IRRIGATION HOSE PESTICIDE APPLICATION PROTOCOL



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Abbreviations:

Gee = Gee Minnow Trap

RSC = Red Swamp Crayfish

Materials

(Note: see Appendix I for purchasing)

|  |  |
| --- | --- |
| 1. Irrigation Hose Setup Equipment  * 1/2" Polyethylene Mainline Tubing * 1/2” Easy Loc Tee * 1/2” Easy Loc Elbow * 1/2” Easy Loc End Caps * 1/2” Easy Loc Coupler * Hose Cutter * 1/4" Goof Plugs * 6-gal Woodpecker Emitters * Zip ties * Thread Sealant Tape * Stakes * Measuring Tape * Mini Sledgehammer * 1/4" Mirical Punch * Pliers | 1. Pesticide Application  * Gee Minnow Traps with Ends Closed Off (Gees) * Buckets * Waders * YSI * Lux Meter * Dog Food * Bait Bags * Floats for Traps * Rope * Calipers * Tablet * Clipboard * Datasheets * Pencil * Sharpie * Strong Plastic Garbage Bags * Long Dip Nets * Knife * 5-gallon Carboys * Carboy with Spigot * 25-gallon Sprayer Tanks * Spray Gun * 15-ft Tank Hose * Hose Fitting-To-Tank Hose Fitting * Air Compressor * Blowout Compressor Kit * Garden Hose * Water Sample Bottles * Pliers * Mesh Filter bags * Activated Charcoal * Cinder Blocks * 12Volt 18Ah Battery * Marine Radio |
| 1. Post-Treatment Monitoring  * Dip Nets * Buckets * Data Sheets * Trash Bags * Air Compressor * Water Sample Bottles * Coolers * Ice Packs * Gee Traps * Dog food * YSI * Light Meter | Genetics Equipment (if needed)   * Jars * Sharpie * Pencil * Waterproof (Rite in the Rain) Paper * 95-100% Ethanol * Genetics Protocol |
| Safety Equipment   * Gloves (Nitrile and Elbow Length) * Rubber boots or waders * Tyvek coats * Safety Glasses * First Aid Kit * Eye Wash Kit * Wash Station (high volume, rapid discharge or quick access to water hydrant/faucet/clean pond water * Handheld Sprayer * Absorbent Pads * Heavy-duty Plastic trash bags * Pesticide Safety Data Sheet * Spill Contact Numbers * See Safety and Spill Protocols |



Figure 1: Setup of irrigation lines in golf course ponds.

1. Irrigation Hose Setup
2. Measure the amount of hose needed per pond using GIS.
   1. Circle

      Description automatically generated with low confidencePlace a length of hose on each side with a tee fitting in the middle (Figure 2). Do not exceed 550 feet for a section of irrigation hose (i.e. 550 feet of hose = 1 pump)

Figure 2: Irrigation hose set up in half pond. Repeat until all sides of pond have hose.

* 1. Additionally, attach a short length of hose to the T joint in the middle of each length to connect to the pump.

