

# R. A. BERRIEN ASSOCIATES (RURAL) LTD.

ACCREDITED RURAL APPRAISERS

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## Impact Assessment of Reduced Spacing Units in the Daly Field

Prepared on July 18, 1986

Prepared on the Instructions of  
Chevron Canada Resources Limited

# R. A. BERRIEN ASSOCIATES (RURAL) LTD.

ACCREDITED RURAL APPRAISERS

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July 18, 1986

Chevron Canada Resources Limited  
500 - 5th Avenue, S.W.  
Calgary, Alberta  
T2P 0L7

ATTENTION: Mr. Harvey Pockrant

Dear Sirs

This is the first of two reports that address essentially the same aspect of oil wells being placed on agricultural land. This report is to identify and assess what the impacts are or are likely to be. The subsequent report details how those impacts can be minimized by planning and placement.

This report is self explanatory and stands as a concise recital of the considerations usually addressed at a Surface Rights compensation hearing, where any impact is eventually reduced to a claim for dollars.

We wish to point out that while these reports are presented together, they are independent. The result is some unavoidable duplication in order that each report may stand alone.

We will be happy to discuss further our findings and conclusions at the hearing.

Yours truly

R. A. BERRIEN ASSOCIATES (RURAL) LTD.



R. A. BERRIEN, P.Ag., A.R.A.  
President

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## A. BACKGROUND

### 1. Function of the Study

This study is to identify and assess the impacts that result from the co-existence of agricultural and oil operations on the same lands. Specifically, we are concerned with those effects that will arise from the proposed change in spacing from one well per 40 acres (16 ha) to one well per 20 acres (8 ha).

### 2. Effective Date

This study was performed in July 1986, and is for presentation to a hearing of The Oil and Natural Gas Conservation Board on August 7, 1986.

### 3. The Assessment Problem

Wellsites on 40 acre spacings have been in existence in the Virden area for 30 years or more. Enhanced recovery procedures may be appropriate, due to poor formations or oil quality or as production diminishes from these wells over time. In the Daly field, Chevron proposes to undertake both a reduced spacing program and a waterflood process that, if successful, will improve and enhance oil recovery. That process requires, as we understand it, additional wells to be situated in the field. Water will then be forced down these new or converted wells to force oil up the producing wells. In practise, this means that wherever the scheme is to be implemented, a new well must generally be drilled between any two existing wells. That has the effect of doubling the number of wells, and reducing the separation space by half.

This report addresses itself to the task of assessing how Chevron's enhanced recovery procedures will affect the agricultural community. We perceive that community to include both the human and business elements of agriculture.

We will review the general nature of impacts, and then evaluate three different scenarios for the types of specific effects they would have.

The three scenarios considered in assessing impact include the following.

- (a) An existing pad in the middle of an interior legal subdivision (LSDs 6, 7, 10 or 11) in a section (640 acres) that would be expanded to accommodate 16 slant drilled wells, adequate to develop that section.
- (b) An existing pad per quarter section would be expanded to accommodate four new deviated wells, adequate to infill drill a quarter section.
- (c) Set up new pads and wells on the surface that correspond to the down hole location and vertically drill these 16 holes.

#### 4. Limiting Conditions

- (a) This report is based mainly upon agricultural considerations. To the extent that oil production activities are outside those with which we are generally familiar, the impacts we perceive may differ due to technical requirements.
- (b) The location of facilities has been determined without the benefit of a survey or survey documents. The features on the ground as opposed to any plans take precedence in this evaluation.
- (c) The base information for this assessment has been provided by Chevron Canada Resources Limited. Our assessment is based upon the original maps provided to us.

## B. SUBJECT PROPERTIES

The project is proposed to be developed in an area of very variable topography. As opposed to flat square fields in other areas, most of these quarters have numerous natural obstructions, such as drainways, coulees, sloughs, and bush or pasture areas, especially at the north and south ends of the project area. Numerous depressional areas are also noted that might occasionally be farmed through.

The 13 sections where new wells may be drilled are serviced by roads on one mile intervals. There are seven homes in close proximity to the new well activity, in Sec. 26-9-28WPM and in Sec. 2, 10, 11 and 12 of 10-28WPM. There are roads through or in very close proximity to these yards to service existing wells.

Most of the land is devoted to grain production, however, cattle operations are quite frequent in the area, owing probably to the rougher land in pasture. Some land is in summerfallow, and the crops included wheat, oats, barley, with flax and some canola nearby. Clover, hay and pasture were also found. On these pastures and around grain fields, single wire electric fences were common, and many dugouts, even in cultivated lands, were noted.

The lands which are included in the project area include all or part of the following sections.

- Sections 25, 26, 27, 34, 35 and 36 all in Township 9, Range 28WPM
- Sections 1, 2, 11, 12, 13, 14 and 24 all in Township 10, Range 28WPM

To varying degrees, these lands are now drilled in a 40 acre spacing configuration, which sees four wells per quarter section, one each in approximately the middle of the legal subdivision. The project generally proposes to put one new well at the junction point where the four legal subdivisions meet. In theory, this means one well in the middle of the quarter, and eight around the perimeter of a fully drilled quarter section.

### C. GENERAL TYPES OF IMPACTS

Impact is an over-used word that means the effect that one thing has upon another. The implication, however, is that something is being hit with considerable force by something else. There is no doubt that the secondary meaning is more applicable to oilwells being placed on farm land. The presence of the well, and especially the road, has a number of very immediate effects on the farmer. This report will identify what those effects are, and what they mean.

From the broadest possible perspective, an oil installation is an obstacle and focus of concern to a farmer. It takes up land that might otherwise be in production; it must be avoided by equipment and new field patterns must be formulated; and it presents an added set of who, what, when and where questions about Chevron's activity on his land.

In the following section specific effects will be detailed and explained, as well as various measures dealing with the problems discussed. All these impacts are reflected in three major ways.

#### 1. Time Requirements

Beginning with the knock on the door by the landman, to the cashing of the compensation cheque, a landowner must spend time dealing with his new neighbor, the oil company. Farming operations may now take longer, and interruptions may be more frequent.

#### 2. Money

As distinguished from the value element of time, dollars are expended by the landowner, in most situations, to accommodate the wellsite. As well, some previous cash flow may be diminished.

#### 3. Mental and Emotional Involvement

A factor not usually measured in time or money, this impact arises out of the landowner's concern to properly integrate the new and unfamiliar, into the established and known elements of his operation. General worry and concern by the farmer and his family may also accompany a new wellsite.

When dealing with farms, the business element and the human element can be tied very closely together. It seems to depend upon the situation whether or not the farm operation will be considered as a business or a way of life. When the latter view is being espoused, any alternate land use can be made to appear shabby and less desirable by comparison. We believe it is important to maintain objectivity in an assessment such as this.

In our assessment we will identify those elements that are likely to arise from the mineral extraction activities of Chevron Canada Resources Limited. To the extent that the impact identified has mental or emotional aspects, we will deal with that in a frank and concise way. As to the other effects, these will be discussed in somewhat greater detail. We might state as a preliminary finding that most impacts were determined to be business oriented.

#### D. SPECIFIC EFFECTS AND IMPLICATION

The nature of any given impact from oilfield activities may blend elements of all three general effects. These specific effects are identified below. Their similarity to the considerations set forth in the Surface Rights Act is not entirely coincidental.

##### 1. Value of Land

The company's lease or Right of Entry Order creates a registerable interest in the farmer's land. While falling well short of the fee simple interest, most landowners equate the loss of exclusive possession to the full value of the land. Without discussing the merits of the arguments on that position, suffice it to say that compensation for the partial interest has always been treated on the basis of full market value. Although the company has the right to be there, this intrusion onto the farmer's land is often taken as a violation of surface ownership.

The attempt to secure the interest in land by way of a lease is the first expense of time by the owner. The loss of land rights are his first perceived cash loss, and fretting over how much money should be paid is the first mental effort required when a well is to be drilled.

From our experience there is no concern over loss of land value of the quarter section. Annual payments are at such a level they actually create a premium on land with wellsites.

##### 2. Loss of Use

Individual owners will see this element quite differently, depending upon the nature and type of land to be occupied. Crop land ownership results in a loss of grain or hay production over the area that is occupied by the installation. Pasture land ownership evokes more concern about gates left open, than how much grass will be lost.



The operational size of the majority of Manitoba wellsites can be measured in tenths of an acre. That will be the case for the proposed single infill wells. The multiple well leases would retain their full size. Farming activities generally resume on single wellsites as soon as drilling activities are concluded. Roadways, however, are more problematic. If the road is built up, it will generally occupy the surveyed area, which might typically range from .56 acres to 1.12 acres. Many of these proposed wells will be water injection wells, and many will be adjacent to municipal roads. Non-built up trails that may be farmed through, rather than built up roads, are appropriate in those situations. The loss of use in those cases is cut back to areas not unlike the wellsite, measured in tenths of an acre.

Loss of use is not often a major factor from the farmer's point of view. Compensation for the net loss is readily estimated. By agreement, or through the Surface Rights Board, the amounts paid are invariably based upon the area of the lease and not the area actually out of production. While the casual observer might believe this area is the major problem faced by the farmer, it is in fact the smallest area of concern.

### 3. Temporary or Permanent Land Damage

This is an area of great concern to most farmers. With a vision of themselves as temporary custodians and guardians of the land, the destruction of any of it is very disturbing. The payment of the value of the area involved is not sufficient to allay this consternation.

The only solution is reclamation of the productive ability of the land. This is an ongoing problem solving process in the Virden area. Salt water and oil spills are a fact of life with the older equipment and pipelines that characterize the existing field. Just as factual is Chevron's soil reclamation process that has seen 40% of the damaged areas returned to production.

There is no question that in many cases where stripping of the topsoil has occurred, that the soil will not be restored to the exact same structure it had before. However, if care is taken in the various mechanical activities and, if necessary, soil amendments are employed, it is usually possible to regain most, if not all, of the productive capability of the land.

It is our view that the concern of the landowners is justified, but that sufficient reasonable measures are now in place that see the lands used for a normal single wellsite restored to production. There is a risk of greater damage, however, where more activities due to multiple wells are concentrated into a single area.

#### 4. Adverse Effects on Farming Activities

Wellsites, roads and power poles are obstructions. With the placement of new oilfield facilities on his land, the farmer must divert his implement away from the new barrier. Any change in field pattern usually results in additional turning, overlapping, new corners, headlands, and possibly travel time. The result is more time, more fuel, more fertilizer and seed, and generally, more costs.

The landowner sees all these aspects very quickly and is concerned that they must be paid, or he will be out of pocket or have a lower profit.

From the vantage point of a participant in many Surface Rights hearings, we have formed the opinion that this area is easily the largest concern to a landowner.

As an overall comment about this area of impact, the existing compensation scheme views the wellsite and access roads as if the leased area were actually totally occupied by the oil company. This occurs very infrequently and creates a significant over statement of the actual losses under this category.

Specific increased costs that result from new wellsites on farm land are detailed below.

##### (a) Equipment Operating

Working around a wellsite results in new headlands, additional corners, or greater overlap. The specific result depends on the operation, field pattern, equipment size, and wellsite location. The area that must be overlapped is double or triple worked. To the extent that the ground covered by the implement exceeds the pre-existing area, a need for compensation arises. The compensation must take account of fuel, depreciation, maintenance, labour, wear and tear, and field efficiency. It should be noted that the impact may change as equipment and cropping choices develop. Fortunately, the Surface Rights Act of Manitoba has review provisions that provide for this eventuality. Power poles create the largest degree of irritation in this area, but roadways have the largest impact.

(b) Extra Materials Applied

When working the incremental area, or performing the overlap, it is often the case that fertilizer, chemical or seed are being applied. To the extent this usage is greater than the normal amount required for that ground, a further cost is incurred.

