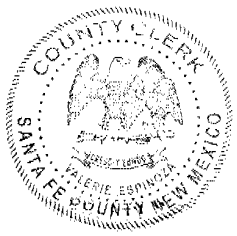


SANTA FE

BOARD OF COUNTY COMMISSIONERS

SPECIAL PRESENTATIONS MEETING

May 16, 2007

Virginia Vigil, Chairman
Jack Sullivan, Vice Chair
Paul Campos [excused]
Michael Anaya
Harry Montoya

SANTA FE COUNTY

SPECIAL PRESENTATIONS MEETING

BOARD OF COUNTY COMMISSIONERS

May 16, 2007

This special presentations meeting of the Santa Fe Board of County Commissioners was called to order at approximately 10:05 a.m. by Chair Virginia Vigil, in the Santa Fe County Commission Chambers, Santa Fe, New Mexico.

Following the Pledge of Allegiance and State Pledge, roll was called by Deputy County Clerk Shirley Hooper Garcia and indicated the presence of a quorum as follows:

Members Present:
Commissioner Virginia Vigil, Chair
Commissioner Jack Sullivan, Vice Chairman
Commissioner Mike Anaya
Commissioner Harry Montoya

Member Excused:
Commissioner Paul Campos

V. Invocation

An invocation was given by Justin Salazar from the Human Resources Department.

VI. Approval of the Agenda

Commissioner Anaya announced that representatives from the Estancia Valley Water Utility were unable to be present and asked that item J be removed from the agenda. Upon motion by Commissioner Montoya and second by Commissioner Sullivan, the agenda was unanimously [4-0] approved as amended.

VII. Presentations

A. Employee of the Quarter

Joseph Gutierrez, Director of Community Services, presented the Employee of the Quarter award to Ron Sandoval, whom he described as an asset to the Projects Division. He has

overseen large capital outlay programs, including the Arroyo Hondo Fire Station, the Eldorado Community Center and the Agua Fria Community Center. Additionally, he has worked on the spur trail. He commended Mr. Sandoval for being a great team player.

Commissioner Anaya said he was happy to be going to so many groundbreakings, a sign that they were getting things done. Commissioner Sullivan thanked him for his work on the Eldorado Senior Center which just had a grand opening. He described Mr. Sandoval's job as juggling a lot of balls at the same time. Commissioner Montoya said he appreciated the work done in the northern part of the county and thanked him for being a true professional and a gentleman. Commissioner Vigil mentioned it was rare to have the opportunity to recognize good employees and she thanked him for his willingness to go above and beyond the call of duty, such as he did with the Agua Fria Community Center.

Mr. Sandoval thanked Mr. Gutierrez for nominating him. He expressed gratitude to the Commission, the other divisions, and to Pam and Shelly from his office, saying it was a team effort. He said it was his job to try to make the County look good.

Noting that a number of youth athletes were present for recognition, Commissioner Vigil asked the parents to stand up and they were given a round of applause for their support.

B. Recognition of Santa Fe High School Cheerleaders

Commissioner Vigil announced that the Demon Cheer Squad placed first in the West Coast Championships Large Co-ed Division held in California. She added she had been a Santa Fe High cheerleader. A video of the winning routine was shown, and coaches Tyra Martinez and Sylvia Martinez helped present trophies to Meghan Alire-Maez, Mary Apodaca, Kalie Archuleta, Keith Downey, Charlene Gallegos, Antonio Lopez, Jillian Martinez, Caesar Montano, Samantha Montano, Mikaya Oliver, Augustine Ortiz, Andrea Probst, Charlette Probst, Jennifer Romero, Alysha Salazar, Ashley Varela, Robin Varela, and Eliza Webb.

D. Recognition of Class AAA District State Champs St. Michael's High School Varsity Basketball Team

Saying he played basketball for St. Mike's rival, Santa Fe High, Commissioner Anaya talked about the accomplishments of the team for the season, and a highlight tape was played. The following players were presented with trophies: Jordan Romero, Robert C de Baca, James Hart, Mark Manning, Jeremy Romero, Marcus Martinez, Robbie Castillo, Mike Hart, Erik Geyer, Louie Eres, Elijah Garcia and Leo D'Amour.

Head Coach Ron Geyer congratulated his team, calling them a very coachable group.

E. Recognition of Santa Fe Elementary Division I Champs, Chaparral Firebirds

Commissioner Sullivan congratulated the team, stating they have won the last three championships, adding they have a combined record of 35 wins and 7 losses. He invited the coaches, Ben Montoya, Jay Maestas and Dave Gonzales, along with school principal Teresa Ulibarri to help distribute the trophies and basketballs to Martin Montoya, Jalen Maestas, Diego Gonzalez, Jonathan Arevalo, Emilio Yim-Pacheco, Derek Salazar, Iseah Olguin, Aaron Chaparro, Estevan Sandoval, Nathaniel Lucero, Gabriel Ortiz, Fotios Patsalis, Gerard Benavidez, Josh Carrasco and Sterling Luna.

F. Recognition of Santa Fe Elementary Division II Champs, Nava T-Birds

Commissioner Montoya outlined the record of the Thunderbirds, adding they also hold a collective 3.8 GPA. Coaches Randy Herrera, from the County Legal Department, and Peter Martinez helped pass out basketballs and trophies to Michael Leyba, Drake Nieto, Jeremy Trujillo, Joseph Romero, Marcos Mendez, Peter Bartlett, Trent Spencer, Andrew Martinez, Christian Herrera, David Tapia, Dylan Leonard, Edgar Santos, and Mikey Lopez.

G. Recognition of Santa Fe Elementary Division III Champs, Carlos Gilbert Blackhawks

Commissioner Anaya stated the Blackhawks came in first in the regular season, then went on to defeat the Pinon Eagles and finish the season undefeated. Basketballs and trophies and basketballs were presented to Andre Chavez, Andrew Delgado, Mathew Smallwood, Jonathan Bartleson, James Trujillo, Manuelray Benavidez, Carlos Acosta, Brandon Ortiz, Ian Aarons, Elijah Berry, Vicente Garcia, Jacob Sanchez, Sevastian Gurule, Tyler Ortiz and Grant Keesing. Coach Ray Acosta expressed his thanks to his fellow coach, Harold Moya, to the school, and to the Commission for their recognition.

Commissioner Vigil said the County appreciates all the young athletes for "being the shining stars that you all are today."

H. Department of Transportation Recognition

Commissioner Anaya reminded those attending of the snowstorm at the beginning of the year, followed by mud problems. He said the DOT was working round the clock to help. He commended everyone involved and was joined by DOT Commissioner David Schutz in recognizing Buck Chavez from the Moriarty Patrol, Lawrence Cordova from the Cerrillos Patrol, and district-wide: Dennis Valdez, Gregory Martinez, Clarence DeYapp, Fernando Gurule, Everardo Ulibarri, John Mascarenas, Brian Marquez, Lino Herrera and Andrew

Montoya. Commissioner Schutz spoke of the coordination that occurred during the storm, and expressed the appreciation of Rhonda Faught, Secretary of Transportation, who was unable to attend.

I. EMS Week, Proclamation 2007-3

Commissioner Anaya thanked the Fire Department for bringing this proclamation forward, and called up Kemit Holland and Chief Stan Holden to read the proclamation *[Exhibit 1]* which honors the volunteers providing emergency medical response to the people of the county, especially in the rural areas.

Commissioner Anaya moved to approve Proclamation 2007-3 and Commissioner Vigil seconded the motion, which carried by unanimous [4-0] voice vote.

In response to a question from the chair, Chief Holden said there have been over 70 applications for cadet firefighter positions.

K. La Cienega Community Plan Update and Report on what it means to be a rural community *[Exhibit 2:Outline of Presentation; Exhibit 2: Notes on Comprehensive Energy Plan]*

Carl Dickens, president of the La Cienega Valley Association, stated he was excited to be making a presentation to the Board of County Commissioners. The presentation was an idea of Robert Romero who saw it as an opportunity to speak when not fighting for something in particular. He said the group represents not only Upper and Lower La Cienega but also La Cieneguilla and two acequias.

Mr. Dickens said when he was growing up the area was nothing but alfalfa fields and acequias. He explained the composition of Valley Association board, saying they are able to deal with matters of importance efficiently. He introduced vice president José Varela López, rancher and businessman, Mary Dixon, who has an organic garden in La Cienega and is very active in the community, Greg Howell, secretary of the Association and master craftsman, J.J. Gonzales and Mike Taylor. Ray Romero, Camille Bustamante and Cathy McCloud were unable to attend.

Mr. Dickens reminded the Commission that it took five years to put together the community plan, and he spoke of the important community issues, such as parks and trails, and a community center.

Gene Bostwick, chair of the Development Advisory Committee, stated they have been dealing with large issues, such as the Santa Fe Canyon Ranch development, along with looking into the future towards a comprehensive energy plan.

The Beautification Committee is co-chaired by Mr. Dickens and Susan Simons and has the priority of cleaning up the roads and putting up signs, making use of the artistic talents of the resident. There is a plan to install planters at the three entrances into La Cienega.

Mary Dixon stated she had been farming in La Cienega for 25 years and is the chair of the Agricultural Club. She said they want to see the agricultural component of the community come back to life. They are working to get the youth involved.

Mr. Dickens introduced Jesusita Larrañaga, saying her farm last year produced 8,000 pounds of produce for the food depot, include chile.

Mr. Dickens also heads the Communications Committee which is instrumental in keeping the community informed.

Turning to the issue of community challenges, Mr. Dickens spoke of a spill-over at the City wastewater treatment plant, which has led to cooperation with the City on well testing. A water fair was held recently and 120 people showed up to have their water tested. A second issue is the community's dealings with PNM and the effort to underground the power lines. Santa Fe Canyon Ranch continues to be an issue and a video by David Camp was shown later in the meeting to highlight the beauty of the area.

A comprehensive water plan is essential to the well being of the community, and there are concerns about airport expansion, the Rail Runner and the upcoming concert at the Downs.

Mr. Dickens said they are struggling to maintain the community's rural ways and involve the youth in that tradition. "We can deal with housing but the housing shouldn't be on farmland." There are various ideas afoot to promote this. Water management and wastewater treatment figure prominently in the concerns of the area.

Commissioner Anaya thanked the community for coming to the meeting. Commissioner Montoya pointed out they have done a good job in cleaning up problem areas they had inherited. Chair Vigil asked where the new community center would be located, and Mr. Dickens said there is a proposal for an area near Rancho de las Golondrinas and the proposed park, on State Land Office land.

L. Mentoring New Mexico – The Boys Crisis in Santa Fe County *[Exhibit 4: The Boys Initiative]*

Gene Weisfeld from Mentoring New Mexico pointed out that they had seen today some of the successful boys in the community and he would be talking about the not-so-successful boys in the community. Statistically, there is a great amount of evidence that girls and women

are now excelling while boys and men are lagging behind. "It's clear there is a growing problem with boys." He spoke of the "2/3 rule" which says if it's a good thing, 2/3 of those involved will be girls and if it's a bad thing, 2/3 will be boys.

Mr. Weisfeld spoke of a new mentoring program where men come into the high schools and teach the most challenging boys both math and basketball. The program starts with third graders. He talked of recent research that shows how the brains of boys and girls develop differently, and how the differences are across the socio-economic spectrum. He asked the County to help recruit men to serve as male role models in the voluntary program. He recognized that the County was active in encouraging mentoring.

Commissioner Anaya moved to strongly support the program and Commissioner Vigil seconded. The motion carried by unanimous [4-0] voice vote.

Mr. Abeyta said they can put a notice on the website and have the employee development division of Human Resources Department contact Mr. Weisfeld to promote participation.

M. FastDitch *[Exhibit 5: Power Point Presentation; Exhibit 6: Product Guide]*

Ed Suazo stated they were not there to sell anything but to make the Commission aware of an option for ditches. He said the company and technology began in response to having to repair the acequia on their family ranch. He said this system saves time, water and money. It conforms to existing waterways and is easy to install. Mr. Suazo said the first one they installed nine years ago is still in place with no maintenance. It is less expensive than concrete, lasts longer and doesn't leak.

[Commissioner Vigil left the meeting.]

Mr. Suazo described the installation process and said 98 percent of the water is transported, compared to 65 percent water loss in unlined ditches. He described projects in Acoma and Cuba and pointed out the system is environmentally friendly and can be hand-carried into inaccessible places.

Commissioner Montoya asked if concrete had to be used first and Mr. Suazo said it did not, adding the SmartDitch was mostly self-scouring. A pitchfork can be used to clean out debris that has gathered in the winter. Some sand can accumulate in places where there is very mild slope. He described how the lateral ditches can be accessed by compuertas. They have met with acequia associations, some of which are sponsored by the federal government.

VIII. Adjournment

Vice Chair Sullivan declared this meeting adjourned at approximately 12:40 p.m.

Approved by:

Board of County Commissioners
Virginia Vigil, Chair

Respectfully submitted:

Debbie Doyle, Wordswork
227 E. Palace Avenue
Santa Fe, NM 87501

ATTEST TO:

VALERIE ESPINOZA
SANTA FE COUNTY CLERK

Santa Fe County
Proclamation

No:

WHEREAS, Traumatic injuries are the leading cause of death for New Mexicans under the age of 44; and

WHEREAS, Other medical emergencies such as cardiac problems, strokes poisonings, respiratory distress, etc, adversely affect the citizens of Santa Fe County, particularly rural residents living far from medical facilities; and

WHEREAS, Access to quality emergency care dramatically improves the survival and recovery rate of those who experience sudden illness or injury; and

WHEREAS, Emergency medical service providers have traditionally served as the safety net of America's Heath Care System; and

WHEREAS, Many physicians, nurses, and emergency medical technicians in Santa Fe County have devoted their lives to serving others; and

WHEREAS, Many emergency service providers in Santa Fe County are volunteers who have dedicated a tremendous amount of time and effort in receiving training and education to provide emergency medical services to our citizens; and

WHEREAS, The observance of emergency medical services week will recognize the accomplishment of all members of the emergency medical care team, including emergency dispatchers, fires responders, firefighters, law enforcement officers, emergency medical technicians, and paramedics;

NOW THEREFORE, WE THE BOARD OF SANTA FE COUNTY COMMISSION HEREBY PROCLAIMS:

the week of May 20 through May 26th as

"Emergency Medical Services Week"

throughout Santa Fe County and urge all citizens to recognize and honor all emergency service providers in Santa Fe County

Chairwoman Virginia Vigil
District 2

Vice- Chair Jack Sullivan
District 5

Harry Montoya
District 1

Mike Anaya
District 3

Paul Campos
District 4

ATTEST:

Valerie Espinoza
County Clerk

La Cienega Valley Association

Presentation to the Santa Fe County Comission

May 16, 2007

Preserving our rural way of life.

1. Opening.
2. The organizational structure of the LCVA.
3. Introduction of Board Members
4. Introduction of Committee Chairs
   a. Parks and Trails – Robert Romero and Rey Romero
   b. Development Advisory Committee – Gene Bostwick
   c. Beautification Committee – Carl Dickens and Susan Simons
   d. Agricultural Club – Tom and Mary Dixon
   e. Communication – Carl Dickens
5. Community Challenges.
   a. City Waste Water Treatment Plant – Ed Sceery and Jesusita Larranga
   b. PNM – JJ Gonzales
   c. Santa Fe Canyon Ranch
   d. County wells and water issues
   e. Rail Runner
   f. Airport expansion
   g. Concert at the Downs
6. What the Future Holds
   a. Holding on to rural ways and traditions and involving the youth of our community.
   b. Expanding agricultural capacities and production, Agricultural Revitalization Initiative project.
   c. Planning for energy conservation and production.
   d. Establishing a water management plan that respects the traditional uses of water for agricultural and takes into account the quality of life issues associated with our streams, springs and ponds.
   e. Developing a waste water treatment management plan with systems that work for our area and terrain.

