

WATER AND SEWER LINE CONSTRUCTION STANDARDS AND POLICIES

Established by the
ILLINOIS DEPARTMENT OF AGRICULTURE

The following standards and policies will serve to minimize the negative agricultural impacts that may result due to water and sewer line construction.

The standards and policies apply to construction activities occurring partially or wholly on privately owned agricultural land. They do not apply to construction activities occurring on highway or railroad right-of-way, or on publicly owned land. The only exceptions are the construction standards relating to the repair of drainage tile (Item No. 3). The tile line construction standards shall be implemented regardless of where drainage tile is encountered.

Conditions

The mitigative actions specified in the construction standards and policies will be implemented in accordance with the conditions listed below.

- A. All mitigative actions are subject to change by Landowners, provided such changes are acceptable to the Project Sponsor.
- B. The Project Sponsor may negotiate with Landowners to carry out the mitigation actions that Landowners wish to perform themselves. The Landowners will receive the area commercial rate for their labor and machinery costs.
- C. All mitigative actions, unless others specified, will be implemented within 45 days of completion of water or sewer line facilities on any affected property, weather and Landowners permitting. Temporary repairs will be made by the Project Sponsor during the construction process as needed to minimize the risk of additional property damage that may result from an extended construction time period.
- D. All mitigative actions will extend to associated future construction, maintenance and repairs.
- E. The Project Sponsor will provide a copy of the Illinois Department of Agriculture (IDOA) ***Water and Sewer Line Construction Standards and Policies*** to all owners of agricultural land that will be impacted by water and/or sewer line construction at least 30 days prior to easement contract negotiations.

Definitions

Agricultural Inspector

Full-time on-site inspector retained by Project Sponsor to verify compliance with requirements of this Agreement during construction of the pipeline.

Agricultural Land

Land used for cropland, hayland, pasture land, truck gardens, farmsteads, commercial ag-related facilities, feedlots, livestock confinement systems, land on which farm buildings are located within 100 feet of the pipeline, and land in government set-aside programs.

Best Management Practice (BMP)

Any structural, vegetative or managerial practice used to treat, prevent or reduce soil erosion. Such practices may include temporary seeding of exposed soils, construction of retention basins for storm water control and scheduling the implementation of all BMPs to maximize their effectiveness.

Cropland

Land used for growing row crops, small grains, or hay; includes land which was formerly used as cropland, but is currently in a government set-aside program and pastureland that was formerly utilized as cropland or is comprised of Prime farmland.

Drainage Tile

Any artificial subsurface drainage system including, but not limited to, clay and concrete tile, vitrified sewer tile, corrugated plastic tubing, and stone drains.

Landowner

Person(s) holding legal title to property on the pipeline route from whom the Project Sponsor is seeking, or has obtained, a temporary or permanent easement.

Landowner's Designate

Any person(s) legally authorized by a Landowner to make decisions regarding the mitigation or restoration of agricultural impacts to such Landowner's property.

Non-Agricultural Land

Any land that is not "Agricultural Land" as defined above.

Prime Farmland

Agricultural land comprised of soils that are defined by the USDA Natural Resources Conservation Service as being "prime" soils (generally considered the most productive soils with the least input of nutrients and management).

Project Sponsor

The entity proposing the construction of water or sewer lines and their related appurtenances.

Right-of-way

Includes the permanent and temporary easements that the Project Sponsor acquires for the purpose of constructing, operating and maintaining the pipeline.

Surface Drains

Any surface drainage system such as shallow surface field drains, grassed waterways, open ditches, or any other conveyance of surface water.

Tenant

Any person lawfully residing on or leasing/renting of the land.

Topsoil

The upper most part of the soil commonly referred to as the plow layer, the A layer, or the A horizon, or its equivalent in uncultivated soils. It is the surface layer of the soil that has the darkest color or the highest content of organic matter (as identified in the USDA Natural Resources Conservation Service County Soil Survey and verified with right-of-way samples as stipulated under 2A below).

WATER AND SEWER LINE CONSTRUCTION STANDARDS AND POLICIES

1. Water and Sewer Line Depth

- A. All water and sewer lines which are placed in **trenches 24 inches in width or less**, are adjacent to roads and do not extend more than 20 feet into agricultural fields, will be buried a minimum of 42 inches of topcover (60 inches is advised by the IL Dept. of Agriculture) where they cross cropland.
- B. All water and sewer lines that are placed in **trenches greater than 24 inches in width** that will cross cropland will be buried with a minimum of 60 inches of topcover.
- C. In terrain where bedrock prevents the placement of any water or sewer lines at the depths specified in 1.A. or 1.B above, the water or sewer lines will be buried as deep as is practicable and feasible.

2. Topsoil Replacement

The following standards apply only when water and sewer lines are buried in trenches that are greater than 24 inches in width.

