Temporary Right-of-Way Width Requirements for Pipeline Construction

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F-9902

INGAA FOUNDATION

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Executive Summary

The INGAA Foundation commissioned Gulf Interstate Engineering (GIE), a professional engineering firm, to undertake a study and make an objective determination of appropriate widths for safe, maneuverable pipeline construction rights-of-way. To ensure the objectivity of the study, GIE examined current practices and safety codes, surveyed pipelines and industry contractors, and analyzed the right-of-way widths needed for a typical interstate pipeline construction spread for a range of pipe diameters. GIE's analysis evaluated the storage space requirements for excavated soil, size of construction equipment, pipeline materials, and the varied operations of the workforce.

GIE found that the diameter of the pipe determines the baseline width for a safe and maneuverable construction right-of-way. Four baseline construction right-of-way widths should be permitted, based on pipe diameter.

Pipe Diameter (Inches)	Right-of-Way Widths (Feet)
8 to 16[1]	80
18 to 24	95
30 to 36	110
40 to 42	125

GIE believes that these baseline widths should be adopted, with increases or decreases for special conditions. Consideration should be given to the effects of different soils, terrain, construction techniques, and other factors that could play a role in selecting the widths needed to safely construct pipelines.

Use of these baselines will not alter FERC's existing procedures for increasing or decreasing construction workspace at specific locations for special conditions (e.g., wetlands, side hill cuts, stream crossings, etc.). The study recognizes that widths may need to be narrowed in sensitive environmental areas, sites with cultural or historic significance, and densely populated areas.

[1] This baseline width would also be appropriate for pipeline less than 8 inches in diameter.

1.0

Introduction

This study analyzes the basic right-of-way width requirements for the construction of cross-country natural gas pipeline projects in the United States and offers recommendations for right-of-way widths.

1.1 Goals and Objectives

The goal of this study is to analyze and recommend the right-of-way widths needed to construct natural gas pipelines. It is intended to inform the various parties concerned with pipeline projects, such as sponsoring companies, pipeline construction contractors, engineering firms, regulatory agencies, environmental interests, and landowners.

This study analyzes three major issues related to construction rights-of-way: (1) required space for safe operation of equipment and worker safety, (2) environmental impacts due to appropriate right-of-way width, and (3) placement of excavated soil.

Specific objectives are to:

(1) Identify and discuss variables that affect typical construction widths, such as pipe diameter, width of ditch, depth of pipe burial, treatment of topsoil, grade, terrain, equipment use, etc., and determine recommended construction right-of-way widths.

(2) Discuss federal safety requirements for pipeline construction.

(3) Assess the impact on the environment of potential increases in right-of-way widths.

(4) Solicit experience from members of the pipeline industry about right-of-way width requirements. Information was requested from: (1) Natural Gas Transmission Companies, (2) Pipeline Contractors, (3) Environmental Service Firms, and (4) Safety Specialists.

1.2 Background

The U.S. natural gas pipeline industry faces a significant challenge in obtaining sufficient width on the pipeline right-of-way to safely build new cross-country pipeline projects. FERC, which approves federal applications for natural gas pipeline projects, has the difficult task of selecting pipeline projects that will maintain an adequate supply of natural gas in a growing marketplace. At the same time, the commission must minimize the impact of pipeline construction on the local environment and on adjacent landowners.

The Federal Energy Regulatory Commission publication *Upland Erosion Control, Revegetation, and Maintenance Plan* applies to all non-wetland natural gas construction projects. The FERC staff encourages its use for all construction activities. It says:

> The construction right-of-way width shall not exceed that described in the project sponsor's FERC application unless otherwise modified by a certificate condition. However, additional construction right-of-way may be used (subject to compliance with all applicable survey and mitigation requirements) in limited areas for full right-of-way width topsoil segregation or where topographic conditions, such as side-slopes, require it to ensure safe construction. In no case shall the construction right-of-way width exceed 100 feet without the prior written approval of the Director of OPR.

Pipelines are concerned that the baseline construction right-of-way for a medium diameter pipeline may come to be 75 feet, with a limited number of variances up to 100 feet.[2]

Although the narrower baseline is sometimes thought to reduce environmental impacts of pipeline construction, that is not always, or even usually the case in the absence of sensitive environmental areas, cultural, or historic sites and/or densely populated areas. A wider baseline construction right-of-way is consistent with environmental and safety goals and will expedite the certificate process by minimizing the time requirement of sponsors and FERC staff in preparing and evaluating variances.

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[2] U.S. Federal Energy Regulatory Commission, 85 FERC 61, 432, *Order On Rehearing And Issuing Certificate*, CNG Transmission Corporation and Texas Eastern Transmission Corporation, Docket No. CP97-774-001, Washington, D.C., December 23, 1998. *See Also* U.S. Federal Energy Regulatory Commission, 84 FERC 61,345, Revision of Existing Regulations Under Part 157 and Related Sections of the commission's Regulations Under the Natural Gas Act, *Notice of Proposed Rulemaking*, Docket No. RM98-9-000, Washington, D.C., September 30, 1998.

1.3 Technical Approach to the Study

GIE used its professional experience in the pipeline industry to analyze and calculate the different dimensional components that make up the width requirements of a recommended construction right-of-way. GIE calls this method the *Engineering Approach.*

Information was also obtained from three interested groups in the pipeline industry: (1) Natural Gas Transmission Companies, (2) Pipeline Contractors, and (3) Environmental Service Companies. The subjects covered were width requirements, safety, and environmental aspects of pipeline construction.

The Engineering Approach was compared to the width requirements as described by pipeline contractors (*Contractors' Requirements).* A comparison of the two views is given in Section 2.4 and shows that the contractors' practical experience is consistent with good engineering judgement.

Section 2 of the study provides recommended construction right-of-way widths while Section 3 identifies variables that could modify (increase or decrease) the right-of-way width requirements.

Worker safety issues within the construction right-of-way are discussed in Section 4 and the potential environmental impact of construction right-of-way width is analyzed in Section 5.

1.4 Limitations of the Study

This study analyzes the basic right-of-way width requirements for cross-country conventional-type pipeline construction using criteria for a typical pipeline spread. Analysis of construction right-of-way widths or extra workspace for the following conditions is not included in this study.

(1) Road crossings
(2) Railroad crossings
(3) River and stream crossings
(4) Pipe burial depth in excess of 36 inches
(5) Hard rock excavation
(6) Topsoil excavation beyond the ditch and spoil pile areas
(7) Timber storage on the right-of-way
(8) Steep side-slope terrain
(9) Mountains
(10) Major wetland crossings
(11) Marsh construction
(12) Unstable or contaminated soils
(13) Environmentally sensitive areas
(14) Co-location within existing utility corridors
(15) Residential or industrial areas
(16) Pipeline maintenance
(17) Off-sets from existing pipelines
(18) Special environmental or regulatory restrictions
(19) Clearance near structures and utility facilities
(20) Landowner depth requirements
(21) Landowner special topsoil segregation requirements
(22) Groundwater table levels
(23) Frequency of field drainage tile

2.0

Recommended Construction Right-of-Way Width

This section analyzes the basic right-of-way width requirements for conventional cross-country pipeline construction and recommends the use of a series of standard baseline right-of-way widths. Section 2.1 sets out the steps to determine right-of-way width; Section 2.2 establishes a baseline for a typical pipeline construction spread; Section 2.3 uses the Engineering Approach to analyze each component of a typical right-of-way cross-section; Section 2.4 lists the average width requirements needed by contractors; and Section 2.5 compares the Engineering Approach with the Contractors' Requirements.

2.1 Determination of Construction Right-of-Way Width

Decisions about the width of temporary right-of-way for pipeline construction are made at three distinct phases of the Pipeline Construction Project.

The initial decisions about the needed width are made during preliminary project planning when a general route is determined. General conditions are examined and default construction practices are considered.

The second, more refined determination, is made at the time of final routing and bidding of the construction job. Areas of special concern may be identified and widths may need to be adjusted.

The third determination occurs at the time of construction when acute weather and site conditions vary from the planned construction conditions.

The purpose of this report is to define the baseline right-of-way width that can be used for preliminary project planning and identify the localized variables that modify these recommendations.

2.2 A Typical Pipeline Construction Spread

The terms *typical pipeline construction spread* and *typical width requirement* can be misleading because width requirements vary from location to location for any given pipe size and

construction condition. Consequently, this study establishes a baseline definition for what constitutes typical so a frame of reference can be used for discussion.