(c) Risk of Crop Loss

A yield reduction may be experienced on the incremental area. These possible yield reductions are caused by trampling, excess chemical or fertilizer, or by double seeding the overlapped areas. In years of high moisture, the double seeded areas may respond in a reverse situation where yields could, in fact, be equal or greater than the balance of the field. For purposes of the typical compensation scenario, it is assumed a yield reduction occurs in the order of 20% on the affected areas. The gross revenue is applied to any estimate of the risk of loss of yield since all of the cash operating costs have been incurred on the affected areas.

5. Severance

This impact may occur depending upon the nature of the landowner's holdings and extent of the roadway. However, severance is a consequential impact only if it results in some specific damages. Where the severed parcel is so small or oddly shaped that it ceases to be useful in its previous capacity, an impact on capital value may occur. This is true severance. If the result is merely inconvenience or greater distance, the impact is in the nature of an adverse effect, as already described, or a nuisance as noted in the next section.

6. Nuisance, Inconvenience, Disturbance and Noise

These are all impacts on a very personal level. However, the fact of these impacts is what the individual perceives. No one else can say what they are or should be. There is no doubt that any individual pursuing his own interests is disturbed by the intrusion of a landman, for example. But it depends upon the individual whether or not that disturbance is a nuisance or a normal business activity. It is not unusual to find a landowner that perceives an oilwell on his land as an excellent source of revenue in a depressed farm economy. Another landowner with different motives may place farming over all other priorities and be severely inconvenienced by any oil related time expenditure, and consider any such involvement a nuisance.

Noise is a question of fact. The likely situation is that the seven residences will hear some noise, but its duration and intensity will vary according to site specific considerations.

The impacts related to these elements will be different in the initial year of wellsite drilling, as opposed to the operational phase over later years.

#### 7. Other Impacts

- (a) Cumulative effect may occur if wellsites, roadways or power lines interact with each other in some additive way that exceeds the problems they create in and of themselves. This impact would be a question of fact. It may occur if the frequency of roadways, for example, is such that only one field pattern or working direction was possible.
- (b) Weed problems may cause an impact. However, Section 55 of the Surface Rights Act would have to be totally abrogated for this to occur. The use of non-built up roads, or trails that may be farmed over, would go a long way towards avoiding such problems.
- (c) Aerial spraying activities may be affected if a great number of above ground installations were to result from the project. However, the indication from Chevron that all power lines will be underground should virtually eliminate any impact on aerial applications.
- (d) Risk of collision with oilfield facilities is a concern of some landowners. We consider this would most likely impact on management decisions such as who to send to a particular field, especially in night time or dusty conditions. Power poles are of the most concern here, but as noted, there will be underground power to these new sites.
- (e) Impact on management decisions generally is perceived by some to be an adverse result of oilfield development. When it occurs, it is proportional to the number of sites, and the location of them relative to various operations. From our experience, the learning curve of farmers is sufficiently rapid that most problems are resolved in the first year.
- (f) An impact upon equipment selection may result if an entirely new field pattern was imposed upon a landowner. However, even where fields would be traversed by roads or trails to the new wells, the location of the planned wells is such that the distance is evenly split and no additional constraints are placed upon equipment width.

- (g) Increased risk of trespass is a concern of some landowners. The matter is individual and depends upon whether the landowner views Chevron's operators as interlopers or responsible people who will look out for the interests of both parties.
- (h) Impacts on the operation of aerial facilities may be a concern of at least three owners with runways on their land. Those concerns could be essentially eliminated with proper placement and marking of any new facilities.
- (i) Other impacts may exist, but these would be very individual. Those presented above are the ones we have had occasion to be made aware of at many previous hearings of surface related matters.

#### 8. Economic Impacts

The economic impact of a wellsite on farm land varies depending upon point of view. For a farmer working part time as an operator, 79 new wells might be a positive impact indeed. For a landowner with new wells, it is not so clear. In absolute terms, a small 2.81 acre site, placed tight to the roadway, and in the presence of existing mid-legal subdivision wells, merited \$1,023 per year in a recent Surface Rights board decision (Order 3/86). Without weighing the extent or merit of the individual landowner's personal concerns, revenue of some \$364 per acre per year is an attractive income derived from the ownership of agricultural land. This number will rise as the size of the wellsite increases, and the placement of the well and road becomes more problematic. Landowners that go to the Surface Rights Board have expressed the concern that they are under-compensated for their problems. In litigation of that sort, one expects those positions.

At the risk of being accused of bias, but with the firm belief that the objectivity of our observations will indicate otherwise, we opine that virtually all surface rentals are higher than is justified by the actual losses. Why else would the presence of oil revenue raise the value of agricultural land with wellsites above that of the adjacent lands with no such revenue?

We are forced to make this observation to enable us to accurately note the impact of wellsite rentals on the agricultural community.

#### E. IMPACT ASSESSMENT

The impacts that may or may not result from the various Chevron enhanced recovery schemes have been set forth and discussed. Those schemes must now be rated against one another by a comparison of those impacts. In such an assessment one cannot suspend the recognition of economic compensation from consideration.

The scenarios are rated as to how they would impact on a quarter that already has numerous wells on a 40 acre spacing. It must be recalled that we are not starting from ground zero. When noting the impacts, one must consider the impact itself. That is to say, while 16 wellsites may indeed create the greatest loss of use, and hence the most negative impact of the three scenarios, there may be an offsetting positive impact on economic considerations. But that is separately evaluated. The neutral impact recognizes that the existing development will remain and its pre-existing impact is not made any greater by the new development.

The impact assessments are noted below.

Land Value	The greater the number of sites, the higher the annual rental. The most positive effect will be seen from the multiple single wellsites. There will be no increment from either of the intensification programs.
Loss of Use	The greater the number of sites, the greater the area lost to production. Especially the need for access through crop land will cause production losses. The 16 in 1 scenario will clearly occupy the entire lease area, and a good built up road will be necessary. The 4 in 1 situation may leave some area that could be farmed on the leases, but not a significant amount. Compared to the pre-existing single wellsites, the loss is greater on the multi-well sites, but not nearly as much as the larger number of single wellsites.

- Land Damage** The greater the level of oilfield activity there is on the site, the greater the chance that damage to the land can occur. With the exception of salt water spills from broken pipelines, the damages seen in the Virden area from single wells on a lease is very minimal. The largest part of most leases are back in production. Hence, we believe that the single wells create the least land damage impact, while the more developed sites are incrementally worse.
- Adverse Effect** More obstructions mean more adverse effect. There will be no change in adverse effects from the intensification of the existing leases into multi-well facilities. Of course, if the lease is not fully occupied by the single existing well, there will be a loss of the area being cropped on that lease. However, this is no real loss as that area was subject to compensation already. Depending on the integration of the new sites with existing obstructions, and the use of non built up roads, the degree of adverse effect can vary widely. But in any event, the more wells, the greater the negative impact.
- Severance** The only scenario that could create severance is the 16 wells on 16 sites. However, that is a matter of fact depending upon final placement. The impact of multi well schemes is neutral.
- Nuisance etc.** From the perspective of the landowner, activities other than those based upon his own priorities are a nuisance. The development of 16 separate new wells has a high likelihood of being a nuisance. Putting all the wells in one spot (16 in 1) can reduce the overall nuisance, especially if the location is favourable. Indeed, there is considerable flexibility when only one location will be needed to drill out the section. That is not always the case when 4 pads are being developed more intensively. One will likely be too close to a residence, for example. More wellsites mean more documents and signatures. As the project develops over time it means repeated

landowner participation as each new well is drilled. We must conclude that the most negative impact on agriculture from the nuisance perspective is caused by the 16 on 16 case. The impact of four more intensive sites will be negative, but not to the same degree. The 16 in 1 situation is essentially impact neutral. X

**Cumulative  
Effect**

With reference to the pre-existing field patterns and roadways, any cumulative effect that exists will remain the same when the 16 in 1 and 4 in 1 leases are developed. New sites resulting from the 16 on 16 scenario could cause additional effects, hence the potential impact is negative, while the others are neutral. X

**Weeds**

The greater the disturbance, the greater the chance of weed infestation. However, this is a smaller consideration where the roadway and wellsite can be farmed. More sites mean more potential problems and hence the 16 on 16 case creates the greatest impact. X

**Aerial Spray**

The scenarios are equally neutral in this area. /

**Collision**

The most concern expressed about collision is related to power poles. There will be no new power poles in any of the scenarios. There is always some chance that the oilfield facilities could be hit, and more wellsites mean more risk and greater negative impact. However, the normal separation distance means a minimal negative impact. /

**Management**

The intensified sites create no change in farm management requirements. In the 16 on 16 case, the owner must contend with each new site as it is developed. Thereafter it may rate some regular consideration, but there is no doubt that more sites will cause a greater negative impact on farm management.

**Equipment  
Selection**

The sites are all neutral on equipment selection. This is true, particularly for the 16 on 16 case because the need for more maneuverable equipment has existed since the development of the initial wellsites.



- Trespass**                   The greater number of access points, the greater chance of trespass. However, the normal operations of Chevron to check their wells will also put them on site more often, and over a greater area. As they have a considerable interest in their facilities, it is reasonable to expect them to be responsible observers. But further, most operators know the landowners personally and take an active role in being a good neighbor. We see the 16 on 16 scenario as only mildly more negative.
- Aerial  
Facilities**               As far as aerial facilities are concerned, all the schemes are neutral. This presumes that the landowner will be able to have the wellsites located in a position that will not interfere with the aerial facilities.
- Economics**               The more wellsites, the greater the annual and up front revenues. It is reasonable to assume that these new individual wells will be developed the same as the existing ones, and that compensation will, therefore, be greater than the actual losses. This generates a very positive economic benefit. The intensively developed sites are economically neutral.

#### E. CONCLUSION

From the display ratings of the various scenarios, it is clear that the 16 well program will have the greatest number of negative effects on farmers. This is self evident when there is a larger number of interactions between two industries on the same piece of real estate. Were we to conclude from that analysis that the vertical well program was undoubtedly the worst possible avenue, we would be making a shallow, one-sided evaluation. We do not feel we can legitimately ignore the existing economic considerations.

It is our experience that farmers must make a profit or they go broke as any other business. If their incomes can be enhanced by some other revenue source, while their costs are controlled, they improve their profits and likelihood of survival. If, for example, a farm were to yield up, say six sites on a quarter that total some 10 acres out of production, and experience a cash injection of some \$30,000 or more in the first year, and from \$6,000 to \$10,000 per year thereafter, we believe that would be a positive impact.

After considering all the aspects, we conclude that the multi-well pad scenarios have no significant positive or negative impact on the farm community. They are essentially neutral.

The vertical well program will create a significant negative impact on day to day agricultural operations due to the simple physical presence of the more numerous installations. However, proper planning can minimize that impact, while at the same time realizing the maximum positive impact by taking advantage of the existing compensation scheme. This individual well program can mean a distribution of some of the economic benefits from the project to the landowners.

CERTIFICATION

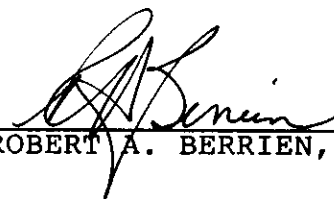
I, the undersigned appraiser/agrologist, certify that I inspected the subject properties, including the existing wells and the prospective wellsites, on July 16 and 17, 1986.

I further certify that neither the assignment to do this report, nor the fee, is contingent on the assessments determined. I have no undisclosed interest, either present or contemplated, in the subject matter.

The statements and maps provided by others are the base upon which assessments have been made. They are believed to be accurate, however, their accuracy and validity cannot be guaranteed.

This report is made under the Code of Ethics of the Alberta Institute of Agrologists and the American Society of Farm Managers and Rural Appraisers.

Respectfully submitted.

  
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ROBERT A. BERRIEN, P.Ag., A.R.A.

