:** _____ **Single Net Orientation:** Upstream  Downstream Perpendicular 

Diagonal Up  Diagonal Down 

Length/Weight Only on Exit

Length (mm)	Weight (g)	Reproductive Condition	In	Out	Comments
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			
		Grav/Egg Milt Spent NA/Unknown			

Appendix E-4. Rio Grande silvery minnow length and weight data collection field form.

2008
RGSM Moore Egg Collector Data

Site _____ Date _____ Sample Time Begin _____ Sample Time Duration _____

Number of MEC's _____ Num RGSM Eggs _____

Water Temp °C _____ MEC Flow (m/s) _____

Site _____ Date _____ Sample Time Begin _____ Sample Time Duration _____

Number of MEC's _____ Num RGSM Eggs _____

Water Temp °C _____ MEC Flow (m/s) _____

Site _____ Date _____ Sample Time Begin _____ Sample Time Duration _____

Number of MEC's _____ Num RGSM Eggs _____

Water Temp °C _____ MEC Flow (m/s) _____

RGSM Egg Transect Data

Transect No _____ Date _____ Num RGSM Eggs _____ Num Larvae _____

Transect No _____ Date _____ Num RGSM Eggs _____ Num Larvae _____

Transect No _____ Date _____ Num RGSM Eggs _____ Num Larvae _____

Transect No _____ Date _____ Num RGSM Eggs _____ Num Larvae _____

Transect No _____ Date _____ Num RGSM Eggs _____ Num Larvae _____

Transect No _____ Date _____ Num RGSM Eggs _____ Num Larvae _____

Transect No _____ Date _____ Num RGSM Eggs _____ Num Larvae _____

Appendix E-5. MEC and transect egg collection field form.

APPENDIX F
FIELD SAFETY PLAN

SWCA Environmental Consultants, Inc. Field Safety Assessment/Plan 2008

A copy of this document is to be provided to each field crew member in the initial Pre-Field Safety Meeting. Each member of the crew is to review and sign the Employee Acknowledgement Form on the back page and return it to the Field Safety Officer (FSO) for delivery to the Project Manager (PM). All field crew members must review and sign this document prior to participation in field efforts; failure to do so may result in inability to participate in field activities. The FSO is to complete indicated portions of this form and return to PM with signatures of all field crew members on the Employee Acknowledgement Form.

SWCA field crews may experience a wide variety of field conditions and potential hazards. It is the responsibility of the PM, FSO, and various other project personnel to ensure the safety of the field crew is maintained and safety protocols are upheld throughout the duration of the field effort. Often field efforts require the use of various forms of equipment requiring additional field safety measures be taken

The PM will designate one field person, typically a Crew Chief or Field Crew Leader, to serve as the FSO prior to the commencement of field efforts. The FSO will assume the role of conducting a pre-field safety assessment of each site where crews will be working. It is the responsibility of this person to view the site prior to allowing crew members to begin work to determine specific site hazards and debrief these hazards with the crew members in a pre-field safety briefing prior conducting any work. The initial pre-field safety briefing may occur in the field on the first day of field work or may be conducted in the office prior to the initiation of the field component. All potential hazards are to be addressed in the pre-field safety briefing. The FSO must possess a clear vision of what constitutes unsafe field conditions and be capable of determining when conditions become too unsafe to allow continued field efforts.

Field crews must protect themselves from potential field hazards they may be exposed to during field activities, including, but not limited to: biological hazards, such as bacterial and other micro-organisms; exposure to inclement weather; heat and cold; dangerous water conditions; animals and insects, over-exertion, falls, electric shock, and vehicular accidents; over-exposure to UVA/UVB rays; fire and chemical exposure. High stream flows commonly associated with storm events present additional threat to workers. Slippery conditions, stream-side vegetation, and unstable stream banks could cause a worker to fall into a body of water. The risks of such a fall include hypothermia, bodily injury, and drowning.

