REDUCING SILT IN YOUR IRRIGATION DRAIN WATER

A HANDBOOK ON

BEST MANAGEMENT PRACTICES

FOR THE IMPERIAL COUNTY SILT TMDLs

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Imperial County Farm Bureau Voluntary TMDL Compliance Program
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The Regional Water Quality Control Board's first Total Maximum Daily Load, (TMDL), directed at the Imperial Valley farmers, is the Silt TMDL. It mandates that farmers will be required to reduce the amount of silt leaving their fields enough so that the amount of silt entering the Salton Sea is reduced by 50%.

To achieve this goal growers can either deal directly with the Regional Water Quality Control Board or they can choose to join the Imperial County Farm Bureau's Voluntary TMDL Compliance Program, designed to facilitate the implementation of the Silt TMDL and provide assistance to farmers who have joined the program.

A turbidity meter, which measures how much sediment is suspended in the water, can be used to see what degree of clarity is acceptable and what degree of clarity is not acceptable. The Imperial County Farm Bureau's Voluntary TMDL Compliance Program Director has meters available for loan and can instruct growers on their proper use

Growers will find that many of the farming practices they use today will reduce the amount of silt leaving their fields. The key is to determine which combination of erosion conservation practices are the most economical and beneficial to accomplish the job. Those practices that reduce that amount of silt in the drain water are called Best Management Practices or BMPs, for short.

All growers should keep a running log or diary of what they are doing for each field to reduce the amount of silt leaving a field in the drain water. Dates, methods used, photographs, and actual turbidity meter readings are important to show that progress is being made.

SLOW IS THE ONLY WAY TO GO!

The key to the reduction of silt leaving the field is to keep the velocity of drain water below the magic speed at which soil particles are picked up and put into suspension by the speed of the water. The faster the water flows, the more silt it will carry in suspension.

The important thing to remember is that once the silt is in suspension, and the drain water is muddy, it becomes almost impossible to improve the situation until that muddy water has left the field. If you keep the drain water moving slow from the very start, it becomes much simpler to manage.

Experience has shown that if the drain water velocity is kept below 6/10 of a foot per second, (36 feet per minute), the water will pick up little, if any clay or silt, and will remain clear.

IMPORTANT BMPs

In most cases, one single BMP is not enough to reduce the silt leaving a field. Instead, many different BMPs, working together are usually required to reduce the sediment suspended in the drain water.

Drain Box

The Imperial Irrigation District requires a drain box on most valley fields so that drainage water leaving the field can be measured as it drops in elevation from the farmer's field to the IID drain ditch. Although this simple device is designed to transfer water to different levels while allowing it to be measured, it also becomes one of the best tools that farmers can use to reduce silt in their drains.

By regulating the sill or grade board of the drain box, soil erosion can be minimized. In many instances farmers will find that the soil around their drain box has been eroded over the years because the height of the sill is not adjusted properly. In many situations the elevation can be significantly higher, especially when anticipated tailwater flows will not reach elevations that will cause crop damage.

A new injection molded plastic drain box with a steel frame is currently available that reduces the cost of installation. The whole box weighs less than 50 pounds and is easily handled by one person however care must be taken to keep the area around the box free of dry weeds since the plastic material will burn.

Wider Drain Box

If the current drain box is broken and needs to be replaced the grower should consider replacing it with a much wider 42” version. The major cost of replacing a drain box is labor, so the extra dollars spent for a wide version does not change the total cost that much.

A wide drain box allows more water to be removed from the field without having to lower the level of the drain box sill. Other BMPs may deliver the drainwater to the drop box slowly but if the opening is narrow, the water builds up in height and the velocity near the drain box increases. If the drain box is checked up too high the beds or crops near the drain box may become submerged.

Wide Pan Ditch

The bottom of a pan ditch is usually the width made by a grader blade, (12-14 feet), and level from side to side so that drain water flows evenly across its width. Because of its width, a pan ditch is able to carry a much larger quantity of water at a slower speed and with less depth. For vegetable growers, who need to enter a field soon after irrigating to harvest, a pan ditch has the added benefit of drying much faster than a deep V-ditch.

In most cases, a wide pan ditch can replace a deep V-ditch for the same amount of labor and do a much better job of moving drain water off the field at a slower velocity without the water becoming muddy.

A wide pan ditch in conjunction with a wide drain box are two of the best tools available to reduce silt in the drainwater.

Deep Drains and Deep Reverse Grade Drains

Deep Drain Before Irrigation

Deep Drain Blocked While Irrigating

Many fields east of Brawley and Calipatria have very deep drain ditches. Drain water moves from the field into the drains through concrete drop boxes or plastic spills. Some of the deeper versions are designed to flow in the opposite direction of the natural side-fall of the field.

Although this type of field drain is very efficient in removing drain water from the field it can create many problems when trying to satisfy the requirements of the Silt TMDL.

The first point of erosion is where the irrigation water exits the end of the furrow, or area planted to crop, and travels straight for 20 to 50 feet across the lower end

of the field to the drain. The sill boards in the concrete drain box should be adjusted while the field is being irrigated so the water can tell the irrigator what the proper level is. Ideally, when adjusted correctly, the water should be backed up to where the water exits the furrow or planted crop. Care must be taken that the crop is not submerged and that water will not stand when the field is finished irrigating.