Closing

Notes on a Comprehensive Energy Plan for the Community of La Cienega/La Cieneguilla.

An overview by Gene Bostwick
La Cienega/La Cieneguilla, 2007

Introduction: Beyond conservation and efficiency

The village of La Cienega/La Cieneguilla is located in a what many people see a primary development zone between the cities of Santa Fe and Albuquerque. Pressures on the community to allow growth and development have steadily eroded much of the rural agricultural nature of the area, and there is no reason to believe that these forces won't continue to exert influence.

In the face of these pressures the community has built a strong sense of purpose. Preservation of the rural lifestyle, agricultural and ranch activities, and low-density growth are widely seen as key elements of the community plan for its future. In keeping with those elements, the La Cienega Valley Association continues to search for way to improve the community and preserve its fundamental nature. One part of that strategy is to reduce the village's dependence on outside resources, thereby reducing the political and economic influence of those who supply resources to us.

Because of this, an energy plan can play a larger role than conservation and efficiency. It becomes a factor in our future, whether we can preserve the nature of the traditional community, or whether La Cienega/La Cieneguilla will succumb to suburbanization and development. Too many other traditional communities have been lost to these forces to think that it cannot happen here. The development and institution of an energy plan deserves our best effort.

An Overview

A comprehensive energy plan should address more than conservation or alternative energy use. It should look at the way the community works and lives, and how habits and lifestyles create expectations of energy use. Most households consume energy - not just electricity, but all manner of resources - with comfort and convenience as the primary concerns. Efficiency and conservation play secondary roles, rising in significance only as the utility bill rises. We should not expect this to fundamentally change, and an energy plan that does not recognize it is bound to fail.

A plan should look at how energy is distributed. The "pipeline" or infrastructure can be very costly to expand or upgrade. But most studies on the infrastructure have demonstrated that more efficient systems tend to reap big long-term rewards. A better built car delivers better performance and lasts longer. Less "down time" means less production loss, etc. Add up all the direct and indirect savings, and the better system costs less in the long run. Energy infrastructure obeys the same laws.

A plan also needs to consider the pressures that seek to change the community as well as the forces that resist change. There will not be one "right answer" for

everyone, and there may be no answer for some. Developments as yet undreamt of may greatly change the plan before it is realized. Some barriers may never be overcome. But the community stands to benefit in many ways, not the least of which is the preservation of La Cienega/La Cieneguilla as a unique and special place.

A plan, our plan, will need to catalogue its resources and maximize their use. We are fortunate as rural communities go. We have an excellent community plan and a supporting county ordinance. We have a dedicated and knowledgeable group of citizens who care about the future of the village. Many people here are willing to work to preserve and improve it. This is the most vital element, because a comprehensive energy plan will need the support of the broad community, and it will rely on many individuals to be successfully developed and implemented.

And finally, our energy plan should not be afraid to dream big. Some of the ideas for energy conservation and production may be expensive or may require extensive infrastructure. Some may ask us to change the way we do things. But if we only focus on the easy goals, we stand to lose much. We should use the smaller goals to sustain us as we work toward the bigger ones. We cannot accomplish what we will not try.

Working within the La Cienega/La Cieneguilla Community Plan

Our energy plan should not seek to re-write the community plan, it should stem from it. As such, we can use an energy plan to promote its goals as laid out in the LCVA community plan. Goals that can be enhanced with the energy plan include:

- sustaining a rural lifestyle by reducing the cost burden imposed by it, including reduced transportation costs, infrastructure maintenance costs, and utility costs.

- maintaining an agricultural and ranching base - transforming agricultural and ranching waste into economic return, and expanding agricultural and ranching activities that make positive contributions to the village's energy cycle

- promoting a strong sense of community - shared energy systems will require cooperation and communication - things that cannot be taken for granted.

- preserving the rural landscape from population expansion by dedicating areas to energy production via low impact systems such as solar and wind power generation.

- reducing the pressure to grow, which makes easier the preservation of natural resources, culturally significant sites, and other important features of the community.

What are the elements of a comprehensive energy plan?

We need to begin by defining what we mean by energy. The easily recognized elements include electrical power, natural gas and propane. Nearly all of the established programs to save energy look to reducing our use of these fuels. These include use of more efficient electrical devices, installing weatherproofing and insulation to reduce heat loss, and installing better hot water heaters.

Beyond these, there are a growing number of programs that provide incentives to generate power locally. Wind generators and photovoltaic power systems have become easier to install and more efficient at creating electrical power. Major utilities are rapidly increasing their own capacity to generate power in these ways, a sure sign that the technology and the economics are viable. In the future, if history repeats, the opportunity to use these systems locally may diminish as government backed incentives are shifted from individual user to corporations, and as manufacturers shift production in the same direction. The time to consider these systems is now.

An beyond even these energy saving methods, there are less obvious, far-ranging ideas. Our community, like every other, has cycles of use of water, waste disposal, and land utilization. Though not traditionally considered in energy plans, these areas have perhaps the greatest potential to move us toward energy independence. These are the big ideas, bigger than home wind generators and solar panels on every rooftop. These ideas ask us to look at every aspect of our community and at the forces that affect it from outside and in. Some people may be frightened by the very idea of considering them, but these areas are where the stakes are highest, and the potential rewards are greatest.

Elements of a plan should address all of the energy inputs and outputs that the community could utilize in more efficient, cleaner ways. It should look at trends in growth within the community and surrounding it. It should recognize political and economic forces that can be used to our benefit, and seek to moderate those forces that would detract from or harm the community. Similarly, it should understand the human resources available for good or for harm. It should be realistic in scope, but not confined by the past. It should think in big terms, but be prepared to act at the smallest scale if necessary.

A complete energy utilization plan will reclaim lost energy from waste, lost heat energy, and inefficient consumption. It will also develop the community's inherent energy resources - solar power and wind power as significant contributors to the total energy cycle.

With energy savings from reclamation and greater energy efficiency combined with input from inherent systems, the community can move much closer to a model of reasonable energy independence. The degree of energy efficiency that we can achieve can be determined by weighing all possible factors, assigning energy values to each,

and determining the costs of each to accomplish. A cost-to-benefit per factor can be used to plot a good course toward an achievable goal, and to determine the time and funding needs of the plan.

An outline of existing and possible energy cycles.

The energy plan should address all aspects of the community's energy cycles. A partial list includes:

- energy management in existing homes and other buildings.

  The community is nearly 100% residential. Every home consumes energy in several forms, including electricity, heating energy, cooling energy, and waste disposal energy. Even passive homes consume energy whether they are on the "grid" or not. It is likely that every home in the community would benefit from a plan to improve energy management.

- agriculture and ranching energy management

  Agricultural activity consumes energy in the form of fertilizer use, mechanical processes, transportation of crops, and waste disposal. Freeze and thaw cycles sometimes required moderation, particularly with delicate crops, fruit crops, etc. Drought, heavy snow or rain, and extreme cold effect livestock and can necessitate energy-intensive programs to protect it.

- water cycle management.

  The water cycle is energy intensive. Delivery of water, heating of water, and disposal of water all consume large quantities of energy. We must avoid the "developer" mentality that looks at water as strictly a waste disposal medium. Water is life.

- waste cycle management.

  The existing waste cycle is generally inefficient and provides little or no reclamation of the energy locked in the waste. In a perfect world there would be no waste. In a better world, we can take practical steps to reduce the loss and re-charge the energy system.

- local energy generation.

  The potential for local energy generation is greater than ever. Technologies now exist to take better advantage of solar and wind energy, and to convert waste into clean energy. At one end of the technological scale there are devices in development that would efficiently turn heat from the sun directly into electricity. At the other end, a simple water wheel turns flowing water into mechanical (or other) power.

- local energy storage and distribution.

The great achievement of the country's energy grid is its ability to store energy. Without storage, energy must be produced on demand. Unless the production capacity equals peak demand, there will be shortages. La Cienega/La Cieneguilla can use the national energy grid as a storage bank.

Electricity generated in the village can be sent into the grid using special meters that credit the community for each watt generated. The credit is applied against the cost of electricity used. Under current programs, the credit per watt is about one 1/4 of the cost to use electricity from the grid, meaning that the village would have to generate four times the energy it uses just to break even.

An alternative plan would create storage capacity within the community. Batteries are the standard now used, but better storage systems are in the works. Some of these use heat as the storage medium, and some use chemical reactions. A combination of these systems could move the community much closer to energy self-sufficiency. Imagine no energy bills, and you will see how great the benefit could be.

Energy cycle details:

A. Energy management in existing homes and other buildings

Where energy can be saved or better managed:

1. Heat loss. Existing programs to reduce heat loss are managed through city, state, and utility company organizations. Programs address simple heat loss problems - mostly air leakage from poorly fitted doors and windows, and other openings. Some plans address insulation issues and seek to increase thermal barriers to reduce overall heat loss.

2. Heat gain. As global warming intensifies, cooling costs will rise. Evaporative cooling is simply an unacceptable method in water conservation conditions. On a basic level, the same techniques used to prevent heat loss in the winter can reduce cooling loads in the summer. Insulation is a primary example. Most structures would probably benefit from additional ventilation systems, including passive attic ventilators (wind driven) and solar-driven exhaust fans. With these systems, a "tight" building that allows for control of air flow will also improve the cooling efficiency. Also, the addition of shading devices- awnings, shades, and screens and such - can have a dramatic impact.

3. Lighting. High-efficiency lighting can significantly reduce energy use and excess heat generation that may require energy for cooling.

4. Heating and cooling cycles. Non-peak heating and cooling systems can reduce energy cost and move the entire energy grid toward more efficient operation. Most of these systems rely on some type of heat or cooling

"well" to store energy during off-peak hours for later use. Battery systems, heat sinks, and water tanks, etc. are a few examples. On a more ambitious scale, the addition of "mass" to a building will have permanent beneficial effect to reduce heating and cooling loads. Mass can be traditional adobe, masonry block, brick, stone, or other dense building materials.

Beginning course of action:

- conduct a survey of homes, trailers, and other buildings in the community to determine the energy management problems and requirements.
- catalog programs that support and fund energy saving measures.
- explore other energy management options.

B. Agriculture and ranching energy management

Improving use of resources and energy:

1. Water conservation. In some cases the traditional use of water for irrigation can be very inefficient. Convincing acequia water users to conserve through better watering methods may be difficult because of traditions, fear of loss of water rights, and competitive use between neighbors. If the ditch associations adopted water conservation policies, many of these problems could be resolved. Modern watering methods in dry climates utilize drip irrigation, automated monitoring to only water when conditions merit, and planting cycles/combinations that better utilize each drop of water by planting complimentary crops. Water conservation could allow more agricultural production on more land and extend the life of the acequia supply that is already stressed by changing aquifer/climate conditions.

2. Agriculture and ranching waste product management. Most current and potential agricultural activities generate waste in several forms. Discarded plant matter (both weeds and "stalks"), methane gas bi-products, and animal waste are three types. Not including plant and animal waste currently used to reinvest in soil quality, nearly all remaining waste could be "processed" to recapture energy as heat that converts to electricity.

Equally important, the waste water runoff from agriculture and ranch activity should be examined to determine the amount of nutrients and pollutants. Localized bio-driven processing stations already exist to capture both of these components, nutrients for re-use, and pollutants for conversion to harmless agents or for disposal. Since both nutrients and traditional pollutants are known contaminants to water supplies and aquifers, mediation of runoff will be very important to protecting the water supply.

3. Expansion of traditional agricultural and ranch lands. La Cienega/La

Cieneguilla is one of very few rural communities in New Mexico that are actively seeking to protect and recover agricultural and ranch traditions. A program to create a community-held land trust to preserve these uses could reverse the trend toward lot-split and overcrowding in prime growing and ranching areas. As part of an energy plan, resources created through the plan could make agricultural and ranching activities more viable in the long term.

4. Planning for climate change. Drought, torrential rain, and heavy snowfall are all more likely to result form the current global warming trend. Farm and ranch operators already know how to react to these problems. In most case the solutions require large, directed energy surges such as spraying or heating crops to protect from freezes or helicopter transport of food to stranded livestock. Some of these situations may never be mitigated, but the cost of others might be reduced from a ready supply of local energy.

Beginning course of action:

- review existing agricultural and ranch activities and potential energy saving measures.
- evaluate potential agricultural and ranch lands that have been taken out of production to determine if these lands might be returned to traditional use.

C. Water cycle management.

The water cycle is complex. It includes the system of water distribution, water quality maintenance, heating and cooling water for domestic use, and disposing of "used" water. The future of the community is intimately tied to water. Political influence, economic growth, and sustainable lifestyle depend on access to affordable water in sufficient quantity. Unlike most rural New Mexico villages, La Cienega/La Cieneguilla has a large reserve of water in the form of aquifer and surface springs. The threat to these supplies grows each day with stress from surrounding development, growing population within the village, and changing climate.

If La Cienega/La Cienguilla is going to control its future, it must control its water:

1. Water supply. The current trend toward imported water comes at a price. The present County Growth Plan aside, outside political forces will eventually see the village lands as a potential profit source and growth area. Urbanization will result. If control of the water is from the outside, the village may not have the power to stop urbanization.

It seems only prudent to include control of the village's water supply as a part of an energy plan. Potential funding of the plan through political resources may be the only way to finance the high cost of creating a village-capacity water supply.

2. Water distribution. About 15% to 20% of the village currently uses a community water system. Some use the local association system, and some use the county system. The remainder use private wells. A village-wide distribution network will cost many millions of dollars, but the need is inevitable. Private wells should continue to be a viable part of the system, but not to the extent that they deplete aquifers. Rather than exclude wells from a village system, they should be maintained. Monitoring and testing can be automated so that the village does not rely on individual reporting. An engineered piping plan would include a "monitoring system" conduit. The overall system would require a base station and equipment to record monitoring data and alert the village to problems of leakage and/or contamination.

3. Domestic water heating and cooling. The village should look at a generation and distribution plant for hot and cool water as part of its energy production system. While there is a reasonable argument for distributed hot and cool water - huge long term cost savings and energy reduction - the logistics and up-front cost may make it improbable. Alternately, individual residential systems should be considered. Solar hot water units are an inexpensive and immediate step we can take, and these units could be part of community-wide conversion program. Storage tanks can enhance these systems and provide better energy balance, heating and cooling the supply during off-peak hours. Simple improvements to water heating units - insulation, replacing older, inefficient units, and eliminating leaks - can reduce energy costs. A more ambitious approach would install hot water circulation loops to reduce wasted water and reduce heating cost. Solar-powered, battery-driven pumps would reduce the circulation cost to nearly zero.

4. Water conservation. It's not a misnomer that the village could supply 100% of its water from precipitation if every drop was saved and used. (With 12" of annual rainfall - that's at least 4,000 acre feet of water per year.) Although that's unrealistic and probably detrimental to the environment, there is still potential to capture a huge volume of water for village use. Individual residential storage tanks to save rain water from roofs can be installed without major expense or infrastructure. More aggressively, landscape alterations could create ponding areas that also bank water, and these can be 'tanked" for longer term use. Even without introduction into the domestic system, retained water could greatly reduce or eliminate the need for additional water for landscape and agricultural use.

Beginning course of action:

- Initiate a study of the existing village water use, supply, and distribution.