- A. The actual depth of the topsoil, will first be stripped from the area to be excavated for a water or sewer line trench, all bore pits and other areas of excavation.
- B. All subsoil material that is removed from the trench will be placed in a second stockpile that is separate from the topsoil stockpile.
- C. In backfilling the trench and other excavated areas, the stockpiled subsoil material will be placed back into the trench first. The topsoil will be replaced last so that it remains the top layer of soil.
- D. The topsoil and subsoil must be replaced within the trench and other excavated area so that after settling occurs, the land's original contour (with an allowance for settling) will be achieved.
- E. The portion of the subsoil displaced by the water or sewer line must be hauled off the Landowner's premises or disposed of on the Landowner's premises at a location that is acceptable to the Landowner.

3. Repair of Damaged Tile Lines

All drain tile repair and/or replacement shall be completed prior to topsoil replacement.

If underground drain tile is damaged by the pipeline installation, it shall be repaired in a manner that assures the drain tile proper operating condition at the point of repair. If underground drain tile lines in the pipeline construction area are adversely affected by the pipeline construction, the Project Sponsor will take such actions as are necessary to insure the proper functioning of the drain tile lines, including the relocation, reconfiguration, and replacement of the existing drain tile lines. The following standards and policies shall apply to the drain tile line repair:

- A. The Project Sponsor shall make a conscientious effort to locate all drain tile lines within the right-of-way prior to the pipeline installation. The Project Sponsor will contact affected Landowners and/or Tenants for their knowledge of drain tile line locations prior to the pipeline installation. All identified drain tile lines will be marked with a highly visible lathe to alert construction crews to the need for drain tile line repairs.

- B. During construction, all drain tile lines that are damaged, cut, or removed shall be distinctly marked by placing a highly visible lathe in the trench spoil bank directly opposite each drain tile line. This marker shall not be removed until the drain tile line has been permanently repaired and such repairs have been approved and accepted by the Landowner and the Agricultural Inspector. Also, the location of damaged tile lines will be recorded using Global Positioning System technology as a method of permanently charting tiles for ease in locating in the future.
- C. If water is flowing through any damaged tile line, the tile line will be immediately and temporarily repaired, as necessary, to ensure continuous flow until such time that permanent repairs can be made. If the tile lines are dry and water is not flowing, temporary repairs are not required if the permanent repairs can be made within 14 days of the time damage occurred; however, the exposed tile lines will be screened or otherwise protected to prevent the entry of foreign materials, small mammals, etc. into the tile lines. This shall include the use of filter material to prevent the movement of soil into the drain tile line or the temporary plugging of the drain tile line until permanent repairs can be made.
- D. Where tile lines are severed by the pipeline trench, repairs shall be made using **Figures 1 and 2** or as agreed upon by the Landowner and the Project Sponsor.
- E. There will be a minimum of one foot of separation between the tile line and the pipeline whether the pipeline passes over or under the tile line.
- F. The original tile line alignment and gradient shall be maintained. A laser transit shall be used to ensure the proper gradient is maintained.
- G. Before completing permanent drain tile repairs, all drain tile lines shall be probed or examined by suitable means on both sides of the trench for their entire length within the right-of-way to check for drain tile that might have been damaged by construction equipment. If any drain tile line is found to be damaged, it shall be repaired so it will operate as well after construction as before construction began.
- H. All permanent drain tile line repairs shall be made within 14 days following completion of the pipeline installation on any affected Landowner's property unless otherwise authorized by the Landowner, weather and soil conditions permitting. Landowners and/or Tenants will be contacted prior to final backfill and restoration and offered opportunity to witness final tile line repair.
- I. Following completion of the pipeline, the Project Sponsor will be responsible for correcting all tile line repairs that fail due to pipeline construction, provided those repairs were made by the Project Sponsor. The Project Sponsor will not be responsible for drain tile line repairs that the Project Sponsor pays the Landowner to perform. The plans for the repairs shall be approved by the Landowner prior beginning work on the repair.
- K. The Project Sponsor will remain liable for a period of 3 years following the completion of the water or sewer lines to ensure that all tile line repairs do not fail. The Project Sponsor will not be responsible for tile line repairs that the Project Sponsor pays the Landowner to perform.

4. Rock Removal

- A. The top 42 inches of a water or sewer line trench will not be backfilled with soil containing rocks that are larger than 3 inches of any dimension.

- B. If trenching, blasting or boring operations are required through rocky terrain, suitable precautions will be taken to eliminate the potential for rocks to become interspersed with the soils material that is placed back in the trench.
- C. Rocks and/or soils containing rocks that are larger than 3 inches must be hauled off the Landowner's premises or disposed on the Landowner's premises at a location that is acceptable to the Landowner.

5. Removal of Construction Debris

All construction-related debris and material that are not an integral part of the pipeline will be removed from the Landowner's property. Such material to be removed would include litter generated by the construction crews which will be removed on a daily basis.

