Memorandum

To: Lee County Board of County Commissioners
From: David W. Depew, PhD, AICP, LEED AP, on behalf of Troyer Brothers, LLC
Date: March 3, 2010
Subject: DR/GR Amendments, CPA 2008-06

Troyer Brothers Florida, Inc. ("Troyer Brothers") objects to the amendments to the Lee County Land Development Code ("LDC") and to the proposed amendments to the Lee Country Comprehensive Plan ("Comp. Plan") that relate to resource extraction and the creation of a mining overlay for the reasons stated on the record before the Board on September 24, 2009, and as stated when Troyer Brothers requested an amendment to the Mine Overlay on October 22, 2009. We object for the following reasons (feel free to condense these remarks to single bullet items):

(i) Troyer Brothers has and had an expectation of developing their property as a mine and the amendments to the LDC and proposed amendments to the Comp. Plan will unfairly and severely burden, restrict and limit their property rights and will substantially deny the economical, beneficial or productive use of the land;

(ii) The facts and studies relied upon by Lee County and the related agencies in passing and proposing the aforementioned amendments are incorrect;

(iii) The proposed amendments are based on invalid science and other invalid or improper justification, based on conclusions and/or opinions by persons who lack the qualifications and/or expertise needed in the relevant areas, and are scientifically unsupportable; furthermore, all of the necessary studies needed to proceed with the amendments at issue have not been completed;

(iv) The amendments disregard the limited quantity of mineable limerock reserves and the limited locations in which mineable reserves occur;

(v) In order for a land use amendment to be a valid exercise of local government authority, it must be based upon the best available data and analysis, and be supported by professionally accepted methodology. The input that has been provided by various independent professionals concerning the amendments to the LDC and the proposed amendments to the Comp. Plan demonstrates that the amendments are demonstrably not based upon either the best available data and analysis or professionally accepted methodology;

(vi) The amendments are arbitrary and capricious in nature, and unfairly benefit certain properties over others;

(vii) The proposed amendments do not reflect an appropriate response for the data available, and do not reflect an accurate assessment of the existing natural resources, specifically the minerals and soils of the Troyer property; and

(viii) The amendments to the LDC do, and if passed the proposed Comp. Plan amendments will, constitute an invalid and unreasonable exercise by Lee County of its powers and are against applicable law, including acting as a deprivation of Troyer Brothers' constitutionally protected interests.

Troyer Brothers also objects for the reasons stated in our letter to the Florida Department of Community Affairs on December 18, 2009, a copy of which we would like to place into the record at this time.

Hopping Green & Sams

Attorneys and Counselors

December 18, 2009

Ms. Brenda Winningham
Florida Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100

Re: Lee County Amendment 09-1 (CPA 2008-00006-DR/GR)

Dear Ms. Winningham:

On November 18, 2009, Lee County ("County") transmitted its 09-1 proposed Comprehensive Plan Amendment package ("Amendment"), also identified as CPA 2008-00006 DR/GR Study Implementation, to the Department of Community Affairs ("Department") for review. The Amendment proposes significant changes to the Lee Plan including to the Future Land Use Element, Future Land Use Map Series, Community Facilities and Service Element, Conservation and Coastal Management Elements.

Our clients, the Troyer Brothers Florida, Inc. ("Troyer"), participated in the transmittal hearing proceedings before the County and interposed objections to the Amendment at that time and will be adversely affected if the Amendment is adopted.

As proposed the Amendment accomplishes several things:

(1) establishes inappropriate precedential concepts of "need" for the mining of construction aggregate materials (limerock) and a finite acreage purported to meet that need that are not based on relevant, appropriate data;

(2) makes the restoration of "historic" surface and groundwater levels based on 1953 aerial photos a goal of the Plan and requires applicants to make two contradictory demonstrations as to the impact of projects on these levels;

(3) establishes a transfer of development rights ("TDR") program which encourages urban development without the infrastructure to serve it, including roads, potable water and sewer facilities, contrary to growth management law;

(4) violates numerous provisions of the County's own Plan related to economic development and requirements to assess the impact of regulations such as those proposed by the Amendment upon the local economy.

The Florida Legislature enacted legislation in 2007 which was amended in 2009 recognizing that limerock mining is of critical importance to the state and that the mining of limerock is in the public interest. § 337.0261(1), Florida Statutes (F.S.). Chapter 337 also provides that "there is a strategic and critical need for an available supply of construction aggregate materials within the state" and that "a disruption of the supply would cause a significant detriment to the state's construction industry, transportation system, and overall health, safety, and welfare." § 337.0261(2), F.S. This Chapter also requires that the County consult with the Florida Department of Transportation ("FDOT")

State law prohibits local governments from approving or denying a comprehensive plan amendment related to limerock without consulting with or considering any information provided by the FDOT regarding the effect the Amendment would have on the availability, transportation, and potential extraction of limerock materials on the local area, the region and the state. § 337.0261(3), F.S. The Amendment is contrary to Section 337.0261, F.S., because it will have the effect of disrupting the supply of limerock to the detriment of the construction industry and transportation system, and impacts to and information from FDOT were not considered.

Therefore, along with the requirements of Chapter 163, F.S. and Rule 9J-5, Florida Administrative Code ("F.A.C."), the Amendment must be considered against the framework of legislative requirements and direction applicable to the mining of limerock. When considered against this backdrop, it is clear that the Amendment is inconsistent with state law on many levels.

Need for Limerock Mining

The Amendment establishes a new regulatory framework for the permitting of limerock mining. The Amendment proposes changes to the Vision Statement for Planning Community #18, Policy 1.2.2, Policy 1.4.5.2.c, new Policy 1.7.12, Objective 30.1 and implementing policies, Table 1(b) and Future Land Use Map 14 Future Limerock Mining Overlay ("Overlay"). The County has determined that the limerock materials available in the area identified in the Overlay are sufficient to serve "regional" need for the resource through 2030.