- Investigate the acquisition of outside water sources - water rights, etc. that can be permanently dedicated to supplying the village.
- Investigate distribution system options, multiple networks, single network, or other plans.
- Investigate water "plant" technology and ways to purify water from multiple sources, including wells, surface water, and recycled water.
- Investigate long term agreements to supply water through the county distribution system without transferring future control of the supply.

D. Waste cycle management.

Most energy plans tend to ignore the waste cycle. The nation's infrastructure to recycle and re-use is poorly developed. Studies show that most people are not willing to expend a lot of effort on these things, in part because they do not see a reward for their work. Reduced electrical bills send a clear message. It's harder to qualify the benefit of less waste at the dump, less consumption of raw materials, and less pollution. Nevertheless, waste cycle management has great potential to benefit the community and realize economic rewards. In combination with other elements, waste cycle management can make our an energy plan exceptional. Exceptional plans can garner exceptional support.

Some basic components a waste cycle management include:

1. Sewage. Individual septic systems pose one of the greater threats to the valley's water supply. Contamination continues to spread as more and more systems are installed using standards, though state mandated, that are neither sufficient to confine pollution, nor designed to convert sewage into a usable resource. Both of these goals are essential if the ground water resources are going to be preserved.

Confining contamination is a straightforward process. Several manufactured systems exist that contain all pollutants. Some require frequent pumping, and some process waste until "clean" discharge is created. The latter systems begin to achieve both goals, confining pollution and producing a usable resource. The problem with this approach may be that it requires every existing septic system to be replaced, probably at great expense to the community or to individuals.

Another possibility would involve localized waste treatment plants or a single plant. The advantages include:

- greater assurance that pollution will be eliminated from individual lots as septic systems are removed.
- utilization of advanced processing systems that can produce very clean discharge.
- conversion of waste solids into safe, re-usable nutrients for agricultural use or for other landscaping purposes.

Waste treatment in other countries is far better managed. Across Asia

and Japan, many people use a purely organic approach to sewage conversion. These systems rely on beneficial microbes and simple aeration techniques to virtually eliminate nitrates and other contaminants, while producing high-quality solid and liquid bi-products that are commonly re-used. We do not have re-invent these methods. We simply have to apply them.

2. Solid waste. Each week our little community manages to fill several large containers with "trash" at the county transfer station. In that same time period we recycle about one sixth as much material.

Typically, of the couple hundred cubic yards of trash we throw away, about 80% to 90% is combustible or decomposable material - paper and wood, some plastics, organics, and some composite materials. The remaining 10% to 20% is mostly metal and ceramic/stone in content.

Converting trash into energy without consuming more fuel than you create can be very difficult, but it has been accomplished. Most successful plans begin with a good sorting process where materials are selected for one of several uses. Some is burned - combusted in a highly efficient furnace/generator system that converts heat into electricity. These systems can be made to recycle pollutants as well, until they are virtually pollution free. Other materials can be decomposed - composted into high-grade nutrients. With the right bacterial assistance, just about every known contaminant can be removed or converted to harmless substances.

3. Recycling. Recycling is already an established practice. Too much of the materials we save, though, are not being used, or are being stored indefinitely until they can be reprocessed.

It is not inconceivable that our community could create its own reprocessing system. Current reprocessing plants are energy intensive to the degree that the recycled materials are often less environmentally sound than new materials. If we eliminate that equation as a local possibility, there are still potential ways we can make a reprocessing program work.

Most paper goods are bio-degradable. And most could also be converted into pulp for reuse, not with chemicals and intense energy use, but with simple bio-processors. We can literally use a specialized microbial agent to turn paper waste into liquid pulp. The process is much slower than commercial enterprises demand, but we have the time to do it right.

Plastic and glass waste are more challenging, but they do have the potential to be used locally. In one scenario - picture a modern, wind-driven version of an old Dutch windmill - glass and plastic could be ground into fine powder. That first step in reprocessing is often the nemesis of commercial systems that rely on fuel to drive the grinding process. A wind-driven system may be slower, but the energy cost becomes almost a non-factor. Markets for these powders are readily available compared to markets for the unground raw waste. With an investment into a reprocessing center, we might even turn those powder products into new goods. It may seem beyond the reach of a small community, but the potential exists to create a significant, community-based income stream from recycling.

Beginning course of action:

- investigate advanced sewage treatment systems for individual and community plans.
- survey the extent of existing septic system use and assess the contamination risks.
- explore recycling systems that could work on a small community level.
- explore energy conversion systems - combustion and decomposition - that could work on a small community level.

E. Local energy generation.

The distinction between individual, "homestead" energy generation and community or "commercial" generation is an artificial separation. The techniques and systems employed are virtually identical, only differing in scale, not result. Energy generation systems are broadly supported by government funding programs, including tax reduction plans and direct subsidy funding. Pilot programs and "model community" programs are popular in political circles, and energy production figures prominently in the new definition of the "model". The bounds of energy production systems are expanding, and there are excellent opportunities to create integrated plans that capture a variety of resources.

1. Photovoltaic systems. The technology has advanced steadily over several decades. New systems are being incorporated into roofs, designed into complete panel-based packages, and even overlaid onto cars and many other surfaces. Most systems seem better suited to individual users, by adding onto residences, for example, to generate electricity that is fed back into the energy grid.

2. Wind generators. This is another advancing technology, with particular emphasis on commercial systems. Individual residential packages are on the market, but most of the new technology is going into wind farm programs. Our community could benefit from either plan, but we may be particularly well suite to use wind powered technology. We have the open space, and we have ample exposure to prevailing winds.

3. Thermocouple systems. These are similar to photovoltaic systems, but based on converting heat into electricity. Some proposed systems used a chemical conversion to store heat for later use. (Zeolite systems.) Others convert heat directly into electricity. The latter systems could be combined with photovoltaics to create greater efficiency. The former systems could store energy in individual homes for later reconversion into heat energy. The benefit of chemical storage is no loss of system energy over time, which would allow one to capture heat during the entire hot season and re-use it at any time during the cold season.

4. Combustion systems. As noted in waste management, conversion of waste into heat and then into electricity is a proven technology. These plans tend to only work efficiently on a community-wide basis.

Beginning course of action:

- explore the available systems for applicability and cost.
- catalogue the available community lands that could be utilized for energy systems - wind farms, combustion plants, etc.
- survey existing residences for potential addition of energy production systems.

F. Energy storage.

Perhaps the most ambitious aspect of an energy plan, energy storage is the final step in making a community independent. Energy storage would move us from a client relationship with the energy providers to a partnership. The long term benefits would exceed any other single aspect of our energy plan. Not only would the community reap a measurably large financial reward, it would also establish a significant buffer against many of the economic problems that have plagues communities in the past - problems that will recur and will influence our local lifestyle. In a real way, we would be securing our future.

1. Electrical energy. In simple terms, electrical energy storage requires a battery. If the battery is large enough, the energy needs of the community are never compromised, and we are "off the grid" in the sense that we do not use more energy than we generate, averaged over a defined time period.

In practical terms, a battery or series of batteries of this magnitude would be extremely expensive. There are some proposed systems that would store huge amounts of electricity in a small space, but none of these have been proven, and they, too, involve large expense. But battery technology is advancing quickly, and the future of large battery storage is bright. We should not have to wait too many years before practical batteries are available to satisfy our needs without spending a fortune.

2. Heat energy. Heat energy storage tends to be overlooked by most energy plans. Most homes have a hot water heater, but beyond that there is little thermal energy storage used day to day.

It's possible to design a much larger version of the water storage heater that could hold heat for a very long time (months) with little loss. The main issue would be the reservoir size and location, and how to put heat in and take it out to serve the community.

Another alternative would be to use chemical conversion of heat and store it for later re-conversion. Zeolite, a common clay used in many manufactured products, has been demonstrated to store heat via a chemical process. With the right system, this energy could be stored and recovered in a fairly efficient

process that is well suited to individual residential use. Other chemical storage systems could be similarly applied.

3. Biofuels. Biofuels store a unique form of energy in their nutrient value. Conversion from base material to usable energy has been closely studied of late, with emphasis on creating replacement motor fuels. Biofuels can also be converted into crop supplements and mulches for landscape and agricultural uses.

Our community has a built-in ability to create biofuels. Depending on the volume, the possibilities for using it could include all of the ideas above. On the simplest level, mulching would require a space to store unprocessed and processed material, and the equipment to create mulch. At the other end of complexity, a fuel producing plant could utilize a wide variety of organic materials to produce motor fuel products. Combined with local energy generation, the efficiency issues that limit commercial production would be mostly eliminated.

Beginning course of action:
- in combination with energy production systems, make a beginning determination of the potential amount of energy that might be generated from various sources
- survey the current state of electrical energy storage systems and review potential systems that may be appropriate to out community's use.
- investigate zeolite and other chemical storage systems.
- investigate biofuel generation systems, including mulching, nutrient conversion, and motor fuel conversion.

Summary

It's not enough to plan for one aspect of an energy plan. Each component has genuine value and benefit, but no single element can truly change the community's energy future. Only by combining these elements can we create a model that is sustainable and defendable. The power of energy independence could make La Cienega/La Cieneguilla a stronger, safer, and better place. We owe it to ourselves and our children to do our best to achieve it.

Picture a complete energy cycle:

- every residence and other building is optimized for energy savings: weatherstripping, insulation, air leakage reduction, controlled ventilation for heating and cooling.
- every residence and building is optimized for passive solar heating: mass walls, southern exposure glass, insulating curtains and screens.
- every residence and building becomes an energy producer: photovoltaic panels, wind generation, thermocouple generation.
- community based waste treatment systems: grouped waste treatment plants that are completely non-polluting and bio-friendly.

- agricultural and ranch lands add supplemental energy generation with wind farms and photovoltaic plants.
- agricultural and ranch lands maximize water conservation with irrigation systems and water re-capture systems.
- community based water distribution ensures that the water supply is safe and secure.
- local water resources are protected and preserved.
- former agricultural and ranch lands are "reclaimed" and put back into service.
- local waste is recycled and re-used locally with combustion-to-electricity, conversion to mulch and agricultural nutrients, conversion to bio motor fuel, and processing into reusable glass and plastic base materials.
- energy is locally generated and locally stored, reducing or eliminating the dependence on the utility companies and politically driven energy plans.
- La Cienega/La Cieneguilla takes control of its future, becoming a source of wealth to all its community members.

THE BOYS INITIATIVE

How Are Our Boys Doing?

Academically:

Nation wide, boys are two times more likely than girls to be diagnosed with learning disabilities in elementary school and twice as likely to be placed in special-education classes.

The situation Santa Fe is very troubling. There is a direct correlation between poverty and ethnicity and between them both and low test scores on the 2004-05 New Mexico Standards Based Assessment ("NMSBA").

Overall, boys are doing very poorly academically and even more significantly, do worse with each succeeding grade. Below are the NMSBA test results for 2004-05 by grade in percent of students who are proficient in:

	3rd	4th	5th	6th	7th	8th	9th
Reading and Language Arts:	53	50	54	43	29	44	33
Math:	40	37	24	25	13	18	22
Science:	79	54	53	35	20	20	32

What may be most disturbing is that between the 3rd and 9th grades, test scores dropped 20 percentage points in reading, 18 percentage points in math and 47 percentage points in science. Attending school is apparently detrimental to student performance.

When you consider that there is an "ethnicity gap" (non-Hispanic white students do significantly better academically than minority students) and that many of the poorest students have dropped out by the 9th grade, these figures are even more shocking.

Statewide, 44.9% of Hispanic 4th graders are at or above proficient in reading. Only 32.3% of Native American 4th graders are while 70.0% of White non-Hispanic students are. Research shows that students who are not reading at grade level by the 4th grade have very little hope of graduating from high school.

The latest test scores posted on the PED are equally grim. At Alameda Middle School here in Santa Fe, only 6.78% of Hispanic students were proficient in math and less than 35% were proficient in reading. Of the English Language Learners (155 out of a student body of 341) 5.43% were proficient in math and 28.13% were proficient in reading. Other schools did better but the overall test scores are very low. Perhaps the most discouraging things is that schools only needed to have between 15% to 23% of students be proficient in math and 40-41% proficient in reading to meet AYP and many still were unable to do it.

Health:

Obesity and lack of physical activity is also a major problem facing many of our boys. The adverse health effects of obesity are well documented.

The New Childhood Epidemic:

Type 2 diabetes could become the most widespread, and potentially devastating, disease to attack America's kids since polio. At one time, type 2 was called adult-onset diabetes; nearly all its victims were over 30. But now, type 2 affects children as young as 4, and the American Diabetes Association says it is "approaching epidemic proportions" in teens.
Because of rising obesity and lack of exercise, the Centers for Disease Control and Prevention recently predicted that among African-American, Hispanic, Asian, and Native American children, the odds of getting diabetes are one in two, or every other child!

Trust for America's Health recently found that New Mexico the 35th highest overweight level for low-income children ages 2-5 at 9.3 percent.

Mentoring New Mexico intends to address these problems by creating The Boys' Initiative ("TBI"), a collaboration of the schools, parents, students, the City of Santa Fe, Santa Fe County, city, county, state and federal officials, the Santa Fe Chamber of Commerce, businesses, individuals and other non-profits concerned about our boys. TBI seeks to create more "boy friendly" schools in the Santa Fe schools by encouraging and implementing these "boy friendly" innovative programs:

New Mexico has one of the highest suicide rates in the country. Too many of our young men are addicted, abusive, in prison or a threat to themselves or others.

The Crises

We need to help all of our struggling students, and particularly our boys. Their situation is critical, challenging and growing. Providing positive male role models and finding ways to engage all of our students in school and in healthy activities is essential.

We need to take action now, before more or our youth are lost. Working together we can make a positive difference in the lives of youth. "If not us, than who? If not now, when?"

MENTORING NEW MEXICO/SANTA FE PUBLIC SCHOOLS
SPONSORED TEAM COMPETITIONS

An individual, governmental entity, organization or business (the "sponsor") sponsors a team of five or more elementary school boys chosen by a participating teacher at a participating school. Sponsors provide "coaches" for this team. All the "coaches" will be screened and trained by Mentoring New Mexico and will meet with participating teachers to coordinate their activities before beginning the program.

There are two ways "coaches" can be provided. They are:

1. If there are enough high school coaches to assign one to each team, one or more men from the sponsor is teamed with this student and together they are the coaches.

2. If there are not enough high school coaches to assign one to each team, two men from the sponsor are assigned to coach a team of boys.

The sponsor coaches agree that at least one of them will meet with their team at an agreed upon time at least once a week for an hour during the school year and to attend a three hour tournament at the end of each semester.

Once a week for an hour, coaches work with their team, coaching them in basketball and solving math word problems. This give the coaches the opportunity to teach the boys on their teams math and academic skills as well as building character, sportsmanship, and teamwork. Teammates will be encouraged to work together and to help each other. Good eating habits and a healthy active life style strongly encouraged.

Teams compete at a tournament at the end of each semester in both basketball and math that takes place on a school day. Parents are encouraged to come and cheer for their children.

Sponsors contribute $100-$125 to cover the cost of tee shirts for their teams with the names of the school and the team name chosen by the boys, the cost of medals to be awarded at the tournament and the cost of food at the party following the tournament.

The purpose of the program is to engage boys in academics, provide positive male role models, build team spirit, improve behavior, encourage a healthy life style and give boys the opportunity to excel both athletically and academically.

Your participation will help our boys become men and will be greatly appreciated by the boys, their teachers, their schools and the community.

To become a sponsor or for more information contact Eugene Weisfeld, Executive Director of Mentoring New Mexico by phone at 988-1611 or 470-2833 or by email at mnm@cnsp.com.