6. Compaction, Rutting, Fertilization, Liming

When water and/or sewer lines are buried in trenches **greater than 24 inches in width**:

- A. In all agricultural sections of the right-of-way that were traversed by vehicles and construction equipment, where topsoil is stripped and prior to topsoil replacement, the subsoil shall be fractured by deep ripping to a depth of not less than 16 inches below the surface of the subsoil with the appropriate industrial ripper. Subsurface features (i.e. drain tiles, other utilities) may warrant less depth. Deep ripping shall be conducted using a ripper or subsoiling tool with a shank length of no less than 18 inches and a shank spacing of approximately the same measurement as the shank length. Ripper shanks mounted on the back of a dozer are not an acceptable method of decompaction. The footprint of the tractor used to pull the ripper must be equal to or less wide than the width of the decompacted soil created by the ripper. Should multiple passes of the ripper be needed to achieve decompaction between the knives/shanks of the ripping tool, the subsequent passes should be positioned so the knife tracks from the previous pass are split by the second pass.

Decompaction shall be conducted according to the guidelines provided in **Appendices A and B**.

Following the ripping operation, all stone and rock material three (3) inches and larger in size which have been lifted to the surface shall be collected and removed from the site for disposal.

Upon approval by the Agricultural Inspector of the subsoil decompaction and the stone removal, the topsoil that has been temporarily removed for the period of construction shall then be replaced. The topsoil profile in the full width of the right-of-way shall be shattered to a depth of approximately 2 inches greater than the depth of topsoil with a heavy-duty subsoiling tool having angled legs. Stone removal shall be completed, as necessary, to eliminate any additional rocks and stones brought to the surface as a result of the final subsoil shattering process.

The existence of stumps, tile lines or underground utilities may necessitate less depth.

- B. Traffic on the decompacted ROW should be kept to a minimum. If the ripping pass has left the soil surface too rough and uneven for the Landowner to efficiently farm the field, the field can be smoothed with a shallow pass using a chisel, field cultivator, or similar agricultural finishing tool.
- C. Ripping and light tillage passes will be done at a time when the soil is dry enough for normal tillage operations to occur on undisturbed farmland adjacent to the areas to be ripped.

- D. Should conditions persist that do not allow for effective decompaction prior to topsoil replacement the following alternate decompaction plan will be implemented. Utilizing the alternate decompaction plan, topsoil can be replaced prior to decompacting the subsoil. This alternate decompaction plan will be implemented only when the Landowner has requested the alternate plan or when soil conditions, such as high moisture levels, do not allow for proper and effective decompaction of the subsoil prior to topsoil replacement in a timely manner. Decompaction of the subsoil through the topsoil will be conducted when the soil moisture levels are such that decompaction efforts will reduce compaction levels. The depth of decompaction will be no less than the depth of topsoil (up to 16 inches) plus 16 inches into the subsoil. Decompaction under the alternate decompaction plan shall be conducted according to the guidelines provided in **Appendices A and B**.
- E. The Project Sponsor will restore all compacted or rutted land as near as practicable to its original condition.
- F. The cost of applying fertilizer, manure, and/or lime will be included in the damages paid to the Landowner, thereby allowing the Landowner to apply the appropriate type and amounts of fertilizer, manure, and/or lime as needed depending on the crops contemplated and the construction schedule. These included costs are designed to cover the expense to maintain or restore soil fertility and pH levels on the ROW to similar levels as the immediately adjacent off-ROW portions of the field.
- G. If there is a dispute between the Landowner and the Project Sponsor as to what areas need to be ripped, the depth at which compacted areas should be ripped, or the necessity or rates of lime and fertilizer application, the appropriate county Soil and Water Conservation District's opinion in conjunction with the opinions of other experts will be considered by the Landowner and the Project Sponsor.

7. Land Leveling

- A. The Project Sponsor will remain liable, for a period of two (2) years, following the completion of a water or sewer line, to restore any right-of-way to its original elevation and contour should uneven settling occur or surface drainage problems develop due to inaccurate land leveling immediately following a water or sewer line's construction.
- B. The Project Sponsor will provide the Landowners with a telephone number and address that may be used to alert the Project Sponsor of the need to perform additional land leveling services.

8. Prevention of Soil Erosion

- A. The Project Sponsor will work with Landowners to prevent excessive erosion on land disturbed by construction. Reasonable methods will be implemented to control erosion. This is not a requirement; however, if the land across which a water or sewer line is constructed is bare cropland that the Landowner intended to leave bare until the next crop is planted.
- B. If the Landowner and Project Sponsor cannot agree upon a reasonable methods to control erosion on the Landowner's right-of-way, the Project Sponsor will follow the recommendation of the local county Soil and Water Conservation District if the Landowner so requests.

9. Repair of Damaged Soil Conservation Practices

All soil conservation practices (such as terraces, grassed waterways, filter strips, concrete structure, dams, etc.) that are damaged by water or sewer line construction will be restored to at least their preconstruction condition.