The Amendment would only allow limerock mining in the next twenty years within a limited portion of Southeast Lee County. In determining how much area to set aside for this use, the Amendment establishes precedential concepts of "need" for the mining of limerock in quantities that are purported to be sufficient to serve an undefined "regional" area but fails to account for a basic concept in resource extraction – that mining can only take place where the resource at issue is located. (*See Objective 30.1 and implementing policies.*)

The Amendment fails to consider rock quality, quantity, or mineability in establishing the Overlay and mine acreage limitations in Map 14 and Table 1(b). In addition to a paucity of rock borings information, there is no assessment as to whether the areas identified in the Overlay are available or capable of being mined for limerock. In fact, many of those areas are not available for mining, have limited resources, or their resources have already been or are being exhausted.

We have outlined our concerns with regard to the Overlay and the manner in which it renders the Amendment inconsistent with Chapter 163, F.S., and Rule 9J-5, F.A.C., in a letter previously provided to the Florida Department of Transportation ("FDOT"). A copy of that letter is provided herewith for your consideration as Attachment "A".

We provide the following additional thoughts with regard to the regulatory overlay concept put forward by the Amendment. The Amendment proposes a methodology for determining need for a resource of critical state concern that is flawed. Establishing this flawed methodology as precedent, available as guidance to other local governments, will have significant repercussions on the ability to mine for limerock in appropriate locations not only in the County, but across the State. The methodology is now before the Department for approval. The Department must review both the numerical outcome of that methodology, as depicted in the County's Overlay, along with its larger policy implications.

Unlike residential, commercial and traditional types of industrial development, all of which are subjected to a need determination by the Department, limerock mining can only take place within limited areas of certain jurisdictions across the state. Mining can occur only where the resource is located and cannot simply be placed in the most expedient location. With other forms of development, a need determination may lead to the conclusion that a particular jurisdiction is over-allocated and, therefore, should not be approved for further development. However, this determination does not foreclose the development of such uses in another jurisdiction which may be able to satisfy the need showing. That option is not available for limerock mining because it cannot simply be relocated to another jurisdiction where the resource does not occur. This resource is finite and necessary, not just to serve an undefined local or even regional area, but to serve statewide needs for the construction of infrastructure.

It is inappropriate to establish traditional "parcel-based" need methodologies to restrict the availability of a resource which is not limited in its importance by geographic or political boundaries and cannot be transplanted to other locations. Furthermore, the County did not consult with FDOT concerning local, regional, or statewide production needs for limerock in developing its methodology nor in the numerical outcome.

Even if the methodology used here were to be deemed acceptable, the Overlay which purports to identify the appropriate locations for that need to be met is itself

flawed for several reasons. The Overlay includes three types of property as depicted on the aerial attached hereto as Attachment "B" (1) Approved Existing Mines (portions of which are already being mined with the resource on site close to being exhausted); (2) Residential Neighborhoods (cross hatched areas in yellow which are not available for mining); and (3) Tradeport Land designated for industrial development to serve the Southwest Florida International Airport. Inclusion of these areas in the Overlay improperly boosted the acres assertedly available to meet the County's limerock "need," and in turn inappropriately restricted the size of the Overlay.

As proposed, the Overlay portion of the Amendment is inconsistent with Section 187.201(13)(b)9. F.S. of the State Comprehensive Plan which requires that mining regulations recognize the geological constraints and inherent differences in the types and locations of resources to be mined because it identifies and inappropriately conditions mining development to areas which are not those most geologically suited for mining. The Amendment ignores geological constraints entirely and establishes an Overlay which does not recognize or consider location, mineability, quality, quantity, or availability of the resource to be mined.

Conflict with Environmental Resource Regulations due to Restoration of Historic Surface and Groundwater Levels

The Amendment proposes addition of Map 24, the Historic Surface and Groundwater Levels overlay to the Future Land Use Map series, amendment of Policy 1.4.5 and a new Policy 1.7.14. Together the proposed map and policies require every applicant for a rezoning or development order within the Density Reduction Groundwater Recharge Area ("DR/GR") to affirmatively:

> ...demonstrate compatibility with maintaining surface and groundwater levels at their historic levels (except as provided in Policies 30.1.3 and 30.3.3) utilizing hydrologic modeling, the incorporation of increased storage capacity, and inclusion of green infrastructure. The modeling must also show that no adverse impacts will result to upstream, downstream, and adjacent property. Offsite mitigation can be utilized, and may be required, to demonstrate this compatibility. Historic wet-season water depths and hydroperiods are depicted on Map 24, based on detailed analyses of 1953 aerial photography. Additional evidence as to historic levels may be submitted during the rezoning or development review processes.

Thus, the Amendment defines "historic" as the 1953 condition, without justification for choosing that particular year or true analysis of the feasibility of attaining that condition and then mandates that applicants demonstrate compatibility with this historic condition. The requirements to "maintain" a historic water level and to "show" no adverse impacts to upstream, downstream and adjacent property (even though it is apparent that 1953 water levels have been substantially altered in 50 years) are directly

in conflict with each other. Those applicants that cannot make both demonstrations simultaneously (i.e., all applicants) will be required to provide undefined off-site mitigation to offset unspecified adverse impacts. This provision is vague and lacking in articulated standards and so cannot be rationally and consistently applied.

Further, the Overlay is based on an underlying assumption that there will be "wall to wall" mining meaning that the excavation pit footprint will encompass essentially all of the mine property, including flood plains, wetlands and areas which have been identified as primary panther habitat and areas of moderate species richness as detailed in the County's own data and analysis. See County Transmittal Package to the Department, PowerPoint Presentation of Bill Spikowski pages 10-13. For this reason the Overlay fails to react appropriately to the relevant data and analysis regarding the location and extent of environmental resources.

We have outlined our concerns with regard to the historic surface and groundwater overlay and other environmental permitting provisions of the Amendment and its inconsistency with Chapter 163, F.S., and Rule 9J-5, F.A.C., in a letter previously provided to the Florida Department of Environmental Protection ("FDEP") and the South Florida Water Management District ("SFWMD") which is attached to this letter as Attachment "C."

In summary, the goals and policies requiring this historic water level demonstration are not based on relevant and appropriate data and are vague and inconsistent with state law.

TDR Infrastucture Impacts

In order to establish a TDR program, the Amendment proposes *new* Policy 1.7.13, Objective 30.3 and implementing Policies 30.3.3, 30.3.4 and 30.3.5, Future Land Use Map 17 and *amended* Table 1(a).