FastDitch, Inc.
"Your Water Solutions Company"

Presents

SMARTDITCH ™

Finally, Smarter Solutions in Water Management

FastDitch, Inc. is a family owned business located in Vallecitos, New Mexico. FastDitch, Inc. is a water solutions company that helps our clients solve their diverse and complex water conservation and storm water management issues. We engineer and customize products to meet the unique needs of our clients.

FastDitch, Inc. was established to find solutions to our own irrigation practices as well as to conserve water within our acequias, in doing so, we designed a liner system that met these objectives. In doing so, we realized that we could use our expertise from our development efforts to develop solutions to persevering problems that affect other ranchers and farmers.

Water Management Issues / Problems

- Seepage, vegetation overgrowth, erosion to ditch banks, and rodent holes disrupt water flow.
- Natural ditches deteriorate, ditch walls collapse and debris fills the waterway.
- Failure of ditch banks result in:
  - Lost Irrigation Time
  - Unscheduled maintenance
  - Irretrievable loss of precious water resources

The Solution to Water Management Issues

FastDitch,Inc. determined that a need exists for a system that:

- Is cost effective
- Requires low maintenance
- Conforms to existing waterways with minimum disturbance to the natural setting.
- Easy to assemble and install
- Conserves our valuable water resources

The solution found by FastDitch,Inc. was a lightweight and durable high molecular weight, high density polyethylene liner that adapts to existing meandering waterways with minimum impact to the natural setting

Overview

•SmartDitch is a revolutionary new product line that combines time-tested materials with advanced technology to produce a product not seen until now.

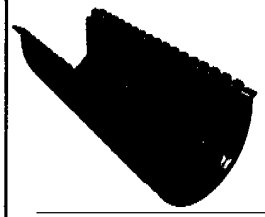
•Manufactured via a thermoforming process from high molecular weight high-density polyethylene, SmartDitch utilizes a material proven in the construction industry for durability and strength.

•SmartDitch is currently available in four different product configurations:

- •12" depth trapezoidal
- •24" depth trapezoidal
- •24" semi-circular
- •36" semi-circular

SmartDitch™ Product Comparison

Semi-Circular Product



Width: 24"
Length: 96"
Depth: 20"

Width: 36"
Length: 96"
Depth: 28"

Trapezoidal Product

Width: 37.50"
Bottom width: 8"
Length: 120"
Flow Depth: 13.50"

Width: 65"
Bottom width: 12"
Length: 96"
Flow Depth: 25"

Product Advantages

•HDPE has lower life-cycle costs compared to concrete and steel due to unparalleled corrosion resistance.

•HDPE has excellent low temperature properties and is not affected by freeze-thaw cycles.

•Light weight compared to pipe and therefore, easy to install in remote areas not accessible to heavy equipment.

•Flexibility of liners allow for installation in meandering waterways.

•Reduced maintenance costs once installed.

•Excellent abrasion resistance.

•Projected minimum lifespan of 20 years.

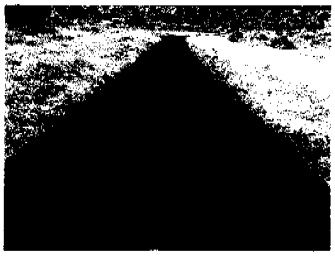
Applications

- SmartDitch liners are designed to compete in multiple markets such as:
  - Stormwater management
  - Agriculture / Irrigation
  - Erosion Control
  - Concrete ditch re-lining
- In the following areas:
  - Construction
  - Public works and municipal projects
  - Highway and transportation programs
  - Landscaping applications

SmartDitch Competitors

Concrete linings, one of our major competitors, though efficient, have a:

- Shorter lifespan compared to SmartDitch.
- Higher maintenance cost
- Problems with installation in remote areas



Deteriorated concrete ditch lined with a trapezoidal SmartDitch liner

Water Flow Using SmartDitch

Depth of flow	Friction Factor (n)	Area (sq. ft.)	Wetted Perimeter (ft)	Hydraulic Radius	Slope	Flow (cfs)	Flow (gal/min)	Gallons/ day
0.833	0.028	3.81	7.97	0.48	0.01	11.41	5,094	7,374,714
1	0.028	4.33	7.96	0.54	0.01	15.36	7,664	9,926,243
1.5	0.028	6.5	8.3	0.78	0.01	29.34	14,639	18,959,689
2	0.028	8.66	8.77	0.99	0.01	46.7	22,905	29,638,338
2.33	0.028	10.1	9.13	1.11	0.01	57.5	28,693	37,161,201

Summary

SmartDitch™ is a competitive alternative to other competing ditch lining system along with a number of other important advantages:

- Long-lasting and durable
- Easy to install in virtually any terrain
- Requires minimal maintenance once installed
- Can be installed in meandering ditch beds
- Non-toxic and environmentally friendly
- Manufactured via a thermoforming process

FastDitch™

"Your Water Solutions Company"

FastDitch, Inc. thanks you for the opportunity to have been able to talk to you about SmartDitch, and we are up to the challenge of working with you in providing an efficient and cost effective solution to the many water management problems which exist today.

For additional information, contact Julian "Ed" Suazo

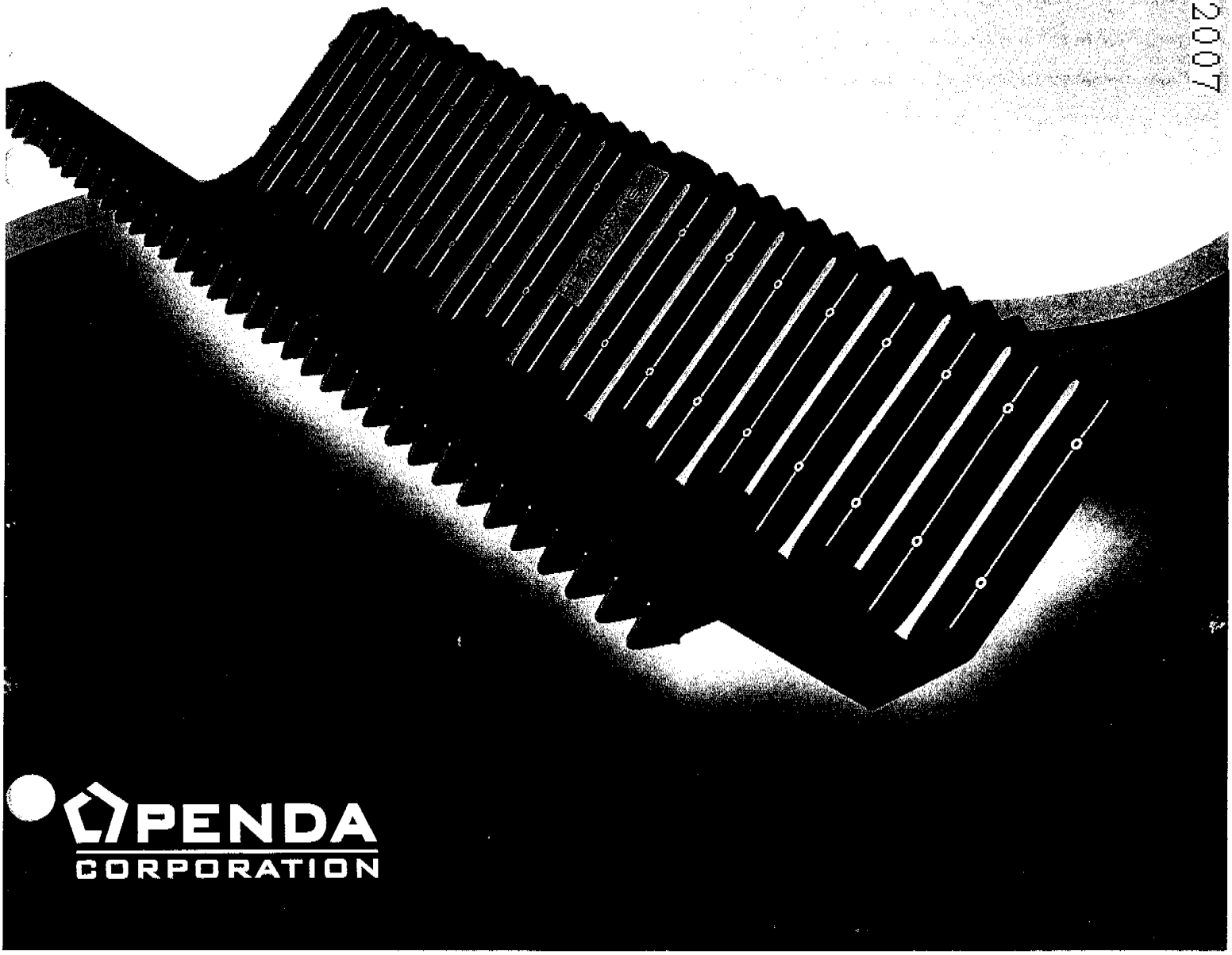
Home: (719) 376-6504; Cell (713) 569-4821

E-Mail: fastditch3@fone.net

SMARTDITCH™

FINALLY, SMARTER SOLUTIONS IN WATER MANAGEMENT.™

PRODUCT GUIDE



PENDA CORPORATION

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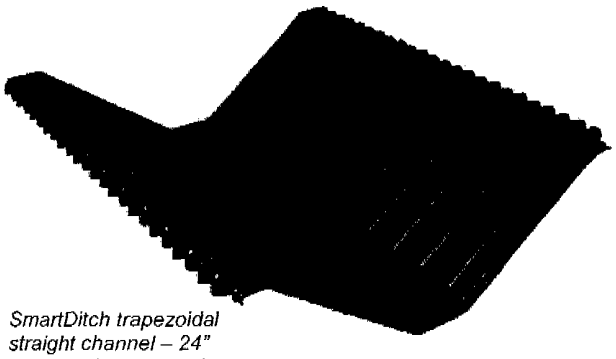
1.0 OVERVIEW

1.1 Introduction

For too long, the challenges inherent to water conveyance have seemed insurmountable. Water in the wrong amounts or in the wrong places. Flow rates that are too quick or too slow and erosion problems caused by drainage flow problems. Until now traditional approaches and technologies in channel and ditch construction simply haven't delivered what's needed most: a safe, economical, easily installed and maintained, long-lasting and environmentally sound way to manage water flow.

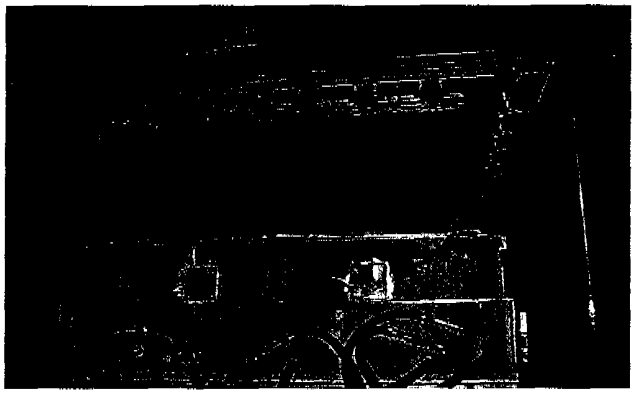
The solution to these problems is SmartDitch; a flexible, thermoformed plastic HDPE channel system from Penda Corporation. While traditional water management products deteriorate and fail, the SmartDitch system guarantees a stronger, longer-lasting solution that can be used for new construction or rehabilitation. SmartDitch can be installed far more easily and quickly than traditional products, and offers significantly lower maintenance costs combined with versatility.



SmartDitch trapezoidal straight channel – 24" depth series application

1.2 Penda Corporation

Penda Water Management is a strategic business unit of Penda Corporation, located in Portage, WI. For more than 30 years, Penda Corporation has been one of North America's largest and most advanced thermoforming plastics operations. Penda offers a wide array of quality manufacturing process and materials – from HDPE to ABS plastics, thermal plastic olefin (TPO) to co-extruded sheets using cap-stock layers, and textured surfaces to high-gloss molded in color. Our manufacturing expertise has made Penda the global leader for pick-up truck bedliners and the preferred supplier to the world's largest automotive manufacturers.



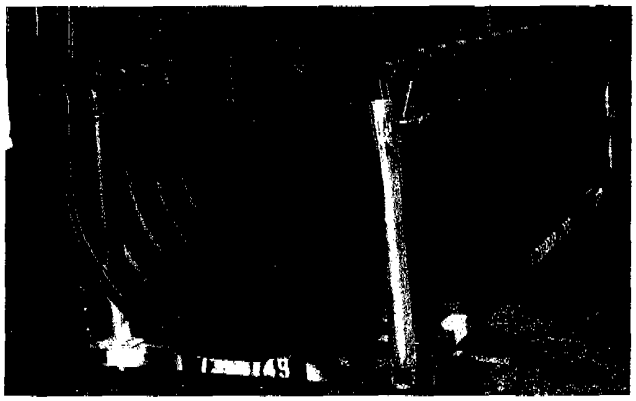
Framed SmartDitch sheeting entering tool for forming

Penda Corporation is uniquely suited to bring SmartDitch to the market. Penda is leveraging our globally recognized expertise in materials research, product development and manufacturing to deliver unmatched product benefits with SmartDitch applications.

Penda has 13 in-house, rotary sheet-fed, four-station vacuum formers. Our leading in-house forming capabilities enable us to deliver greater production efficiency on a full range of products. Every member of our team is committed to the total satisfaction of each of our thousands of customers worldwide. The proof of that commitment is seen in the many awards and recognitions our products have earned.

1.3 Water Management Vision

Penda's vision in bringing SmartDitch to the market is to provide its customers with water management solutions in a smarter way. Penda's guiding principles are to be Safe, Successful, and Smart in the products that we provide and how we conduct business. Penda is dedicated to bringing to market products that fulfill these guiding principles and provide our customers with solutions to their water management needs.

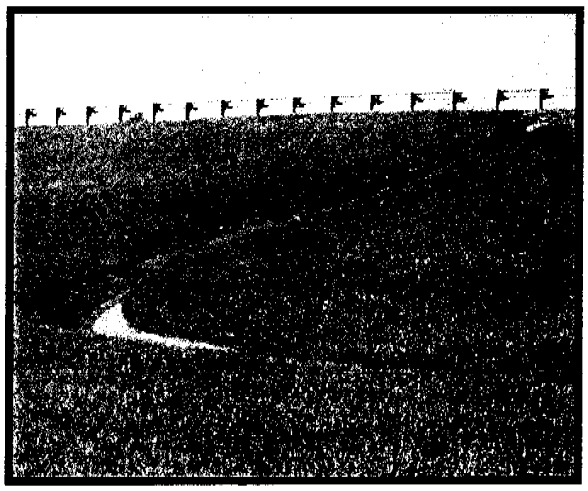


SmartDitch semi-circular tee-section channel in trim fixture

1.0 OVERVIEW

1.4 SmartDitch Applications

The SmartDitch channel/lining system developed by Penda Corporation is a reliable, easy to install, high performance way to manage water conveyance. Manufactured from high quality HDPE material and available in trapezoidal and semi-circular configurations, SmartDitch is durable, corrosion resistant and unaffected by acidic or alkaline soils and chemicals. SmartDitch offers many advantages over traditional water conveyance products.