10. Damages to Private Property

- A. With the exception of the tile line repairs, the Project Sponsor will repair, replace or pay to repair and replace damaged private property within 45 days, weather and Landowner permitting, after a water or sewer line has been constructed across any affected property.
- B. Similar relief for damages will be extended by the Project Sponsor for any construction-related damages that occur off of the established water or sewer line right-of-way.
- C. The Project Sponsor will remain liable to correct damages to private property beyond the initial construction of water or sewer line, to those damages incurred by future construction, operation, maintenance and repairs.

11. Clearing of Trees and Brush from the Easement

- A. If the trees to be removed are from the right-of-way the Project Sponsor will consult with the Landowner to see if there are trees of commercial or other value to the Landowner.
- B. If there are trees of commercial or other value to the Landowner, the Project Sponsor will allow the Landowner the right to retain ownership of the trees with the disposition of the trees to be negotiated prior to the commencement of land clearing.
- C. The Project Sponsor will follow the Landowner's desires which are consistent with any applicable laws or ordinances regarding the disposal of trees, brush and stumps of no value to the Landowner by burning, burial, etc., or complete removal from any affected property.

12. Interference with Irrigation Systems

- A. If a water or sewer line intersects an operational (or soon to be operational) spray irrigation system, the Project Sponsor will establish with the Landowner an acceptable amount of time the irrigation system may be out of service.
- B. If an irrigation system interruption results in crop damages, either on the water or sewer right-of-way, the Landowner will be compensated for all such crop damages.
- C. If it is feasible and mutually acceptable to the Project Sponsor and the Landowner, temporary measures may be implemented to allow an irrigation system to continue to operate across land on which a water or sewer line is along being constructed.

13. Ingress and Egress Routes

Prior to any water or sewer line construction, the Project Sponsor and the Landowner will reach a mutually acceptable agreement on the route that will be utilized for entering and leaving the water or sewer line right-of-way should access to the right-of-way not be practical or feasible from an adjacent segment of the water or sewer line right-of-way or from public highway or railroad right-of-way.

14. Temporary Roads

- A. The location of temporary roads to be used for construction purposes will be negotiated with the Landowner.
- B. If temporary roads must be constructed, they will be designed to not impact surface drainage. Soil erosion on or near the temporary roads will be minimized.
- C. Upon abandonment, temporary roads may be left intact through mutual agreement of the Landowner and the Project Sponsor.
- D. If the temporary roads are to be removed, the right-of-way upon which the temporary roads are constructed will be returned to their previous use and restored to the same or better condition as existed prior to their construction.

15. Weed Control

- A. On any right-of-way over which the Project Sponsor has jurisdiction as the surface use of such land (wellheads, pump or lift stations, valve sites, etc.), the Project Sponsor will provide weed control in a manner that does not allow for the spread of weeds onto adjacent lands used as cropland.
- B. The Project Sponsor will remain liable for the costs incurred by owners of land adjacent to surface facilities when the Landowners must control weeds on their land which have spread onto land accommodating water or sewer line surface facilities.

16. Pumping of Water from Open Trenches

- A. In the event it becomes necessary to pump water from open trenches, the Project Sponsor will pump the water in a manner what will avoid damaging adjacent agricultural land. Such damages include, not are not limited to, the inundation of crops for more than 24 hours and the deposition of sediment and gravel in fields, pastures, ditches and any water bodies or water course.
- B. If it is impossible to avoid water-related damages as described in 16.A. above, the Project Sponsor will compensate the Landowners for the damages or will correct the damages so as to restore the agricultural land, water courses, etc, to their pre-existing conditions.
- C. All pumping of water shall comply with existing drainage laws, local ordinances relating to such activities and provisions of the Clean Water Act.

17. Aboveground Facilities

Aboveground facilities shall be located so they will not be a hindrance to ongoing agricultural activities occurring on the lands adjacent to the facilities. First priority shall be made to locating aboveground facilities on right-of-way that is not used as cropland. If this is not feasible, such facilities shall be located to incur the least hindrance to the adjacent cropping operations (i.e., located in field corners or areas where at least one side is not used for cropping purposes).

18. Advance Notice of Access to Private Property

- A. The Project Sponsor will provide the Landowner or Tenant with a minimum of 24 hours prior notice before accessing the property for the purpose of constructing a water or sewer line.

- B. Prior notice shall first consist of a personal contact or a telephone contact, whereby the Landowner or Tenant is informed of the Project Sponsor's intent to access the land. If the Landowner or Tenant cannot be reached in person or by telephone, the Project Sponsor will send certified mail or hand deliver to the Landowner (or Tenant's home) a dated, written notice of the Project Sponsor's intent. The Landowner or Tenant need not acknowledge receipt of the written notice before the Project Sponsor can enter the Landowner's property.