July 18, 1986

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ACCREDITED RURAL APPRAISERS

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## Impact Minimization of Reduced Spacing Units in the Daly Field

Prepared on July 18, 1986

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	<u>16 wells on 1 lease</u>				
	<u>Very Negative</u>	<u>Negative</u>	<u>Neutral</u>	<u>Postive</u>	<u>Very Positive</u>
Land value			x		
Loss of use		x			
Land damage	x				
Adverse effect			x		
Severance			x		
Nuisance			x		
Cumulative effect			x		
Weeds			x		
Aerial spray			x		
Collision			x		
Management			x		
Equipment selection			x		
Trespass		x			
Aerial facilities			x		
Economic			x		

	<u>4 wells on 1 lease</u>				
	<u>Very Negative</u>	<u>Negative</u>	<u>Neutral</u>	<u>Positive</u>	<u>Very Positive</u>
Land value			x		
Loss of use		x			
Land damage		x			
Adverse effect			x		
Severance			x		
Nuisance		x			
Cumulative effect			x		
Weeds			x		
Aerial spray			x		
Collision			x		
Management			x		
Equipment selection			x		
Trespass			x		
Aerial facilities			x		
Economic			x		

16 wells on 16 leases

	<u>Very Negative</u>	<u>Negative</u>	<u>Neutral</u>	<u>Postive</u>	<u>Very Positive</u>
Land value					x
Loss of use	x				
Land damage			x		
Adverse effect	x				
Severance		x			
Nuisance	x				
Cumulative effect		x			
Weeds		x			
Aerial spray			x		
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July 18, 1986

Chevron Canada Resources Limited  
500 - 5th Avenue, S.W.  
Calgary, Alberta  
T2P 0L7

ATTENTION: Mr. Harvey Pockrant

Dear Sirs

Re: Our Evaluation of the Facility Placements  
For the Daly Field

Further to your request to examine this field from an agricultural perspective, we have set forth in the accompanying report a number of criteria that will minimize agricultural interference. The criteria have been implemented in the prospective wellsite placements, and where necessary, roadways to those infill wells.

It would be an oversimplification to characterize these additional wells as either beneficial or harmful. They will assuredly raise the annual rentals on those affected lands and will just as assuredly cause some adverse effects. We believe that good planning, coordinated with good communication with the landowners will minimize the problems and allow a workable situation. Indeed, we saw such a field with reduced spacings in operation just to the west, in the West Daly area. The land was productive and no great problems were in evidence. A number of photos of this field are in the Appendix for your reference.

We would be happy to expand on any of the ideas or proposals contained herein.

Yours truly

R. A. BERRIEN ASSOCIATES (RURAL) Limited



R. A. BERRIEN, P.Ag., A.R.A.  
President

RAB/vfs



## A. BACKGROUND

### 1. Function of the Study

This study is to evaluate the problems that result from the co-existence of agricultural and oil operations on the same lands. And further, to apply those findings to the proposed change in spacing from one well per 40 acres (16 ha) to one well per 20 acres (8 ha), and thereby minimize the impact of the oil industry on farming operations.

### 2. Effective Date

This study was performed in July 1986, and is for presentation to a hearing of The Oil and Natural Gas Conservation Board on August 7, 1986.

### 3. The Study Problem

Wellsites on 40 acre spacings have been in existence in the Virden area for 30 years or more. Enhanced recovery procedures may be appropriate, due to poor formations or oil quality or as production diminishes from these wells over time. In the Daly field, Chevron proposes to undertake both a reduced spacing program and a waterflood process that, if successful, will improve and enhance oil recovery. That process requires, as we understand it, additional wells to be situated in the field. Water will then be forced down these new or converted wells to force oil up the producing wells. In practise, this means that wherever the scheme is to be implemented, a new well must generally be drilled between any two existing wells. That has the effect of doubling the number of wells, and reducing the separation space by half.

The question we are addressing is how might these wells be placed and accessed to minimize the consequences of the oil industry in the farmer's field.

In answering this question, the elements of practicality, legal requirements, physical constraints, and economics all play a role. Blending these together properly should minimize the impact of one industry upon the other.

Three scenarios were considered in assessing impact. These included the following.

- (a) An existing pad in the middle of an interior legal subdivision in a section that would be expanded to accommodate 16 slant drilled wells, adequate to develop that section.
- (b) An existing pad per quarter section would be expanded to accommodate four new deviated wells, adequate to infill drill a quarter section.
- (c) Set up new pads and wells on the surface that correspond to the down hole location and vertically drill these 16 holes.

#### 4. Limiting Conditions

- (a) This report is based mainly upon agricultural considerations. To the extent that oil production constraints are outside those with which we are generally familiar, the recommendations we make may be voided by technical requirements.
- (b) The location of facilities has been determined without the benefit of a survey or survey documents. The features on the ground as opposed to any plans take precedence in this evaluation.
- (c) The recommendations in this document are suggested with the assumption that the oil company has a degree of flexibility for placements of, say, 50 yards in any direction. As well, we assume that a roadway or trail that exists now may be utilized to access a second wellsite, or more.
- (d) Where there are insufficient differences to distinguish potential placements from an agricultural perspective, then other criteria are brought to bear that include economics, land administration costs, and possibly other considerations. The priority given these is our own, based upon experience.
- (e) The base information for this report has been provided by Chevron Canada Resources Limited. It is believed to be accurate, however, it may be subject to change, addition or deletion. Our recommendations are based upon the original maps provided to us.

## B. SUBJECT PROPERTIES

The project is proposed to be developed in an area of very variable topography. As opposed to flat square fields in other areas, most of these quarters have numerous natural obstructions, such as drainways, coulees, sloughs, and bush or pasture areas, especially at the north and south ends of the project area. Numerous depressional areas are also noted that might be farmed through occasionally, nonetheless, we still consider these obstructions.

The 13 sections where new wells may be drilled are easily accessible as they are serviced by roads on one mile intervals. There are only seven homes in close proximity to the new well activity, in Sec. 26-9-28WPM and in Sec. 2, 10, 11 and 12 of 10-28WPM. There are roads through or in very close proximity to these yards to service existing wells.

Most of the land is devoted to grain production, however, cattle operations are quite frequent in the area, owing probably to the rougher land in pasture. Some land is in summerfallow, and the crops included wheat, oats, barley, with flax and some canola nearby. Clover, hay and pasture were also found. On these pastures and around grain fields, single wire electric fences were common, and many dugouts, even in cultivated lands, were noted.

The lands which are included in the project area include all or part of the following sections.

- Sections 25, 26, 27, 34, 35 and 36 all in Township 9, Range 28WPM
- Sections 1, 2, 11, 12, 13, 14 and 24 all in Township 10, Range 28WPM

To varying degrees, these lands are now drilled in a 40 acre spacing configuration, which sees four wells per quarter section, one each in approximately the middle of the legal subdivision. The project generally proposes to put one new well at the junction point where the four legal subdivisions meet. In theory, this means one well in the middle of the quarter, and eight around the perimeter of a fully drilled quarter section (see Figure 1). The characteristics of each quarter were considered prior to determining where each one of these perimeter wells might be placed. As may be obvious, when wells are in the middle of two legal subdivisions separated by a roadway, e.g., LSD 16 of Sec. 36 and LSD 1 of Sec. 1, the infill well must go to one field or the other.

### C. THE STUDY

#### 1. Single Pad Per Section

To even begin to evaluate this proposed situation, the final size of the pad that would result must be determined. We understand from the Petroleum regulations that the well heads must be 16 feet apart. This would mean a double row of eight wells in the middle of the leased area. To allow drilling and servicing equipment access, there must be 150 feet from the outer edge of the row of wells to the edge of the lease. It is clear that the rows of wells would be only approximately 130 feet long. This will easily fit inside a typical 300 foot square lease. The pad width would need to be expanded, however, by the distance necessary to accommodate the slant drilling equipment between the rows. Even if this distance were considerable, the 90,000 square feet of the existing lease could accommodate the entire operation, as long as the shape of the pad were altered from a square to a rectangle.

The impact of 16 wells on this single lease of the same overall square footage on the land owner would not be noticeable from the agricultural perspective. Headlands would be in different places but of the same total length. The area out of production would be the same. The only incremental aspect would be that of concentrated activity in one part of the section. When the legal subdivision selected for the pad is one of the interior ones, the noise to adjoining lands would be minimized by distance.

The likelihood of damage to the land is greater where the concentrated activity of 16 wells is found. However, it is not unlike a battery site or plant location. We have seen reclamation of these sites. However, this is a consideration to be dealt with in the future.

Surface land costs would be lower to Chevron with a single lease rather than a 16 lease arrangement. But the costs of the drilling and servicing would go up dramatically. There is no relationship between the surface rights costs and the drilling and operating costs of a slant well.

It is clear to us that the only siting considerations for these types of leases would be to select the existing site that was most distant and screened from home sites in the general vicinity.

## 2. Single Pad Per Quarter Section

This scenario is very much like that of the single pad noted above, but virtually no change is required as there would be adequate room to manoeuvre equipment about the lease. Aside from a marginal increase in noise and activity levels, this site is indistinguishable from an ordinary wellsite.

## 3. Sixteen Vertical Wells Per Section

This scenario obviously has the most potential to create problems for the landowners. We will address this in detail in the following sections.

### (a) Background Considerations

Chevron Canada Resources Limited has asked us to examine the subject lands with a view to placing the wells and roads in such a fashion that the impact on agriculture will be minimized. No specific constraints were placed upon us and we were provided a free hand to select and weight the judgment criteria for placement. That flexibility extended to a capacity to offset wells from their most geologically desirable locations in order to maximize the surface integration. The optional considerations at our disposal included:

- underground power;
- relocation advice for existing facilities;
- trails rather than roads; and
- well offsets to a maximum of 50 yards.

The use of these options, while no doubt less convenient and more costly to Chevron, greatly enhanced likelihood of placing a well and access road in such a way as to minimize surface disturbance.

### (b) Placement Criteria

The only fixed element in the study was the general location of some 79 wells that we were informed would be drilled if the entire enhanced recovery program were to be implemented. That number of wells includes some wells that will be needed if the NW 1/4 26-9-28WPM is added to the unit.

The single most important consideration in the study was the adherence to, or integration with, existing linear disturbances or field obstructions. This consideration clearly recognizes that it is the roads, and not the wells, that are the most problematic in terms of day to day operations and farming difficulties.

Each prospective wellsite was viewed from the perspective of those elements that give rise to compensation under the Surface Rights Act. The goal was to minimize the adverse effect and loss of use.

One consideration investigated included setback requirements from municipal roads. A great many of the wells in this project are on the perimeter of sections. Hence, the closer they might be to the fence line, the less interference they will create. We have requested that Chevron seek relaxations of the 50 meter setback requirements of the Petroleum Branch, and the 125 feet setbacks required by the R.M. of Wallace and the R.M. of Pipestone. The minimum distance that can still allow the well to be drilled is 60 feet from a boundary point. That is the setback Chevron will be seeking.

Other factors we took into consideration include the following.

- (i) Power poles: Chevron has made the commitment that power supply, if needed, will all be underground.
- (ii) Trails versus roads: Chevron has stated that where appropriate we may recommend non-built up roads that may be farmed over.
- (iii) Obstacle elimination: in a few cases there may be a preference to remove an obstacle going in a different direction before putting in another to service the new well. Chevron has given assurances, where warranted, that they will do it.
- (iv) Fence lines: existing fence lines have been given higher priorities to other existing linear disturbances, such as the edge of a crop type in a field.
- (v) Pasture areas versus crop land: areas of permanent pasture were considered preferred areas for wellsites and roads versus cropped areas and these were utilized where possible.

- (vi) Topographic features: there were numerous occasions where depressional lands were found. Many tree and bush covered sloughs were also in the area. Where possible, wells were tucked in tight to these obstacles, or in some situations, actually placed within the depressional or sloughy area.
- (vii) Field patterns: where there was evidence of a predominant direction of work in a field, for whatever reason, care was taken to see this was maintained when new placements were made.
- (viii) Land administration: in some situations there was no significant difference in the impact of a well on one side of a road or the other, from an agricultural viewpoint. In such cases, if one of the possible placements was on land where no other wells were found, versus one where, of necessity, wells would be situated, the well would be placed on the property along with the other wells.
- (ix) Patterns of ownership: holdings larger than quarter sections are the rule rather than the exception. Access that traversed quarter section boundaries always considered the ownership of the lands, and where the only boundary was a legal one, an effort was made to preserve the integrity of the field.