1. Evenly distribute wooden stakes along the shoreline of the pond and drive stakes into pond bottom using a mallet until securely anchored 5 feet from shore, but not deeper than by access with waders. Stakes will be used to hold the irrigation hose in place in the pond.
2. Unwind irrigation hose slowly on the bank and measure necessary length for one side of the pond using a measuring tape.
   1. The hose can become kinked easily, a minimum of 5 people is recommended for a large pond. Use pliers to fix kinks if necessary.
   2. Remove slack from hose as it is unwound to keep the hose straight.
3. Walk the hose into the pond with at least 4 people and place hose next to stakes.
   1. Excess hose can be trimmed off the end.
   2. If there is an extreme curve in the pond that the hose cannot bend around without kinking, cut the hose with hose cutters and insert an elbow fitting. Push the hose over the barbed end as far as possible, then hand-tighten locking nut over hose until secure. The locking nut screws on counterclockwise.
4. Begin zip tying the hose to the stakes in the pond in a “x” fashion to avoid slipping.
   1. Start at one end of the pond and work towards opposite end of hose.
   2. One person can pull out the slack from the hose while another person zip ties.
   3. Use multiple zip ties to secure the hose.
   4. Attach the hose slightly above the water’s surface. This will allow holes to be punched into the hose.
   5. Leave the zip ties loose enough for the hose to slide down the stake later.
5. Measure the halfway point of the length of hose, pound in a stake at that point, and cut the hose in half with hose cutters.
6. Select a safe, flat location near the tee fitting where a water tank can be placed on the day of application.
   1. Pound a stake near the chosen location, preferably in the pond.
   2. Measure a length of hose from that location to the tee fitting.
   3. Cut the hose with a hose cutter and attach one end of the hose to the middle of the tee fitting.
   4. Push the hose over the barbed end as far as possible, then hand-tighten locking nut over hose until secure. The locking nut screws on counterclockwise.
   5. Coil the newly cut hose and very loosely zip tie it to the stake in a way that will be easy to take on and off and is easily accessible from shore.
7. Wrap Teflon tape over threading on three end caps, and screw the cap over the tape and threading.
   1. The cap screws on clockwise.
8. Attach the three end caps to both ends of the hose and the coiled-up hose coming out of the middle of the tee fitting.
9. Repeat steps 3-10 on other sides of the pond until the perimeter of pond is traced in hose.
   1. Straight couplers can be used to extend the hose if needed, not to exceed 550 feet. Push the hose over the barbed ends of the coupler as far as possible, then hand-tighten locking nuts over hose until secure. The locking nuts screws on counterclockwise.
10. Each length of hose should have 20 emitters evenly spread across the hose. To determine the distance between emitters, divide the total length of hose by 19 (e.g. 500 ft/19 = ~26 ft between emitters).
    1. Insert the first emitter in at the end of one side of the hose. Measure out the length of the hose and divide by 19 to estimate distance between remaining 19 emitters on the hose. Measure with a measuring tape or by pacing. If you use pacing, use one person to do all pacing.
11. Punch holes in the hose with handheld irrigation hose hole puncher.
    1. Holes should be angled towards the center of the pond and parallel to the surface of the water.
    2. Holes can be hard to find if not immediately shown to person inserting emitters, so it is best to work in pairs with the person inserting the emitters.
    3. If a hole is punched incorrectly, it can be filled with a goof plug.
12. Insert emitters into holes.
    1. The emitter will make a clicking noise when fulling inserted. Make sure the barbed end is what is inserted into the hose.
13. Repeat steps 12-14 on entirety of hose.
14. Push irrigation hose under the water’s surface at each stake and tighten the zip ties.
    1. The hose will continue to float in between stakes until it is filled with liquid.
15. A picture containing water, outdoor, nature, lake

    Description automatically generatedEnsure all emitters are installed correctly, and all end caps are on tightly. Coil excess hose extending from “T” onshore for ease of access during application.

Figure 3 : Irrigation lines attached to wooden stakes.

A picture containing water, grass, outdoor, tree

Description automatically generated

Figure 4: Irrigation lines attached to wooden stakes.