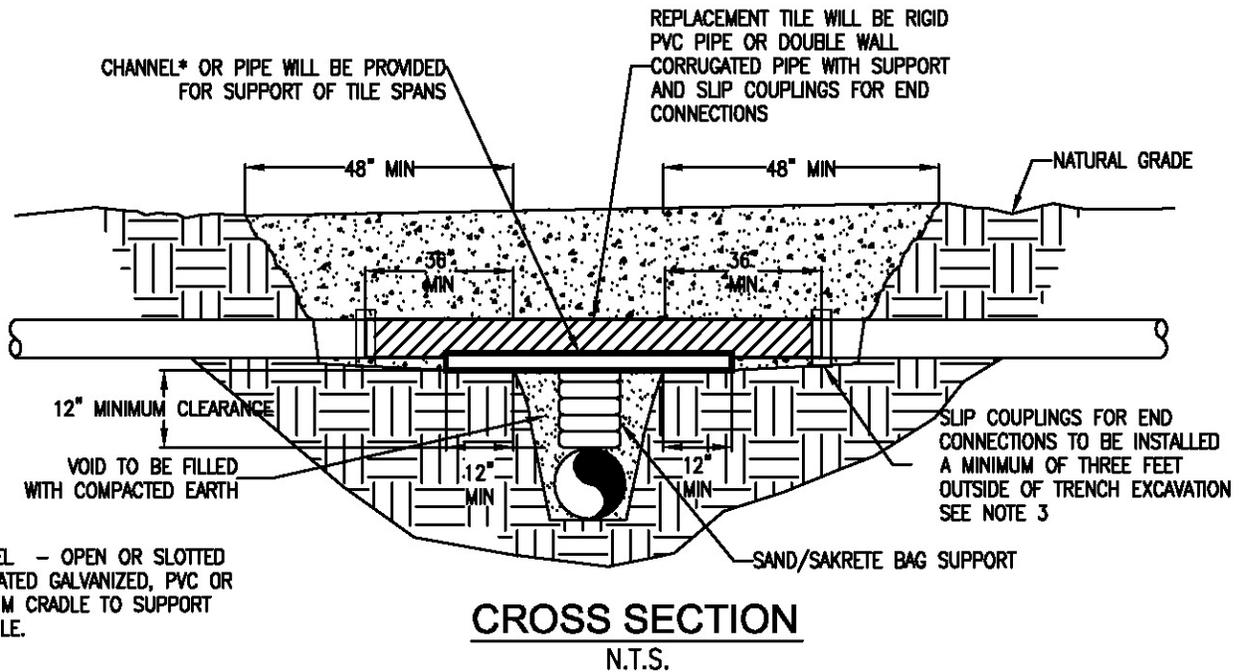
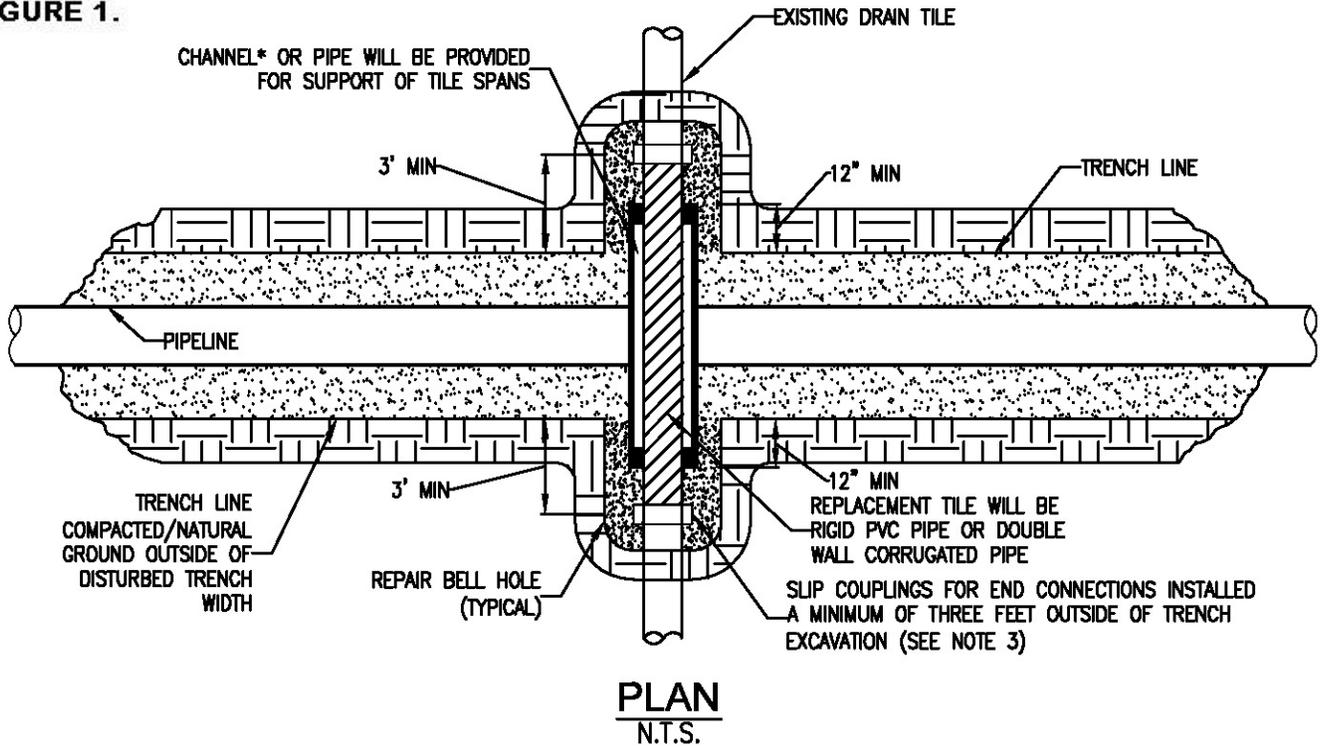
19. Reporting of Inferior Agricultural Impact Mitigation Work