(c) Method of Criteria Application

Having determined the factors which were important in placing the wells and roads, the subject properties were inspected, wellsite by wellsite, and specific situations were noted. Without a survey, of necessity, many sites could only be estimated as to their prospective location. However, back in the office, with the help of aerial photography, these were more precisely plotted.

The resulting maps that are attached indicate the new and existing wells, the existing roads and trails, and the recommended new access routes.

The routes we recommended were considered against the apparent impact of the West Daly infill well program. This appeared to be a similar development that was accommodated quite well by the farmer in his operations.

The plans and maps that illustrate the potential facility placement are appended to this report, on a section by section basis.

(d) Conclusion

The maps will illustrate the very large percentage of wells and roads that have been situated next to existing obstructions. It is clear that this has been possible only because of the nature of the land. The potholes and sloughs, combined with depressional drainways, have afforded many opportunities to place wells and roads in totally non-obstructive locations. Even where a non-built up road must be used in crop land, the well is most often tight against some natural obstruction.

When natural obstructions are utilized as one boundary of the new well, there is virtually no additional adverse effect generated. The farmer is still going around an obstruction, albeit, a larger and differently shaped one.

When all the factors are considered, all the wells plotted, and the resultant impacts on agricultural operations observed, one must conclude that the impact on agriculture at large is minimal. The losses that do occur are compensable through the Manitoba Surface Rights Board.



CERTIFICATION

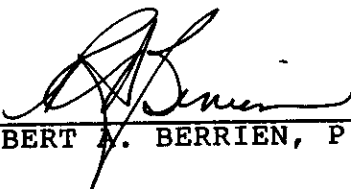
I, the undersigned appraiser/agrologist, certify that I inspected the subject properties, including the existing wells and the prospective wellsites, on July 16 and 17, 1986.

I further certify that neither the assignment to do this report, nor the fee, is contingent on the placements. I have no undisclosed interest, either present or contemplated, in the subject matter.

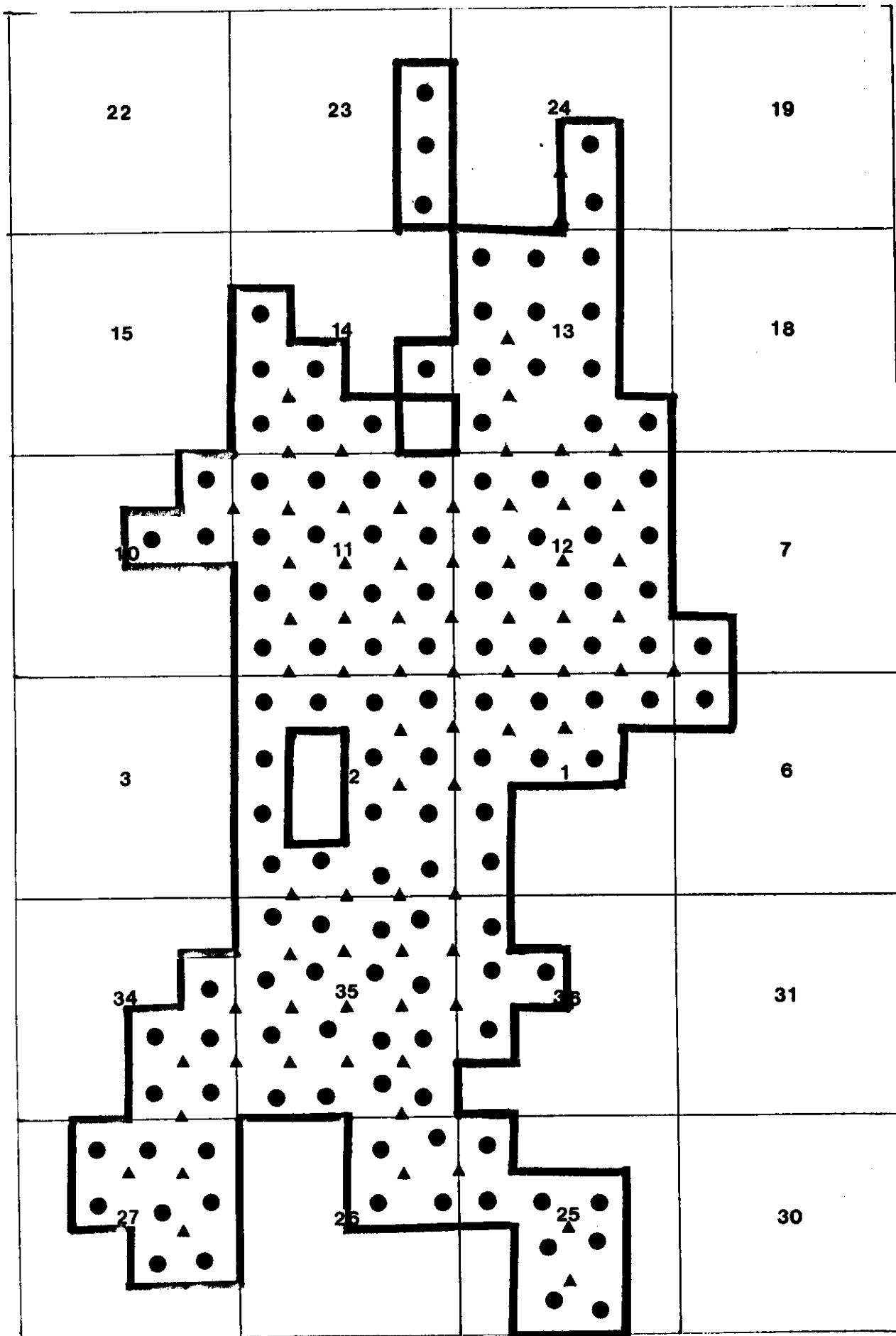
The statements and maps provided by others and contained in the report are the base upon which conclusions have been made. They are believed to be accurate, however, their accuracy and validity cannot be guaranteed.

This report is made under the Code of Ethics of the Alberta Institute of Agrologists and the American Society of Farm Managers and Rural Appraisers.

Respectfully submitted.

  
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ROBERT A. BERRIEN, P.Ag., A.R.A.