A typical pipeline construction spread is a unit of equipment and personnel required to construct a pipeline. The modern-day pipeline construction spread is, in essence, a moving assembly line that may consist of 18 separate operations, up to 100 pieces of heavy construction equipment, and hundreds of skilled craftsmen working in unison. These individual operations, each performed by a specially trained crew, usually proceed in a definite sequence as shown in Figure 1. These operations are:

(1) Clearing and grading
(2) River crossings (not included in the study)
(3) Ditching
(4) Stringing pipe
(5) Pipe bending
(6) Pipe set-up
(7) Pipe end preparation
(8) Pipe alignment
(9) Pipe welding
(10) X-ray inspection of welds
(11) Joint coating
(12) Field coating inspection
(13) Bottom padding
(14) Lowering-in
(15) Top padding
(16) Backfilling
(17) Pressure testing
(18) Revegetation and Cleanup

Although a typical pipeline project may not exist, representative criteria, commonly seen on a pipeline construction spread, are defined as follows:

Baseline Construction Right-of-Way Assumptions for Illustrative Purposes

(1) General

- Cross-country pipeline
- Twenty-five mile pipeline
- Upland construction methods
- Pipe cover is 36 inches
- Access to the right-of-way is from an adequate number of secondary roads.
- Weather – temperate with normal rain

(2) Pipe

- Double random lengths – factory coated
- Stick rod welding

(3) Terrain

- Undulating – Approximately 20 percent bending

(4) Land Use

- Timber – 22 percent (3rd growth, 1 to 35 years, hardwood and pine mixed). Timber is salvageable by logging on right-of-way and hauling to local mills. Undergrowth is chipped on the right-of-way.
- Cultivated land – 35 percent
- Pasture – 38 percent
- Wetlands – 5 percent

(5) Soil

- Cohesive soil (clay, fine grained or high clay content – OSHA Type B)
- Soft Rock – 5 percent (diggable - rippable)
- Topsoil segregation is 12 inches deep only over ditch and spoil pile areas.
- Flat right-of-way (no side slope) with a 30 percent "swell" factor on excavated soil.

2.3 Right-of-Way Width Requirements—Engineering Approach

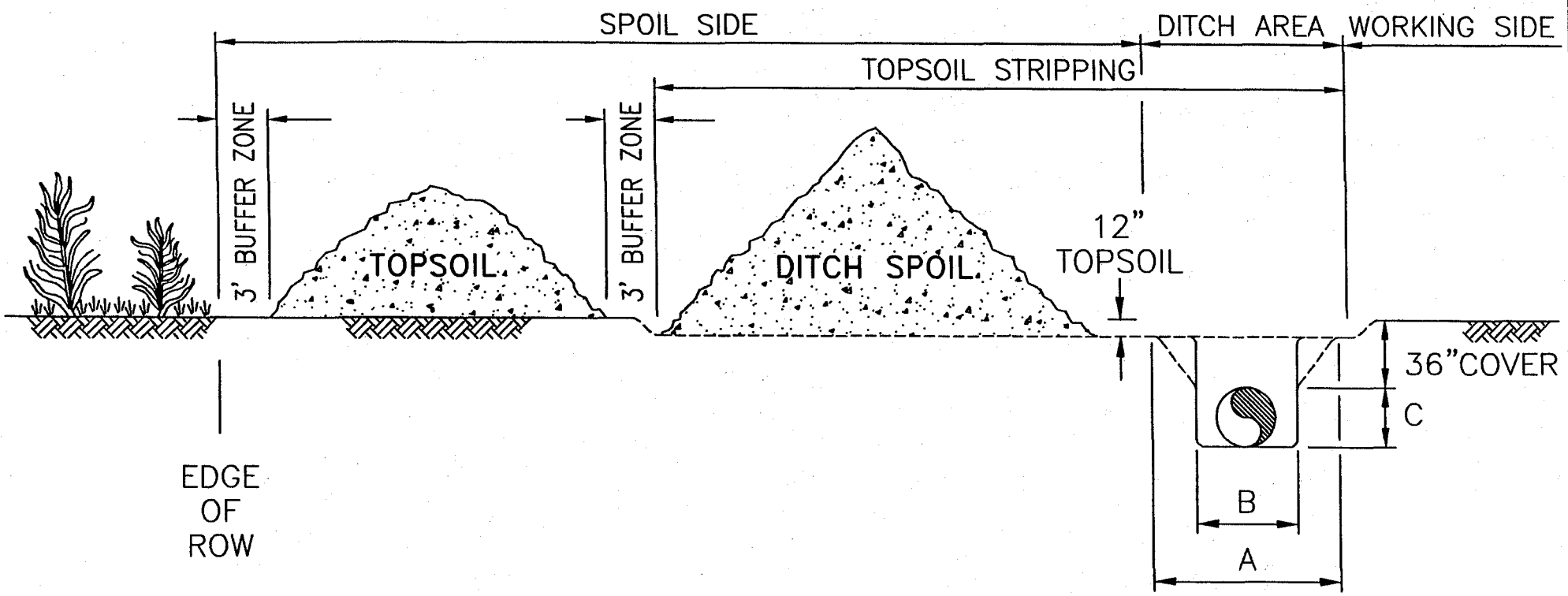
The analysis of width requirements is based on what GIE calls the *Engineering Approach*, that is, the identification and discussion of each component that makes up the cross-sectional dimensions of the right-of-way width. This approach consists of the analysis of each component of the construction right-of-way width from an objective viewpoint. Each dimension given in this approach is based on GIE's past experiences and professional opinion.

The analysis divides the construction right-of-way width into three major components: (1) Ditch Area, (2) Spoil Side, and (3) Working Side. The ditch area is for placement of the pipe; the spoil side is for the temporary stockpiling of excavated subsoil during construction; and the working side is for the construction equipment and crew.

As a result of using the Engineering Approach to analyze construction right-of-way widths, GIE has divided right-of-way requirements into four standard default widths based on pipe diameter groups. See Figures 4 to 7 for the four default widths.

(1) Ditch Area

Pipe ditch—Figure 2 shows a cross-section of the recommended ditch dimensions. The areas required for the pipe ditch are tabulated in the accompanying table. The pipe diameters, ranging from 8 to 42 inches, are divided into four groups based on the size of equipment required to construct the pipeline. In other words, a particular size bucket is used to excavate the ditch for 8 inch through 16 inch pipe, and a different size of bucket is used to excavate the ditch for 18 inch through 24 inch pipe, and so on. The ditch dimensions within each group of pipe sizes (8 inch to 16 inch, 18 inch to 24 inch, etc.) remain the same regardless of the respective pipe diameter.



PIPE DIAMETER	WORKSPACE TO STOCKPILE SPOILS				DITCH DIMENSIONS			TOTAL WORKSPACE FOR DITCH AREA AND SPOIL SIDE
	BUFFER ZONE	TOPSOIL	BUFFER ZONE	DITCH SPOIL	A	B	C	
8" – 16"	3'	10'	3'	14'	6'	3'–4"	16"	36'
18" – 24"	3'	14'	3'	19'	8'	4'	24"	47'
30" – 36"	3'	20'	3'	24'	10'	5'	36"	60'
40" – 42"	3'	20'	3'	29'	12'	5'–5"	42"	67'

NOTES:
1. THIS FIGURE IS NOT DRAWN TO SCALE.
2. DIMENSIONS ARE IN FEET AND INCHES.

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FIGURE 2
CROSS SECTION
RECOMMENDED CONSTRUCTION ROW
DITCH AREA AND SPOIL SIDE

The dimensional requirements of the pipe ditch are directly related to each pipe size and soil conditions, but also are strongly influenced by the terrain and weather. Although pipe diameter is the major factor in determining ditch dimensions, the soil type, which can vary from one location to the next on a single pipeline system, will influence the equipment requirements and the resulting ditch dimensions. Also, the type of equipment used, such as wheel-type ditcher or backhoe, can result in a different ditch configuration.

Ditch area requirements are site specific and can not be assumed to remain constant from one location to another. The area to be ditched should be determined based on OSHA requirements, construction equipment, construction techniques, soil, and the weather conditions likely to be encountered during construction. These factors contribute significantly to variability of right-of-way width.

Ditch calculations – The calculations of ditch area for each pipe diameter group is based on the following conditions:

- The calculation of ditch area uses the largest size pipe in each category.
- The method of excavation is by conventional wheel or boom-type ditcher.
- The dimensions of the pipe ditch are uniform throughout the length of the pipeline.
- The top part of the ditch wall can be sloped back, if necessary, for ditch access.
- The soil is stable and the spoil is considered stackable.
- The clearance between the pipe and the ditch wall is a 12 inch minimum.
- The soil cover over the pipe is 36 inches.

All of the dimensions given in Figure 2 are carried forward to Figures 4 to 7 which show an overall view of the recommended right-of-way widths.

(2) Spoil Side

Spoil is the term used for excavated soil. Figure 2 shows a cross-sectional view of the spoil side of the right-of-way width. The spoil side area, for stockpiling topsoil and ditch spoil, is directly proportional to the quantity of soil materials to be stored and the soil consistency (wet, dry, or sandy).

Topsoil—Before ditching begins, topsoil is removed and stockpiled near the outer edge of the right-of-way. Topsoil removal is normally site specific and may vary in width from only the ditch line to the entire width of the right-of-way, and from a few inches in depth to more than one foot. This study considers the removal of 12 inches of topsoil from the ditch line and ditch

spoil area. Depending on the pipe size, the amount of topsoil stripped will require from 10 to 20 feet for stockpiling.

Ditch spoil—After topsoil removal, the ditch is excavated to the necessary depth for each pipe size and the ditch spoil is stockpiled no closer than two feet to the ditchline, where it is segregated from the topsoil by a three foot buffer zone. Depending on the pipe size, the ditch spoil will require from 14 to 29 feet for stockpiling.

Buffer zones—A three-foot buffer zone is allowed between the edge of the right-of-way and the topsoil, and between the topsoil and ditch spoil. This buffer zone allows for sloughing of soil and avoids mixing of the soil during stockpiling and backfilling operations. Buffer zones increase the right-of-way width requirements.