Prior to the installation of any water or sewer line, Landowners will be provided with a telephone number they can call to alert the Project Sponsor should Landowners or Tenants observe inferior agricultural impact mitigation work that is performed on their property.

20. Indemnification

The Project Sponsor will indemnify all owners and farm tenants of agricultural land upon which such pipeline is installed, their heirs, successors, legal representatives, assigns (collectively "Indemnitees"), from and against all claims by third parties losses incurred thereby, and reasonable expenses, resulting from or arising out of personal injury, death, injury to property, or other damages or liabilities of any sort related to the design, laying, maintenance, removal, repair, use or existence of such pipeline, whether heretofore or hereafter laid, including damages caused by such pipeline or any of its appurtenances and the leaking of its contents, except where claims, injuries, suits, damages, costs, losses, and expenses are caused by the negligence or intentional acts, or willful omissions of such Indemnitees provided further that such Indemnitees shall tender any such claim as soon as possible upon receipt of notice thereof to the Project Sponsor.

FIGURE 1.

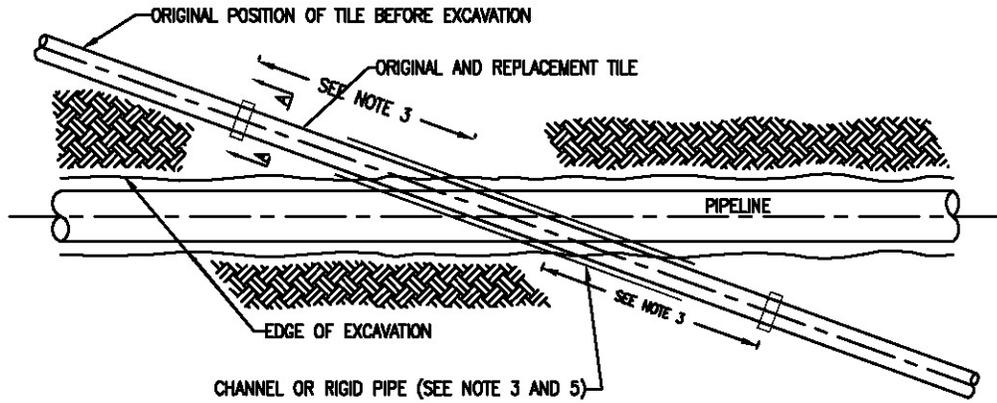


*CHANNEL - OPEN OR SLOTTED CORRUGATED GALVANIZED, PVC OR ALUMINUM CRADLE TO SUPPORT DRAIN TILE.

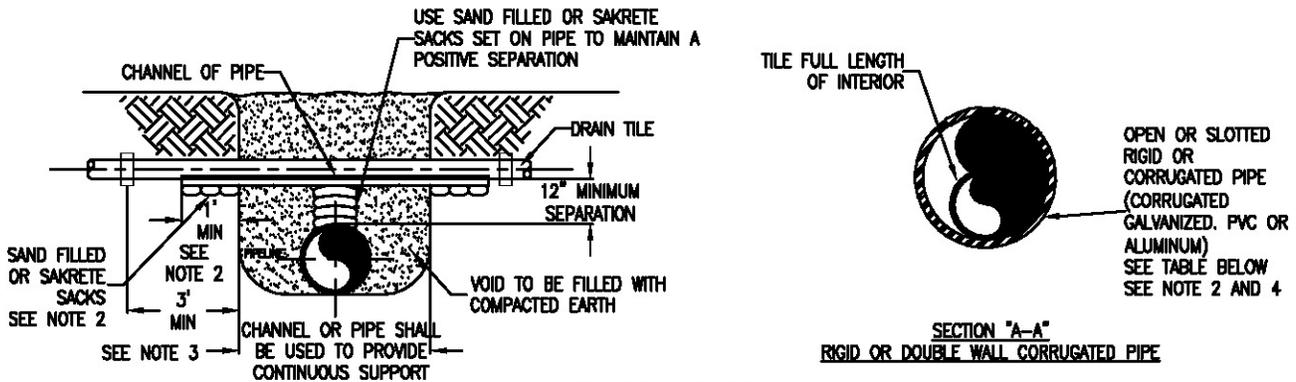
- NOTE:**
1. IMMEDIATELY REPAIR TILE IF WATER IS FLOWING THROUGH TILE AT TIME OF TRENCHING. IF NO WATER IS FLOWING AND TEMPORARY REPAIR IS DELAYED, OR NOT MADE BY THE END OF THE WORK DAY, A SCREEN OR APPROPRIATE 'NIGHT CAP' SHALL BE PLACED ON OPEN ENDS OF TILE TO PREVENT ENTRAPMENT OF ANIMALS ETC.
 2. CHANNEL OR PIPE (OPEN OR SLOTTED) MADE OF CORRUGATED GALVANIZED PIPE, PVC OR ALUMINUM WILL BE USED FOR SUPPORT OF DRAIN TILE SPANS.
 3. INDUSTRY STANDARDS SHALL BE FOLLOWED TO ENSURE PROPER SEAL OF REPAIRED DRAIN TILES.