In many cases this 20 to 50 foot strip of land between the end of the furrows and the drain is bare of any growth. In some situations planting this bare area with a grass will greatly reduce soil erosion. Any grass that is planted should be mowed and baled before it is allowed to go to seed. Rye grass, wheat, or oats would be good choices for planting on the end of sugar beet or alfalfa fields and the baled grass would make excellent feed for horses or calves. The grass should not be allowed to become too rank or it may back the water up into the field. On sandier fields bermuda grass may start growing naturally at the lower end of the fields.

The second point of erosion is where the water dumps into the drain ditch and begins flowing towards the final drain box that empties the field drain ditch into the Imperial Irrigation District's drain ditch.

In some cases plastic sheeting is used as a spillway to dump water from the field into the drain. This usually causes heavy erosion because the water picks up speed as it travels across the plastics sheeting. A layer of fiber mat material over the plastic sheeting may slow down the water enough to stop the erosion if the differences in elevations are not too great.

Where concrete drain boxes are used to dump water from the field level to the drain ditch level, erosion occurs as the water exits the concrete pipe and drops a distance into the drain ditch causing large, round washes. If control structures were installed in the deep drains at the proper intervals, determined by the side fall of the field, it would allow the drains to remain full of water during irrigation. The pipes from the drop boxes would then be submerged by the water, which should help reduce turbulence and erosion. Each control structure including the final drain box would need a self starting siphon to slowly drain the drain ditch over a 24 hour period after the irrigation was completed.
It's important that the final drain box, which dumps into the district drain, is adjusted to the correct level. Many of the deep drains are far deeper than they need to be and have become even deeper over the years. With the sill board set correctly, and water left to stand in the drains for a few days after each irrigation, the drains may slowly fill up with silt to the proper levels.

Self-Starting Siphon in Installed In Grade Board

Self-Starting Siphon Installed In Drain Box

Drain Water Ditch Checks

Drain water ditch checks are small temporary or permanent dams placed in a ditch to control the flow.

When the side-fall of a field is too steep to allow drain water to run slowly, drain water ditch checks can be added to back up the water, slow it down, and reduce erosion.

These small dams can be made from concrete, plastic covered earth, metal, wood, or whatever works the best for the grower.

New, labor saving products, woven from straw and other fibers, are being produced in the Imperial Valley by Greenfix America for erosion control in highway construction and landscaping. The company's fiber logs work very well as drain water ditch checks and can be installed very quickly by staking them to the contour of the drain ditch. Just as a "speed bump" in a shopping center slows the traffic, so do these logs slow the water in a drain ditch.

Lined Spillways to Drain Water Into Drain Ditches

Small spillways, usually made from plastic sheeting are then used where the water drops from the small V-ditch down to the lower level of the main drain ditch. Lining the spillway with slick plastic sheeting only speeds up the water and means even more erosion may occur when the water hits the bottom of the drain ditch.

Instead of plastic sheeting, if the spillway is lined with woven fiber mat, like produced by Greenfix America, the water velocity is reduced by the coarse texture of the woven fiber mat and much less erosion occurs.

Maintaining the Proper Grade

While doing the groundwork for a new crop, growers should check the levels on the tail end of their fields. Many times low spots develop, particularly close to the drain box, and a slight touch-up with a laser land leveler plus resetting the height of the sill board on the drain box will do wonders to reduce the amount of erosion that occurs in the new crop.

Draining Water Across the End of a Field (No Drain Ditch)

If the borders are eliminated on the last 50 feet or so of the field, and the crop is maintained to the end of the field, the drain water from the upper lands can be used to irrigate the crop at the ends of the adjacent lower lands.

The growing crop acts as a barrier to slow down the velocity of the water and crystal clear water is usually the end result when this method of drainage is used.

This method will not work if there is too much side slope on the field or where water standing in the lower portion of the field for too long a period may harm the crop or rise too high in the furrows and submerge the plants.

Filter Strips

The bed that crops are planted on must end before they reach the end of the field so cultivation and harvesting equipment can turn. In addition, the lower ends of hay fields, irrigated with borders, may die out from heavy traffic and compaction caused by the harvesting equipment.

This is where a filter strip works well, with or without a drain ditch, to reduce the velocity of the drain water. On sandy fields, different types of grasses will automatically replace the alfalfa on the lower ends of fields and act as a filter strip.

For crops planted on beds, natural occurring grassy weeds or light plantings of grasses such as wheat or rye grass will create a very good buffer to reduce the velocity of the drain water. Care should be taken to select the proper plant to use for the filter strip so that it does not become a weed that is difficult to control in the crop being grown.

For hay crops, the planted filter strips should be harvested separately so as not to contaminate the quality of the crop being grown. Even in hot weather when rye or wheat filter strips die out, the roots left in the soil will help prevent erosion until the process can be repeated in the fall.