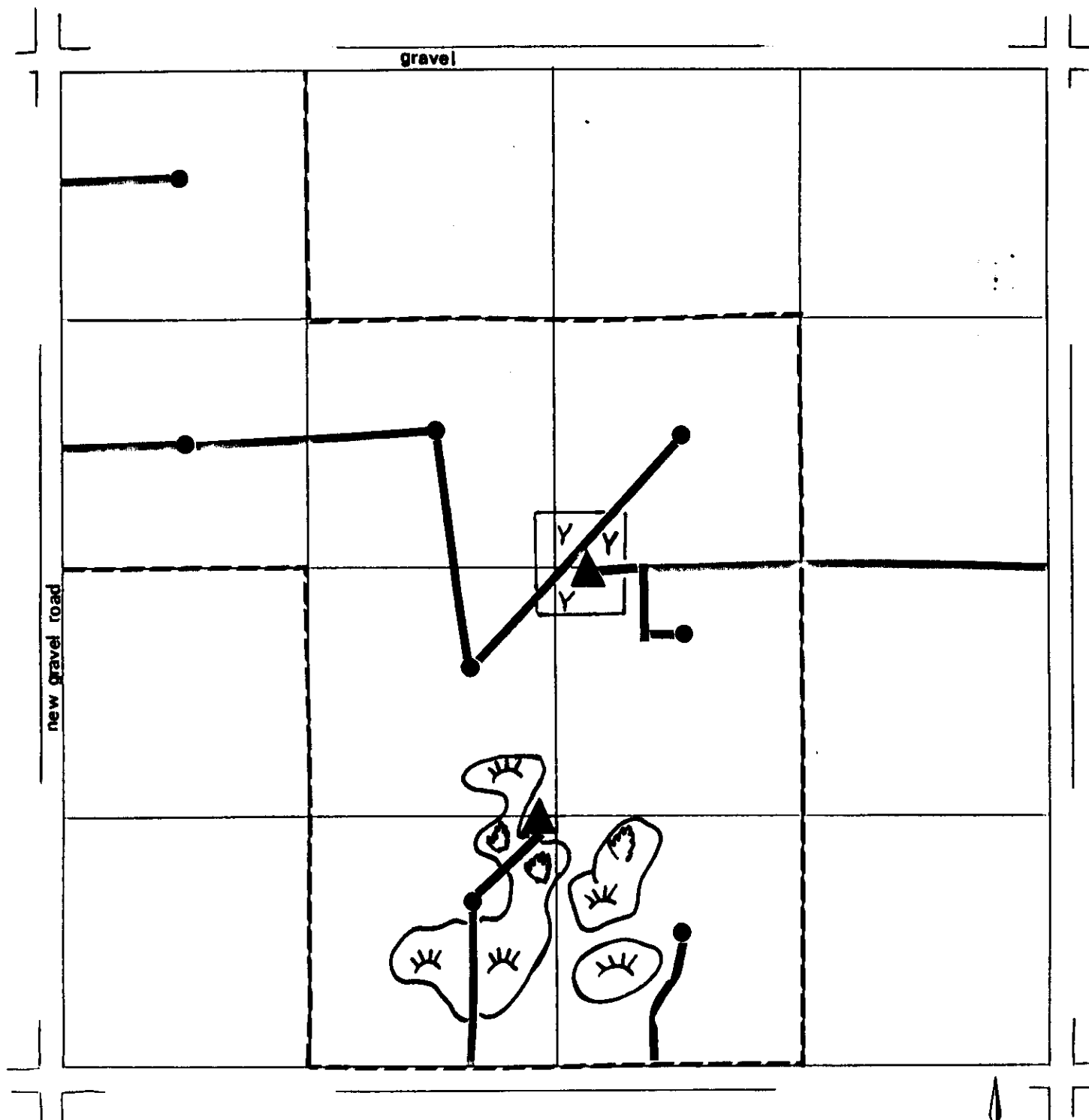
July 18, 1986



Range 28

Range 27

▲ proposed  
● existing



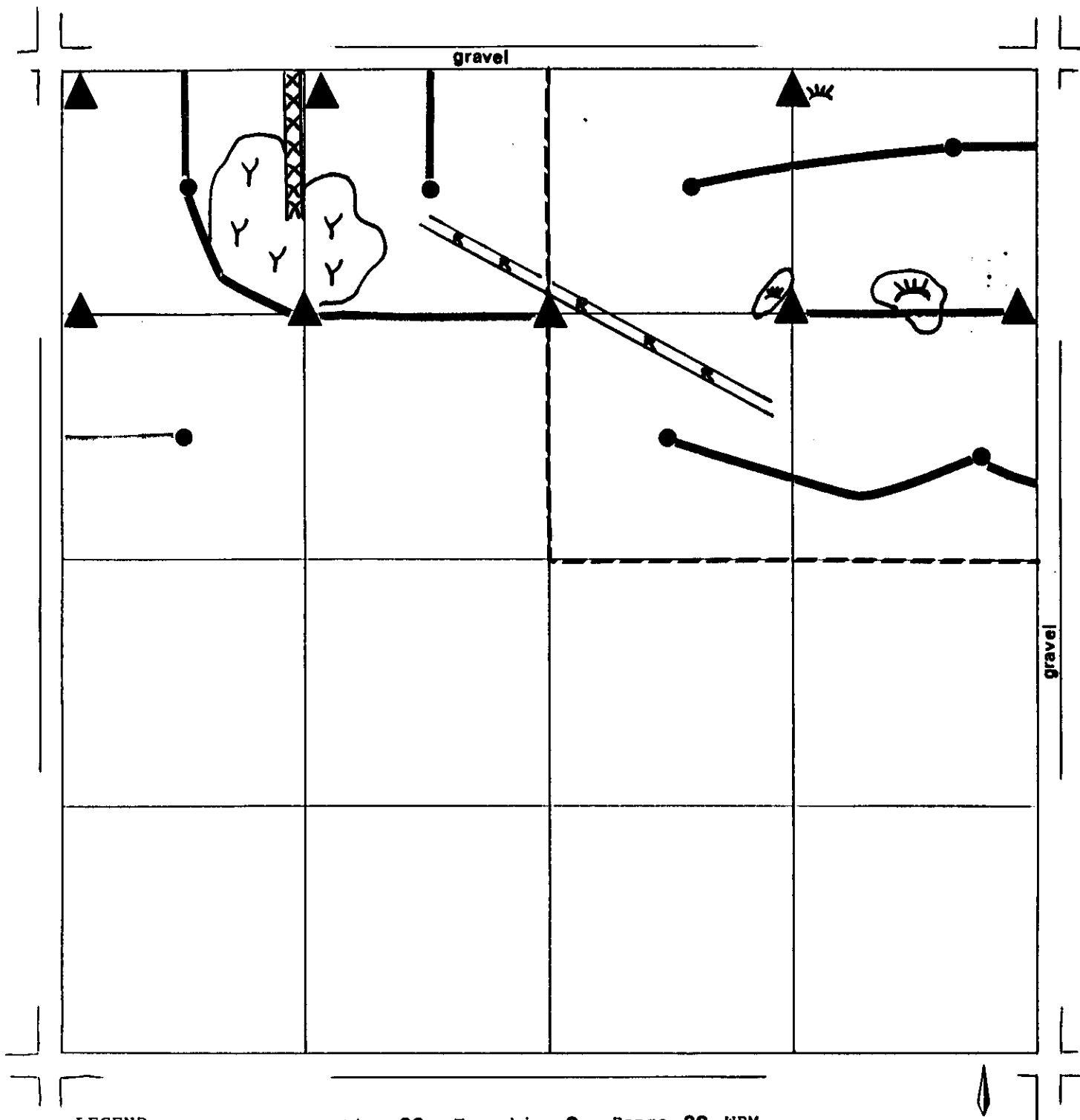
Section 25 Township 9 Range 28 WPM

LEGEND

- Existing well
- ▲ New well
- Existing road
- New Road
- Existing trail
- New trail
- - - Unit boundary

- ☀ Slough area
- ☐Y☐ Farmyard
- ☞ Bush



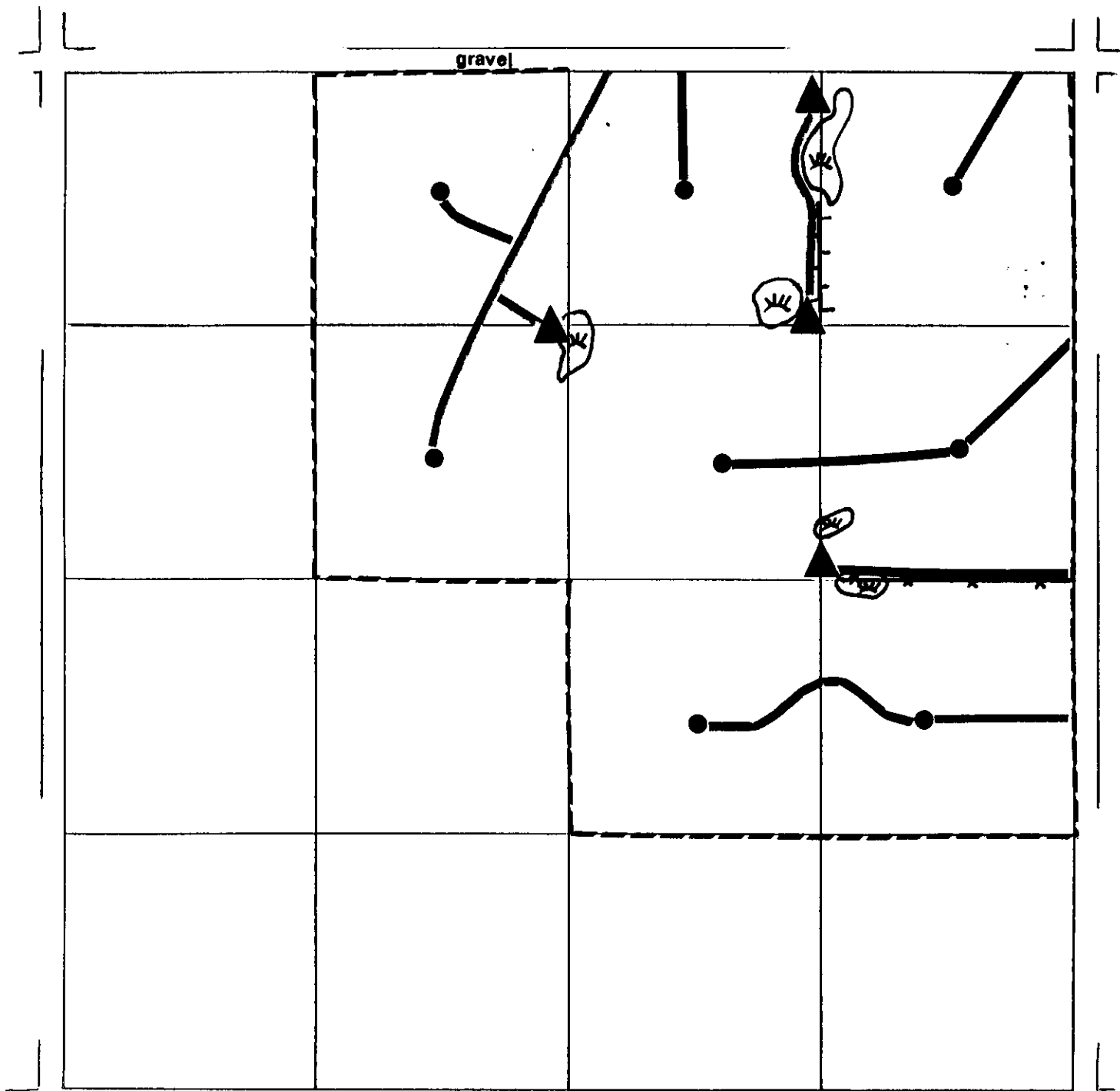


**LEGEND**

Section 26 Township 9 Range 28 WPM

- |                     |                |
|---------------------|----------------|
| ● Existing well     | YY Farmyard    |
| ▲ New well          | XXXX Farm lane |
| — Existing road     | ⊖ Slough area  |
| — New road          | == Runway      |
| — Existing trail    |                |
| — New trail         |                |
| - - - Unit boundary |                |



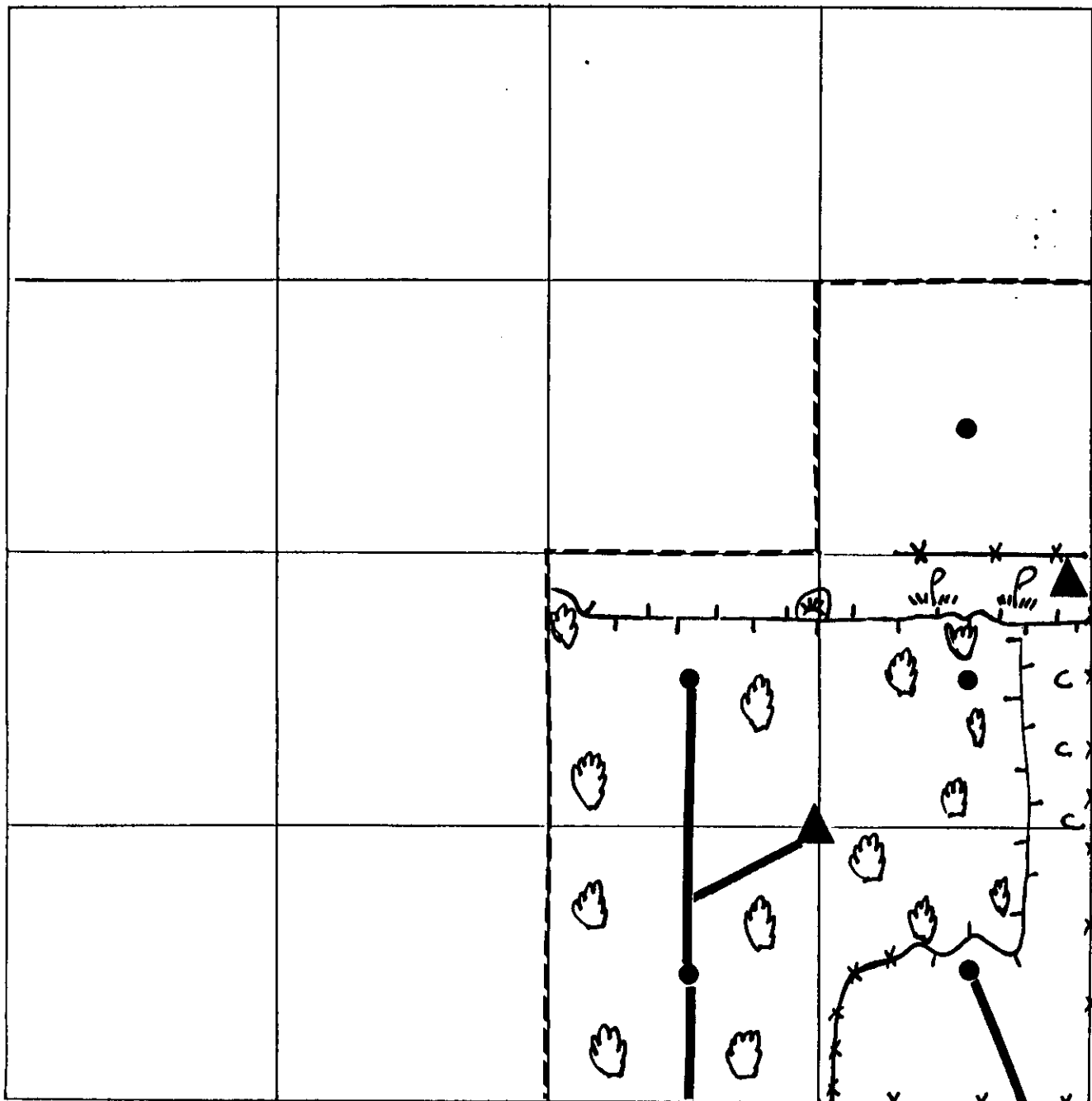


**LEGEND**

Section 27 Township 9 Range 28 WPM

- |                     |                          |
|---------------------|--------------------------|
| ● Existing well     |                          |
| ▲ New well          |                          |
| — Existing road     | ⊞ Slough area            |
| — New road          | ⊞ Field/crop delineation |
| — Existing trail    | *** Fence                |
| — New trail         |                          |
| - - - Unit boundary |                          |