The Amendment violates numerous comprehensive planning requirements related to the need to coordinate infrastructure impacts with land use decisions. Specifically, the TDR portion of the Amendment will allow for significantly more intense urban development along SR 82 far beyond the uses currently contemplated for that roadway by the adopted Future Land Use Map without a plan to address any level of service ("LOS") deficiencies caused by the increase.

The TDR portion of the Amendment conflicts with the purpose of the DR/GR area, which resulted from settlement of compliance proceedings brought by the Department against the County alleging, in part, that the County's Future Land Use Map allocated too much land for urban growth. The Comprehensive Plan was amended to provide that permitted uses in the DR/GR include "agriculture, **natural resource extraction and related facilities**, conservation uses, publicly-owned gun range facilities, private recreation facilities and residential uses at a maximum density of one

dwelling unit per ten acres (1 du/10 acres)." (emphasis added) Lee Plan Policy 1.4.5. As such, the Amendment results in numerous internal inconsistencies with existing Plan limitations on the need for additional residential development in the DR/GR and the provision of centralized potable and sewer facilities to serve the proposed urban development form. A memorandum outlining these inconsistencies in relation to the Plan is provided as Attachment "D" to this letter.

We have also outlined our concerns with regard to the TDR program and the manner in which it renders the Amendment inconsistent with Chapter 163, F.S., and Rule 9J-5, F.A.C., in our letter to FDOT which is attached as Attachment "A".

Furthermore, as proposed by the County, the infrastructure concerns and deficiencies inherent in the TDR program render it an inappropriate mechanism by which to comply with the State Comprehensive Plan and its requirements for the balancing of private property rights with other planning goals. Specifically, the Amendment is inconsistent with the requirement of Section 187.201(14)(a) F.S., related to protection of private property rights and recognition of the existence of private interests in land use regulations. Pursuant to the Florida Statutes, the County has a duty to consider and protect private property rights when amending its comprehensive plan.[1] Florida's State Comprehensive Plan states in unequivocal terms that "Florida **shall** protect private property rights and recognize the existence of legitimate and often competing public and private interests in land use regulations and other government action." § 187.201(14)(a), F.S. (emphasis added). This provision, and the balancing inherent in it, is applicable to the County's proposed Amendment.

It is clear that the County failed to adequately consider and protect private property rights. Although the TDR provisions ostensibly seek to protect private property rights by allowing the transfer of densities and intensities from lands in the DR/GR they fall far short of the mark. As detailed above, the TDR is unlikely to be implementable within the 2030 timeframe of the Plan for many reasons, including infrastructure deficiencies. Simply put, when applied, the protections offered by the TDR becomes illusory, thus making it clear that the Amendment fails to adequately consider and protect private rights. Owners of property with valuable limerock resources located outside the Overlay will be essentially precluded from utilizing those resources. The County's own attorney has highlighted the private property rights concerns associated with the Amendment. See Memorandum of David Owen, County Attorney, dated July 7, 2009, attached hereto as Attachment "E".

Internal Inconsistency with Economic Development Requirements of the Plan

- The Amendment is internally inconsistent with several additional policies of the Plan including the following policies of the Economic Element and Future Land

[1] *See CNL Resort Hotel, L.P. v. City of Doral*, 991 So. 2d 417, 420-21 (Fla. 3d DCA 2008) (citing §§ 187.101 and 187.201(14)(a), F.S. (2006)).

Use Element:

- Policy 158.1.10 of the Economic Element which requires the County to evaluate the current land development regulatory and fiscal structure to identify and remove where appropriate the unwanted impediment to ensuring development is fiscally beneficial. Yet, the Amendment creates an expensive, time-consuming regulatory hurdle for mine applicants outside the Overlay, in addition to creating substantial and burdensome regulatory requirements for mine applicants within the Overlay. This in turn creates substantial economic and timing impediments to transportation projects, which necessarily rely upon a long-term, consistent source of limerock for construction needs;

- Policy 158.3.5 of the Economic Element which requires the County to ensure that adequate land is allocated in the comprehensive plan to meet future needs. The Amendment specifically fails to appropriately ensure adequacy of designated land for mining in light of regional and state needs and the availability of the resource within the designated areas. This lack of availability seriously constrains long-term planning of the state's transportation planning efforts, which must rely on consistent, long-term sources of limestone;

- Policy 158.6.1. of the Economic Element which provides that before adopting any new regulation which potentially imposes new costs to taxpayers and private business, the County first will generally assess the impact of that regulation upon the local economy and will adopt such regulations only in cases of compelling public need. There is no data and analysis to demonstrate that the County conducted any such evaluation; yet such evaluation would reveal that the new regulatory structure being imposed by the County creates substantial new costs for private business, specifically including those related to mining, construction, and transportation, as well as to FDOT.

- Due to these inconsistencies the Amendment is also inconsistent with Policy 7.1.10 of the Future Land Use Element which provides that all County actions related to industrial land uses must be consistent with the goals, objectives and policies of the Economic Element of the Plan.

- The Amendment is inconsistent with Future Land Use Element Objective 1.2, its implementing policies and numerous other policies of the Plan, because it incorporates areas into the Future Limerock Mining Overlay which have been designated to be the economic engine of the County, necessary for expansion of the economic base and employment opportunities and complementary to the Southwest Florida International Airport and Florida Gulf Coast University.

Agricultural Overlay

- New Policy 30.1.7 declares that the County will "Protect agricultural activities on lands designated as Agricultural on the agricultural overlay (see Map 20) from the impacts of new natural resource extraction operations ..." This policy renders the Amendment inconsistent with Section 187.201(22)(b)1.F.S., which provides that state and regional plans should not be interpreted to permanently restrict the conversion of agricultural lands to other uses. The policy could be interpreted to restrict the ability of agricultural lands to be converted to natural resource extraction and establishes a new concept - - that agricultural operations and natural resource operations are inherently incompatible.

Conclusion

In conclusion, the Amendment fails to meet the standards established under Florida's Statutes and is contrary to the intent and direction applicable to the mining of limerock. The County failed to consult with FDOT, the FDEP or the SFWMD in revising its plan to effect sweeping changes which result in significant inconsistencies with the requirements and regulations of those agencies which were established by law to provide the expertise to oversee these matters.