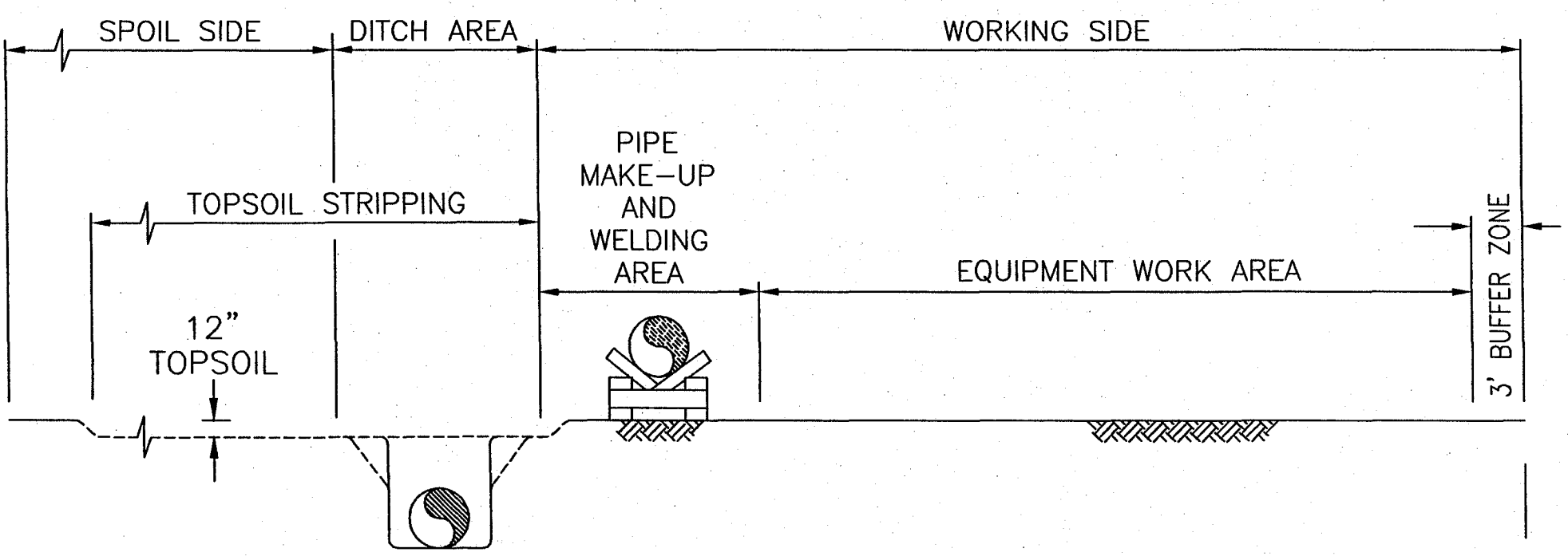
Backfilling—After the pipeline is lowered into the ditch, the ditch spoil is then placed back in the ditch over the pipeline and the topsoil returned to its original location.

Spoil side width—All of the dimensions given in Figure 2 are carried forward to Figures 4 to 7 which show an overall view of the recommended construction right-of-way widths that include the spoil side width.

(3) Working Side

Figure 3 shows the cross-sectional view of the working side of the right-of-way width. This side consists of two separate areas: (1) pipe make-up and welding of the pipe, and (2) access and movement of construction equipment, personnel crews, and materials.

Area for pipe make-up and welding – The area for pipe make-up and welding is parallel and adjacent to the pipe ditch. This area is for pipe laydown, pipe alignment for welding, and the welding operations. The space requirements include a buffer zone between the ditch and the pipe, space for the pipe itself, and operational space for several welders and their equipment. Depending on the range of pipe diameters under consideration, this area will have a width of 10 to 13 feet.



PIPE DIAMETER	PIPE MAKE–UP AND WELDING AREA	EQUIPMENT WORK AREA	BUFFER ZONE	TOTAL WORKING SIDE
8" – 16"	10'	31'	3'	44'
18" – 24"	11'	34'	3'	48'
30" – 36"	12'	35'	3'	50'
40" – 42"	13'	42'	3'	58'

NOTES:
1. THIS FIGURE IS NOT DRAWN TO SCALE.
2. DIMENSIONS ARE IN FEET.

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FIGURE 3
CROSS SECTION
RECOMMENDED CONSTRUCTION ROW
WORKING SIDE

Equipment work area—The area for equipment and crews is parallel and adjacent to the pipe make-up and welding area. While this area is primarily for construction equipment, working crews, supervision, and inspection, it also provides access for safety and environmental monitoring. Most important, this is the designated route for emergency equipment in the event of an accident during construction.

Depending on the range of pipe diameters under consideration, this area will have a width of 31 to 42 feet that includes a 5 foot separation zone for passing and maneuvering of equipment.

The side to side dimensions given in Figures 4 to 7 for each sideboom (or pipe layer) are different because bigger equipment is required to construct larger size pipelines. All of the dimensions given in Figure 3 are carried forward to Figures 4 to 7 which show an overall view of the recommended construction right-of-way widths.

2.4 Right-of-Way Width Requirements-Contractors' Requirements

GIE queried contractors about their recommended width requirements for the pipe ditch, the working side, and spoil side. The information was tabulated and an average construction right-of-way width was determined for the four pipe diameter groups.

The contractors identified the following widths:

Pipe Diameter (Inches)	Right-of-Way Widths (Feet)
8 to 16	80
18 to 24	93
30 to 36	110
40 to 42	121

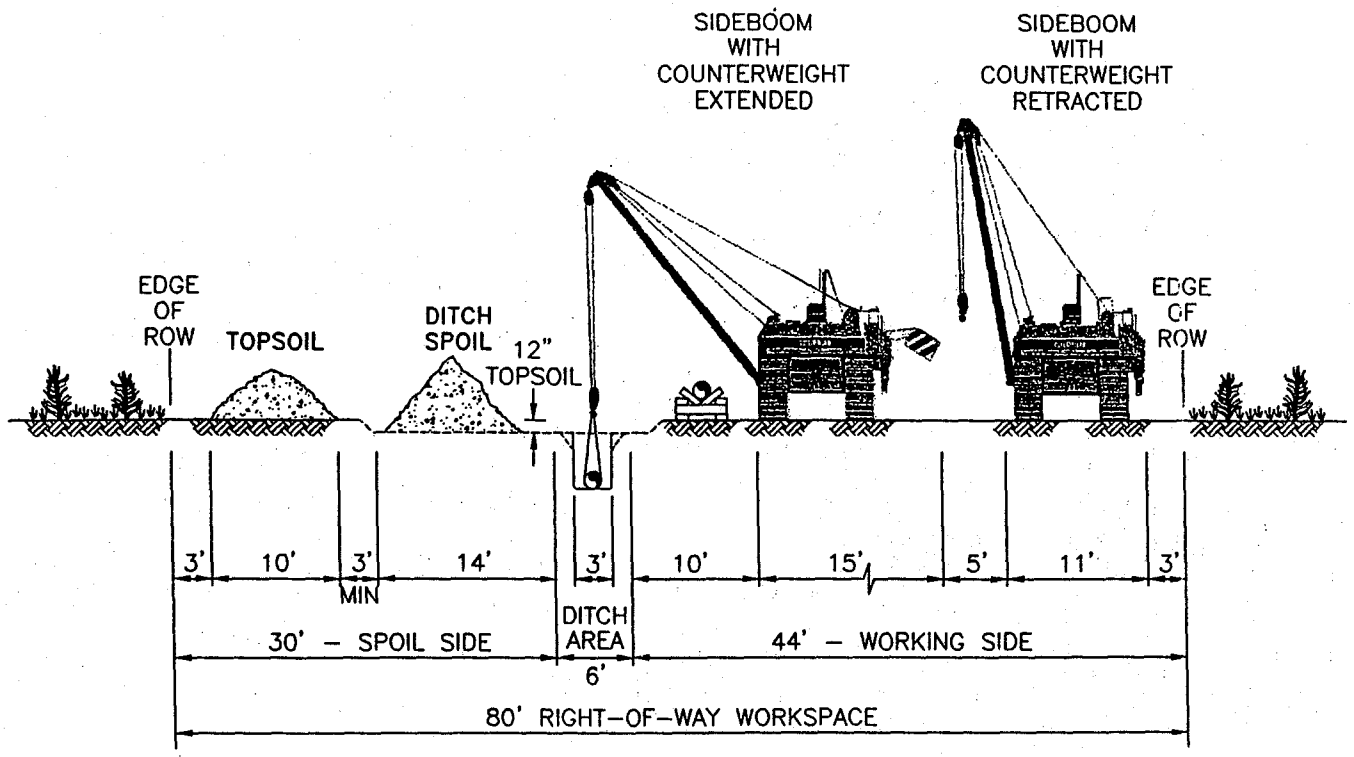
2.5 Comparison of Right-of-Way Width Requirements

A comparison of right-of-way width requirements between the Engineering Approach and Contractors' Requirements are given in Table 1. The width recommended by the Engineering Approach is equal to or minimally greater than the average of widths requested by the contractors. GIE believes that the Contractors' width requirements vary because of individual interpretation of soil conditions and different terrain.