gravel

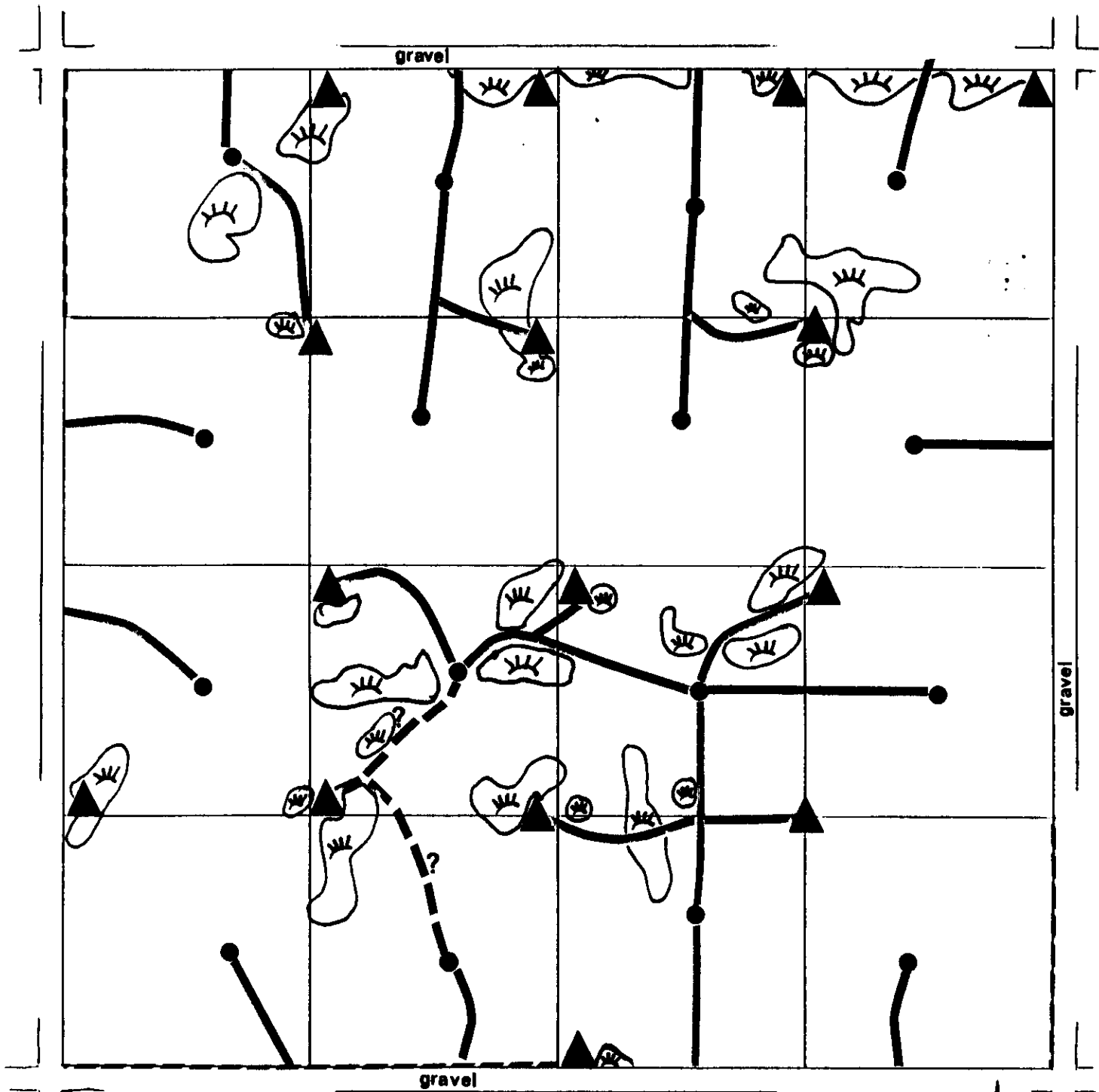
**LEGEND**

Section 34 Township 9 Range 28 WPM

- Existing well
- ▲ New well
- Existing road
- New road
- Existing trail
- New trail
- Unit boundary

- Pasture
- CC Crop land
- Bush
- Field/crop delineation
- Fence
- Slough area





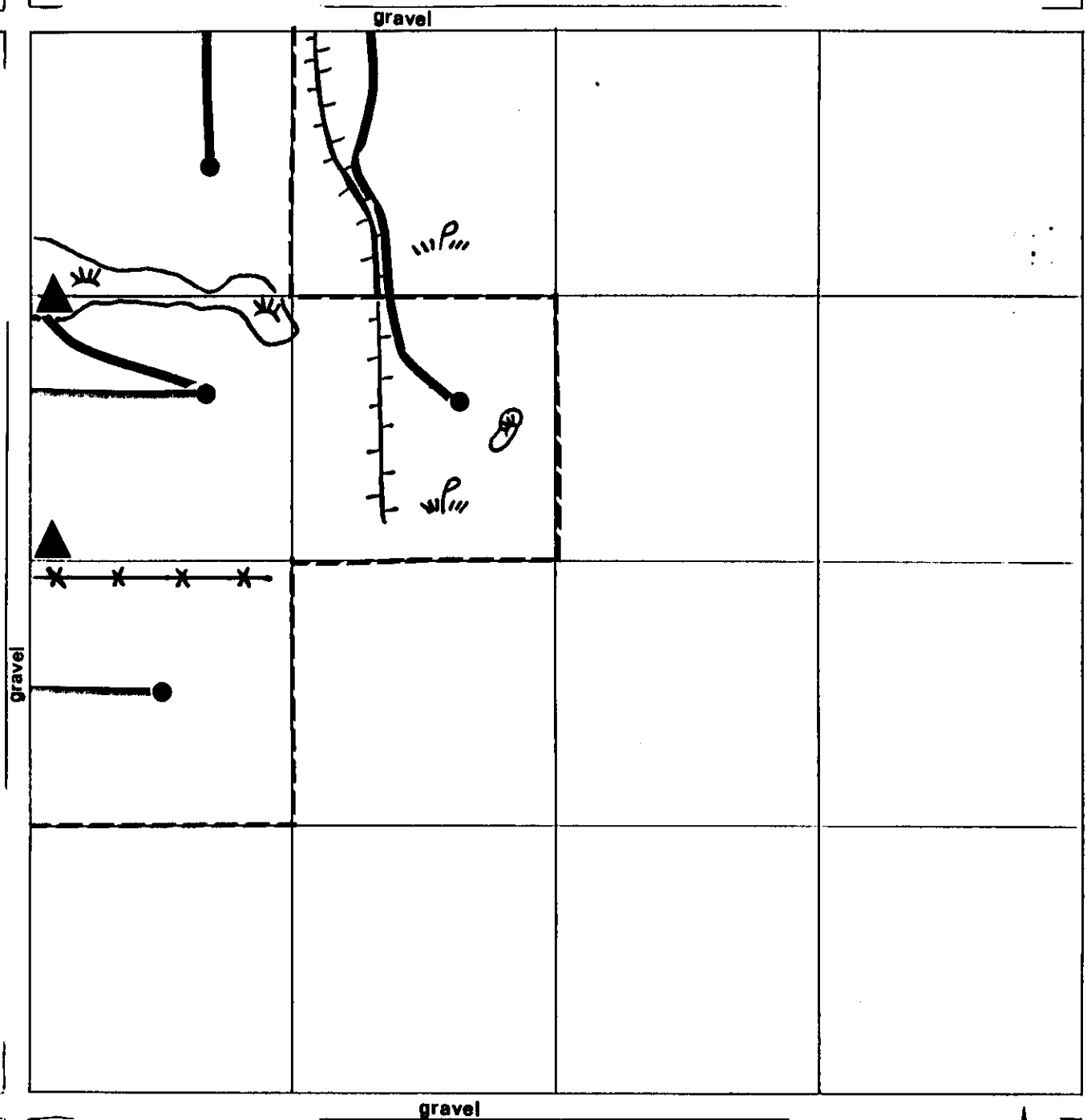
**LEGEND**

Section 35 Township 9 Range 28 WPM

- Existing well
- ▲ New well
- Existing road
- New road
- Existing trail
- New trail
- - - Unit boundary

(☼) Slough area





**LEGEND**

Section 36 Township 9 Range 28 WPM

- Existing well
- ▲ New well
- Existing road
- New road
- Existing trail
- New trail
- - - Unit boundary

- (wavy lines) Slough area
- \*-\*-\* Fence
- [T-shaped lines] Field/crop delineation
- (wavy lines) Pasture







**LEGEND**

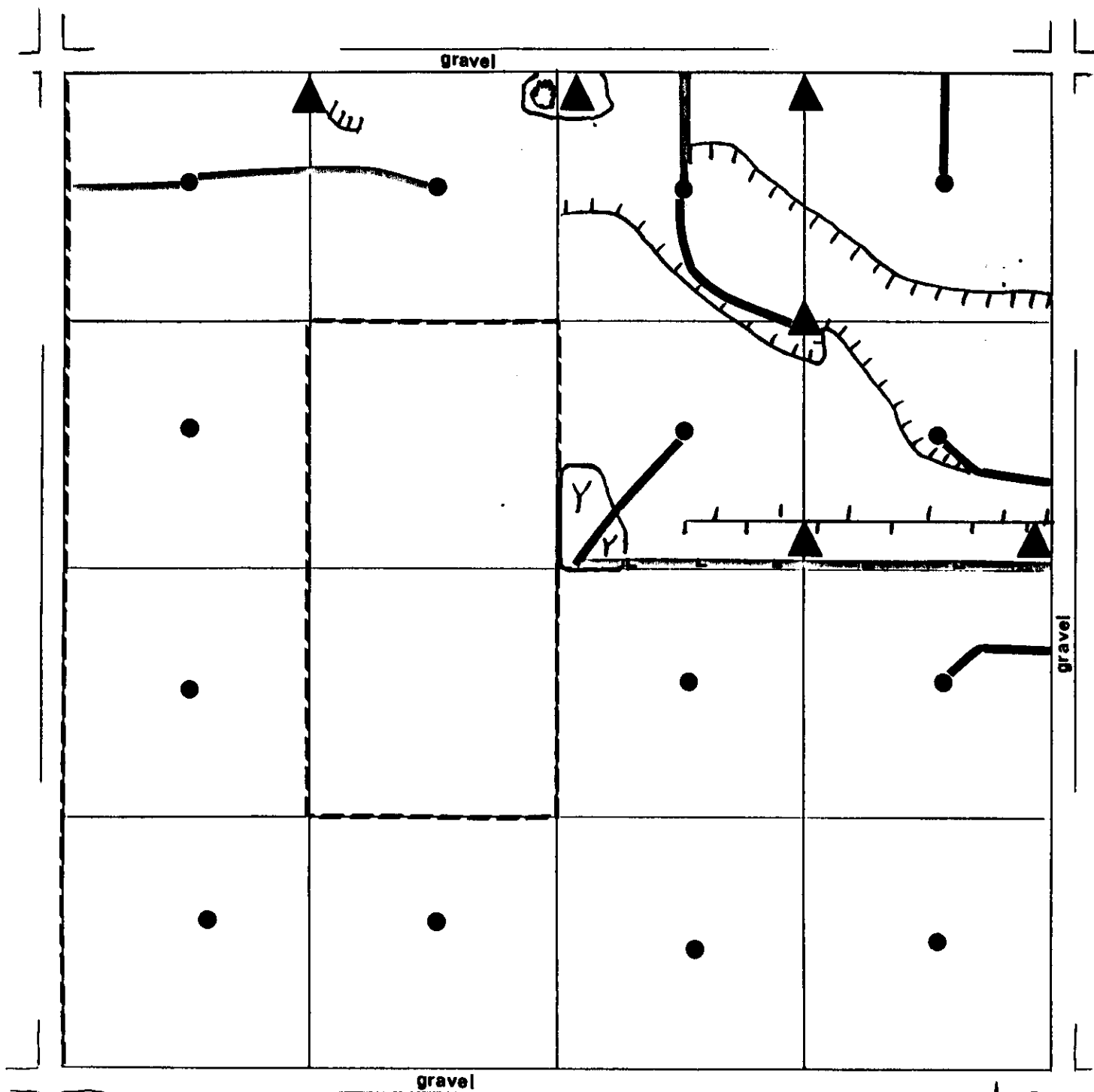
Section 1 Township 10 Range 28 WPM

- Existing well
- ▲ New well
- Existing road
- New road
- Existing trail
- New trail
- - - Unit boundary

- Field/crop delineation
- G G Gravel pit
- ☼ Slough area
- Plant site
- wP Pasture