We look forward to meeting with you to discuss these matters further.

Sincerely,

Susan L. Stephens
Vinette D. Godelia

cc: Michael McDaniel
Scott Rogers

Hopping Green & Sams

Attorneys and Counselors

December 14, 2009

Mr. Stan Cann, Secretary District One
Florida Department of Transportation
801 North Broadway
PO Box 1249
Bartow, FL 33831

Re: Lee County Amendment 09-1 (CPA 2008-00006-DR/GR)

Dear Secretary Cann:

On November 18, 2009, Lee County ("County") transmitted its 09-1 proposed Comprehensive Plan Amendment package ("Amendment"), also identified as CPA 2008-00006 DR/GR Study Implementation, to the Department of Community Affairs ("DCA") for review. The Amendment proposes significant changes to the Lee Plan including to the Future Land Use Element, Future Land Use Map Series, Community Facilities and Service Element, Conservation and Coastal Management Elements.

Our clients, the Troyer Brothers ("Troyer"), have pending applications to mine certain property in the County for limerock. Data to demonstrate the large quantities of mineable limerock suitable for creating Florida Department of Transportation ("FDOT") - specification aggregate and construction aggregate material available on the parcel was previously provided to the County and is provided herewith for your information. (See attached). Troyer participated in proceedings before Lee County and interposed objections to the Amendment at that time and will be adversely affected if the Amendment is adopted.

As set forth below, the Amendment conflicts with state law and with FDOT long-term transportation planning and strategies explained in its Strategic Aggregates Study: Sources, Constraints and Economic Value of Limestone and Sand in Florida, dated March 12, 2007("Strategic Aggregates Study"), and acts as a deprivation of Troyer's constitutionally protected interests. If the Amendment is applied to the Troyer property, Troyer will likely be unable to obtain approvals from the County for mining, notwithstanding the large quantities of high quality, mineable rock located on the property. It will also serve to deprive FDOT of the ability to utilize these strategically important reserves in transportation projects.

ATTACHMENT
A

The Amendment redefines the process for permitting of construction aggregate materials ("limerock") mining in the County. It does so in a manner which: (1) establishes precedential concepts of "need" for the mining of limerock to serve a limited, undefined "regional" area and essentially excludes mining to serve other areas; and (2) establishes a transfer of development rights ("TDR") program which encourages urban development along a failing Strategic Intermodal System ("SIS") roadway with no short or long-term plans in place to address the substantial burden on the roadway caused by the additional development. Both of these aspects of the Amendment are contrary to state law relevant to transportation infrastructure.

The Florida Legislature enacted legislation in 2007 and amended in 2009 recognizing that limerock mining is of critical importance to the state and that the mining of limerock is in the public interest. § 337.0261(1), Florida Statutes (F.S.). Chapter 337 also provides that "there is a strategic and critical need for an available supply of construction aggregate materials within the state" and that "a disruption of the supply would cause a significant detriment to the state's construction industry, transportation system, and overall health, safety, and welfare." § 337.0261(2), F.S.

State law also prohibits local governments from approving or denying a comprehensive plan amendment related to limerock without considering any information provided by the FDOT regarding the effect the amendment would have on the availability, transportation, and potential extraction of limerock materials on the local area, the region and the state. § 337.0261(3), F.S.

Therefore, along with the requirements of Chapter 163, F.S. and Rule 9J-5, Florida Administrative Code ("F.A.C."), the Amendment must be considered against the framework of legislative requirements and direction applicable to the mining of limerock. It must also be evaluated against FDOT's local, regional, and state-wide transportation planning and construction needs, and requirements for a long-term, consistent supply of limerock aggregate to meet those needs. When considered against this backdrop, it is clear that the Amendment is inconsistent with state law on many levels, particularly with respect to transportation impacts and long-term transportation planning and project development. The Amendment effectively deprives FDOT of a long-term consistent supply of limerock aggregate to meet its transportation needs.

TDR Transportation Impacts

In order to establish a TDR program, the Amendment proposes *new* Policy 1.7.13, Objective 30.3 and implementing Policies 30.3.3, 30.3.4 and 30.3.5, Future Land Use Map 17 and *amended* Table 1(a).

The Amendment violates numerous comprehensive planning requirements related to the need to coordinate infrastructure impacts with land use decisions. Specifically, the TDR portion of the Amendment will allow for significantly more intense urban development along SR 82 far beyond the uses currently contemplated by the

adopted Future Land Use Map without a plan to address any level of service ("LOS") deficiencies caused by the increase. No improvements resulting in increased roadway capacity are programmed in the short or long-term by the County.

The Amendment is inconsistent with Chapter 163, F.S., and Rule 9J-5, F.A.C., as detailed below:

- The Amendment is not supported by relevant and appropriate data and analysis, fails to react in an appropriate way to available data as required by Rule 9J-5.005(2)(a), F.A.C., and Sections 163.3177 (6) and (8), F.S. and fails to establish meaningful and predictable standards for the use and development of land in violation of Rule 9J-5.005(6), F.A.C. because:

    - The County failed to provide data and analysis related to infrastructure impacts from the assignment of additional densities and intensities along SR 82. Table 1(a) is amended to allow the transfer of up to 9,000 dwelling units to Mixed-Use Communities including four such communities proposed along SR 82. New Policy 30.3.3 provides that "Within the Mixed-Use Communities shown on Map 17, significant commercial and civic uses are encouraged. Specific requirements for incorporating these uses into Mixed-Use Communities will be found in the Land Development Code." The County's failure to provide a numeric threshold or other means by which to calculate immeasurable "significant commercial and civic uses" results in the complete absence of data and analysis sufficient to assess the infrastructure impacts from the assignment of additional commercial and institutional intensities along SR 82.

    - The Amendment fails to provide the level of detail necessary to ascertain consistency with growth management laws because it does not detail the regulatory framework which will be the basis for the TDR program. As such, the TDR program evades the required demonstration of consistency with the minimum criteria of Chapter 163, F.S., and Rule 9J-5, F.A.C.