TABLE 1

Comparison of Right-of-Way Width Requirements
Engineering Approach versus Contractors' Requirements

Pipe O.D. Range (in.)	Right-of-Way Width Required by Contractors (Feet) Individual Contractors are listed as A to I										Engineering Approach (feet)
	A	B	C	D	E	F	G	H	I	Average Width	
8 to 16	70	75	84	90	85	80	90	75	75	80	80
18 to 24	80	100	89	95	100	90	100	90	90	93	95
30 to 36	100	127	99	115	110	115	110	100	115	110	110
40 to 42	110	143	118	120	115	125	120	115	125	121	125



0' 5' 10' 15'

SCALE: 1"=10'-0"

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FIGURE 4
CROSS SECTION
OF
RECOMMENDED CONSTRUCTION ROW WIDTH
8" TO 16" PIPE DIAMETER

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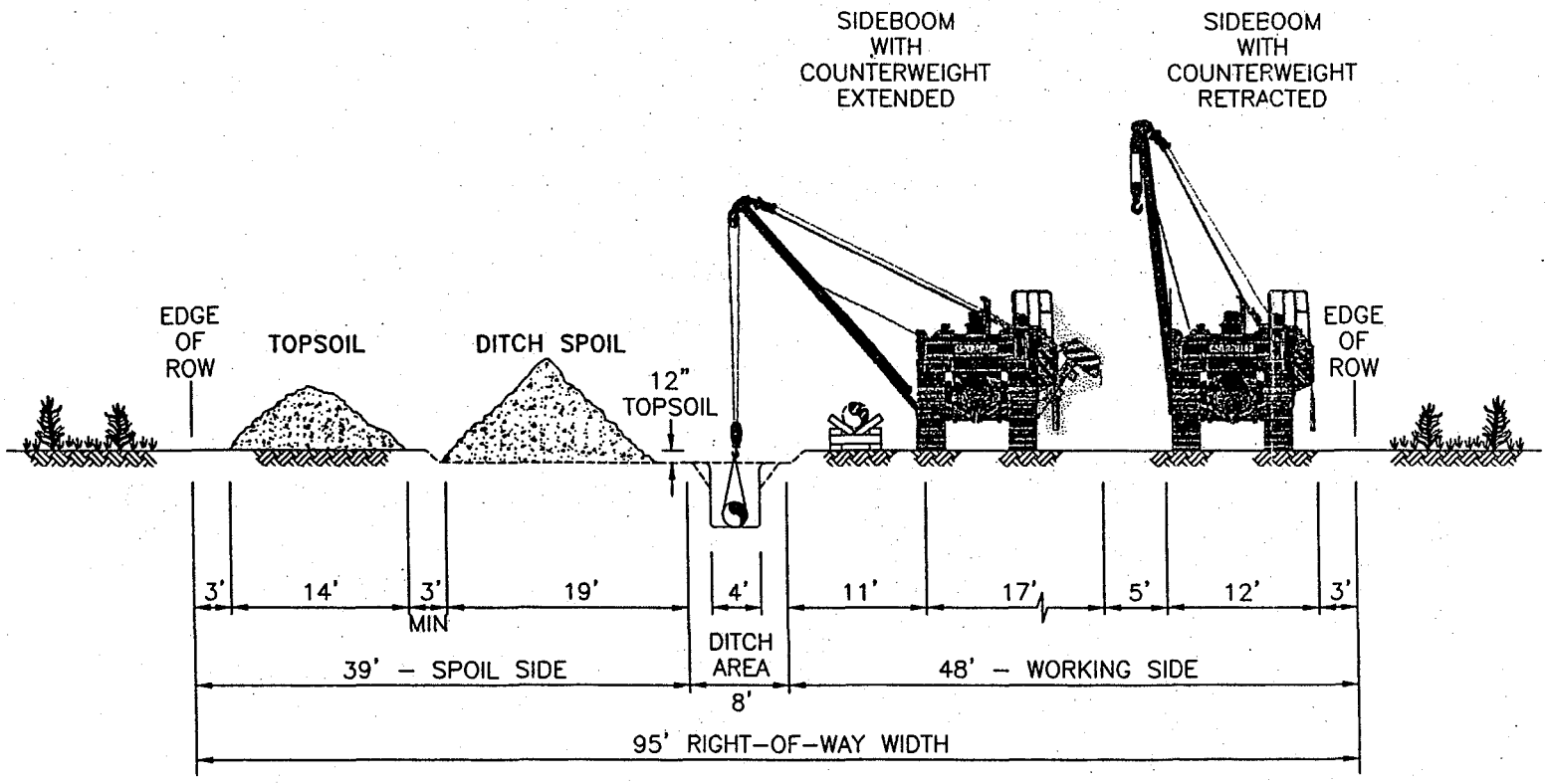

0' 5' 10' 15'

SCALE: 1"=10'-0"

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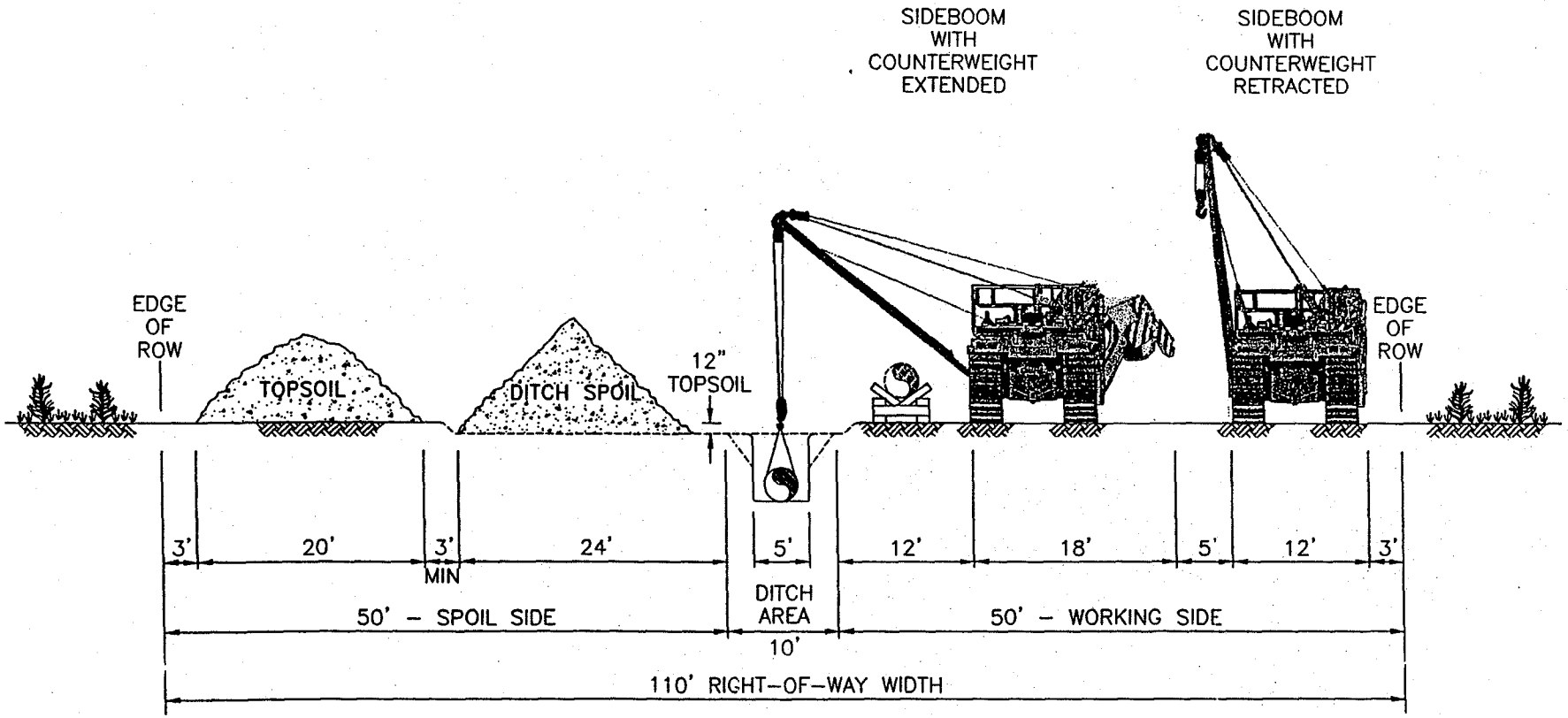
FIGURE 5
CROSS SECTION
OF
RECOMMENDED CONSTRUCTION ROW WIDTH
18" TO 24" PIPE DIAMETER



0' 5' 10' 15'

SCALE: 1"=10'-0"

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FIGURE 6
CROSS SECTION
OF
RECOMMENDED CONSTRUCTION ROW WIDTH
30" TO 36" PIPE DIAMETER