1. Safety and Spill Response
2. Review protocols focused on Safety and Spill Response.
3. All staff should review pesticide safety data sheet. Staff should be aware of how to contact emergency response services (e.g., 9-1-1) and where local hospital services are.
4. Personal protection equipment (PPE) should be worn to reduce risk of pesticide exposure for eye and skin contact, ingestion, and inhalation.
5. The poison control center (1-866-257-4118) should be call for treatment advise in cases of significant exposures. Signs of acute exposure are skin dermatitis, numbness, sneezing, vomiting, diarrhea, headache, restlessness, tinnitus, incoordination, convulsion, difficulty breathing, burning, and itching to eyes/throat, swollen eyes. Call 9-1-1, if necessary.
6. Do not open or pour chemical unless in well-ventilated area and keep pesticide below head-level. Personnel should remain upwind of pesticide if possible.
7. Rinse with water for at least 15 mins if pesticide contacts skin and eyes. If product is inhaled, more to fresh air.
8. PPE should be worn when handling or applying pesticide and removed prior to leaving treatment site. Personnel minimally wash hands with water and soap prior to leaving site, eating or drinking.
9. Disposal of all PPE and product containers according to federal, state, and local regulations.
10. Minor spills (5 gals) should be cleaned up using absorbent material. Emergency services may need to be contacted for major spills (>5 gals). Major spills need to be reported as an adverse incident.
11. Personnel should shower and wash clothes separately after pesticide applications.
12. Pesticide Application

Figure 5: Pesticide being applied to a pond and burrows.

Pond Application

1. Monitor weather for 7 days leading up to the treatment and record the weather forecast with screenshots from the National Blend of Models at Station K1D2 (or other station specified in permits) made by the National Weather Service (link below):
   1. <https://www.weather.gov/mdl/nbm_text?ele=NBP&sta=K1D2&cyc=01>.
   2. Forecast must have the Q24P5 (i.e., median 24-hr rain prediction in hundredth of inches) to be below 50 and the Q24P9 (i.e., 90th percentile 24-hr rain prediction in hundredth of inches) to be below 100. If any single day exceeds either of those thresholds the week following the treatment, the treatment must be postponed.
2. Place filter bags at outflows of treatment areas prior to pesticide application (if needed).

Figure 6: Mesh filter bags placed on the outflow of a treated pond.

* 1. Filter bags are made of mesh and are filled with approximately 2 bags of activated charcoal.
  2. Weigh down filter bags with cinder blocks to keep them in place if necessary. Bags will float in deep water.
  3. Prevent as much water as possible from going over, around, or between filter bags by tightly packing bags.

1. Calculate the amount of pesticide needed for each pond if not completed pre-treatment. Record on data sheet. Target concentration in ponds is .2 mg/L pyrethrin.
   1. Determine volume of pond in Liters, back calculate. Pond volume is determined by collecting depth measurements and averaging those to get an average depth. Then, estimate the pond’s surface area with satellite imagery and multiply the surface area by the depth.
2. Wear safety glasses, gloves, and Tyvek jackets/coats while working with pesticide. Rubber boots or waders are also recommended.
3. Place safety signs around treatment ponds in easily visible locations to warn people to not enter the pond or consume anything out of it.
4. Fill carboys and water supply tanks with water at source (i.e., hose spigot). Prior to treatments beginning, fill treatment tanks with 7 gallons of water. After mixing product, fill remaining space in tanks with carboys.
   1. Fill the tanks to the 25-gallon mark with water from carboys. An additional 15 gallons should be placed by each tank for rinsing. At this time, any empty carboys and water supply tanks can be ferried back to be filled by a gator, as needed, to be ready for another application.
   2. Water running is ideally done with two people and two gators. After pesticide is mixed at ponds, person one should take all empty carboys to hose to refill. As carboys are emptied into tanks for triple rinse, person two begins filling carboys with tank on the back of gator. Keep rotating empty carboys to one person to run to refill and leave full carboys with the other for the duration of treatments.
5. Mix product
   1. Place pesticide application tanks on a cart. Fill tanks 1/3 of the way full before adding pesticide. Evenly divide the total amount of pesticide needed for a pond between all treatment tanks. Check the that valves are closed on the bottom of the tanks, and then carefully pour the pesticide into the tank.
6. Triple rinse used pesticide containers with the spigot and pour rinse contents into the tank before throwing away the bottles. Mix pesticide for 10 minutes and water by shaking the tank by hand or turning on agitator if available.
7. Apply treatment
   1. Screw central piece of the irrigation hose into the pesticide application tank. Make sure there are no kinks in the line and the tank is on a flat location.
   2. Open the valves on the tank, connect battery, and turn on the pump. Use walkie talkies to synchronize beginning application from different tanks on the pond. Record the start time for the treatment.
   3. Keep the pressure at 15 psi. Pump will automatically turn off if the pressure is too high. To adjust pressure, use the far-left valve marked “Pressure Adj.” and slowly adjust to desired pressure.
      1. If the pump seems to be working slowly, the filter screen may on the pump may be clogged. In this case, remove it and clean it off. The filter screen is located on the bottom of the tank where the mixture goes into the pump.
8. When the tank is almost empty, begin the triple rinse process.
   1. Pour 1 5-gallon carboy of water into the tank; when the tank is almost empty, repeat two more times.
   2. Dump out any excess triple rinse fluid that cannot be sucked up by the pump into the treatment pond.
9. Record the end of treatment time for each length of hose. Replace the end cap on the irrigation hose and replace it on the stake in the pond.
10. A body of water with trees around it