- The Amendment fails to demonstrate that the Lee Plan remains financially feasible and that transportation LOS standards established by FDOT can be achieved and maintained as required by Sections 163.3177, 163.3180, F.S., and Rules 9J-5.005(6), 9J-5.0055, 9J-5.016 and 9J-5.019, F.A.C.

    - The County is admittedly aware of the facial LOS deficiency of the proposed TDR program, yet is nonetheless proceeding with the Amendment. At its October 29, 2009 transmittal hearing, the County stated that among the options available to remedy the facial transportation deficiency is a LOS variance from FDOT. [Statement of Bill Spikowski, consultant to Lee County] No such application is pending. Further, Florida Statutes require applicants for a LOS variance to demonstrate that

maintaining FDOT established levels of service would create a substantial hardship or would violate principles of fairness. However, any hardship here would be self-created as the County is already aware that, regardless of other planning goals, the TDR program cannot be successfully implemented because of the deficiencies it would create along SR 82. The record submitted with the Amendment documents the County's awareness of the LOS deficiency on SR 82. In any case, the requisite demonstration was not provided. *See County Amendment transmittal package- Staff Analysis and Recommendations pp 16 – 17; Memorandum of David Owen, County Attorney, dated July 7, 2009, pp 4-5, which is Attachment 13 to the County transmittal package ("Owen Memo").*

- The purpose of the facially-deficient TDR program is clear: it purports to address the property rights infringement imposed by other portions of the Amendment. As repeatedly stated by the County, the TDR program is necessary at this juncture in order to reduce the likelihood of litigation related to the implementation of new comprehensive planning limitations which, in effect, remove the ability of landowners to seek permits for limerock mining where the existing future land use map and zoning classifications already allow that use. *(Lee County BOCC Hearing, October 29, 2009, Statement of Donna Marie Collins, Assistant County Attorney; see also proposed Policy 30.1.3 which provides that "the Land Development Code will be amended and maintained to include provisions for ... transferring residential development rights on land zoned for limerock mining pits.")* However, the TDR program is inconsistent with state law, and, as stated below, the portions of the Amendment purporting to necessitate the TDR program are also inconsistent with state law. (*See Owen Memo, pp 4-5)* Thus it is clear that any "hardship" is self-created.

Limerock Mining

The Amendment establishes a new framework for the permitting of limerock mining. The Amendment proposes amendments to the Vision Statement for Planning Community #18, Policy 1.2.2, Policy 1.4.5.2.c, new Policy 1.7.12, Objective 30.1 and implementing policies, Table 1(b) and Future Land Use Map 14 Future Limerock Mining Overlay ("Overlay").

Primarily, the Amendment would allow limerock mining in the next twenty years only within a limited portion of the County. In determining how much area to set aside for this use, the Amendment establishes precedential concepts of "need" for the mining of limerock in sufficient quantities to serve an undefined "regional" area but fails to account for a basic concept in resource extraction – that mining can only take place where the resource at issue is located. (*See Objective 30.1 and implementing policies.*)

The County has determined that the limerock materials available in the area identified in the Overlay are sufficient to serve "regional" need for the resource through

2030. In order to add land to the Overlay, an applicant who already has the appropriate land use and zoning designations must undertake an additional and separate comprehensive plan amendment in order to be added to the Overlay and must, by a showing of "clear necessity.," demonstrate that the amount of the resource within the Overlay has been depleted, thereby requiring the addition of new lands. Owners of existing agricultural property face additional hurdles.

Further, the assumptions on which the Overlay is based are faulty for several reasons including: (i) that the area included in the Overlay contains the resource in question; (ii) that the limestone in the Overlay is actually recoverable; (iii) that there is a sufficient amount of limestone in the area that would render its mining economically feasible; and (iv) that the actual amount of the limestone available within the Overlay is sufficient in both quantity and quality to meet the resource needs for the region and to meet FDOT transportation needs. §337.0261(3), F.S.; § 14-103, F.A.C. Thus, the FDOT is not assured that this critical strategic resource will be available in the region over its next twenty year planning period.

In developing the Overlay, the County chose to ignore data and analysis in the form of geological studies which clearly demonstrate where the resource at issue is available in sufficient mineable quantities. The County also failed to appropriately consider the Strategic Aggregates Study prepared for FDOT in assessing the regional need and statewide need for limestone aggregate and, instead, developed an artificially constrained and unsupported projection of current and future limerock need. The Overlay admittedly contains hundreds, if not thousands, of acres of lands in areas more suitable for commercial airport development and/or existing residential communities with owners who have expressed no interest in mining the property. No limerock data has been provided or appears to be available concerning these properties. The inclusion of these acreages in the Overlay artificially inflates the number of mine acres available to meet the County's asserted limerock "need." *(See Owen Memo dated July 7, 2009 at page 4.)* The Overlay excludes known reserves and includes areas where no proven mineable reserves exist, thus depriving FDOT of a reliable long-term supply of mineable rock.

For these and other reasons, the Amendment is inconsistent with Chapter 163, F.S., and Rule 9J-5, F.A.C. as detailed below:

- The Amendment's Overlay provisions are not supported by relevant and appropriate data and analysis and in fact fail to react in an appropriate way to available data as required by Rule 9J-5.005(2)(a), F.A.C., and Sections 163.3177 (6) and (8), F.S. because:
    - The Amendment creates a regulatory resource identification map with which land use decisions must be consistent, but fails to coordinate the map with the actual location of the resource in question. Therefore, the amendment is unsupported by the best available data and analysis.

- The Amendment provides that future mining areas should be limited to the Alico Road corridor, based solely on urban planning considerations, not based on identification of the areas most appropriate for mining. By ignoring geologic data identifying mineable areas in the region and relying instead on an urban planning report to establish the Overlay, the Amendment fails to rely on best available data and analysis. *(See Prospects for Southeast Lee County Planning for the DR/GR Area, dated July 2008, prepared by Dover, Kohl & Partners)*

- The Amendment fails to consider rock quality, quantity, or mineability in establishing the Overlay and mine acreage limitations in Map 14 and Table 1(b). In addition to a paucity of rock borings information, there is no assessment as to whether the areas identified in the Overlay are available or capable of being mined for limerock.