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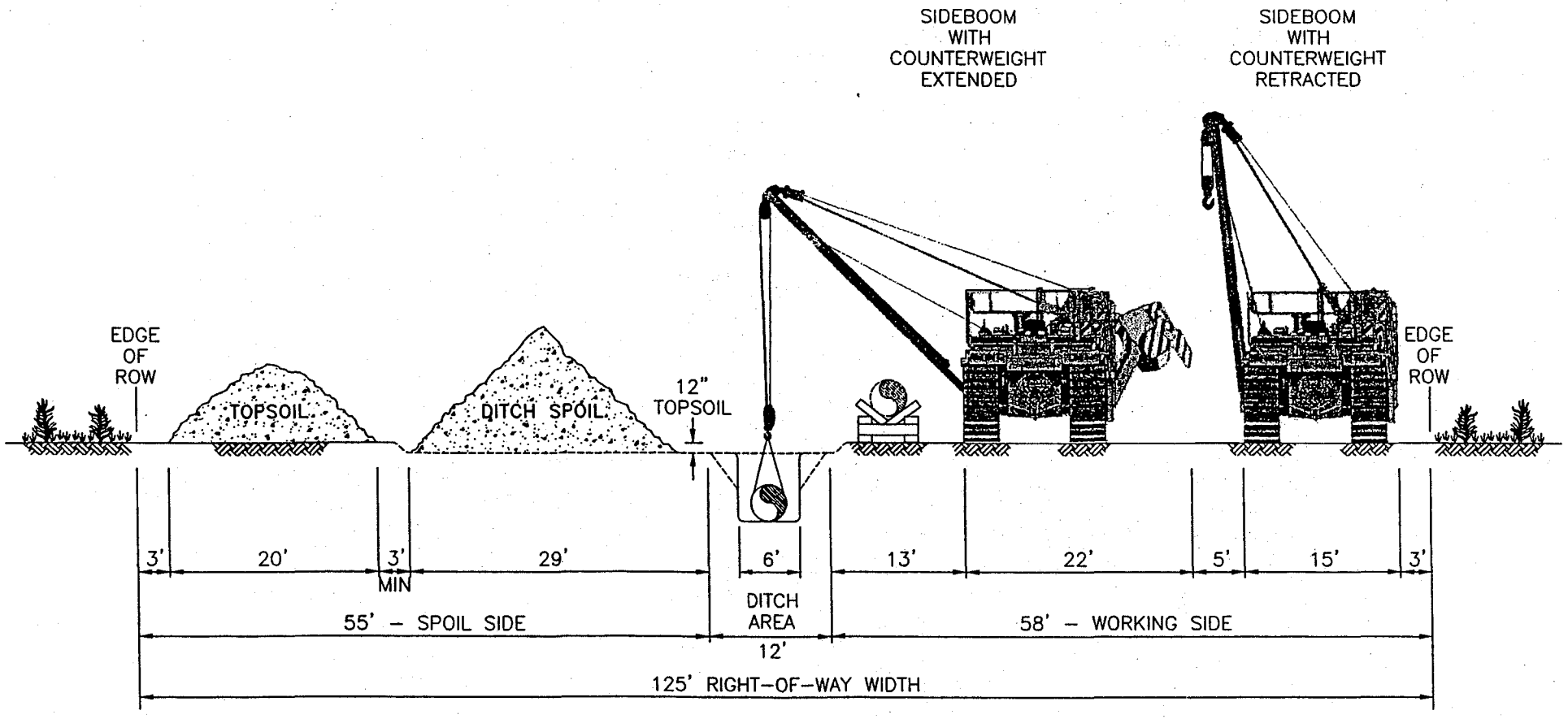

0' 5' 10' 15'

SCALE: 1"=10'-0"

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FIGURE 7
CROSS SECTION
OF
RECOMMENDED CONSTRUCTION ROW WIDTH
40" TO 42" PIPE DIAMETER

3.0

Modifying the Recommended Construction Right-of-Way Width

The recommended construction right-of-way width was discussed in Section 2.0. This section identifies and provides a brief discussion of variables that could possibly modify the recommended right-of-way width.

3.1 Variables that Affect Right-of-Way Width

Major variables that can increase or decrease the typical construction right-of-way are:

(1) Environmental, Cultural, Archeological
(2) Design Considerations
(3) Terrain
(4) Soils and Rock
(5) Landowner Requirements
(6) Construction Plans
(7) Special Construction Work Areas
(8) Uncertainties

Table 2 shows how each major variable was subdivided for purposes of discussion and summarizes the impact of each variable on the construction right-of-way width.

(1) Environmental, Cultural, and Archeological

New pipelines are carefully routed to avoid land areas of special environmental, cultural, and archeological significance. Alternate routes are identified that route the pipeline around special use lands, residences, and public areas that add many miles to the straight-line distance between the origin and destination point of the pipeline. Project sponsors take great care and assume considerable additional expense to route a pipeline, but in some cases even the least intrusive alternate route will pass through special land use areas.

(2) Design Considerations

Pipe diameter – Pipe diameter is the major determinant of the width of the ditch. The diameter of the pipe determines the amount of ditch excavation material and the type and size of the construction equipment needed, and therefore has a direct relationship to the increase or decrease of the construction right-of-way width.

Pipe depth—The depth of the pipeline affects the amount of excavated material to be removed and stockpiled during pipeline construction. Increased pipeline cover requirements, as may be required on agricultural land and steep terrain, would increase the spoil side and overall width of the construction right-of-way.

(3) Terrain

Undulating alignment profile—Pipeline construction normally takes place on a reasonably leveled construction work area to permit the movement of equipment onto and along the right-of-way. Undulating topography requires the leveling of high areas to create a more uniformly leveled construction right-of-way. This process may result in increased movement of soil and the need for stockpiling along the right-of-way.

Alignment grade—The right-of-way must be reasonably level to accommodate the efficient and safe movement of construction equipment and materials during pipeline construction. Ditching on severe inclines or steep grades may not require special pipeline construction equipment, just more of it. A common technique is to use cables to tie the working backhoe or ditcher to several tow tractors positioned at different levels along the right-of-way above it. Tension on the cables enables the excavation equipment below to hold the position for efficient digging. These tractors gradually tow the excavation equipment up the grade as ditching progresses. The increased complexity required for this pipeline construction approach on steep mountainous inclines typically increases the construction right-of-way width.

Side slope grade—The high point of a steep side slope is cut and sloped to provide a level working surface for the right-of-way. The cut soil material is either stockpiled or used to fill in nearby low points in undulating terrain. Most of the soil produced by the side slope cut is not suitable as backfill material. Therefore, steep side slopes increase the construction right-of-way width.

(4) Soil and Rock

Soil and rock type—The soil type and the physical characteristics of excavated soil materials determine their performance during pipeline construction and affect ditch design.

Consolidated rock and very cohesive stable soils result in a vertical wall ditch and less excavated material. Noncohesive, unstable, organic, and sandy soils create large spoil piles, and may result in a sloping wall ditch.

The organic and moisture content of soils assumed to exist in the right-of-way during the preliminary design and construction planning phases can differ from that found during the actual construction phase. Stockpiled soils with greater organic and less cohesive material than originally assumed tend to be weaker and do not allow for maximum stockpiling height.

If the ditch soils are wet, the ditch walls become unstable and slough, further limiting the remaining workspace for construction activities. Therefore, the type, characteristics, and condition of soil materials found during excavation for the pipeline will increase construction right-of-way width. Excavated soils may "swell" (increase) in volume by as much as 30 percent.

Soil and rock depth—The depth of topsoil and subsoils and rock removed during pipeline excavation activities determine the volume, area and width of the stockpile along the right-of-way.

Rock disposition by stockpiling—Rock removed by blasting is normally not acceptable as a backfill material until it is reduced in size. When rock is encountered during pipeline construction, and its immediate removal from the right-of-way is not required, the rock is separated from topsoil and subsoils and stockpiled, normally increasing the construction right-of-way width.

Soil segregation requirements—Pipeline construction contractors recognize the value of soil resources and make a concerted effort to implement soil conservation practices during pipeline construction. On cultivated areas, an initial shallow soil stripping operation run is performed to remove only the topsoil. This technique, known as *topsoiling*, places the topsoil in a spoil bank separate from the rest of the ditch excavation material. Later during backfilling, the valuable topsoil and other excavation spoil can be replaced in their original positions.

The removal, segregation, and stockpiling of topsoil in agricultural land across the entire right-of-way is used to minimize impact on topsoils. However, these special soil conservation measures increase the construction right-of-way width.

Topsoil segregation in some areas along the selected route of a pipeline is not required, resulting in only one spoil pile and, therefore, a decrease of the construction right-of-way width. Occasionally, lower topsoil material is uniquely different from the surface topsoil, requiring additional topsoil segregation.

Special erosion control requirements—The use of conventional erosion control methods, such as silt fences and hay bales, on moderately sloped agricultural land during mildly wet weather is a required practice. However, in steep sloped terrain, the use of runoff diversion ditches and other specialized erosion control methods may increase the construction right-of-way width.

(5) Landowner Requirements

Construction through narrow corridors bounded by structures—Occasionally it is necessary to route a pipeline through a congested and densely populated residential, commercial or industrial area. In these areas, special restrictions on construction right-of-way work activities may be imposed and result in a decreased right-of-way width. The decrease in construction right-of-way width in these areas may require longer staging areas outside the constrained area.

Timber disposition by stockpiling—Contract specifications, state and local regulations, and property owner requirements, all affect the nature of the disposal of the brush and timber encountered on the right-of-way. It is very common to clear the right-of-way by cutting large trees, saving large marketable timber for the property owner by sawing into usable lengths, and stacking the logs at various locations along the right-of-way. The temporary stockpiling of timber for the property owner increases the construction right-of-way width.

(6) Construction Plans

Inadequate temporary access roads—Planning adequate access roads is shared between the contractor and the pipeline company. The project sponsor is responsible for securing the land on which to build a proposed pipeline. Existing roads that intersect the right-of-way are the usual means for access to the pipeline. In the absence of existing roads, special access roads, known as shooflies, must be constructed to link the right-of-way with the existing roads. An inadequate number and improper location of temporary construction access roads requires the contractor to consider the movement of men and equipment using turnaround areas along the pipeline right-of-way. The inadequacy of temporary access roads and the resulting need for turnarounds typically increases the construction right-of-way width.

Automatic welding method—The typical welding method for most pipeline construction is manual stick-welding. As weld joint metal deposition rates become significant for large diameter pipelines, semiautomatic and automatic welding methods may be employed. The use of large automatic welding machines and the handling sideboom will require more construction workspace as compared to the typical workspace requirements of stick-welding. The semiautomatic or automatic type of welding method may increase the construction right-of-way width. However, the benefits of automatic welding, such as fewer contractor personnel and fewer repairs, can offset the impact of a wider right-of-way.