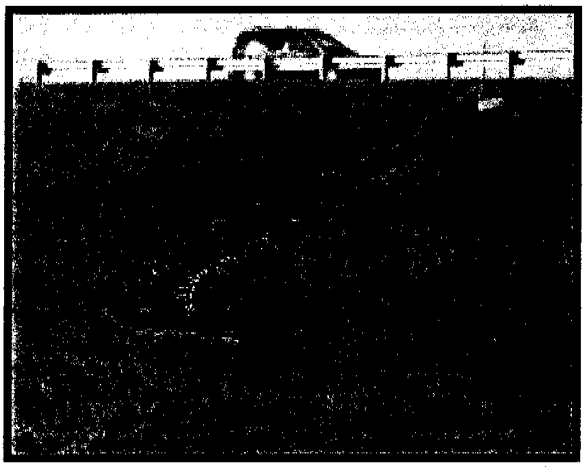


Growing awareness of the benefits provided by SmartDitch has resulted in widespread use in the following applications:

- Drainage applications
- Erosion / sediment control
- Land development applications
- Irrigation / agriculture
- Miscellaneous applications: industrial site containment systems, landfill drainage systems, temporary flow diversions

In replacing other materials SmartDitch delivers a long, effective service life with low operating and maintenance costs. Where can SmartDitch work for you?

SmartDitch Drainage



SmartDitch narrows the performance gap between what traditional drainage channels provide and what today's engineers demand. Available in a trapezoidal configuration, SmartDitch is quickly replacing dumped stone and vegetated channels as a preferred product for drainage applications. Designed for superior hydraulics, durability, structural integrity and easy installation, SmartDitch provides excellent value and cost effective performance.

SmartDitch's hydraulic characteristics remain constant over time providing maximum drainage over the life of the system. The toughness of polyethylene withstands abrasive flows, corrosion, and even the most aggressive chemical attacks. SmartDitch prevents unwanted vegetation growth and the corrugated wall design produces a self scouring action that minimizes silt build up in the flowline.

When designing drainage projects with difficult access, in remote locations, or on uneven terrain and sloped conditions, SmartDitch's lightweight rugged construction allows for a quick installation in the most difficult situations.

Project Applications:

- Municipal stormwater systems
- Transportation system drainage
- Edge and slope drainage
- Site drainage for mine run-offs
- Drainage overflow channels

Product Benefits

- Hydraulic characteristics constant over time
- 0.022 Manning's "n" coefficient
- Reduces runoff velocities.
- Excellent abrasion resistance
- Withstands corrosion and chemical attacks
- Reduces maintenance costs

1.0 OVERVIEW

1.4 SmartDitch Applications (cont.)

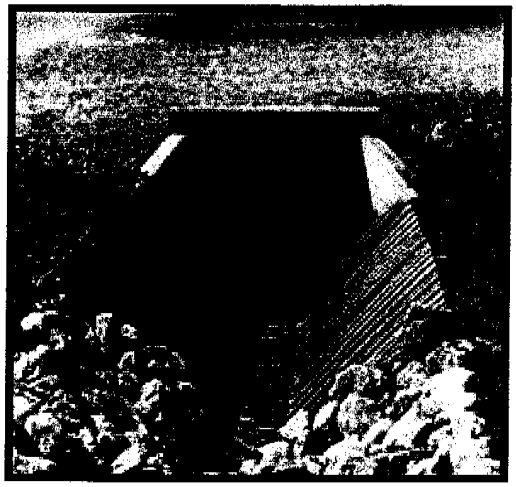
SmartDitch Erosion / Sediment Control

SmartDitch can be used to form defined ditches that can control erosion, catch sediment, and provide superior drainage. Storm water runoff channels help prevent erosion, reduce the risks of structural instability and provide critical drainage for paved areas. SmartDitch meets all of these challenges.

High flows and undesirable soil conditions in drainage ditches can deteriorate the side walls and flow lines. SmartDitch's rugged HDPE construction resists the hydraulic forces of the flow and provides a stable channel that will provide years of maintenance free service.

As a slope or terrace drain, SmartDitch can be used to reduce erosion and be designed as a collector and outlet for the drainage system. SmartDitch's lightweight design makes it the perfect product to install on these difficult sites.

SmartDitch is also ideal on construction sites with potentially high volumes of loose sediment for a best management practice. A temporary perimeter ditch is installed to catch and retain the sediment before it runs off the site. During the project construction the ditches can be easily cleaned and maintained thus preventing costly fines or project delays.



Project Applications

- Roadside drainage ditch stabilization
- Slope and terrace drains
- Stream restoration & stabilization
- Jobsite sediment containment
- Private dam spillways and low flow channels
- Rehabilitation of concrete and/or earthen channels

Product Benefits

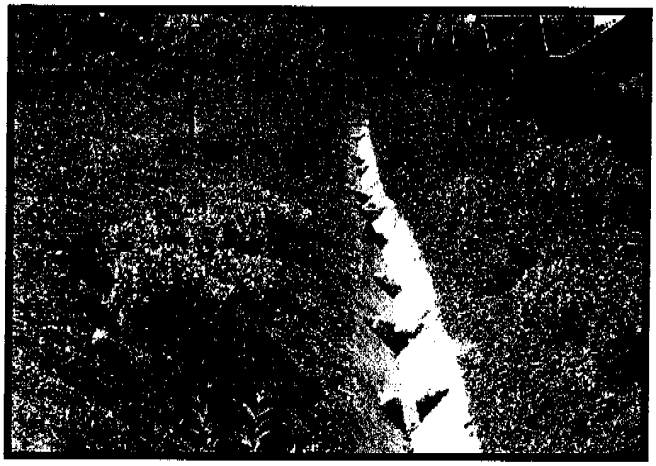
- Stable channel design
- Reduced run-off velocities
- Sediment containment
- Reduced channel maintenance
- Accommodates small changes in line and grade without fittings
- Cost-effective Design Life Costs

1.0 OVERVIEW

1.4 SmartDitch Applications (cont.)

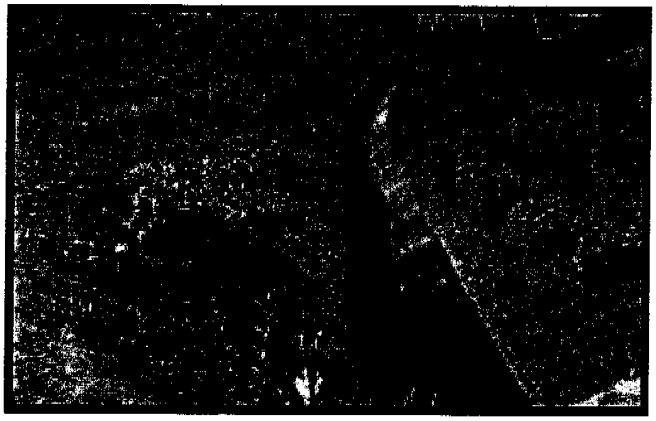
SmartDitch Land Development

The demand for more developable land continues to grow every day requiring engineers and developers to look for innovative means to utilize ground previously considered unusable. SmartDitch can be installed to control drainage and erosion on sites with uneven terrain, large slopes, on property susceptible to flooding or bordering run-offs or spillways.



As part of development's stormwater drainage system, SmartDitch's hydraulic characteristics remain constant over time providing maximum drainage over the design life of the system. The toughness of polyethylene withstands abrasive flows, corrosion, and even the most aggressive chemical. SmartDitch prevents unwanted vegetation growth and the corrugated wall design produces a self scouring action that minimizes silt build up in the flowline.

As a slope or terrace drain, SmartDitch can be used to reduce erosion and be designed as a collector and outlet for the drainage system. SmartDitch's lightweight design makes it the perfect product to install on these difficult sites.



Project Applications

- Subdivision stormwater drainage
- Drainage for retail and business developments
- Edge and slope drainage
- Flood control
- Private dam spillways and low flow channels

Product Benefits

- Eco-friendly material and colors
- Hydraulic characteristics constant over time
- Flexible construction practices for difficult development sites
- Reduced maintenance costs
- Durable, Long-Life Material

1.0 OVERVIEW

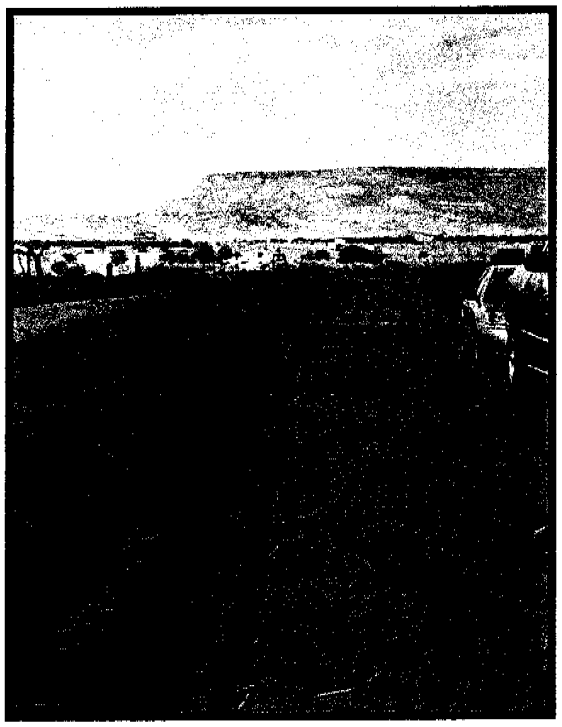
1.4 SmartDitch Applications (cont.)

SmartDitch Irrigation / Agriculture

Agriculture in many parts of the country depends on the availability of irrigation water and channels are typically used to transport water from the sources to end users. Over time these channels can deteriorate due to erosion, ground movement caused by freeze/thaw cycles, or corrosion of the building materials. SmartDitch provides a durable solution to these problems and can increase water distribution in irrigation systems by as much as 90 percent.

SmartDitch's hydraulic characteristics remain constant over time providing maximum flow of water over the life of the system. The product's HDPE material withstands abrasive flows, corrosion, and even the most aggressive chemical attacks. SmartDitch also prevents unwanted vegetation growth and the corrugated wall design produces a self scouring action that minimizes silt build up in the flowline.

SmartDitch liners are easily installed in new construction applications or as slip liners in failed concrete or earthen channels, greatly reducing long term maintenance costs. SmartDitch's lightweight design makes it the perfect product to install in remote sites where accessibility is an issue.



Project Applications

- Irrigation Channels
- Flood Irrigation
- Drainage Channels
- Rehabilitation of Concrete and/or Earthen Channels

Product Benefits

- Hydraulic characteristics constant over time
- 0.022 Manning's "n" coefficient
- Resistant Abrasion, Punctures, and Freeze/Thaw
- Reduces water loss through seepage
- Low Maintenance Costs
- Cost-effective Design Life Costs

2.0 SMARTDITCH PRODUCT INFORMATION

2.1 Product Data

The SmartDitch system is a corrugated section of HDPE sheet formed in a predetermined shape. In the thermoforming process, the plastic sheet is heated to forming temperatures, allowing it to conform to the mold. The minimum formed thickness in all of the channels is 55 mil.

The versatility of this manufacturing process provides Penda with unmatched in-house forming capabilities that enable us to deliver greater production efficiency on a full range of projects.

Penda supports your operation at every level, right from the start. Our world-class design/engineering capabilities allow us to partner with you to meet virtually any need.

2.1.1 Product Attributes, Dimensions & Weights

SmartDitch offers water management channels in the following specific depth/sizes:

- Trapezoidal design
  - 12" depth series
  - 24" depth series
- Semi-circular design
  - 24" depth series

See *Figures 1* and *2* for basic SmartDitch product dimensions and weights.

Figure 1

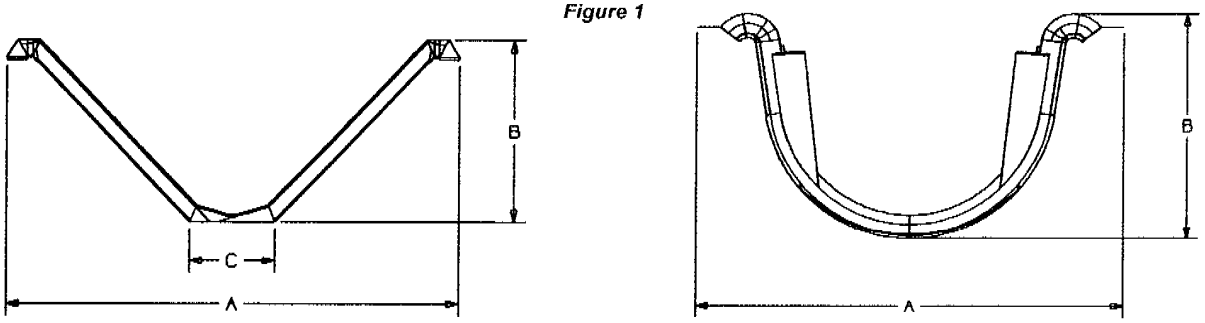
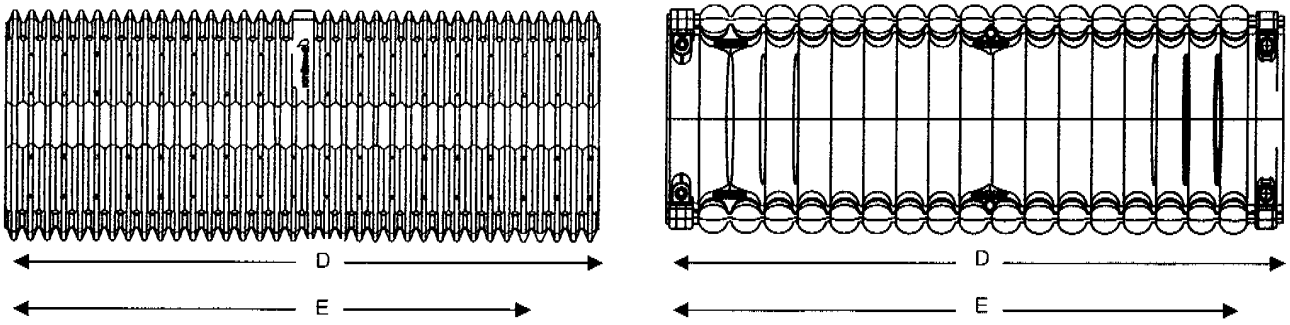


Figure 2



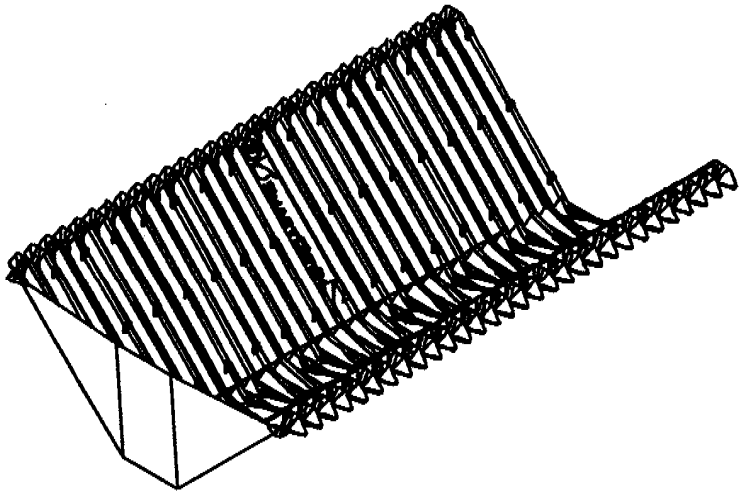
Item Description	Item #	12" Depth Trapezoidal	24" Depth Trapezoidal	24" Depth Semi-Circular
Overall exterior width	A	50.00 in / 1270.00.mm	76.00 in / 1930.40 mm	39.00 in / 990.60 mm
Overall exterior height	B	16.25 in / 412.75 mm	29.50 in / 749.30 mm	19.00 in / 482.60 mm
Bottom channel exterior width	C	10.00 in / 254.00 mm	14.00 in / 355.60 mm	N/A (Rounded Bottom)
Overall exterior length	D	120.00 in / 3048.00 mm	113.00 in / 2870.20 mm	93.00 in / 2362.20 mm
Lay length	E	112.00 in / 2844.80 mm	100.00 in / 2540.00 mm	88.00 in / 2235.20 mm
Weight Per Part	n/a	52.00 lb / 23.59 kg	89.00 lb / 40.37 kg	36.00 lb / 16.33 kg

Note: measurements above are overall part dimensions and are not representative of actual flow areas or earthen fill area.