Traffic hazards will be encountered when working at the side of or in a roadway. These hazards will be increased during times of reduced visibility such as during storm events and at night. The primary threats associated with working in or alongside roadways are workers being struck by passing vehicles or being involved in a vehicular collision. The risk associated with these threats is severe bodily injury and/or death.

Certain flora and fauna, pathogenic microorganisms, and viruses are potential biological hazards of concern. The primary threats associated with these hazards include flesh wounds, acute and/or chronic infection, and/or disease contraction. Water quality associated with any body of water

crews may be exposed to is an aspect of significant concern. Exposure to poor water quality can cause negative, serious, and long-term health effects and should be mitigated with the frequent employment of waterless hand sanitizers and/or washing with soap and water. Crews should also avoid hand to mouth and hand to eye contact until they have had the opportunity to wash with soap and water or a waterless hand sanitizer. Open wounds should be disinfected and covered and direct exposure to open water sources should be limited whenever possible. Eating and drinking should not occur until proper decontamination has occurred. Waders or protective waterproof clothing should be utilized whenever possible to decrease crew exposure to potentially harmful pathogenic microorganisms in water sources. Organic compounds, such as pesticides and industrial chemicals and metals make up most of what are termed toxic substances. At high levels, they can pose a health threat by drinking, swimming, or wading. Common water pollutants of concern include:

- Fecal Coliform: Bacteria found in the intestines and feces of warm-blooded mammals and birds; fecal coliform presence indicates increased potential for pathogenic bacteria, viruses, and parasites to be present in water. Generally highest around wastewater and sewage treatment facilities and areas of city-street and agricultural runoff. Resulting illness include cholera, (*Vibrio cholerae*), typhoid fever *(Salmonella typhi*), shigellosis (*Shigella*), salmonellosis (*Salmonella*), gastroenteritis (*Campylobacter jejuni, Escherichia coli, Giardia lamblia*), ear infections, dysentery, viral and bacterial infection, including Campylobacteriosos and Salmonellosis, hepatitis A, and parasites including Toxocariasis (roundworm) and Toxoplasmosis. The presence of fecal coliform tends to affect humans more so than aquatic creatures, though not exclusively.

- Toxic Metals or Heavy Metals: Among the greatest threats to health are Arsenic, Cadmium, Lead, Mercury, and Silver. Other metals such as Chromium and Selenium may pose a health hazard, depending on the form in which they exist. Toxic metals are associated with nerve damage, birth defects, mental retardation, certain cancers, and increased susceptibility to disease

- Asbestos: Asbestos is linked with gastrointestinal cancer.

- Toxic Organic Chemicals, i.e., Pesticides and Herbicides: Exposure may induce symptoms include recurring headache, rash, fatigue, higher cancer rates, birth defects, growth abnormalities, infertility, circulatory, respiratory complications, and nerve and organ damage.

- Chlorine: Trihalomethanes (THM's) are formed when chlorine, used to disinfect water supplies, interacts with natural organic materials (e.g., byproducts of decayed vegetation, algae, etc.). This creates toxic organic chemicals such as chloroform and Bromodichloromethane. Chlorinated water has also been linked to high blood pressure and anemia and cancer of the gastrointestinal and/or urinary tract.

- Naegleria: The amoeba, naegleria, causes meningo encephalitis, a swelling of the brain caused by a naegleria infection, and may result in brain damage and/or death.

In the event of an injury, illness, or accident that may require the attention of a physician, SWCA supervisory staff must be notified immediately. If a person(s) is transported to a medical facility, the location of this facility must be given to the SWCA supervisory/support staff. In emergency situations field personnel should call 911 for an emergency response team. Describe the injury or illness and answer all questions. All SWCA employees, contracted employees, and subcontractor personnel must be familiar with the location of and route to the nearest medical facilities. Locations of the nearest medical facilities are included as a separate document.