TEMPORARY DRAIN TILE REPAIR

FIGURE 2.



PLAN VIEW



END VIEWS

MINIMUM SUPPORT TABLE			
TILE SIZE	CHANNEL SIZE		PIPE SIZE
3"	4" @ 5.4	#ft	4" STD. WT.
4"-5"	5" @ 6.7	#ft	6" STD. WT.
8"-9"	7" @ 9.8	#ft	9"-10" STD. WT.
10"	10" @ 15.3	#ft	12" STD. WT.

NOTE:

1. TILE REPAIR AND REPLACEMENT SHALL MAINTAIN ORIGINAL ALIGNMENT GRADIENT AND WATER FLOW TO THE GREATEST EXTENT POSSIBLE. IF THE TILE NEEDS TO BE RELOCATED, THE INSTALLATION ANGLE MAY VARY DUE TO SITE SPECIFIC CONDITIONS AND LANDOWNER RECOMMENDATIONS.
2. 1'-0" MINIMUM LENGTH OF CHANNEL OR RIGID PIPE (OPEN OR SLOTTED CORRUGATED GALVANIZED, PVC OR ALUMINUM CRADLE) SHALL BE SUPPORTED BY UNDISTURBED SOIL, OR IF CROSSING IS NOT AT RIGHT ANGLES TO PIPELINE, EQUIVALENT LENGTH PERPENDICULAR TO TRENCH. SHIM WITH SAKRETE, OR SAND BAGS TO UNDISTURBED SOIL FOR SUPPORT AND DRAINAGE GRADIENT MAINTENANCE (TYPICAL BOTH SIDES).
3. DRAIN TILES WILL BE PERMANENTLY CONNECTED TO EXISTING DRAIN TILES A MINIMUM OF THREE FEET OUTSIDE OF EXCAVATED TRENCH LINE USING INDUSTRY STANDARDS TO ENSURE PROPER SEAL OF REPAIRED DRAIN TILES INCLUDING SLIP COUPLINGS.
4. DIAMETER OF RIGID PIPE SHALL BE OF ADEQUATE SIZE TO ALLOW FOR THE INSTALLATION OF THE TILE FOR THE FULL LENGTH OF THE RIGID PIPE.
5. OTHER METHODS OF SUPPORTING DRAIN TILE MAY BE USED IF ALTERNATE PROPOSED IS EQUIVALENT IN STRENGTH TO THE CHANNEL/PIPE SECTIONS SHOWN AND IF APPROVED BY COMPANY REPRESENTATIVES AND LANDOWNER IN ADVANCE. SITE SPECIFIC ALTERNATE SUPPORT SYSTEM TO BE DEVELOPED BY COMPANY REPRESENTATIVES AND FURNISHED TO CONTRACTOR FOR SPANS IN EXCESS OF 20', TILE GREATER THEN 10" DIAMETER, AND FOR "HEADER" SYSTEMS.
6. ALL MATERIAL TO BE FURNISHED BY CONTRACTOR.
7. PRIOR TO REPAIRING TILE, CONTRACTOR SHALL PROBE LATERALLY INTO THE EXISTING TILE TO FULL WIDTH OF THE RIGHTS OF WAY TO DETERMINE IF ADDITIONAL DAMAGE HAS OCCURRED. ALL DAMAGED/DISTURBED TILE SHALL BE REPAIRED AS NEAR AS PRACTICABLE TO ITS ORIGINAL OR BETTER CONDITION.

Appendix A.