2.0 SMARTDITCH PRODUCT INFORMATION

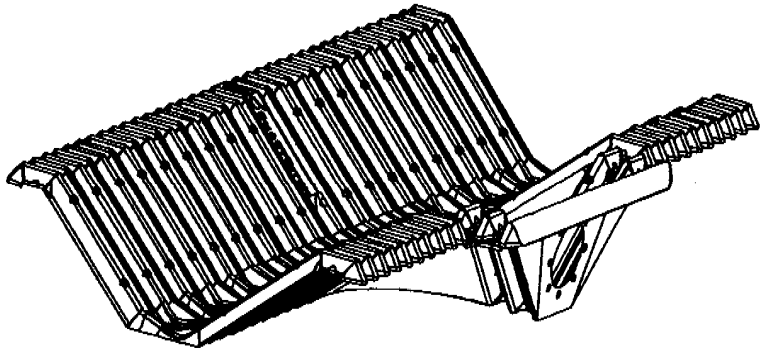
2.1.2 SmartDitch Fittings

SmartDitch offers the following fittings for both our 12" depth and 24" depth series products:



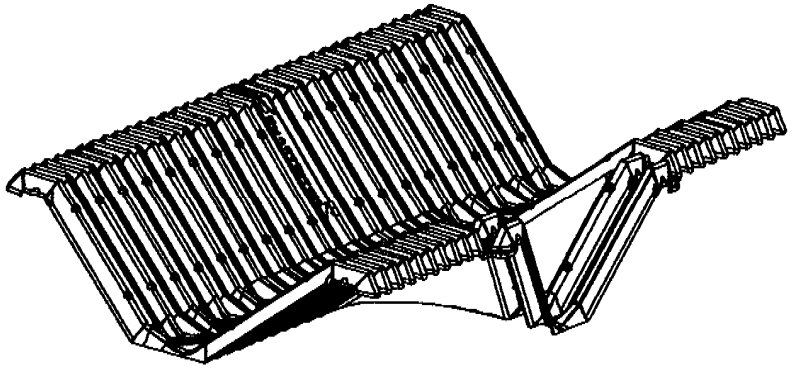
Straight Bulkheads

- Available with or without openings.
- Maximum diameter openings:
  - 12" depth trapezoidal = 6" diameter
  - 24" depth trapezoidal = 12" diameter
  - 24" depth semi-circular = 12" diameter
- Opening configurations include:
  - Circular openings
  - Flange connections
  - Square/rectangular openings
- Bulkhead closure located on downstream portion of straight application.



Left / Right Bulkheads

- Available with or without openings.
- Maximum diameter openings:
  - 12" depth trapezoidal = 6" diameter
  - 24" depth trapezoidal = 12" diameter
  - 24" depth semi-circular = 12" diameter
- Opening configurations include:
  - Circular openings
  - Flange connections
  - Square/rectangular openings
- Multi-directional design for ease of installation/usage.

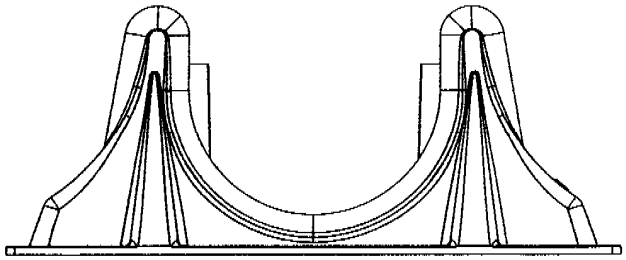


Multi-directional Tee Sections

- Multi-directional design for ease of installation/usage.
- Well suited application for radial turns (see the ***2.7 Joint Angular Deflection*** section on page 12 for additional information).

2.0 SMARTDITCH PRODUCT INFORMATION

2.1.2 SmartDitch Fittings (cont.)



Saddles

- For use with semi-circular channels only.
- Designed for usage in above-ground installations.
- Keeps semi-circular channels upright and stationary.
- Well suited application for temporary transfer of water.

2.1.3 Joint System

The SmartDitch joint system connects standard and fitting sections alike through the use of the following components (see *Figure 3*).

Joint system components consist of the following elements:

- **Screws:**
  - **Trapezoidal:** 1022 steel hard case screws, black dorken finish
  - **Semi-circular:** Black nylon ratchet clips
- **Gaskets:** Closed cell EPDM sponge seal meets
  - ASTM D 1056 B3Z1Z2
- **Anchoring System:** Earth anchor with attached cable
  - 1100 lb. capacity tensile resistant earth anchor
  - 3/32 stainless steel 7x7 cable attached with crimp sleeve

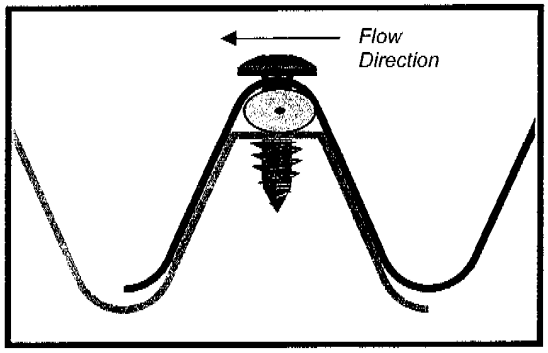


Figure 3

2.1.4 Raw Materials

Raw materials used on all SmartDitch channels and joint systems are delivered with vendor certification demonstrating their compliance with Penda's quality requirements.

In addition, all raw materials are sample tested prior to their use. These tests ensure that the pipe materials comply with the specifications as stated.

2.1.5 Physical Properties

On a sampling basis of each production run, SmartDitch sections are subjected to both visual and dimensional inspections as quality control checks.

During these inspections, the following factors are reviewed and held to established internal audit standards.

- Application length
- Application width
- Sidewall thickness
- Rib thickness
- Overall finishing quality

2.0 SMARTDITCH PRODUCT INFORMATION

2.2 Engineering Properties

SmartDitch is manufactured with a HDPE resin that provides excellent mechanical properties. These properties are instrumental in providing a premier, flexible, thermoformed plastic ditch-lining system.

The following table highlights some of the more important design properties of SmartDitch. Please contact your SmartDitch sales representative if additional design data is required.

Property	Unit	Value	Test Method
Tensile Yield Strength 2" per min.	psi	3000 (min)	ASTM D638, Type IV
Ultimate Elongation 2" per min.	%	500 (min)	ASTM D638, Type IV
Environmental Stress Crack Resistance (ESCR) Condition A (100% Igepal), F_{50} Condition B (10% Igepal), F_{50}	 h h	 250 (min) 100 (min)	ASTM D1693
Flexural Modulus	psi	110,000 (min)	ASTM D790
Density	g/cc	0.946 (min)	ASTM D1505
Brittleness Temperature	°F	131 (max)	ASTM D746
Impact Resistance	Lbs force-ft	2060	ASTM D5420
Coefficient of Linear Thermal Expansion	in/in/°F	0.00007 (nominal)	ASTM D696
Cell Classification	*n/a*	445430	ASTM D3350

2.3 Flow Data

2.3.1 Flow Attributes

The Manning's "n" coefficient of friction for the SmartDitch system is n=0.022. This Manning's coefficient can be used for all calculations required to determine maximum capacity and flow velocities for a lined ditch.

2.3.2 Flow Velocity

The minimum flow velocity to maintain self scouring is 2 ft/sec. Maximum velocities will vary dependent upon the slope of existing ditches. The minimum slope of 0.005 (½%) is recommended to maintain the self-cleansing velocity of the SmartDitch lining system.

2.0 SMARTDITCH PRODUCT INFORMATION

2.3.3 Flow Calculations

Flow rate calculations for the channel system are based on the standard hydraulic flow formula:

$$Q = (1.49/n)\, A\, R^{2/3}\, S^{1/2}$$

Where:
- Q = Total Flow
- N = Manning's Coefficient of Friction (0.022)
- A = area (sf)
- R = hydraulic radius (ft) [R = A / wetted perimeter]
- S = slope (%)

To calculate the hydraulic flow area & radius of each SmartDitch size, dimensions are provided in ***Figure 4***.

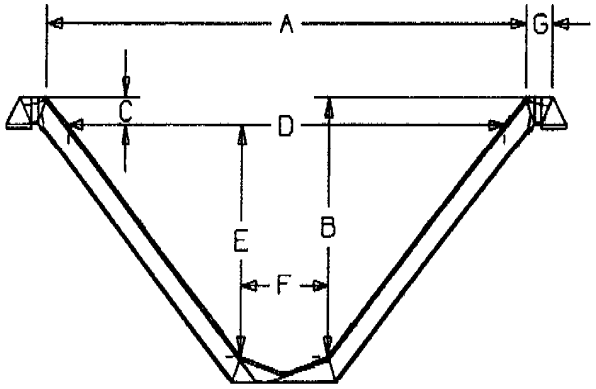
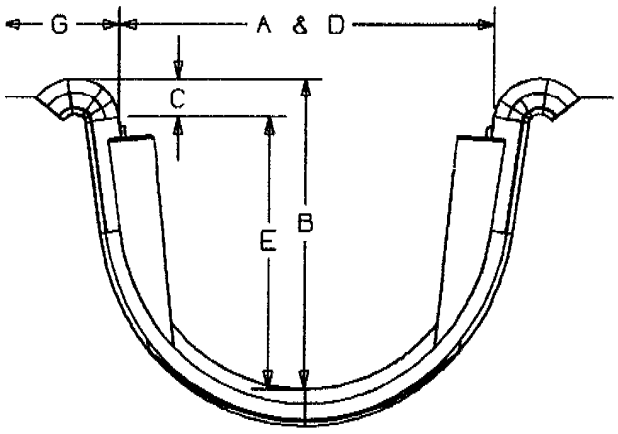


Figure 4



Item Description	Item #	12" Depth Trapezoid – in (mm)	24" Depth Trapezoid – in (mm)	24" Depth Semi-circular – in (mm)
Channel top width	A	37.50 (952.50)	65.00 (1651.00)	24.00 (609.60)
Channel height (interior)	B	14.50 (368.30)	27.00 (685.80)	16.00 (406.40)
Minimum freeboard	C	1.00 (25.40)	2.00 (50.80)	2.00 (50.80)
Maximum flow area top width	D	34.50 (876.30)	59.50 (1511.30)	16.00 (406.40)
Maximum flow depth	E	13.50 (342.90)	25.00 (635.00)	14.00 (355.60)
Bottom channel width (interior)	F	8.00 (203.20)	12.00 (304.80)	N/A (Rounded Bottom)
Top shoulder width (w/out knuckle)	G	4.50 (114.30)	3.50 (88.90)	5.00 (127.00)

2.4 Leakage

The average leakage rate for the SmartDitch system is 0.039 cubic feet / second /1000 ft.

2.5 UV Resistance

There is no evidence to suggest that ultraviolet degradation is a factor affecting the long-term service life of SmartDitch. The outermost surface will be affected with discoloring. The resins used in SmartDitch have a high content of UV stabilizers that inhibit the physical and chemical process of UV-induced degradation.

2.6 Abrasion Resistance

SmartDitch has excellent abrasion resistance. Abrasion from stones or debris is one of the most common durability concerns for SmartDitch especially when the effluent flows at high velocities. While there are no widely standardized testing procedures; various types of test results have shown that it takes longer to abrade through HDPE than concrete or metallic surfaces.

The extent of abrasion in the invert of the SmartDitch channel sections will depend upon the type of abrasive, frequency that the material is in the channel, and velocity of flow.

2.0 SMARTDITCH PRODUCT INFORMATION

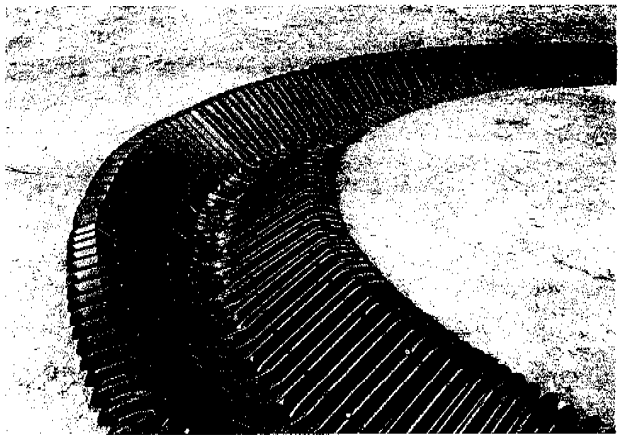
2.7 Joint Angular Deflection

Maximum angular deflection (turn) at each joint, considering both combined vertical and horizontal, must not exceed the amounts given in table below The channel sections must be joined in straight alignment and thereafter deflected angularly as required.

For alignment deflections beyond those stated in the table below, a fitting is recommended.

Angular Deflection at the SmartDitch Joint

Nominal Product Size	Min. Radius of Curvature	Max. Angle of Deflection
12"-depth trapezoidal application	10 feet (3.048 meters)	42°
24"-depth trapezoidal application	75 feet (33.86 meters)	19°
24"-depth semi-circular application	N/A (ridged design for above ground use)	N/A (ridged design for above ground use)



SmartDitch 12"-depth Straight Application Curvature

2.8 Temperature Expansion/Contraction Coefficients

The thermal coefficient of axial expansion and contraction for SmartDitch is 7 x 10^{-5} inch/inch/degree F.

SmartDitch's plastic corrugated design allows it to easily withstand freeze-thaw cycles. The effect of low temperatures on polyethylene materials is unique, the modulus of elasticity increases as temperatures are lowered. In effect, the material becomes stiffer but retains its ductile qualities. The actual low temperature embrittlement for the HDPE resin used in manufacturing SmartDitch is -131°F.

The coefficient of linear expansion for unrestrained HDPE is approximately ten times that of metal or concrete. While the potential for expansion (or contraction) is large when compared with that of metal or concrete, note that the modulus of elasticity for polyethylene is substantially lower than that of alternative materials (less rigid).

This implies that the degree of movement associated with a specific temperature change may be higher for the polyethylene, but the stress associated with restraint of this movement is significantly less. This means that SmartDitch will therefore move with the freeze/thaw movements associated with the ground heaves without damage.

2.9 Flammability

Basic ditch upkeep like burning weeds along the bank will not ignite SmartDitch; the polyethylene material utilized has flame retardant stabilizers added to it that make the material difficult to ignite and it will not continue burning in the absence of an external ignition source.

2.10 Lifespan

SmartDitch is made of HDPE (high-density polyethylene) enhanced with UV inhibitors have a projected minimum lifespan of 20 years.

2.0 SMARTDITCH PRODUCT INFORMATION

2.11 Chemical Resistance

SmartDitch is manufactured from HDPE – one of the most chemically inert materials available. Normal ground water, storm water, salt water, or agricultural run-off typically has no effect on SmartDitch channels.

Some regions of the country have naturally occurring conditions which cause unusually low (acidic) or high (alkaline) pH in the soil and ground water. SmartDitch is ideal for both acid and alkali environments.

The heavy use fertilizers on golf courses and in agriculture can detrimentally affect the pH and chemical composition of run-off water. High concentrations of phosphates and nitrates can be common is these situations. SmartDitch is not affected by these conditions.