    Description automatically generated with medium confidenceRepeat this process at all ponds.

Figure 7: Pesticide being administered through a irrigation line under the water.

Burrow Application

1. Burrows may be treated pre- or post-pond treatment.
2. Use Burrow Treatment RSC Survey123 (see Burrow Treatment protocol) form to record data.
3. Ensure steps 1-6 in the pond application section have been completed.
4. Connect the handgun to the handgun attachment spot on the pump.
5. Ensure all caps are closed securely and that the valve to the pump is closed prior to filling.
6. The amount of pesticide needed will be determined by the amount of water being used. The amount of water needed is roughly 0.5 gallon per burrow. (see calculation sheet)
7. Once water amount is selected and put into tank, pipette the correct amount of pesticide for that amount of water.
8. Open pump valve on bottom of the tank to allow mixture to flow through.
9. Mix pesticide for 10 minutes and water by shaking the tank by hand or turning on agitator if available (will need to connect battery to pump for agitator)
10. Connect battery and turn pump on.
    1. Pump will automatically turn off if pressure is too high. To adjust pressure, use the far-left valve marked “Pressure Adj.” and slowly adjust to the pressure you desire.
11. Start administering chemical into burrow until full. Record burrow location on Survey123 form.
12. Move on to next burrow and repeat step 11 until all burrows have been treated.
13. You may need to stop and refill tank with water and pesticide.
14. Once completely done triple rinse tank with 3 5-gallon carboys. Spray at least 5 gallons of the water out of the handgun to insure proper rinsing. The rest can be drained from the drain hole.

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| --- | --- | --- |
| **Task** | **Staff Needed** | **Notes** |
| Pre-treatment preparation | 3-5 | Place hoses in water, test lines to ensure no holes, repair holes, prep gear at office |
| Product mixing and pond application | 4 | Two people per tank. 2 tanks per pond |
| Burrow application | 2+ | Two per tank: one to apply, one to move tank and record data |
| Fill water carboys and supply tanks | 2 | 2 gators |
| Bioassays and carcass removal | 3+ | Increase if treating a large number of ponds and/or treating ponds for the first time |
| Treatment Coordinator | 1 |  |
| Post-treatment monitoring | 2 | Water samples and bioassays |
| Post-treatment clean-up | 3 | Carcass clean up, blow lines out |