- Fence \*-\*-\*
- Runway ———



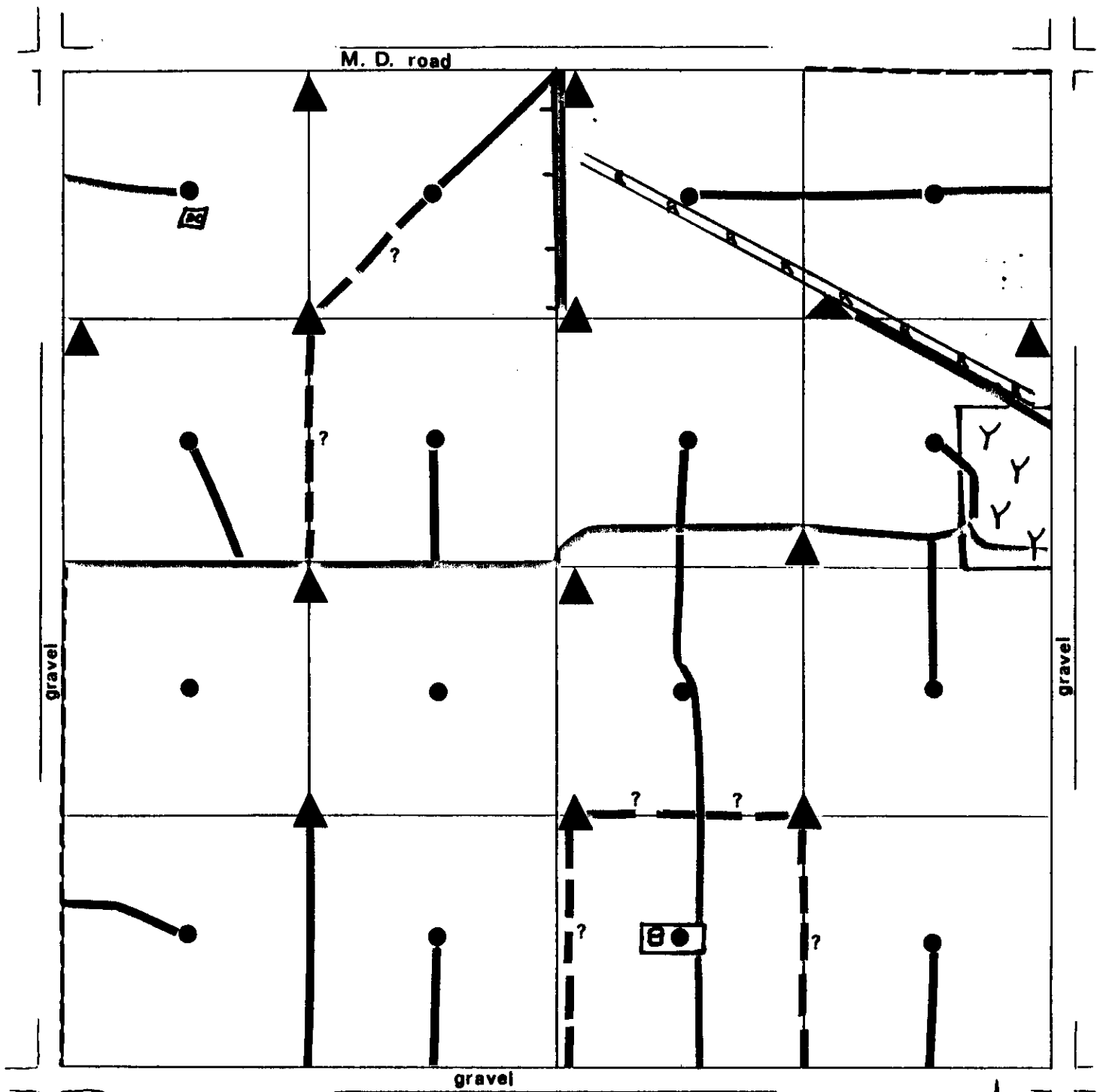


# **LEGEND**

Section 2 Township 10 Range 28 WPM

- |                     |                          |
|---------------------|--------------------------|
| ● Existing well     |                          |
| ▲ New well          |                          |
| — Existing road     | — Depressional area      |
| — New road          | — Field/crop delineation |
| — Existing trail    | Y Yard                   |
| — New trail         | — Farm lane              |
| - - - Unit boundary | — Bush                   |





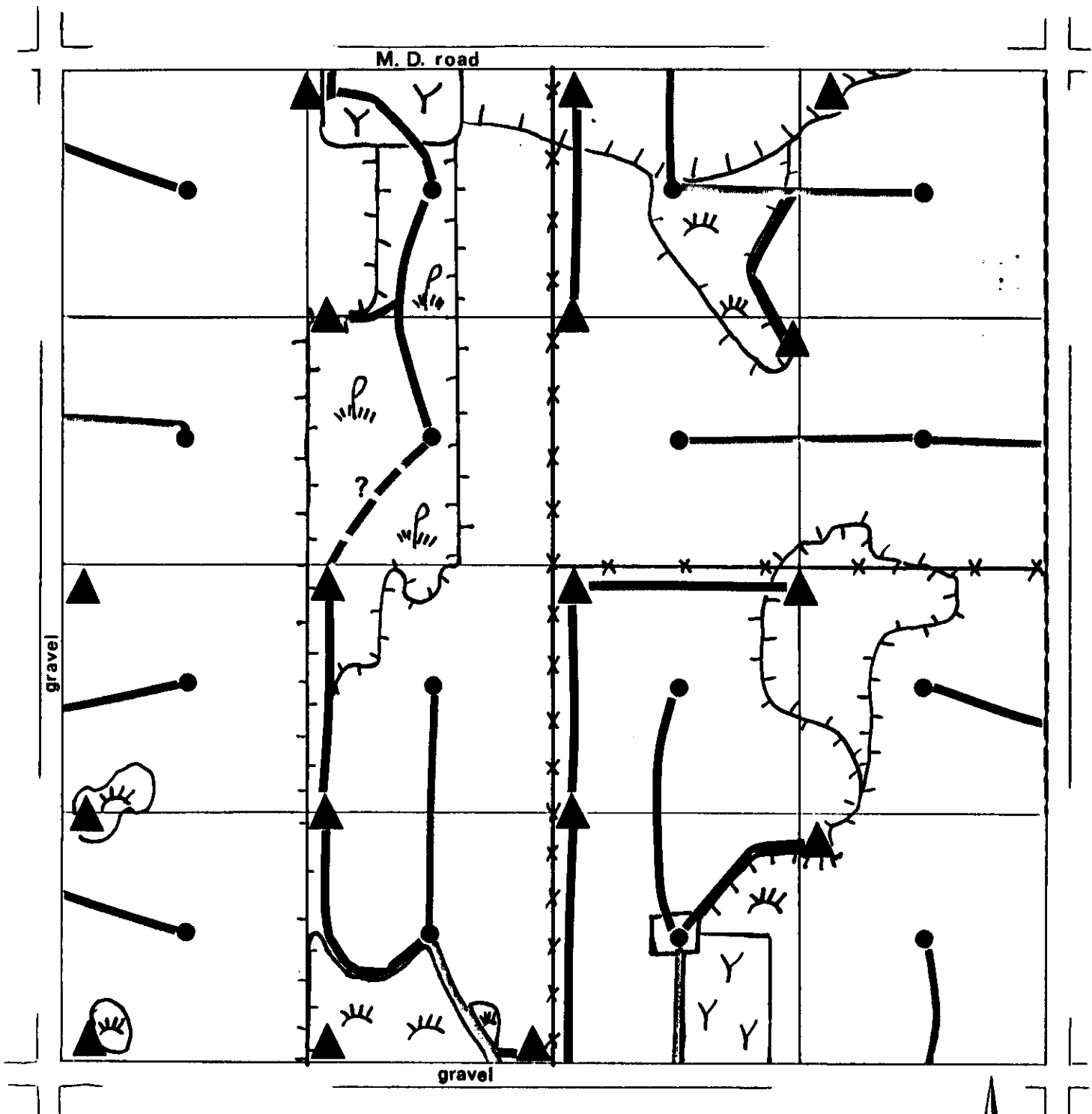
**LEGEND**

Section 11 Township 10 Range 28 WPM

- Existing well
- ▲ New well
- Existing road
- New road
- Existing trail
- New trail
- - - Unit boundary

- P Dugout
- P Plant site
- Y Farmyard
- R Runway





# **LEGEND**

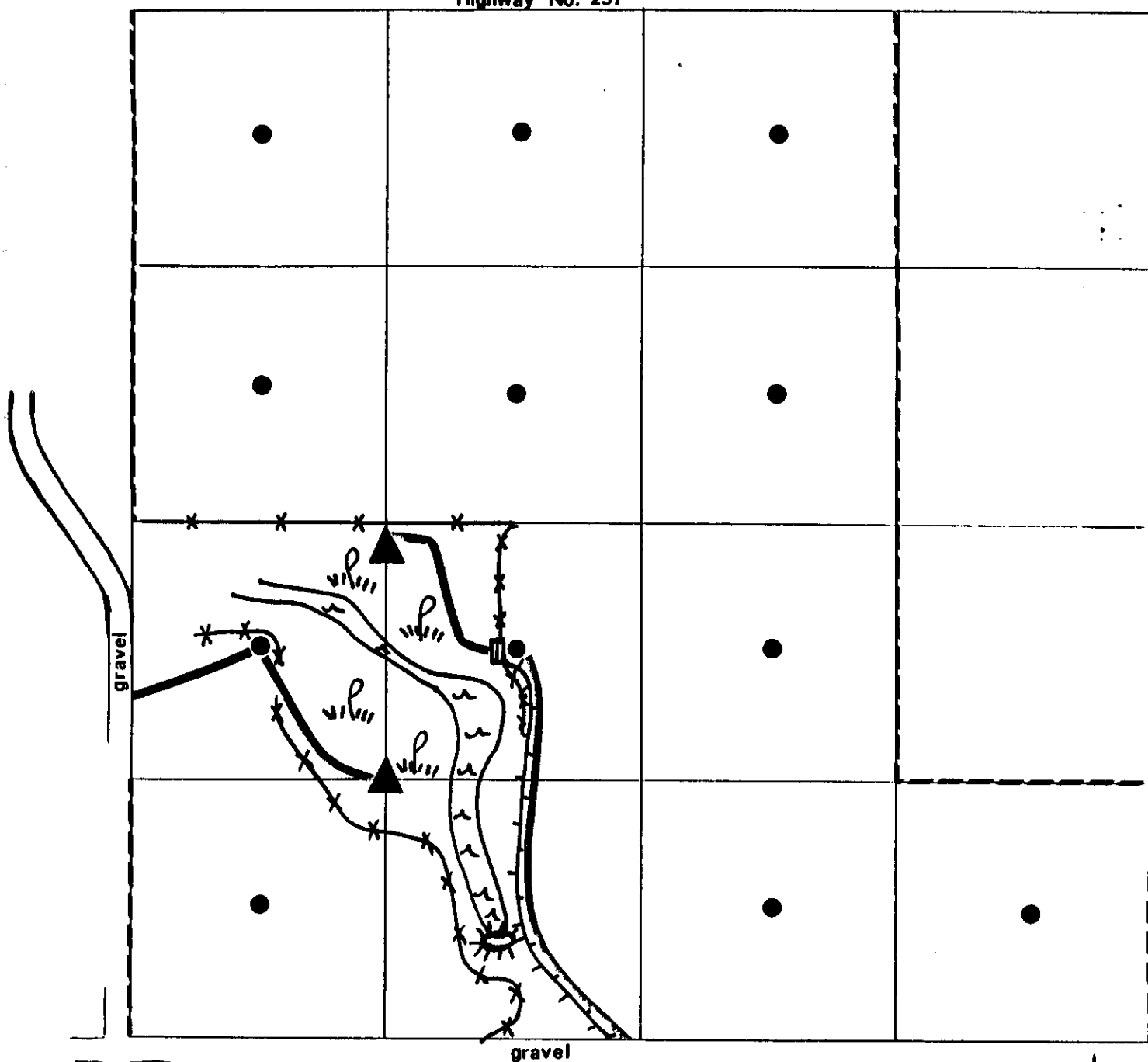
Section 12 Township 10 Range 28 WPM

- Existing well
- ▲ New well
- Existing road
- New road
- Existing trail
- New trail
- - Unit boundary

- Depressional area
- Pasture
- Slough area
- \* \* \* Fence
- Y Yard
- Field/crop delineation