In a salt water environment, galvanic/electro-chemical attack can occur to more traditional materials such as metal or steel reinforced concrete. As HDPE is an insulator, SmartDitch is not affected by galvanic attack.

For a review of chemical resistance of polyethylene material to common selected substances*, see the chart to the left.

Chemical Resistance Chart – Common Substances

Chemical or Substance	Polyethylene Material (73° F / 23° C)
Alcohol, ethyl	R
Antifreeze agents, vehicle	R
Bleaching solution, 12.5% active chlorine	R
Bleaching solution, 5.5% active chlorine	R
Brake fluid	R
Diesel fuel	R
Diesel fuel / oil	R
Ethane	R
Fertilizer salts, aqueous	R
Fuel oil	R
Gasoline	R to C
Hydraulic fluid / oil	R
Hydrogen peroxide, aqueous 10% - 90%	R
Jet fuels	R
Mercury, liquid	R
Methanol, pure	R
Motor oil	R
Nitric acid, 0% - 30%	R
Nitric acid, >30% - 50%	R to C
Petroleum, sour, refined	R
Sea water	R
Sewage, residential	R
Soap solutions, aqueous	R
Sulfuric acid, 70% - 90%	R
Two stroke engine oil	R

R = Material is generally resistant (Specimen swells <3% or has weight loss of <0.5% and elongation at break is not significantly changed).

C = Material has limited resistant only and may be suitable for some conditions (Specimen swells 3% - 8% at weight and loss of 0.5% - 5% and/or elongation at break decreased by <50%).

* Information gathered from *Chemical & Abrasion Resistance of Corrugated Polyethylene Pipe*, Corrugated Polyethylene Pipe Association. Though different in physical design, SmartDitch maintains the same resin cell classification as the samples in this report. A more complete listing of polyethylene's chemical resistance can be obtained by contacting the Corrugated Polyethylene Pipe Association.

3.0 GENERAL INSTALLATION PRACTICES

3.1 New Construction Installation Practices

A long service life and excellent performance characteristics of the SmartDitch system can only be achieved by proper handling and installation of the sections. It is important for the owner, engineer and/or contractor to understand that the HDPE SmartDitch system is designed to utilize the bedding and surrounding soil for support that will result from recommended installation procedures. Engineers have found through considerable experience that properly compacted granular materials are ideal for backfilling the sections. Together, the sections with anchors and surrounding soil form a high performance "anchoring system" that will provide years of stability.

The following is a partial review of installation procedures; it is not intended to replace the installation specifications provided by the engineer or owner. See Appendices for detailed cross sectional shop drawings.

3.1.1 Subgrade / Ditch Preparation

Excavate to the desired line and grade for ditch installation. Grade the subgrade so that the SmartDitch sections can be laid without sags or humps. Grade the ditch cross section to match the SmartDitch cross sectional shape. Excavate or fill as required along the ditch shoulders so that no more than 6 to 8 inches of backfill will be required along ditch side after the sections are placed (see *Figure 5* below).

Prepare the subgrade to be firm, smooth, and free of debris, rocks, and sharp objects. Trim and remove any tree roots. Remove unstable soils and replace with compacted soil fill.

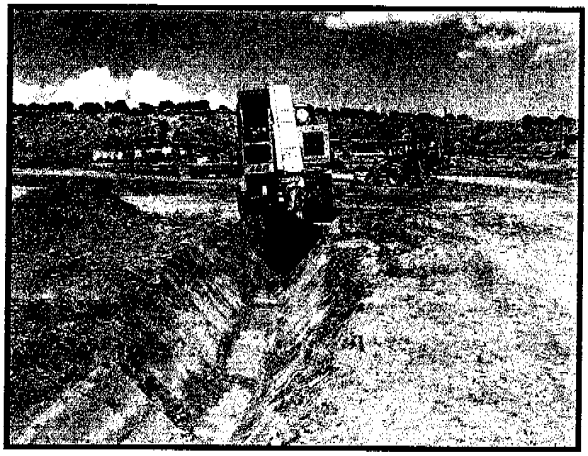


Figure 5

3.1.2 Bedding & Backfill Materials

The ditch subgrade, of suitable material, should provide uniform and continuous support against the SmartDitch walls. Bedding backfill and general installation requirements shall be in accordance with project plans and specifications and manufacturer's recommendations.

Care must be taken to choose foundation, bedding, and haunching materials that are compatible to minimize migration or loss of bedding or haunching support into the surrounding soils

To ensure a satisfactory SmartDitch channel-soil system, correct backfill material must be used. Most coarse grained soils (as classified by the Unified Soils Classification System) are acceptable bedding backfill material.

3.1.3 Suitable Soil Types

The SmartDitch system is suitable for installation in soils that can be excavated and remain unsupported with a cross section that matches the SmartDitch cross sectional shape. Typical suitable soil types include the following:

SmartDitch Section Sidewall Slope	OSHA Soil Type	USCS Soil Group Symbol	AASHTO Classification
1H:1V (1 horizontal to 1 vertical)	Type A or B – stiff clays, silts, dense silty or clayey sands, angular gravels	Stiff CL or CH, ML, MH, SM, SC, SC-SM, GM, GC, GC-GM, angular, GP or GW	Angular A-1, A-2, stiff A-4, A-5, A-6 or A-7

Soils that will not remain unsupported at a sidewall slope of 1H: 1V may not be suitable for SmartDitch channel section installation. These soils may include very soft clays and very loose clean sands. Installation in these soils may be possible by over-excavating the unsuitable soil and replacing it with compacted soil fill meeting one of the typical suitable soil types listed in the table above. Alternately, it may be possible to stabilize localized areas of unsuitable soil by treating the soil with quicklime (calcium oxide, do not use pulverized limestone or "ag lime") or fly ash prior to SmartDitch channel installation.

Where the specifications permit the use of native soil as backfill, care should be taken to ensure that the material does not the include rocks, sharp objects, soil clumps, debris, frozen or organic material.

Backfill between the sections and the ditch using material free of debris, rocks and sharp objects. Bedding backfill and general installation requirements shall be in accordance with project plans and specifications and manufacturer's recommendations.

3.0 GENERAL INSTALLATION PRACTICES

3.1.4 Unstable Soil Conditions

Where the trench bottom has soft, loose or highly expansive soils, it is regarded as unstable. An unstable trench bottom must be stabilized before laying SmartDitch sections or a foundation must be constructed to minimize differential settlement or undermining of the trench bottom. A well-graded sandy gravel compacted to 90% density, or crushed stone is recommended for use in foundation layers.

The depth of the sandy gravel or crushed stone material used for foundation depends upon the severity of the trench bottom soil conditions. When crushed rock is used the use of filter cloth/geotextile material to completely surround the foundation material will prevent foundation and bedding materials from migrating into one another which could cause loss of bottom support. Filter cloth/geotextile material is not needed if the same material is used for foundation and bed, or if graded sandy gravel is used for the foundation.

Cement- or lime-stabilized backfill may also be used to achieve a high stiffness without the need for significant compaction.

Figure 6

3.1.5 SmartDitch Section Installation

SmartDitch sections are typically laid end-to-end along the bank. Ensure that the ditch bank is free of tripping hazards and is level for connecting the ditch sections. NOTE: *connect no more than 3 sections together prior to placement into the ditch.* Sections are typically laid into the ditch flow lines by hand (see *Figure 6*).

Actual/lay lengths and weights for each application can be found in ***2.1.2 Physical Dimensions & Weights*** table on page 7 of this document.

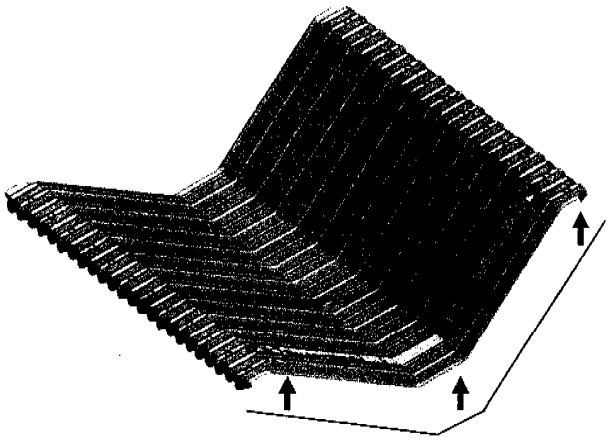


Figure 7

3.1.6 Joint Assembly

Multiple sections of SmartDitch can be assembled at the top of the trench and lowered into the prepared ditch or trench. Each section is approximately 8'-10' in length, depending on the application utilized on the project. The weights for each size can be found in ***2.1.2 Physical Dimensions & Weights*** table on page 7 of this manual.

Install seal underneath the round corrugation on the downstream section of the channel (note that the non-logo end should be upstream). See *Figure 7* for greater illustration.

When connecting individual sections together, upstream sections overlaps previous laid downstream sections. The tops of application corrugations alternate flat to round.

Overlap with the flat corrugation of the upstream end over the rib following the rib with the gasket. Once parts are nested, clamp on each side of nested area to secure for installation of fasteners. See *Figure 8* for greater illustration.

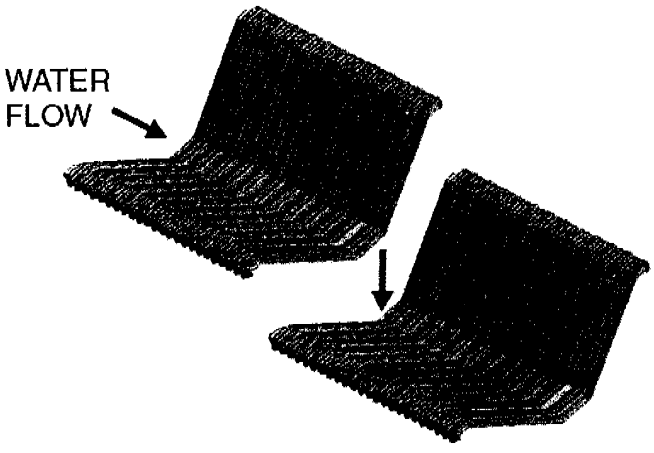


Figure 8

3.1.6 Joint Assembly (cont.)

Drill 1/4" holes through both nested channels at the dimples visible on the top side of the male channel and install screws – five dimples/screws for each 12" connection point, nine dimples/screws for each 24" connection point.

NOTE: Visually inspect backside of connected channels to ensure that screws have pushed through and secured overlapped channels.

The allowances for angular deflection per joint to form a curve can be found in ***Angular Deflection at the SmartDitch Joint*** table on page 9 of this document.

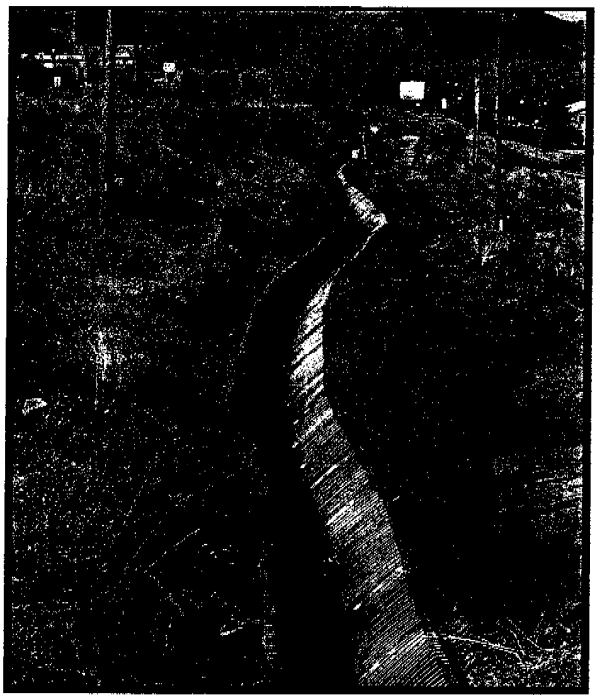
3.1.7 Backfill and Tamping

Trench bedding or bottom shall be of uniform thickness and density. Bedding material should be placed in the haunching zone areas as called for in the engineering specifications. Uniform stable support is provided by placing the specified material in small quantities to eliminate voids and make firm contact with the section.

Bedding shall be placed in 6" - 8" lifts and compacted so as not to disturb the grade or alignment. A tamping bar or shovel slicing can facilitate compaction in the lower quadrant of the channel (haunches). Mechanical tampers may be specified in some instances and care should be taken to avoid contact directly with the channel.

It is recommended that backfill material be compacted to a minimum of 85% of Standard Proctor Density. Prime embedment materials and select backfill are determined by the project specifications.

To assist in determining these backfill/tamping amounts, please review the application measurements found in the ***2.1.2 Physical Dimensions & Weights*** table on page 7 of this manual.



3.0 GENERAL INSTALLATION PRACTICES

3.1.8 Anchoring

Drill 1/2" holes through both joined channels at the shoulder section of the sections. A recessed indentation is provided to pre-mark the location.

Drive cable anchor into ground at desired location close to the recessed pockets. Pull up on cable to engage anchor horizontally. After the sections have been placed in the ditch; anchor first section in place. Pull on unanchored end of last section to straighten connected sections tight. Anchor each section. See *Figure 9* for details.

Thread loose end of cable anchor up through 1/2" holes drilled in section shoulder. Slide the washer over the cable and into the recessed indentation. Take a cable lock and thread the cable up through the narrow end of the cable lock and slide the cable lock down snugly against the washer on the stake column. NOTE: Do not over extend cable anchors such that the section connection is bowed out (see *Figures 10 & 11* for details).

For a more detailed view of cable lock and washer connection, see *Figure 12* below.

Using pliers, grip the cable securely and tighten the cable lock until cable anchor is taut. Trim excess cable leaving 2" above the cable lock. Repeat process at all joints. Additional anchoring may be added as needed.

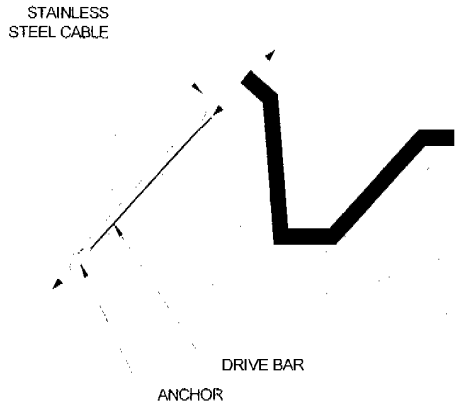


Figure 9

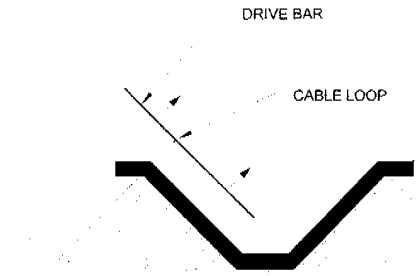


Figure 10

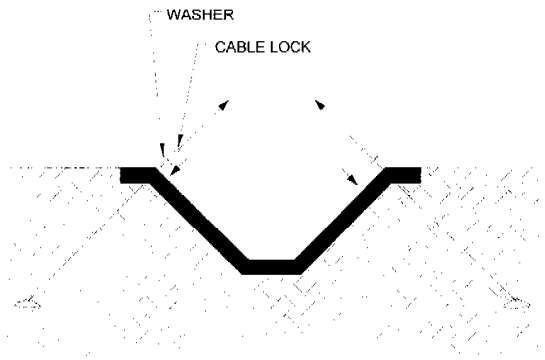


Figure 11

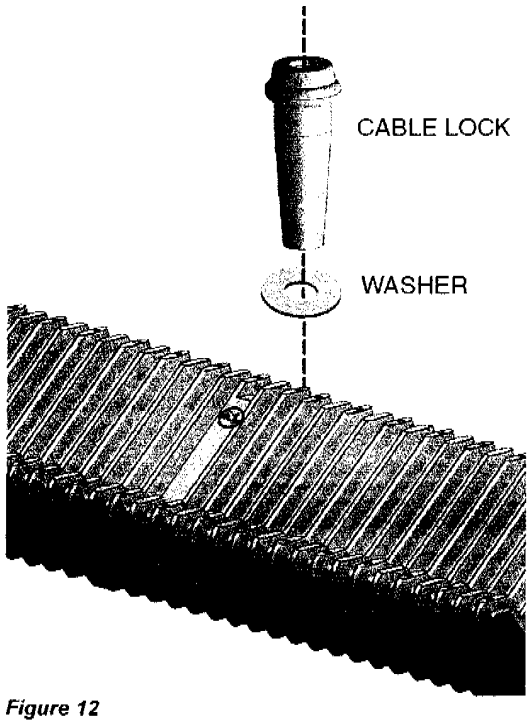


Figure 12

3.0 GENERAL INSTALLATION PRACTICES

3.1.8 Anchoring (cont.)

Note that the total number of anchors used per application is based on the site conditions of the project. For standard projects (i.e. low slope/flow/velocity), standard anchor amounts can be used on applications.