(7) Special Construction Work Areas

A FERC application for a pipeline project requires the development of site specific work plans that show extra workspace for situations such as steep side slopes, wetlands, bodies of water, roads, railroads, and aboveground facilities. Extra workspace areas for these special construction activities are in addition to the baseline determination of the typical pipeline construction right-of-way width.

Foreign structure— The type and relative location of a pipeline, utility, or other structure, above or below ground, either parallel or crossing the new pipeline, typically requires additional construction workspace.

A crossing structure typically requires additional workspace. Additionally, when the proposed pipeline is parallel to an existing belowground pipeline, utility, or other structure, less new permanent right-of-way is added to the existing permanent right-of-way, and some of the new construction right-of-way overlaps the existing right-of-way. However, the construction complexity of the new pipeline generally increases. The existence of a parallel, belowground foreign structure typically requires additional construction workspace beyond that which is available within a typical construction right-of-way width.

The owner of another pipeline, utility, or structure may impose a special minimum horizontal or vertical separation distance between the proposed pipeline and the existing structure to assure their integrity during the new pipeline construction and later during long term operations. The owner may also prohibit any new pipeline construction within the existing permanent operating right-of-way of the other pipeline, utility, or other structure. The minimum horizontal or vertical separation distance may increase the proposed new pipeline construction right-of-way width.

Surface land use classification—Current land use can have a major impact on specific regulatory and landowner requirements for pipeline construction and often establishes the soil conservation procedures to be used.

For example, the conservation of soils across agricultural farmland requires topsoiling. Timber from woodlands may need to be stockpiled for the landowner along the right-of-way. A pipeline planned through a narrow residential, commercial or industrial corridor may encounter limited or restricted widths. Therefore, the type of land use may increase or decrease the construction right-of-way width.

Construction through wetlands—The routing of a pipeline through wetlands challenges the pipeline contractor to employ special construction methods and techniques to minimize environmental impact.

Conventional cross-country upland construction techniques have been used historically to cross wetlands during dry and semi dry conditions. However, wet and saturated surface conditions often require additional measures to assure the safe movement of men and equipment along the right-of-way. Wooden mats composed of large timber boards have been used for the effective and safe movement of construction equipment and workers. In cold northern climates, freezing winter weather conditions allow the movement of pipeline construction equipment over a frozen ground surface resulting in reduced environmental impact.

Alternative construction methods can be used to reduce construction impact on the environment. The INGAA Foundation, for example, has funded research on potential environmental impacts associated with horizontal directional drilling at watercourse crossings. The project also produced software to help select alternative watercourse crossing methods.[1]

(8) Uncertainties

Unknown underground structures—During planning for pipeline projects, various field surveys of aboveground and belowground utilities are performed. The field surveys are intended to identify the various pipelines, utilities, and other structures in close proximity to the proposed pipeline, so pipeline crossings, or a parallel design plan, can be developed. However, even after the best survey work is completed, some underground structures, such as clay drainage tiles in agricultural farm land, cannot be identified before beginning the pipeline construction. The frequency of drainage tile may increase the right-of-way width requirements.

Unexpected inclement weather— The onset of severe weather, such as rain and near or below freezing temperatures, may result in the need for more right-of-way width. If prolonged rains saturate the ground, efficient movement of construction equipment and workers is more difficult, and spoil piles spread out.

3.2 Special Work Areas

The following special situations normally require extra workspace, staging areas, and aboveground facilities in addition to those normally available within the typical pipeline construction right-of-way width.

Other Extra Workspaces

- Roads and highways
- Railroads
- Water Crossings - creek, stream, river, or lake

[1] Golder Associates, Ltd., *River and Stream Crossings Study, Executive Summary and Crossing™ Stream Crossing Decision Support System,* Beta-Version 1.0 Software and Topical Report (INGAA Foundation) 1998.

- Wetlands
- Special pipeline construction areas (fabrication, testing, tie-ins, branch laterals, etc.)

Staging Areas

- Contractor mobilization/demobilization and staging areas
- Pipe storage, coating and staging areas
- Material warehouses and storage yards
- Bending machine set-up

Aboveground Facilities

- Compressor stations, metering and regulation stations, scraper trap facilities, and valve sites

3.3 Regulatory Modifications

Even the most carefully planned projects will encounter situations along the pipeline route that necessitate a change in the construction right-of-way granted in the certificate. Information on field conditions may be limited because the sponsor lacks access to the property before the certificate is issued. The project sponsor may need to request somewhat more right-of-way to avoid potential problems encountered in the construction phase.

There are numerous circumstances that will require modification of basic width requirements. FERC permits pipelines to request a variance in workspace based on the site specific conditions. Variance requests must include construction drawings and present a rationale/justification for the requested change. GIE's recommended baseline construction widths will not change FERC's variance procedure; however, it would significantly reduce the potential number of variance requests required for future projects if a construction right-of-way of 75 feet were to become the "rule-of-thumb" in the future.

TABLE 2

Engineering Variables that Affect Construction Right-of-Way Width

Variable	Decrease Width	Increase Width	*Extra Work Space
1. Environmental, Cultural, and Archeological	X		X
2. Design Considerations			
Pipe Diameter (Included in the Recommended Width)	X	X	
Pipe Depth (Included in the Recommended Width)	X	X	
3. Terrain			
Undulating Alignment Profile		X	X
Alignment Grade		X	X
Side Slope Grade		X	X
4. Soils and Rock			
Soil and Rock Type	X	X	
Soil and Rock Depth	X	X	
Rock Disposition by Stockpiling		X	X
Soil Segregation Requirements	X	X	X
Special Erosion Control Requirements		X	
5. Landowner Requirements			
Construction Through Narrow Corridors Bounded by Structures	X		
Timber Disposition by Stockpiling		X	X
6. Construction Plans			
Inadequate Temporary Access Roads		X	
Automatic Welding Method		X	
7. Special Construction Work Areas			
Foreign Structure			X
Surface Land Use Classification	X	X	X
Construction Through Wetlands	X	X	X
8. Uncertainties			
Unknown Underground Structures-Frequency of Tile	X	X	
Unexpected Inclement Weather		X	

* Extra workspace (area outside the main right-of-way) is required along the construction right-of-way where specialized equipment and crews install pipe at crossings or congested areas, such as overhead utility structures and parallel underground structures. Extra workspace is not evaluated or discussed in this study.

4.0

Considerations for Worker Safety

Responses to the study questionnaires indicated that there are mounting concerns among pipeline construction and safety personnel that unnecessarily restricted workspace may be inconsistent with federal and state safety laws. A safe work site must be the responsibility of all parties involved in a pipeline project from engineering planning, regulatory review, and pipeline construction. Federal and state worker safety laws (work in confined or limited spaces) affect the amount of construction right-of-way needed.

4.1 Major Federal Regulations for Safety in Pipeline Construction

At present all construction activities in the United States are governed by the Code of Federal Regulations Title 29, Part 1926 (29 CFR 1926). Certain sections of this code have a direct effect on the construction methods employed by individual contractors in order to minimize risks to worker safety.

The following is a list of sections of the code that are relevant to pipeline construction methods and associated safety issues.

Subpart D - Occupational Health and Environmental Controls
Section 1926.50 - Medical Services and First Aid

Subpart F - Fire Protection and Prevention
Section 1926.150 - Fire Protection

Section Subpart H - Materials Handling, Storage, Use, and Disposal
1926.250 - General Requirements for Storage

Subpart N - Cranes, Derricks, Hoists, Elevators, and Conveyors
Section 1926.550 - Cranes and Derricks

Subpart P - Excavations
Section 1926.651 - Specific Excavation Requirements
Section 1926.652 - Requirements for Protective Systems

4.2 OSHA Compliance Issues Created by Right-of-Way Width

Sections or subparts of sections listed in Section 4.1 are cited and discussed to show how compliance is hindered by limiting pipeline construction right-of-way widths.

Section 1926.50, Paragraph (b): Provisions shall be made prior to commencement of the project for prompt medical attention in case of serious injury.

Narrow right-of-way widths can limit a clear passage along the construction right-of-way for medical emergencies and place the construction contractor in potential violation of the law.

Section 1926.150, Paragraph (a): General requirements.

(1) The employer shall be responsible for the development of a fire protection program to be followed throughout all phases of the construction and demolition work, and he shall provide for the fire fighting equipment as specified in this subpart. As fire hazards occur, there shall be no delay in providing the necessary equipment.

(2) Access to all available fire fighting equipment shall be maintained at all times.

Narrow right-of-way widths can reduce or eliminate a clear passage along the construction right-of-way for response to fires and place the contractor in potential violation of the law.

Section 1926.250, Paragraph (a): General.

(1) All materials stored in tiers shall be stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling or collapse.

(4) When a difference in road or working levels exist, means such as ramps, blocking, or grading shall be used to ensure the safe movement of vehicles between the two levels.

Section 1926.250, Paragraph (b): Material storage.

(8)(ii) Lumber shall be stacked on level and solidly supported sills.

(8)(iii) Lumber shall be so stacked as to be stable and self-supporting

(9) Structural steel, poles, pipe, bar stock, and other cylindrical materials, unless racked, shall be stacked and blocked so as to prevent spreading or tilting.