III. Post Treatment Monitoring and Clean Up

1. Once pesticide application is completed at a pond, cleanup of crayfish, fish, and other carcasses can begin immediately.
   1. Make sure safety gear (gloves, Tyvek shirts) is always worn. If possible, avoid entering the pond. Waders should be worn if entering the pond, but wearing waders or rubber boots is recommended to protect feet from exposure to treatment water (e.g., drippings from equipment).
   2. Use long handled dip nets to scoop up carcasses and place them into buckets.
   3. If red swamp crayfish are being kept for genetic analysis, they should be taken within 4 hours of treatment. Follow the genetics protocol for more details.
   4. Record the total number of carcasses on data sheets and move the carcasses to trash bags. Crayfish should be identified to the species level and counted individually. Fish and amphibians should be identified to the species level if possible, but total numbers can be estimated by a subsample if necessary due to large numbers of fish.
      1. Subsampling should include counting/weighing a random subsample (N=30 per species) and estimating total number based on total weight of all fish. Total estimated count = total weight\*subsample count/subsample weight
   5. Carcasses should be disposed of in the MSU incinerator.
   6. Carcasses may need to be removed for several days after treatment as they float to the surface. For the first treatment of a pond, plan to conduct daily removals for four days post-treatment. For subsequent treatments, plan to conduct removals for one day post-treatment. Treatments during the spring and summer may have higher carcass counts.
2. Immediately following treatment, water should be blown out of the irrigation hose.
   1. An air compressor should be connected to the irrigation hose using the blowout kit.
   2. Remove end caps to blow out water at the ends of the tube.
   3. Blow out hose until no more water is coming out.
3. Water samples to monitor pesticide concentrations should be taken post treatment. Pyrethrin should be at undetectable levels 13 days out from treatment, so water samples should be taken during that time period. Refer to the specific workplan for additional guidance on sample collection numbers and frequency.
   1. Triple rinse bottle with the water to be sampled before taking the sample.
   2. Note where in the waterbody, the time, and what the field ID is for each bottle on the data sheet.
   3. Store water samples in a cooler with ice, and then move to a freezer for more long-term storage prior to shipping them to a lab for testing.
4. Bioassays should be set in the post treatment period. Pyrethrin should be at undetectable levels 13 days out from treatment. Conduct bioassays during that time.
   1. Bioassays consist of a crayfish in a Gee minnow trap that has the ends closed with pliers.
   2. Trap red swamp crayfish for the bioassay prior to the beginning of treatments. See the trapping protocol for trapping methods.
   3. Place one adult red swamp crayfish (carapace length over 30 mm) in each bioassay trap. Choose individuals that are uninjured and preferably have both claws. Try and evenly distribute male and female crayfish amongst the waterbodies. Make sure the trap is closed with a float attached before setting it in the water.
   4. Note where the cage was set in the waterbody using cardinal directions, what time, the sex, and the carapace length (measured with calipers) of the crayfish on the data sheet.
   5. Soak bioassays cages for 24 hours.
   6. When the cage is pulled, note whether the crayfish is dead, alive, or functionally dead. Functionally dead crayfish will still be moving but will not be able to right themselves when placed on their back.
   7. DO, pH, temperature, conductivity, and light intensity should be measured once per pond each time bioassay cages are pulled.
5. When treatments are complete (~13 days), remove signs and filter bags from the pond.