Sprinkler Irrigation, Drip Irrigation, and Level Basin Irrigation

High amounts of erosion usually occur during the first irrigation when a new crop is being germinated on recently worked soil.

When a moveable sprinkler irrigation system is used to germinate the crop no drainwater is produced. A level basin irrigation system as well as a drip irrigation system also produces no drain water and growers need to understand that these can be considered as the ultimate BMP.

Planting In The Mulch

Planting a crop such as wheat in the mulch is an excellent BMP. The Imperial Irrigation District does not allow any drain water to leave the field during the mulching irrigation. After the soil is mulched the seed is planted below the mulch and into the mud where it germinates without further irrigation. By the time the first irrigation is needed the plant will have grown to almost a foot high with a well-developed root system which reduces erosion. In addition the solid stand of the crop will act like a filter strip to slow down the water and reduce soil movement.

Pump-back Systems

Pump-back systems, which return drain water back to the irrigation ditch, will reduce the amount of silt leaving the field because a portion of the water is being recycled and used over. This too, can be listed as a very useful BMP but it comes with an added expense of labor and fuel required to pump the water back to the irrigation ditch.

Polyacrylamides (PAMs)

Polyacrylamides, or PAMs for short, are group of polymer compounds, relatively new to farming, that show great promise in reducing silt during irrigation where no other method is effective.

The material works by either keeping the silt particles from becoming suspended in the drain water or allow suspended silt particles to settle out rapidly when applied to drainwater.

PAMs can be mixed with the irrigation water or sprayed on the drain water as it leaves the field. The estimated cost of using the material is between $2 and $6 per acre for each irrigation.
PAMs should be considered for higher value crops on very steep ground where the drainwater exiting the furrows is already too muddy.

For more information about the use of PAMs, and the availability of the material in the Imperial Valley, growers can contact the Imperial County Farm Bureau's Voluntary TMDL Compliance Program Director or Farm Consultant for more information.

Gopher Ditch

Unique to this area, a gopher ditch keeps a gopher from burrowing out of the field and directly into a deep drain thus stopping washouts and a tremendous loss of soil. Many times a deep drain or even the Alamo or New River may run next to a field with only a road separating the two. If a gopher burrows out of the field, under the road, and into the deep drain, irrigation water may cause terrible washouts. By digging a deep V-ditch along the edge of the field an extra barrier is created to keep the water contained should the gopher burrow out of the field. Instead of the burrow exiting in the deep drain or one of the rivers it comes out in the gopher ditch which allows the irrigator to see the washout, contain it in the gopher ditch, and repair it before serious damage is done. Care must be taken to keep the gopher ditch as weed free as possible or the weeds may attract gophers as a food source.

Fine Tuning

Already growers are inventing new ways to reduce the amount of silt that leaves a field. One grower has successfully used small lines of planted wheat across the bottom of a pan ditch as well as in front of a drop box to slow down the water leaving the field. With a positive attitude and innovative thinking, just about anything is possible.

The BMPs listed above are only a small portion of what can be used to reduce the amount of silt leaving the fields. Whatever a grower can think of that works for that particular field, can also be considered a BMP whether or not its use is recognized.

The Last Guy on the Totem Pole

Even if all of the key BMP's are implemented, the success of whether or not there is a reduction of silt during an irrigation will depend on the last guy on the totem pole and the one that gets paid the least….**the IRRIGATOR**.

The grower should use every possible means to re-educated the irrigator so that he understands what is trying to be accomplished and that he has the grower's backing to accomplish the task. A TMDL Training Video, in Spanish with English subtitles, is available from the Farm Bureau to help explain why TMDLs are necessary and what the irrigator can do to make the program a success.

APPENDIX

Imperial County Farm Bureau Voluntary TMDL Compliance Program

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Web Site

www.ivtmdl.com

A new web site has been developed to help growers more easily comply with the Silt TMDL. After registering on the website, growers can easily input all the information about their fields in a secure mode. That information will then automatically be uploaded to the main database of the Imperial County Farm Bureau's Voluntary TMDL Compliance Program and ultimately transferred to the Regional Water Quality Control Board.

This should save countless hours of time for both the grower and the staff of the Imperial County Farm Bureau Voluntary TMDL Compliance Program.

The new website will also have current information about the TMDL process, information on BMPs, and many other kinds of information to keep growers appraised of what is happening with the TMDL.

List of Suppliers

Concrete Drain Boxes

Ryerson Concrete Products
802 East Main Street
El Centro, CA 92243
(760) 352-4341

Plastic Drain Boxes

Elms Equipment Rentals, Inc.
1676 Main Street
Brawley, CA 92227
(760) 344-3780

Fiber Mats and Fiber Logs

Greenfix America
6547 Lyerly Rd.
Calipatria, CA 92233
(760) 348-7600

Drainbox Installation and Repair

Clayton's Drain Tile Maintenance
1619 River Drive
Brawley, CA 92227
(760) 344-2183

Elms Equipment Rentals, Inc.
1644 E. Jones Road
Brawley, CA 92227
(760) 351-1911

Tile Maintenance Company
5300 Kalin Road
Brawley, CA 92227
(760) 344-2550