Restrictive workspace creates a tension with these rules for safe storage of construction materials (pipe, heavy timber, large valves, blasted rock, and ditch spoil).

Section 1926.250, Paragraph (c): Housekeeping.

(1) Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire, explosion, or pest harborage. Vegetation control will be exercised when necessary.

Good housekeeping may become impossible due to restricted workspace.

Section 1926.550, Paragraph (a): General requirements.

(1) The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks.

(19) All employees shall be kept clear of loads about to be lifted and of suspended loads.

Restricted workspace may make safe personnel clearances from cranes, track hoes, sidebooms, and hoisting trucks difficult to achieve.

Section 1926.651, Paragraph (a): Surface encumbrances.

All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

Section 1926.651, Paragraph (e): Exposure to falling loads.

No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials.

Section 1926.651, Paragraph (j): Protection of employees from loose rock or soil.

(2) **Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.**

Positioning, placing, or keeping equipment and construction materials at least 2 feet from the edge of open trenches (including pipeline ditches) is difficult or impossible when there is insufficient workspace.

Section 1926.652, Paragraph (b): Allowable configurations and slopes.

(1) ***Option (1)—Allowable configurations and slopes)*** **(i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal)...**

If side wall retaining devices cannot be installed and/or maintained at all times for vertical wall ditches greater than 60 inches in depth, then the ditch wall height in excess of 42 inches must be sloped back to an angle, not less than 34 degrees from the vertical. Depending on depth, this regulation could substantially widen the mouth of the pipeline ditch. To obtain and/or maintain proper sloping may become impossible with restricted right-of-way width. Granted, there are many other ways to protect workers from cave-ins during tie-ins, but they require much more time, effort, and resources than proper sloping.

The above safety regulations are just a few of the OSHA Construction Standards contained in 29 CFR 1926. These specific regulations are most likely to affect construction for right-of-way widths.

4.3 Safety Perspective

Individual worker safety is paramount to the success of the project. Workplace safety is all of the following:

- Reduction of serious injury and fatal accidents
- Good business practice
- Required by most companies both large and small
- Regulated by federal and state law
- Enforced by many federal and state agencies

While much progress has been made in the area of pipeline construction safety, this study proposes that worker safety issues receive full consideration with potential environmental impacts and land take issues. Limiting pipeline construction right-of-way widths must be carefully balanced for safe, workable pipeline construction.

5.0

Potential Environmental Impact of Increased Construction Right-of-Way Width

This section addresses the potential changes in overall environmental impact as the result of an increase in the width of pipeline construction rights-of-way. It addresses the impact of a temporary construction right-of-way on the environment. The impact of permanent right-of-way is addressed in FERC regulations, federal, state, and local permit and certificate guidelines.

Additional construction right-of-way width on some pipeline construction projects can be environmentally favorable, not only to pipeline companies and their construction contractors, but also from the perspective of environmental and regulatory reviewing agencies. In addition, a small increase in the construction right-of-way width provides a needed margin of worker safety with little additional impact on the environment.

The right-of-way widths recommended in this study will provide for optimum construction efficiency and thereby reduce construction time. This means less risk of weather interference, quicker stream and wetland crossings and less soil compaction.

5.1 Positive Impacts Associated with Pipeline Construction

It can be demonstrated that additional construction right-of-way width does not proportionally or even necessarily, increase overall environmental impact. While the potential positive environmental impacts of new pipeline construction are seldom recognized, some well established benefits are listed below.

- Forest fragmentation (known to help control/prevent the spread of forest destroying insects, wild fires, and certain plant diseases)
- Creation of new border areas (favored by many forage fauna)
- Removal of undesirable or non-native plant communities
- Improved bio-diversity of local habitats
- Opportunity for new plant and animal recruitment
- Opportunity to restore degraded wetlands
- Habitat management and fire protection access into remote areas
- Desirable changes in soil mix or compaction

5.2 Actual Impact of Increased Temporary Construction Right-of-Way Width on the Environment

The following assumptions are made to establish a technical basis for discussing additional environmental impact that might result from the granting of a wider pipeline construction right-of-way:

- A sponsor is planning to install a 36 inch pipeline with a 90 foot right-of-way. During the planning and preliminary engineering phase, it is discovered that additional temporary construction right-of-way width is required for safe operations. The project sponsor decides to increase the right-of-way width from 90 feet to the 110 feet recommended in this study. Table 3 lists the potential environmental impacts and their significance if the right-of-way were increased. A brief discussion of the significance of the additional environmental impact is given after Table 3.

- All potential environmental and socioeconomic impacts have been identified, assessed and deemed acceptable or mitigatable for this particular pipeline construction right-of-way.

In addition, it is assumed that within the 25 mile baseline construction right-of-way segment, as described in Section 2, specific construction right-of-way conditions already exist. These conditions are as follows:

- Baseline environmental data reveal no extremely sensitive habitats, critical wetlands, threatened or endangered species, highly prized forest or other vegetation and no prized or unique farmland near the proposed right-of-way.
- The local environment has been disturbed or modified in the past by agricultural land clearing and routine harvesting of forest resources.
- The animal and plant communities disturbed or fragmented by the pipeline right-of-way are similar to those found on adjacent land.
- Proper construction methods and restoration techniques have been carefully selected and fully developed and cleanup and restoration of the right-of-way will occur as planned.

Several major types of environmental effects would have to be identified and assessed in order to determine what the real extent of increased impact would be from the granting of a wider pipeline construction right-of-way.

Table 3
Environmental Impact Increases
Due To
Increased Pipeline Construction Right-of-Way Widths

Potential Environmental Impacts	Significance of Impact					
	Forested Areas	Lower Vegetation Areas	Pasture & Range Land	Cultivated Farm Land	Rivers & Streams	Wetlands
Increases visual impact	MIN	MIN	INS	NN	MIN	MIN
Reduces air quality	NN	NN	NN	NN	NN	NN
Increases noise level	NN	NN	NN	NN	NN	NN
Reduces water resources quality	INS	INS	INS	INS	1-20%	1-20%
Increases disruption of lower vegetation	INS	1-20%	INS	NN	MIN	1-20%
Increases deforestation	1-20%	MIN	NN	NN	1-20%	1-20%
Increases forest fragmentation	INS	INS	NN	NN	MIN	1-20%
Increases opportunity for soil erosion and sedimentation	1-20%	1-20%	1-20%	1-20%	1-20%	1-20%
Changes local drainage patterns and area hydrology	NN	NN	NN	NN	1-20%	1-20%
Changes in soil chemistry and compaction	MIN	MIN	MIN	MIN	MIN	1-20%
Disturbances of animal and plant community structure	1-20%	1-20%	MIN	NN	MIN	1-20%
Chemical, fuel and oil spills	INS	INS	INS	INS	INS	INS
Reduces recreational opportunities	MIN	MIN	NN	NN	1-20%	MIN
Increases opportunities for public intrusion into more remote areas	NN	NN	NN	NN	MIN	NN

Notes:

1. This matrix lists the significance of additional impacts on different elements of the environment due to an increase (up to 20 percent) over a baseline pipeline construction right-of-way width.

2. "Increased Right-of-Way Width" means up to 20 percent additional width over a baseline pipeline construction right-of-way width.

3. INS - Insignificant
   MIN - Minimum
   NN - None
   1-20% - This means that the impact is directly proportional to the percent increase of the pipeline construction right-of-way width.

Increases visual impact—As with many areas of socioeconomic impact analysis, visual impacts can be very individualized and subjective, and may vary considerably. Viewer sensitivity is usually governed by the proximity of industrial activities and the degree of viewer interest in the scenic qualities of the local landscape.

The impact on visible resources is determined by major changes to the natural environment along the baseline construction right-of-way width. In other words, once construction is underway the average viewer would not discern differences between 90 feet and 110 feet where visual impact alone is concerned.

Reduces air quality—Project specific short-term air pollution may directly cause nuisance and health risks to local animal, plant, and human populations. Pollution of the surrounding air along the baseline construction right-of-way would originate from the use of trucks, heavy equipment, and certain construction materials or procedures used to construct the pipeline. Since no additional use of equipment and materials would be associated with increases in width of the construction right-of-way, there would be no incremental reduction in short-term air quality due to increasing temporary construction right-of-way. Indeed, effects on short-term air quality would be reduced by speedier and more efficient construction.

Increases noise level—Although not an obvious threat to public health, noise pollution affects a local community. An acceptable noise level has already been decided for the baseline construction right-of-way width, and noise levels would not increase due to requesting and granting a wider construction right-of-way. Adequate right-of-way width may decrease the number of access roads required by the construction site, thereby decreasing the off right-of-way traffic and disturbance.

As with air quality, noise level could decrease if the increased width of the right-of-way results in better maneuverability and less vehicle time spent on the right-of-way. This may be true even if there is additional clearing and cleanup that is required.

Reduces water resources quality—In public opinion polls, water is noted by many residents of the United States as the most important environmentally sensitive natural resource. In a pipeline construction project, the possibility of water resource contamination is most likely during land clearing and excavation activities. These activities occur during a brief time window in the construction process with remediation and restoration activities soon following. Speedy and efficient pipeline construction will decrease the probability of adverse impacts on water quality.

Increases disruption of lower vegetation—The analysis of impact caused by direct loss of vegetation will depend greatly on the value of the vegetative community that maybe destroyed. If the vegetation is common and unremarkable, the effects of clearing can be rated as acceptable in most cases, since the very same vegetation will reestablish itself during the first growing season from root stock and seeds left behind.