- The County's determination of need is artificially constrained and ignores FDOT's local, regional, and state-wide planning needs, contrary to the requirement to utilize best available data. *(See Strategic Aggregates Study)*

- The Amendment fails to establish meaningful and predictable standards for the use and development of land in violation of Rule 9J-5.005(6) because:

  - It limits expansion of the Overlay to providing limerock supply for regional demand but fails to define the "region" or to provide an appropriate basis for limiting the regulatory Overlay solely to the artificially created concept of the "region."

  - The County establishes a new concept requiring a demonstration of need for limerock to serve the region in order to amend the Overlay. However, the County fails to establish clear parameters and standards by which that demonstration may be made instead requiring a showing of undefined "clear necessity."

- While it is inconceivable that Lee County has not coordinated with FDOT whose own studies address this issue, the County has provided no documentation of such coordination. Therefore, it appears that the County failed to consult with the FDOT in preparing the Amendment, as required by state law, to determine the agency's projections of local, regional, and statewide aggregate needs. The Amendment creates an expensive, time-consuming regulatory hurdle for mine applicants both within and outside the Overlay. This in turn creates substantial economic and time impediments to transportation projects which necessarily rely upon a long-term, consistent source of limerock for construction needs, contrary to § 337.0261(2), F.S.

- By allowing limerock mining within the Tradeport lands, the Amendment allows creation of a flight hazard near a public use airport, in conflict with guidelines issued by the Federal Aviation Authority of the U.S. Department of Transportation. *FAA Advisory Circulate No. 150/5200-33B dated August 28, 2007.*

CONCLUSION

In conclusion, the Amendment fails to meet the standards established under Florida's Statutes and is contrary to the intent and direction applicable to the mining of limerock. The County failed to consult with FDOT or to consider FDOT's local, regional, and state transportation planning needs. The Amendment will serve to deprive FDOT of a reliable, cost-effective and long-term supply of high quality limerock for its transportation infrastructure needs, contrary to state law.

We hope the information provided in this letter assists you in discharging FDOT's responsibility to: (1) provide information to the County regarding the effect the amendment would have on the availability, transportation, and potential extraction of limerock materials on the local area, the region and the state; and (2) prepare an agency comment letter to DCA consistent with the requirements of Section 163.3184(4), F.S. We respectfully request that FDOT object to the Amendment as inconsistent with its transportation planning goals.

We look forward to meeting with you to discuss these matters further.

Sincerely,

Susan L. Stephens
Vinette D. Godelia

cc: Stephanie C. Kopelousos
Kevin Thibault
Thomas O. Malerk
Alexis Yarbrough
Kathleen Neil
Kathleen Toolan

Hopping Green & Sams

Attorneys and Counselors

December 18, 2009

Ms. Brenda Winningham
Florida Department of Community Affairs
2555 Shumard Oak Boulevard
Tallahassee, FL 32399-2100

Re: Lee County Amendment 09-1 (CPA 2008-00006-DR/GR)

Dear Ms. Winningham:

On November 18, 2009, Lee County ("County") transmitted its 09-1 proposed Comprehensive Plan Amendment package ("Amendment"), also identified as CPA 2008-00006 DR/GR Study Implementation, to the Department of Community Affairs ("Department") for review. The Amendment proposes significant changes to the Lee Plan including to the Future Land Use Element, Future Land Use Map Series, Community Facilities and Service Element, Conservation and Coastal Management Elements.

Our clients, the Troyer Brothers Florida, Inc. ("Troyer"), participated in the transmittal hearing proceedings before the County and interposed objections to the Amendment at that time and will be adversely affected if the Amendment is adopted.

As proposed the Amendment accomplishes several things:

(1) establishes inappropriate precedential concepts of "need" for the mining of construction aggregate materials (limerock) and a finite acreage purported to meet that need that are not based on relevant, appropriate data;

(2) makes the restoration of "historic" surface and groundwater levels based on 1953 aerial photos a goal of the Plan and requires applicants to make two contradictory demonstrations as to the impact of projects on these levels;

(3) establishes a transfer of development rights ("TDR") program which encourages urban development without the infrastructure to serve it, including roads, potable water and sewer facilities, contrary to growth management law;

The Amendment fails to consider rock quality, quantity, or mineability in establishing the Overlay and mine acreage limitations in Map 14 and Table 1(b). In addition to a paucity of rock borings information; there is no assessment as to whether the areas identified in the Overlay are available or capable of being mined for limerock. In fact, many of those areas are not available for mining, have limited resources, or their resources have already been or are being exhausted.

We have outlined our concerns with regard to the Overlay and the manner in which it renders the Amendment inconsistent with Chapter 163, F.S., and Rule 9J-5, F.A.C., in a letter previously provided to the Florida Department of Transportation ("FDOT"). A copy of that letter is provided herewith for your consideration as Attachment "A".

We provide the following additional thoughts with regard to the regulatory overlay concept put forward by the Amendment. The Amendment proposes a methodology for determining need for a resource of critical state concern that is flawed. Establishing this flawed methodology as precedent, available as guidance to other local governments, will have significant repercussions on the ability to mine for limerock in appropriate locations not only in the County, but across the State. The methodology is now before the Department for approval. The Department must review both the numerical outcome of that methodology, as depicted in the County's Overlay, along with its larger policy implications.

Unlike residential, commercial and traditional types of industrial development, all of which are subjected to a need determination by the Department, limerock mining can only take place within limited areas of certain jurisdictions across the state. Mining can occur only where the resource is located and cannot simply be placed in the most expedient location. With other forms of development, a need determination may lead to the conclusion that a particular jurisdiction is over-allocated and, therefore, should not be approved for further development. However, this determination does not foreclose the development of such uses in another jurisdiction which may be able to satisfy the need showing. That option is not available for limerock mining because it cannot simply be relocated to another jurisdiction where the resource does not occur. This resource is finite and necessary, not just to serve an undefined local or even regional area, but to serve statewide needs for the construction of infrastructure.

It is inappropriate to establish traditional "parcel-based" need methodologies to restrict the availability of a resource which is not limited in its importance by geographic or political boundaries and cannot be transplanted to other locations. Furthermore, the County did not consult with FDOT concerning local, regional, or statewide production needs for limerock in developing its methodology nor in the numerical outcome.