PERSONAL PROTECTIVE EQUIPMENT

Protective equipment shall be utilized on a project specific basis and may consist of the following:

- hard-hat
- reflective safety vest
- high-top protective boots, rubber boots, or steel toe boots
- personal flotation devices (PFDs)
- rain gear (when needed)
- cold weather gear (when needed)
- latex gloves
- splash-proof goggles (if desired)
- appropriate respiratory protection (i.e.: dust masks) when needed

In addition, the following specific health and safety equipment will be present in each vehicle used for field work:

- first aid kit
- fire extinguisher
- drinking water
- wash water and soap or waterless hand sanitizer
- hoist for lifting water sampler
- emergency medical facilities locations
- emergency roadside assistance telephone numbers

It is the responsibility of FSO to ensure all field vehicles contain these items before entering the field.

SWCA Field Safety Assessment/Plan 2008

A.) Site Description:

Site Name: _____ **Date:**_____

Location: _____

_____

SWCA Field
Safety Officer (FSO):_____ **Phone:**_____

Primary Hazards: (FSO check all that apply):

____ Biological Hazards
____ Heat Stress
____ Cold Exposure
____ Water Related Injury/Drowning
____ Animal Related Injury
____ Electric Shock
____ Fire
____ UVA/UVB Exposure
____ Chemical Exposure

Other: _____

B. Work Plan:

1. All operations shall be conducted in accordance with procedures established during field safety briefings to be conducted prior to onset of field operations and on an as-needed basis, thereafter, to be determined by Project Manager (PM) and/or FSO on a project specific basis.

2. Daily objectives may include documenting site monitoring, sample collection, and related activities. Detailed objectives will be developed daily and will be described during the field safety briefing.

C. Staff Organization and Responsibilities:

- **Field Safety Briefings**

1. All personnel, employees, contractors, and subcontractors shall be provided with an initial site safety briefing to communicate the nature, level, and degree of hazards expected on site.

2. Personnel will receive regular briefings before each shift when significant changes are made in the work procedures or safety plans. The FSO / crew leader shall hold these safety briefings. At a minimum these meetings will describe the work to be accomplished, discuss safety procedure changes, and note any items which need to be communicated to other personnel. General safety topics should also be covered based on points raised in previous meetings and any safety plan attachments.

3. All personnel assigned to perform the work described must: (1) be given a personal copy of this document by the FSO; (2) be briefed on the health and safety requirements of this project by the FSO; and (3) acknowledge receipt of and willingness to comply with the provisions of the plan by signing the attached compliance agreement. Individuals refusing to sign the agreement will not be permitted to

conduct field work for this project. Completed agreements shall be provided to the PM. Additional briefings should be scheduled and conducted by the FSO as needed.

- The **FSO** is responsible for the health and safety of all crew members. The responsibilities of the FSO include (but are not limited to):

✓ coordination of all safety and health concerns for entire work site
✓ keeping this plan current
✓ liaison with site safety officers from other organizations

Other organization key officials (FSO complete, if applicable):

_____
Name/Title/Organization/ Phone

_____
Name/Title/Organization/Phone

_____

D. Site Control Information:

1. No person shall enter the site without subscribing to this or another applicable Field Safety Plan.
2. Personnel shall be adequately trained to perform their assigned tasks safely.

E. General Safe Work Practices:

Depending on the circumstances, any or all of the safe work practices listed below will be adhered to while on site. Place a check next to those that are appropriate for this deployment and add any additional ones that may be required. **(FSO check all that apply):**

_____ **BUDDY SYSTEM:** When deemed necessary by the FSO, the buddy system shall be observed inside the work area. Personnel must work within sight of their assigned partner at all times. The FSO shall assign partners when necessary.

_____ **WORK NEAR WATER:** All personnel working in bodies of water, boats, or generally within 10 feet of water deeper than 3 feet, shall wear approved Personal Floatation Devices (PFDs), as deemed necessary by the FSO.

____ **HEAT STRESS**: Fluids shall be available at all times and encouraged during rest periods. FSO shall ensure water is provided for all field crew members.

____ **COLD STRESS:** Workers shall dress in adequately warm clothing; rest opportunities and exposure protection shall be provided. Fluids shall also be available during rest periods.