If the lower vegetation along the baseline construction right-of-way is listed as common and unremarkable and, in some cases, undesirable, as the vegetation would be part of an emergent ecosystem, the only real issues remaining are visual, erosion control, and wildlife habitat. From a visual standpoint, additional construction right-of-way width would be basically unnoticed by the average observer.

If wildlife is utilizing vegetation in the area as habitat or supporting habitat, then a percentage reduction in habitat would occur. The cumulative effect of lower vegetation being temporarily destroyed on the additional construction right-of-way requested would, in most cases, be negligible.

Increases deforestation—The basic model assumes that only 22 percent of a 25 mile cross-country pipeline construction right-of-way would contain a modified ecosystem, consisting of southern pine and mixed hardwood forest. Since deforestation will have to occur on the baseline construction right-of-way width, then only the effects of additional construction right-of-way width would have to be considered. The overall effect of additional width may be reasonably acceptable.

Where there is third generation growth, modified ecosystem type forest is considered a renewable natural resource by the landowner and can be exploited for economic gain in some future year. The effect of cutting now or later further reduces the potential long term environmental impact to a very acceptable level when viewed against the benefits (safety and decreased time on the right-of-way) of additional construction right-of-way width.

Increases forest fragmentation—As noted above, the baseline model assumed that only 22 percent of a 25 mile cross-country pipeline construction right-of-way would contain a modified ecosystem type consisting of southern pine and mixed hardwood forest. Since forest fragmentation will have to occur on the width of the baseline construction right-of-way, only the effects of additional construction right-of-way width would have to be considered from a forest fragmentation standpoint. When considered against the cumulative effect of forest fragmentation along the baseline right-of-way width as a whole, the overall effect of additional width may be reasonably acceptable. Since the construction process is temporary, mitigation measures can be implemented to lower the permanent impact of fragmentation.

Increases opportunity for soil erosion and sedimentation—The assessment of potential impacts related to soils, erosion, and sedimentation is significantly interrelated to other areas of impact assessment, particularly that of water resources. A specific level of erosion control, resulting in little or no soil sedimentation, has already been decided for the baseline construction right-of-way and would be simply carried forward with an increased right-of-way width. To the extent that construction is speedier, increased construction right-of-way width may reduce the probability of soil erosion and sedimentation.

Changes local drainage patterns and area hydrology—The assessment of potential impact related to drainage patterns and area hydrology is significantly interrelated to other areas of impact assessment, particularly that of water resources, soils, erosion and sedimentation, and many of the same conclusions apply here. A specific level of change in drainage patterns and area hydrology, resulting in little or no negative long term impact, has already been decided for the baseline construction right-of-way. Therefore, the additional changes to drainage patterns and area hydrology would not increase significantly, if at all, due to the granting of additional construction right-of-way width.

Changes in soil chemistry and compaction—Land clearing (removal of vegetation), grading, and trenching can all cause displacement and mixing of the construction right-of-way soils. This can cause both desirable and undesirable changes in soil chemistry and compaction. Careful topsoil segregation and other soil excavation techniques in agricultural lands can reduce to a minimum, the risk of negative impact. A wider construction right-of-way reduces the probability of soil compaction and changes in soil chemistry by distributing traffic loads and permitting more efficient soil separation.

Disturbance of animal and plant community structure—The project environmental analyst must become familiar with the communities of wildlife and lesser vegetation expected to be present within particular ecosystems within the project area. For a pipeline construction right-of-way, it is important to assess and note if land within the right-of-way limits is the same as, or different from, adjoining lands. The results of this analysis are used to develop a scenario of basic impact expected on the original baseline construction right-of-way. This can then be used for comparison, if construction is spread over a slightly wider construction right-of-way.

If in the originally proposed construction right-of-way, disturbance of animal and plant communities is rated as *low*, then additional construction width would introduce a negligible increase in the overall impact. However, if the disturbance in the original is rated as *high*, then the increased disturbance would need to be considered.

Chemical, fuel, and oil spills—Clean-up and prevention of chemical, fuel, and oil spills are regulated by federal law and are carefully avoided, but do occasionally occur. Adequate spill-prevention, response, and mitigation plans have been developed and will be implemented as required. It is further assumed that risks of environmental impact related to chemical, fuel, and oil spills have been carefully evaluated for the originally proposed construction right-of-way and were found to be acceptable. It follows that the area that could be affected by chemical, fuel, and oil spill would be increased by only a small percentage by additional construction right-of-way width. However, to the extent that a wider right-of-way reduces the probability of accidents, the risk of chemical spills would also be reduced.

Reduces recreational opportunities—The direct or indirect impact of construction on vegetation and temporary and/or permanent displacement of wildlife can produce secondary effects on recreational values. Vegetation and wildlife are major attractions in both expansive natural settings and in smaller, landowner held parcels of land. To the degree possible, the impacts of a proposed project on these areas must be assessed and mitigated in order to ensure the return of the recreational areas to pre-construction condition.

For the purposes of this study, it is assumed that potential impacts on recreation, both direct and indirect, have been analyzed on a short and long term basis, and are found to be acceptable for the originally proposed construction right-of-way. Therefore, the impact on the quality of recreation would increase by only a small percentage by additional construction right-of-way width.

Increases opportunities for public intrusion into more remote areas—Problems may occur on unfenced and unprotected public lands, where the pipeline construction right-of-way presents an inviting opportunity for all terrain vehicular traffic to venture into remote and environmentally sensitive areas. Most pipeline construction rights-of-way are situated on private property generally protected to some extent by state trespass laws. In addition, many landowners keep their property fenced with locked gates. On the pipeline construction right-of-way, enforced local trespass laws and natural or constructed barriers are important for prevention of trespassing and other intrusion into remote areas, especially at road, railroad, and river crossings.

Because some level of intrusion into remote areas may occur on the originally proposed construction right-of-way width, additional construction right-of-way width would not increase the likelihood of intrusion or trespass. A passage much narrower than any pipeline right-of-way would in fact, offer about the same opportunity for intrusion into more remote areas as a larger right-of-way. Therefore, no increased risk of intrusion or trespass would be associated with increasing the construction right-of-way width.

5.3 Summary of Findings

When employing carefully controlled construction and maintenance methods, a slightly wider construction and maintenance right-of-way would create only minimal additional surface area disturbance.

The increased speed and efficiency of the pipeline construction process may reduce the probability of adverse environmental impacts.

6.0

Conclusions

Good engineering judgement and practical field experience show that the baseline width for construction right-of-way should vary. This study indicates that in the absence of special conditions, a wider construction right-of-way may have environmental and safety benefits.

6.1 Pipeline Construction Right-of-Way Width Requirements and Federal Government Guidelines

(1) FERC relies on the project sponsor to propose right-of-way width requirements and to provide justification for its proposal.

(2) Federal agencies have made a conscientious effort to streamline the procedures they follow in approving the right-of-way widths for pipeline construction in order to expedite the certification process. These agencies have the difficult task of satisfying regulatory and environmental responsibilities on the one hand, and the needs of worker safety and energy consumers on the other.

(3) In the absence of special conditions, pipeline sponsors believe they are limited to 75 feet of construction right-of-way width unless they submit justification for more work-space. They believe obtaining the required variance may be a time consuming process, jeopardizing the timeliness and viability of a project.

(4) Engineering criteria, supported by industry field experience, indicates that establishing a set of baseline templates for construction right-of-way widths will ensure safe working conditions and minimize environmental impacts.

6.2 Pipeline Construction Right-of-Way Width Requirements

(1) Pipe diameter is a major determinant for right-of-way construction width, along with other factors, including equipment to be used, terrain, soil conditions, and other site-specific factors.

(2) Adequate right-of-way width can decrease the duration of construction and speed the completion of all final cleanup and restoration efforts.

(3) Baseline right-of-way widths may need to be adjusted for numerous factors, including environmental, cultural and/or archeological concerns; residential, commercial and industrial densities; design considerations; terrain; soils and rock; landowner requirements; construction plans; special construction work areas; and even uncertainties.

6.3 Pipeline Construction and Worker Safety

(1) Narrow right-of-way widths can result in violations of federal worker safety regulations and diminish worker safety. It is appropriate, and necessary, to consider worker safety when establishing baseline construction right-of-way widths and necessary variances.

6.4 Pipeline Construction and its Potential Environmental Impact

(1) The study indicates that there is not necessarily a direct relationship between increased right-of-way width for a selected project and increased environmental impact. Indeed, increased right-of-way width can speed construction and restoration efforts and reduce the potential for negative environmental impacts.

7.0

Recommendations

This study recommends the following:

(1) To ensure safe working conditions and to minimize environmental impacts, GIE proposes four baseline widths that are based on pipe diameter for the construction right-of-way. This approach will expedite the certificate process by minimizing the time requirements of sponsoring companies and FERC in preparing, evaluating, and approving variance requests.

The four baselines, which use standard default widths, are as follows:

Pipe Diameter (Inches)	Right-of-Way Widths (Feet)
8 to 16	80
18 to 24	95
30 to 36	110
40 to 42	125

(2) These baseline widths should be adopted, with increases or decreases for special conditions. The study recognizes that temporary construction right-of-way widths may need to be narrowed in sensitive environmental areas, sites with cultural or historic significance, and densely populated areas. Construction on narrow rights-of-ways may require larger work areas at either end of the constrained area.

(2) The effects of different soils, terrain, construction techniques and other factors may require a wider workspace than the baseline.