Even if the methodology used here were to be deemed acceptable, the Overlay which purports to identify the appropriate locations for that need to be met is itself

in conflict with each other. Those applicants that cannot make both demonstrations simultaneously (i.e., all applicants) will be required to provide undefined off-site mitigation to offset unspecified adverse impacts. This provision is vague and lacking in articulated standards and so cannot be rationally and consistently applied.

Further, the Overlay is based on an underlying assumption that there will be "wall to wall" mining meaning that the excavation pit footprint will encompass essentially all of the mine property, including flood plains, wetlands and areas which have been identified as primary panther habitat and areas of moderate species richness as detailed in the County's own data and analysis. See County Transmittal Package to the Department, PowerPoint Presentation of Bill Spikowski pages 10-13. For this reason the Overlay fails to react appropriately to the relevant data and analysis regarding the location and extent of environmental resources.

We have outlined our concerns with regard to the historic surface and groundwater overlay and other environmental permitting provisions of the Amendment and its inconsistency with Chapter 163, F.S., and Rule 9J-5, F.A.C., in a letter previously provided to the Florida Department of Environmental Protection ("FDEP") and the South Florida Water Management District ("SFWMD") which is attached to this letter as Attachment "C."

In summary, the goals and policies requiring this historic water level demonstration are not based on relevant and appropriate data and are vague and inconsistent with state law.

TDR Infrastucture Impacts

In order to establish a TDR program, the Amendment proposes *new* Policy 1.7.13, Objective 30.3 and implementing Policies 30.3.3, 30.3.4 and 30.3.5, Future Land Use Map 17 and *amended* Table 1(a).

The Amendment violates numerous comprehensive planning requirements related to the need to coordinate infrastructure impacts with land use decisions. Specifically, the TDR portion of the Amendment will allow for significantly more intense urban development along SR 82 far beyond the uses currently contemplated for that roadway by the adopted Future Land Use Map without a plan to address any level of service ("LOS") deficiencies caused by the increase.

The TDR portion of the Amendment conflicts with the purpose of the DR/GR area, which resulted from settlement of compliance proceedings brought by the Department against the County alleging, in part, that the County's Future Land Use Map allocated too much land for urban growth. The Comprehensive Plan was amended to provide that permitted uses in the DR/GR include "agriculture, **natural resource extraction and related facilities**, conservation uses, publicly-owned gun range facilities, private recreation facilities and residential uses at a maximum density of one

Use Element:

- Policy 158.1.10 of the Economic Element which requires the County to evaluate the current land development regulatory and fiscal structure to identify and remove where appropriate the unwanted impediment to ensuring development is fiscally beneficial. Yet, the Amendment creates an expensive, time-consuming regulatory hurdle for mine applicants outside the Overlay, in addition to creating substantial and burdensome regulatory requirements for mine applicants within the Overlay. This in turn creates substantial economic and timing impediments to transportation projects, which necessarily rely upon a long-term, consistent source of limerock for construction needs;

- Policy 158.3.5 of the Economic Element which requires the County to ensure that adequate land is allocated in the comprehensive plan to meet future needs. The Amendment specifically fails to appropriately ensure adequacy of designated land for mining in light of regional and state needs and the availability of the resource within the designated areas. This lack of availability seriously constrains long-term planning of the state's transportation planning efforts, which must rely on consistent, long-term sources of limestone;

- Policy 158.6.1. of the Economic Element which provides that before adopting any new regulation which potentially imposes new costs to taxpayers and private business, the County first will generally assess the impact of that regulation upon the local economy and will adopt such regulations only in cases of compelling public need. There is no data and analysis to demonstrate that the County conducted any such evaluation; yet such evaluation would reveal that the new regulatory structure being imposed by the County creates substantial new costs for private business, specifically including those related to mining, construction, and transportation, as well as to FDOT.

- Due to these inconsistencies the Amendment is also inconsistent with Policy 7.1.10 of the Future Land Use Element which provides that all County actions related to industrial land uses must be consistent with the goals, objectives and policies of the Economic Element of the Plan.

- The Amendment is inconsistent with Future Land Use Element Objective 1.2, its implementing policies and numerous other policies of the Plan, because it incorporates areas into the Future Limerock Mining Overlay which have been designated to be the economic engine of the County, necessary for expansion of the economic base and employment opportunities and complementary to the Southwest Florida International Airport and Florida Gulf Coast University.

Hopping Green & Sams

Attorneys and Counselors

December 14, 2009

Mr. Stan Cann, Secretary District One
Florida Department of Transportation
801 North Broadway
PO Box 1249
Bartow, FL 33831

Re: Lee County Amendment 09-1 (CPA 2008-00006-DR/GR)

Dear Secretary Cann:

On November 18, 2009, Lee County ("County") transmitted its 09-1 proposed Comprehensive Plan Amendment package ("Amendment"), also identified as CPA 2008-00006 DR/GR Study Implementation, to the Department of Community Affairs ("DCA") for review. The Amendment proposes significant changes to the Lee Plan including to the Future Land Use Element, Future Land Use Map Series, Community Facilities and Service Element, Conservation and Coastal Management Elements.

Our clients, the Troyer Brothers ("Troyer"), have pending applications to mine certain property in the County for limerock. Data to demonstrate the large quantities of mineable limerock suitable for creating Florida Department of Transportation ("FDOT") - specification aggregate and construction aggregate material available on the parcel was previously provided to the County and is provided herewith for your information. (See attached). Troyer participated in proceedings before Lee County and interposed objections to the Amendment at that time and will be adversely affected if the Amendment is adopted.

As set forth below, the Amendment conflicts with state law and with FDOT long-term transportation planning and strategies explained in its Strategic Aggregates Study: Sources, Constraints and Economic Value of Limestone and Sand in Florida, dated March 12, 2007("Strategic Aggregates Study"), and acts as a deprivation of Troyer's constitutionally protected interests. If the Amendment is applied to the Troyer property, Troyer will likely be unable to obtain approvals from the County for mining, notwithstanding the large quantities of high quality, mineable rock located on the property. It will also serve to deprive FDOT of the ability to utilize these strategically important reserves in transportation projects.