_____ **HIGH NOISE LEVELS:** Hearing protection shall be used in high noise areas (generally where noise levels require personnel to raise their voices to be heard) or where designated by FSO or PM.

_____ **ELECTRICAL HAZARDS:** Electrical hazards are designated on the site map, and shall be marked with suitable flagging, barricades, or warnings.

_____**TRAP HAZARDS:** Trenches, pits, or similar hazards are noted on the site map. The FSO shall ensure that these locations are periodically checked during the day.

_____ **UVA/UVB EXPOSURE:** Sunscreens of protection factor 15 (or greater) and UV tinted safety glasses shall be worn, as needed.

_____ **MOTOR VEHICLES**: Drivers shall maintain a safe speed at all times, and shall not be allowed to operate vehicles in a reckless manner. Seat belts will be worn. Vehicles should pull off road to collect data.

_____ **ALL TERRAIN VEHICLES (ATVs):** Drivers shall maintain a safe speed at all times, and shall not be allowed to operate vehicles in a reckless manner. ATV drivers shall not operate ATVs outside of areas specified by the project site boundary or FSO.

_____ **HEAVY LIFTING:** Manual lifting and handling of drums and/or containers shall be kept to a minimum. Mechanical devices, drum slings or other mechanical assisting devices designed for that purpose shall be used whenever possible.

Flora & Fauna Awareness: The following listed items represent the types of dangers that may be associated with the plants, insects, and animals native to the area of deployment. The FSO will obtain information to determine specific dangers faced in particular areas covered by the site-specific plan.

- **INSECT STINGS:** Bee (European and Africanized), hornet, or wasp stings
- **POISONOUS SPIDERS**: Black widow, Brown recluse, Scorpions, Tarantula
- **TICKS:** Carriers of Rocky Mountain spotted fever and Lyme disease
- **ANIMAL BITES**: Skunks, prairie dogs, foxes, bats, dogs, cats, raccoons, and horses, etc. may not be life-threatening, but bites or scratches may pose infection hazard, and/or rabies, as well as problems associated with open wounds
- **SNAKE BITES:** Rattlesnakes, water moccasins, and coral snakes
- **POISONOUS PLANTS:** Poison ivy, oak, or sumac

General Precautions:
During morning safety briefings, provide information on the location of hazards and how to safely handle problems. Personnel should employ the following, as needed:

- Long sleeved clothing
- Insect repellent
- Snake leggings
- Personnel with severe allergies must work in areas away from known/suspected hazards.
- Personnel with allergies to bee stings or other insect bites should notify their supervisors and the Safety Officer when reporting on this site. They should also carry emergency antidotes on them whenever possible. Supervisors on site should be prepared to deal with medical emergencies that may result when personnel with allergies receive bites or stings.

Additional areas of concern:

_____

_____

F. Personal Protective Equipment (PPE):

***PPE Requirements (*FSO complete below section):**

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

_____ _____ _____

G. Emergency Procedures:
When an on-site emergency occurs, personnel shall not re-enter the area or restart work until:

- Condition resulting in the emergency has been investigated by the FSO and has been corrected
- Hazards have been reassessed
- Personnel have been briefed on any changes in the operation and site safety plan
- Hospitals listed in the communications section have been contacted, as needed
- Fire departments listed in the communications section have been contacted, as needed
- Ambulance services listed in the communications section have been contacted, as needed
- Police forces listed in the communications section have been notified, as needed
- SWCA supervisory support and/or PM have been notified of incident

Field Safety Procedures and Policies
Employee Acknowledgement

I acknowledge that I have read and understand the River and Field Safety Procedures and Policies.

I understand that it is my responsibility to review these procedures and policies, as well as any future revisions. I also understand that I should consult my Field Safety Officer, Field Crew Leader or Crew Chief, Supervisor, or Program Director regarding any questions or for further clarification.

Employee name (please print):	**Employee signature**:	**Date:**