Projects that involve greater slopes, flow levels and velocity may involve more direct assistance from your SmartDitch Engineer or Salesperson contact. See ***Flow Calculations Chart*** in the Appendix (page 32) for greater detail on slope, flow and velocity levels.

3.2 Anchor Capacity and Guidelines

The capacity of the anchors provided with SmartDitch are summarized in the following table.

Model #	Holding Capacity	Drive Rod Diameter	Standard Depth of Installation
400	300 lbs	¼"	20"
680	1,100 lbs	½"	30"
880	3,000 lbs	¾"	42"

The standard anchor provided with the SmartDitch system is model 680. Other anchors can be special ordered if needed.

The holding capacity for the anchor is for average soil conditions (Class 5 as listed in the table below). Site soils will need to be evaluated. Soils in a higher class will have a lower holding capacity. A torque probe can be used to determine soil class

3.3 Soil Classifications and Anchor Capacity

3.3.1 Classifications and Probe Values

The values listed in the table below are estimates based on typical conditions. We recommend you perform a pull test to ensure that the anchor will meet project needs under site conditions.

Class	Description	Probe Value
1	Solid bedrock	+600 in./lbs
2	Dense clay; compact gravel; dense fine sand; laminated rock; slate; schist; sand stone	500-600 in./lbs
3	Shale; broken bedrock; hardpan; compact gravel; clay mixtures	400-600 in./lbs
4	Gravel; compact gravel and sand; claypen	400-500 in./lbs
5	Medium-firm clay; loose standard gravel; compact coarse sand	300-400 in./lbs
6	Medium-firm clay; loose coarse sand; clayey silt; compact fine sand	200-300 in./lbs
7	Fill; loose fine sand; wet clays; silt	100-200 in./lbs
8	Swamp; marsh; saturated silt; humus	Under 100 in./lbs

3.3.2 Anchoring Stability – Steep Slopes

The primary force that will prevent the SmartDitch system from sliding on a slope is frictional resistance. The frictional force must exceed the shear stress created at the channel interface. The frictional resistance can be calculated using the following equation:

$$f = N\tan\Gamma$$

Where:

- f = frictional force
- N = normal force acting on the channel
- Γ = friction angle of the channel-soil interface

The friction angle is dependent upon the soil that is in contact with the SmartDitch. A typical average friction angle between HDPE and sand is 18°. A typical average friction angle between clay and HDPE is 15°.

3.0 GENERAL INSTALLATION PRACTICES

3.3.2 Anchoring Stability – Steep Slopes (cont.)

The primary force acting on the channel-soil interface is shear stress. Shear stress can be calculated using the following equation.

$$t = gdS$$

Where:

t = shear stress
g = unit weight of water
d = depth of water in channel
S = slope of channel

Good contact between the SmartDitch system and the surrounding soil is essential in developing the maximum frictional resistance. The anchors supplied with the SmartDitch system will also provide resistance to sliding and help maintain good contact between soil and channel.

Because of the multiple factors present in any given installation, there is no rule of thumb for how steep of slope to which the SmartDitch system can be installed. Each installation will need to be evaluated individually.

3.4 Lateral Flow Erosion and Undermining

Lateral flow from an adjacent parallel hillside may cause erosion of the soil along the SmartDitch sections or undermine them. Erosion control practices that may be implemented to prevent undermining include geotextile fabric, coconut mat and/or the placement of riprap along the sides of the SmartDitch section. Some conceptual methods are illustrated in *Figures 13 &14*.

Note that Control of side erosion and undermining will need to be designed for site-specific conditions by an engineer.

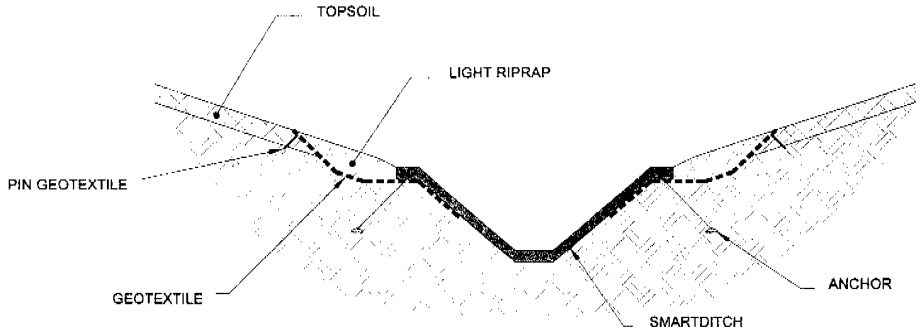


Figure 13

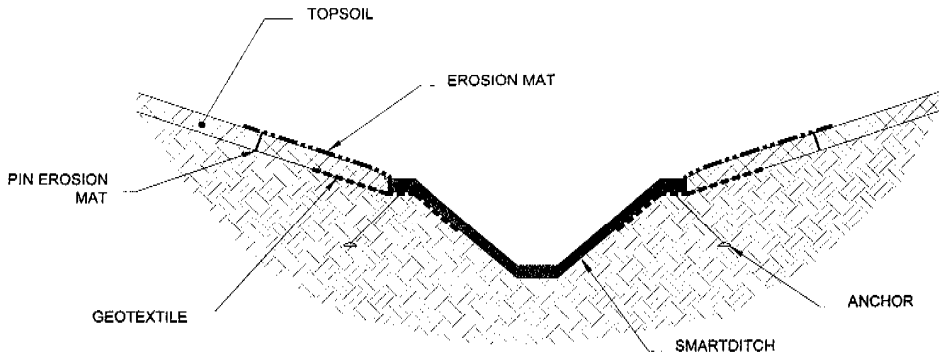


Figure 14

3.5 Fittings

Penda has created a standardized line of SmartDitch fittings that are molded or fabricated using the same materials that are used to produce SmartDitch channel sections. One of the core attributes of Penda is the ability to fabricate a wide assortment of fittings, standard as well as non-standard. For a complete listing of our standard fittings with dimensions, please contact Penda Corporation. Refer to the **Fittings** section on page 8 for additional details.

3.6 Traffic Loading Conditions

SmartDitch sections are not designed to support vehicular traffic. Foot traffic on the sections by people or animals will not damage or affect the performance of the sections.

3.7 Relining Applications

SmartDitch can be used to rehabilitate existing concrete and earthen ditches. Installation procedures are similar to those used in new construction.

The existing ditch subgrade of the concrete or earthen ditch should provide uniform and continuous support against the SmartDitch walls. Prepare the subgrade to be firm, smooth, and free of debris, rocks, and sharp objects. Trim and remove any tree roots. Remove unstable sections of concrete and replace with compacted soil fill.

The soil adjacent to the sections should be graded flush with the top of the concrete ditch prior to installation of the SmartDitch Sections. SmartDitch sections are typically laid end-to-end along the bank. Ensure that the ditch bank is free of tripping hazards and is level for connecting the ditch sections. *(Connect no more than 3 sections together prior to placement into the ditch.)*

Three inches of sand bedding is recommended, but not required. Bedding backfill and general installation requirements shall be in accordance with project plans and specifications and manufacturer's recommendations. See *Figures 15* and *16* below for details.

Joint assembly and anchoring of SmartDitch sections for relining are similar to the new installation practices.

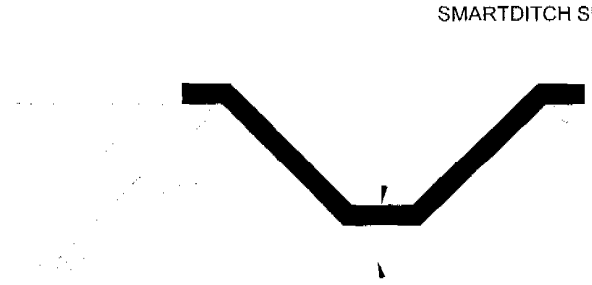


Figure 15

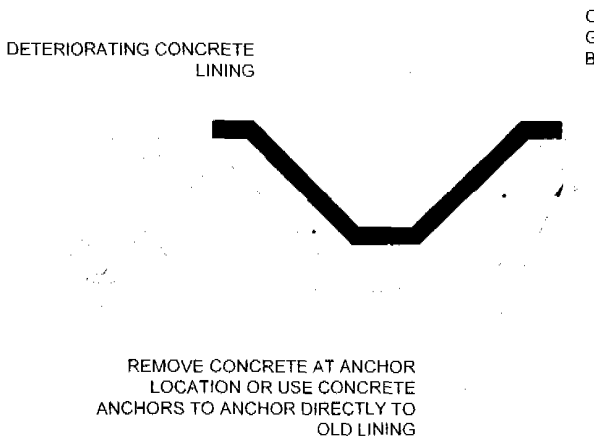


Figure 16

3.0 GENERAL INSTALLATION PRACTICES

3.8 Post Installation Inspection

Once the installation of SmartDitch applications is complete, a comprehensive review of all components and materials is recommended. Based on existing inspection cycles, review the following elements on visual and functional levels:

- Location review
  - Backfill bedding does not disturb grade or alignment and voids are not present (see the **New Construction Installation Practices – Tamping and Backfill** section for details).
- Straight/bulkhead application review
  - Water moves freely at predetermined flow rates (see the **Flow Attributes**, **Flow Velocity** and **Flow Calculations** sections for details).
- Joint connection review
  - Screws are locked in place at drill dimple locations (see the **Joint Assembly** section for details).
  - Water is not leaking beyond expressed rates (see the **Leakage** section for details).
- Anchoring review
  - Anchor number per application is appropriate for flow demands (see the **New Construction Installation Practices – Anchoring** section for details).
  - Anchor cables are taught and pull-tested to appropriate soil levels; loose cable is not visible (see the **New Construction Installation Practices – Anchoring** and **Soil Classifications and Anchor Capacity** sections for details).

3.9 Handling/Shipping/Storage Guidelines

Utilize the following guidelines when handling, shipping or storing SmartDitch applications and installation elements:

Follow all applicable safety guidelines.

- Do not drop the sections from delivery truck into an open trench or onto uneven surfaces.
- Inspect all sections prior to installation.
- Temperature extremes have minimal affect on the strength or handling characteristics of SmartDitch. SmartDitch remains highly impact resistant even in sub-zero conditions.
- Hot weather especially when coupled with direct sunlight, will raise the sections temperature, but will not significantly affect handling or installation behavior.
- Avoid driving over the sections.
- SmartDitch sections should be stored on a flat surface on the original shipping pallets.
- Carbon black is added to polyethylene to protect against UV degradation. Some discoloration may occur if stored uncovered over an extended time period.

3.10 Cleaning

Inspect SmartDitch lined ditches, laterals, or other components of the water distribution system regularly to ensure proper operation and delivery and or drainage of water. Remove any rocks, debris, or other obstructions from sections to ensure maximum flow and efficiency.

In low flow situations or during the dry season some sediment may accumulate in between the corrugations. To minimize potential problems, flow should be maintained at a minimum, or self-cleansing, velocity. When utilizing SmartDitch, a minimum slope of 0.005 (½%) is recommended to maintain the self-cleansing velocity. This minimizes the accumulation of sediments and the likely hood of vegetation starting to grow. If vegetation does grow is can be easily cleaned out with hand tools.

4.0 APPENDIX

4.1 SmartDitch Product Specifications

Section I - General

A. Description: SmartDitch Channel / Lining Systems are designed to improve reliable water flow, reduce water loss, and reduce maintenance requirements for earthen irrigation ditches utilized for storm water management and public works, erosion and sediment control, and agriculture/irrigation applications.

B. Reference Specifications: There currently is not an ASTM standard for the SmartDitch Lining System. The following documents can be referenced to indicate specific manufacturing and material performance capabilities:

ASTM	
D618	Practice for Conditioning Plastics for Testing
D638	Test Method for Tensile Properties of Plastics
D746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
D883	Terminology Relating to Plastics
D1238	Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
D1505	Test Method for Density of Plastics by the Density-Gradient Technique
D1506	Test Method for Carbon Black – Ash Content
D1693	Test Method for Environmental Stress-Cracking of Ethylene Plastics
D5420	Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight

Section II – Material Properties

A. Liner Segments are manufactured from high molecular weight high density polyethylene. (HDPE)

B. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotrophic agents, etc., when used, shall not detrimentally effect the performance of the product.

C. Foam Gaskets: The foam gaskets shall be supplied by qualified gasket manufacturers and be suitable for the service intended.

Section III – Manufacture

A. The liner segments shall be manufactured using vacuum thermoforming.

B. Fittings: All fittings shall be fabricated from material meeting the requirements of these standards.

C. Acceptable Manufacturer or Supplier: Penda Corporation

Section IV - Nominal Dimensions:

A. Nominal Dimensions shall be per the manufacturer's design.

B. Lengths: Liner Sections shall be supplied in nominal lengths per the manufacturer's design. Shorter and custom lengths will be supplied as defined by the project requirements.

C. Wall Thickness: The average wall thickness shall be per the manufacturer's design.

D. The minimum Manning's coefficient of friction for the lining system shall be n=0.022.

Section V – Material Testing:

A. Segments shall be manufactured and tested in accordance with applicable ASTM standards.

Section VI – Design Criteria

A. Capacity: Lined ditch shall have enough capacity to meet the requirements as part of the planned irrigation water distribution/conveyance system without overflow. The minimum Manning's coefficient of friction for the lining system is n=0.022.

B. Velocity: The velocity in ditches lined with the liner shall be sufficient to carry the required flow. Velocity may vary dependent on slope of existing ditch, lateral, or other water work. Minimum slope requirement for installation of SmartDitch liner system is 1/2 percent.

C. Side Slopes/Bottom: Side slopes and bottom of the earthen ditch shall be free of debris, rocks and other sharp objects that may damage the liner system once installed.

D. Leak Rate: The average exfiltration rate shall not exceed 0.039 cfs/1000 ft.

Section VII – Installation Procedures

A. Bedding backfill and general installation requirements shall be in accordance with project plans and specifications and manufacturer's recommendations.

Section VIII – Maintenance

A. Field Inspect lined irrigation ditches, laterals, or other components of the water distribution system regularly to ensure proper operation and delivery of water. Remove any rocks, debris, or other obstructions from liner system to ensure maximum flow and efficiency.

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