APPENDIX I

MATERIALS LIST

Note: Some materials are found in multiple lists. However, in these tables below they are only listed once. Some materials are not listed (e.g. pencils, sharpies, etc.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Irrigation Hose Equipment | |  | Pesticide Application | |
| **Item** | **Link** |  | **Item** | **Link** |
| 1/2" Polyethylene Mainline Tubing (0.600" ID x 0.700" OD) | <https://tinyurl.com/58ccjej6> |  | ProDSS Multiparameter Digital Water Quality Meter (YSI) | <https://www.ysi.com/prodss> |
| 1/2" Easy Loc Tee | <https://tinyurl.com/3m7kutrp> |  | Gee Minnow Traps | <https://tinyurl.com/ytm95wyw> |
| 1/2" Easy Loc Elbow | <https://tinyurl.com/94xnxsra> |  | 5-Gallon Bucket | <https://tinyurl.com/57xtr5et> |
| 1/2" Easy Loc End Cap | <https://tinyurl.com/yy62k826> |  | Waders | Preference |
| 1/2" Easy Loc Coupler | <https://tinyurl.com/y3w2mdw2> |  | Light Meter | <https://tinyurl.com/2s4ce82j> |
| 6-Gallon Woodpecker Emitters | <https://tinyurl.com/y4npama9> |  | Dog Food | <https://tinyurl.com/msu4s9bc> |
| 1/4” Miracle Punch | <https://tinyurl.com/4adpvwmj> |  | Bait Container | <https://tinyurl.com/y67cfmwy> |
| 1/4" Goof Plugs for Repair (One Way) | <https://tinyurl.com/4m8zcuue> |  | Trap Floats | ? |
| Poly Tube Cutter | <https://tinyurl.com/yzujusw6> |  | Rope | <https://tinyurl.com/vyy9f3tr> |
| Zip ties | <https://tinyurl.com/4whakz9u> |  | Caliper | <https://tinyurl.com/m2nysjb2> |
| Thread Sealant Tape | <https://tinyurl.com/3mj6h53e> |  | Clipboard | <https://tinyurl.com/2p98vyzf> |
| Wooden stake | <https://tinyurl.com/4nam9hk9> |  | Trash Bags | <https://tinyurl.com/3mhx47e5> |
| Measuring tape | <https://tinyurl.com/yzm7ycts> |  | Dip Nets | ? |
| Mini Sledgehammer | <https://tinyurl.com/3wmekrzv> |  | Utility Knife | <https://tinyurl.com/yfrk7rf8> |
| Pliers | <https://tinyurl.com/4j5zv886> |  | 5-Gallon Carboy | <https://tinyurl.com/mvxnh9ua> |
|  |  |  | 5-Gallon Carboy with Spigot | <https://tinyurl.com/ha4bynad> |
| Post Treatment Monitoring | |  | 25-Gallon Spot Sprayer | <https://tinyurl.com/mssjsbt3> |
| **Item** | **Link** |  | Hose Fitting-To-Tank Hose Fitting | <https://tinyurl.com/yd6n26cr> |
| Sample Bottles | <https://tinyurl.com/3pe7tbef> |  | Air Compressor | <https://tinyurl.com/mryxapkf> |
| Shipping Cooler | <https://tinyurl.com/3j4yspy6> |  | Blowout Compressor Kit | <https://tinyurl.com/5dpr3jya> |
| Field Cooler | <https://tinyurl.com/2wvx2bjy> |  | Garden Hose | <https://tinyurl.com/3z466tt7> |
| Ice Packs | <https://tinyurl.com/2yk6wzph> |  | Mesh Filter Bag | <https://tinyurl.com/2p97whpn> |
|  |  |  | Activated Charcoal | <https://tinyurl.com/3ns44ryb> |
| Safety Equipment | |  | Cinder Blocks | <https://tinyurl.com/485d3tcf> |
| **Item** | **Link** |  | 12Volt 18Ah Battery | <https://tinyurl.com/2bcb3e9w> |
| Short Gloves | <https://tinyurl.com/bdken5z8> |  | Marine Radio | <https://tinyurl.com/2c9kabrj> |
| Elbow Gloves | <https://tinyurl.com/w6be3wfv> |  |  |  |
| Nitrile Gloves | <https://tinyurl.com/5y4j46ux> |  | Genetics Equipment | |
| First Aid Kit | <https://tinyurl.com/3rs45pv9> |  | **Item** | **Link** |
| Eye Wash Station | <https://tinyurl.com/2crhudsf> |  | Sample Bottles | <https://tinyurl.com/3pe7tbef> |
| Handheld Sprayer | <https://tinyurl.com/mtmcabjd> |  | Waterproof Paper | <https://tinyurl.com/4naac7jj> |
| Tyvek Coat | <https://tinyurl.com/w36uemst> |  |
| Absorbent Pad | <https://tinyurl.com/5avjeskw> |  |  |  |