Guidelines for Conducting Proper and Successful Decompaction

1. Decompaction is required when:
 - A. the area has been trafficked or traversed by vehicles or construction equipment, and
 - B. the soil penetrometer readings are 300 pounds per square inch (psi) or greater, and
 - C. the soil strength (psi) in the right-of-way area is greater than that of the non-trafficked area.
2. An Environmental and/or Agricultural Inspector with experience and training in the proper identification of compacted soil and operation methods of deep decompaction tools is required to observe the daily operation of the ripper/subsoiler to ensure the conditions are appropriate for decompaction efforts and that the proper equipment is utilized and that equipment is set-up and operated correctly.
3. To achieve the most effective shatter of the compacted soil the following guidelines have been established:
 - A. Conduct ripping when the soil is dry. Follow the "Soil Plasticity Test Procedures" detailed in Appendix B to determine if soil conditions are adequately dry to conduct decompaction efforts.
 - B. Deep ripping shall be conducted using a ripper or subsoiling tool with a shank length of no less than 18 inches and a shank spacing of approximately the same measurement as the shank length.
 - C. Use a ripper with a knife length of no less than 2 inches more than the desired depth of decompaction.
 - D. To best promote revegetation and restore crop production, a total depth of 30 or more inches of non-compacted soil (topsoil plus subsoil) is recommended. At a minimum, rip the subsoil to a total depth of no less than 16 inches and rip the replaced topsoil to a depth of no less than 2 inches more than the depth of the replaced topsoil. If decompacting the entire 30 or more inches through the topsoil, a larger ripping tool will be required to achieve the full depth of decompaction.

The knife length required when decompacting the entire 30 or more inches through the replaced topsoil is the depth of the topsoil plus 18 inches or a minimum depth of 32 inches, whichever is greatest. This will allow for decompaction to approximately the same total depth achieved when decompacting the subsoil prior to topsoil replacement or a minimum depth of 30 inches.
 - E. The minimum depths of decompaction stated above in 3.D. are required where possible. A safe distance from sub-surface structures (tile drains, pipelines, buried utilities, bedrock, etc.) must be maintained at all times. Where such structures exist, a lesser depth of decompaction will be required to prevent damage to equipment and the structures as well as to maintain a safe work environment. The allowable decompaction depth in these instances will be determined on a site by site basis.
 - F. When the knives are in the soil to the desired depth the tongue of the ripper should be parallel to the surface of the ground.

- G. Select a tractor that has enough horsepower to pull the ripper at a speed of 1.5 to 2 mph and whose footprint is of equal or lesser width than the ripper. Tracked equipment is preferred and typically required to achieve this criteria.
- H. The ripper shanks should not create ruts, channels, or mixing of the sub-soil with topsoil. A speed of 1.5 to 2 mph is recommended to minimize the risk of rutting and soil mixing. The ideal operating speed can vary with soil characteristics and ripping tool used. An excessive travel speed will often increase mixing of soil horizons.
- I. When the equipment is set up and operated correctly, the ripper should create a wave across the surface of the ground as it lifts and drops the soil.
- J. Make one ripping pass through the compacted area. Using a penetrometer, the AI will measure the PSI between the ripped knife tracks to determine if the single ripping pass was successful. Additional passes should only be used where needed as they may reduce the effectiveness of the ripping by re-compacting the soil shattered in the previous pass.
- K. If the first pass does not successfully decompact the soil, additional passes will be needed. Should multiple passes of the ripper be needed to achieve decompaction between the knives tracks of the ripping tool, the subsequent passes should be positioned so the knife tracks from the previous pass are split by the second pass. If three or more passes have been made and sufficient decompaction has not yet been achieved the AI may choose to halt further decompaction efforts in that area until conditions improve or better methods are determined.
- L. Following ripping, all stone and rock three or more inches in size which has been lifted to the surface shall be collected and removed from agricultural areas.
- M. After ripping has been conducted, do not allow unnecessary traffic on the ripped area.
- N. In agricultural lands and croplands that will not be replanted to vegetation by Alliance, recommend to landowners to plant a deep rooted crop following decompaction. Reduced compaction created by the ripper pass will not remain over time without subsequent root penetration. Root penetration into the shattered soil is necessary to establish permanent stabilized channels to conduct air and water into the soil profile.

Appendix B.

Soil Plasticity Test Procedures

The Agricultural Inspector will test the consistency of the surface soil to a depth of approximately 4 to 8 inches using the Field Plasticity Test procedure developed from the *Annual Book of ASTM Standards, Plastic Limit of Soils* (ASTM D-424).

1. Pull a soil plug from the area to be tilled, moved, or trafficked to a depth of 4-8 inches.
2. Roll a portion of the sample between the palms of the hands to form a wire with a diameter of one-eighth inch.
3. The soil consistency is:
 - A. Tillable (able to be worked) if the soil wire breaks into segments not exceeding $\frac{3}{8}$ of an inch in length.
 - B. Plastic (not tillable) if the segments are longer than $\frac{3}{8}$ of an inch before breaking.
4. This Procedure is to be used to aid in determining when soil conditions are dry enough for construction activities to precede.
5. Once the soil consistency has been determined to be of adequate dryness, the plasticity test is not required again until the next precipitation event.