Highway No. 257

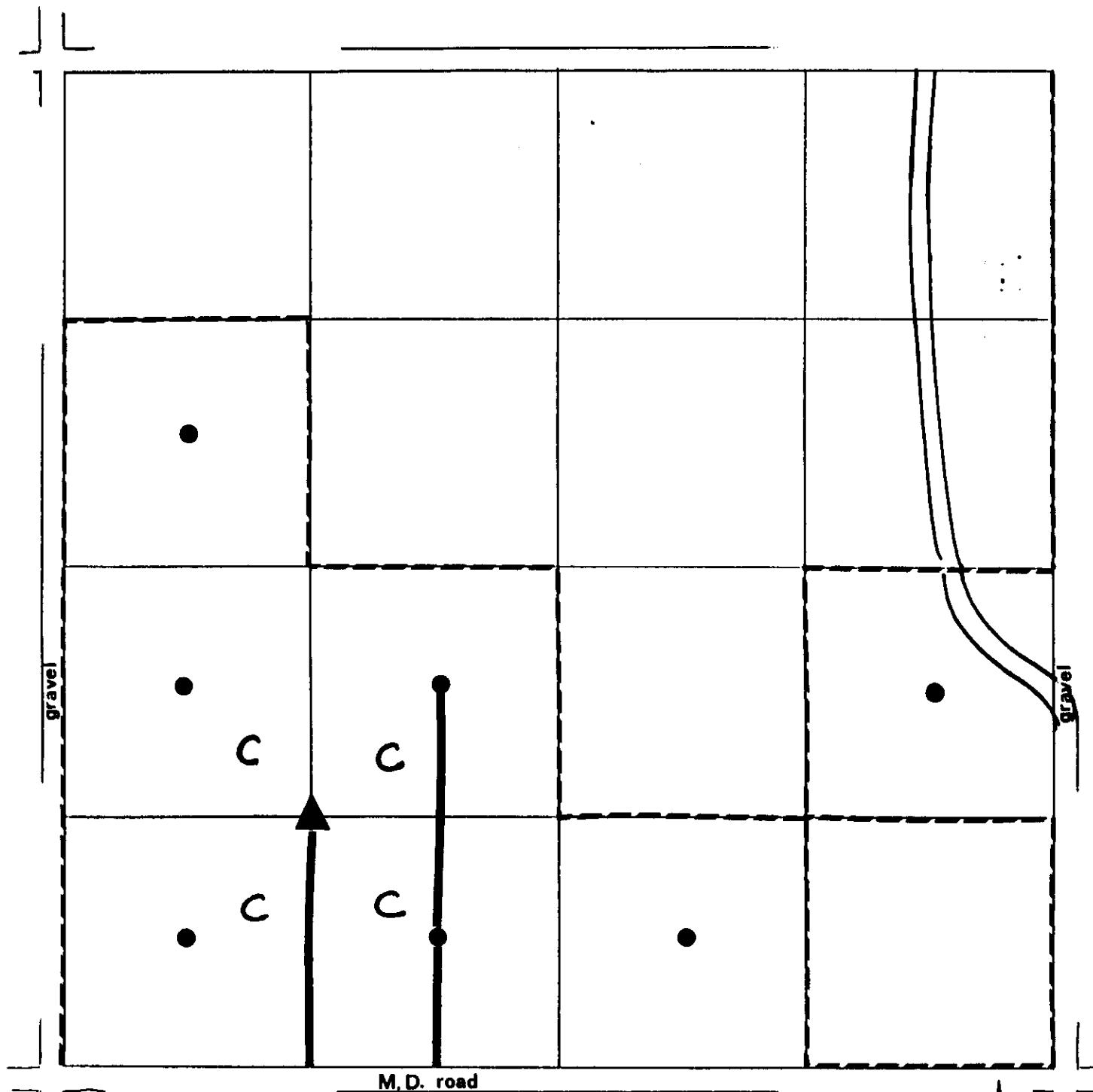


**LEGEND**

Section 13 Township 10 Range 28 WPM

- |                     |                        |
|---------------------|------------------------|
| ● Existing well     | Field/crop delineation |
| ▲ New well          | *** Fence              |
| — Existing road     | ☼ Dam                  |
| — New road          | ^ ^ Water              |
| — Existing trail    | ~ ~ ~ Pasture          |
| — New trail         | ☐ Cattle guard         |
| - - - Unit boundary |                        |





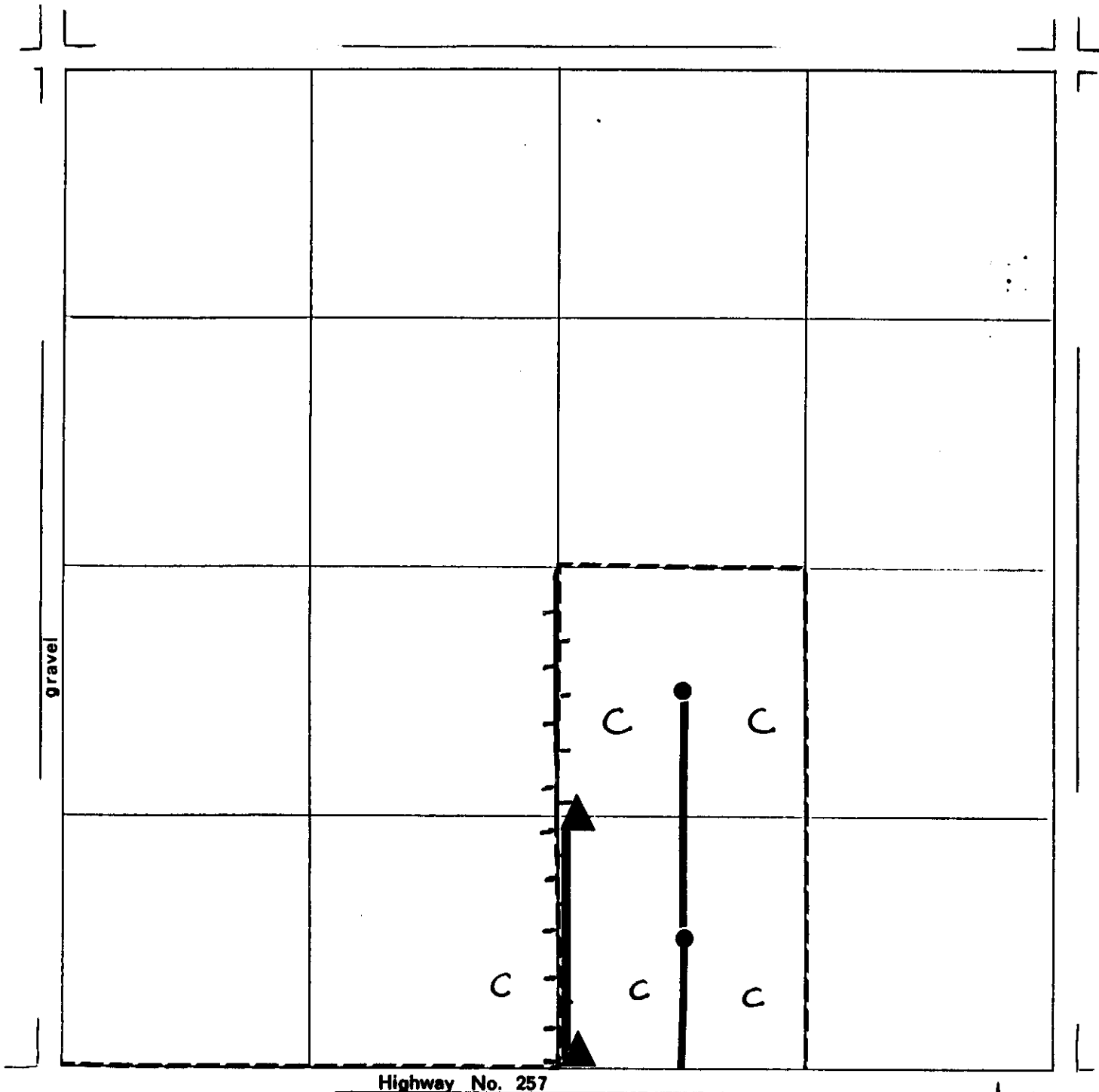
# LEGEND

Section 14 Township 10 Range 28 WPM

- Existing well
- ▲ New well
- Existing road
- New road
- Existing trail
- New trail
- - - Unit boundary

C C Crop land





LEGEND

Section 24 Township 10 Range 28 WPM

- Existing well
- ▲ New well
- Existing road
- New Road
- Existing trail
- New trail
- Unit boundary

Field/crop delineation  
C C Crop





PHOTO 1 An overall view of the NW $\frac{1}{4}$  4-10-28WPM with 20 acre spacing. Note the quarter is fully farmed.



PHOTO 2 A perimeter wellsite in the West Daly Field. Note the farmed over trail.

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PHOTO 3 A corner placement in the West Daly Field. Note how it is set in tight to an existing unfarmed area to minimize adverse effects.



PHOTO 4 A wellsite in 12-25-9-28WPM. The use of trails such as these is common in the south end of the project area. It minimizes the problems of adverse effect. Such trails are recommended throughout the report.

R. A. BERRIEN ASSOCIATES (RURAL) LTD.

ROBERT A. BERRIEN, P.Ag., A.R.A.

EDUCATIONAL BACKGROUND AND PROFESSIONAL QUALIFICATIONS

B.Sc. in Animal Science, Montana State University, Bozeman, Montana, 1967-1970  
Graduate Studies in Animal Science, University of Saskatchewan, Saskatoon,  
1970-1972  
Agricultural Lenders Range School, 1975-1978  
Licenced Alberta Land Man, 1982  
Licenced Alberta Real Estate Agent, 1983  
Accredited Rural Appraiser, American Society of Farm Managers and Rural  
Appraisers

EXPERIENCE

Managed and bred own herd of purebred and commercial cattle, 1973 to present  
Owner/operator of grain farm operation, 1980-present  
Instructor in Animal Science Department at Vermilion College (now Lakeland  
Community College), Vermilion, Alberta, 1973  
Instructor in the Animal Science Department at Olds College, Olds, Alberta,  
1973-1974  
Agricultural Officer, Canadian Imperial Bank of Commerce, 1974-1978  
President, Berrien Agricultural & Financial Consulting Ltd., Calgary, Alberta,  
1977-1978  
Associate, McKinnon, Allen & Associates (Western) Ltd., 1979-1982  
President, R. A. Berrien Associates (Rural) Ltd., Calgary, Alberta, 1983 to  
present

PROFESSIONAL ASSOCIATIONS

Alberta Institute of Agrologists, Professional Agrologist  
Canadian Consulting Agrologists Association  
Agricultural Institute of Canada  
American Society of Farm Managers and Rural Appraisers  
International Right of Way Association

R. A. BERRIEN ASSOCIATES (RURAL) LTD.

#### PROFESSIONAL SPECIALIZATION

Land appraisal in rural and urban fringe areas  
Rural real estate sales  
Rural receivership appraisal and management  
Farm business consulting, agricultural enterprise analysis  
Farm financial management and credit planning  
Surface Rights Act appraisals including damage and compensation estimates  
Expropriation Act appraisals  
Negotiation of compensation settlements for wellsite, powerline, highway and irrigation rights-of-way  
Appraisal of the effects of the industrial/agricultural interface including:

- coal, power and oil industry effects on farm land and farm businesses
- land reclamation
- effects of sour gas facilities and pipelines on rural land values

#### EXPERIENCE IN EXPERT TESTIMONY ON TECHNICAL AGRICULTURE

Accepted as an expert in agricultural matters and land value by the:

- Court of Queen's Bench in Alberta
- Court of Queen's Bench in Manitoba
- Surface Rights Board of Alberta
- Land Compensation Board of Alberta
- Local Authorities Board of Alberta
- Manitoba Surface Rights Board
- Energy Resources Conservation Board

#### OTHER PERTINENT ACTIVITIES

Calgary Exhibition & Stampede, Associate Director, 1976 to present  
Society of Range Management, Financial Chairman, 1982 Annual Meeting  
Legal Education Society of Alberta, Instructor in Surface Rights Seminar, 1983  
Canadian Bar Association Mid-Winter Meeting, Surface Rights panelist  
Accrediting Committee, American Society of Farm Managers and Rural Appraisers, 1984, 1985  
Instructor in Rural Appraisal, American Society of Farm Managers and Rural Appraisers, 1985, 1986