ATTACHMENT
A

adopted Future Land Use Map without a plan to address any level of service ("LOS") deficiencies caused by the increase. No improvements resulting in increased roadway capacity are programmed in the short or long-term by the County.

The Amendment is inconsistent with Chapter 163, F.S., and Rule 9J-5, F.A.C., as detailed below:

- The Amendment is not supported by relevant and appropriate data and analysis, fails to react in an appropriate way to available data as required by Rule 9J-5.005(2)(a), F.A.C., and Sections 163.3177 (6) and (8), F.S. and fails to establish meaningful and predictable standards for the use and development of land in violation of Rule 9J-5.005(6), F.A.C. because:
    - The County failed to provide data and analysis related to infrastructure impacts from the assignment of additional densities and intensities along SR 82. Table 1(a) is amended to allow the transfer of up to 9,000 dwelling units to Mixed-Use Communities including four such communities proposed along SR 82. New Policy 30.3.3 provides that "Within the Mixed-Use Communities shown on Map 17, significant commercial and civic uses are encouraged. Specific requirements for incorporating these uses into Mixed-Use Communities will be found in the Land Development Code." The County's failure to provide a numeric threshold or other means by which to calculate immeasurable "significant commercial and civic uses" results in the complete absence of data and analysis sufficient to assess the infrastructure impacts from the assignment of additional commercial and institutional intensities along SR 82.
    - The Amendment fails to provide the level of detail necessary to ascertain consistency with growth management laws because it does not detail the regulatory framework which will be the basis for the TDR program. As such, the TDR program evades the required demonstration of consistency with the minimum criteria of Chapter 163, F.S., and Rule 9J-5, F.A.C.
- The Amendment fails to demonstrate that the Lee Plan remains financially feasible and that transportation LOS standards established by FDOT can be achieved and maintained as required by Sections 163.3177, 163.3180, F.S., and Rules 9J-5.005(6), 9J-5.0055, 9J-5.016 and 9J-5.019, F.A.C.
    - The County is admittedly aware of the facial LOS deficiency of the proposed TDR program, yet is nonetheless proceeding with the Amendment. At its October 29, 2009 transmittal hearing, the County stated that among the options available to remedy the facial transportation deficiency is a LOS variance from FDOT. [Statement of Bill Spikowski, consultant to Lee County] No such application is pending. Further, Florida Statutes require applicants for a LOS variance to demonstrate that

2030. In order to add land to the Overlay, an applicant who already has the appropriate land use and zoning designations must undertake an additional and separate comprehensive plan amendment in order to be added to the Overlay and must, by a showing of "clear necessity.," demonstrate that the amount of the resource within the Overlay has been depleted, thereby requiring the addition of new lands. Owners of existing agricultural property face additional hurdles.

Further, the assumptions on which the Overlay is based are faulty for several reasons including: (i) that the area included in the Overlay contains the resource in question; (ii) that the limestone in the Overlay is actually recoverable; (iii) that there is a sufficient amount of limestone in the area that would render its mining economically feasible; and (iv) that the actual amount of the limestone available within the Overlay is sufficient in both quantity and quality to meet the resource needs for the region and to meet FDOT transportation needs. §337.0261(3), F.S.; § 14-103, F.A.C. Thus, the FDOT is not assured that this critical strategic resource will be available in the region over its next twenty year planning period.

In developing the Overlay, the County chose to ignore data and analysis in the form of geological studies which clearly demonstrate where the resource at issue is available in sufficient mineable quantities. The County also failed to appropriately consider the Strategic Aggregates Study prepared for FDOT in assessing the regional need and statewide need for limestone aggregate and, instead, developed an artificially constrained and unsupported projection of current and future limerock need. The Overlay admittedly contains hundreds, if not thousands, of acres of lands in areas more suitable for commercial airport development and/or existing residential communities with owners who have expressed no interest in mining the property. No limerock data has been provided or appears to be available concerning these properties. The inclusion of these acreages in the Overlay artificially inflates the number of mine acres available to meet the County's asserted limerock "need." *(See Owen Memo dated July 7, 2009 at page 4.)* The Overlay excludes known reserves and includes areas where no proven mineable reserves exist, thus depriving FDOT of a reliable long-term supply of mineable rock.

For these and other reasons, the Amendment is inconsistent with Chapter 163, F.S., and Rule 9J-5, F.A.C. as detailed below:

- The Amendment's Overlay provisions are not supported by relevant and appropriate data and analysis and in fact fail to react in an appropriate way to available data as required by Rule 9J-5.005(2)(a), F.A.C., and Sections 163.3177 (6) and (8), F.S. because:
    - The Amendment creates a regulatory resource identification map with which land use decisions must be consistent, but fails to coordinate the map with the actual location of the resource in question. Therefore, the amendment is unsupported by the best available data and analysis.

- By allowing limerock mining within the Tradeport lands, the Amendment allows creation of a flight hazard near a public use airport, in conflict with guidelines issued by the Federal Aviation Authority of the U.S. Department of Transportation. *FAA Advisory Circulate No. 150/5200-33B dated August 28, 2007.*

CONCLUSION

In conclusion, the Amendment fails to meet the standards established under Florida's Statutes and is contrary to the intent and direction applicable to the mining of limerock. The County failed to consult with FDOT or to consider FDOT's local, regional, and state transportation planning needs. The Amendment will serve to deprive FDOT of a reliable, cost-effective and long-term supply of high quality limerock for its transportation infrastructure needs, contrary to state law.

We hope the information provided in this letter assists you in discharging FDOT's responsibility to: (1) provide information to the County regarding the effect the amendment would have on the availability, transportation, and potential extraction of limerock materials on the local area, the region and the state; and (2) prepare an agency comment letter to DCA consistent with the requirements of Section 163.3184(4), F.S. We respectfully request that FDOT object to the Amendment as inconsistent with its transportation planning goals.

We look forward to meeting with you to discuss these matters further.

Sincerely,

Susan L. Stephens
Vinette D. Godelia

cc: Stephanie C. Kopelousos
Kevin Thibault
Thomas O. Malerk
Alexis Yarbrough
Kathleen Neil
Kathleen Toolan

12/09/09 REV.

TROYER

Quantity Calculations

North Pit	Area s.f.	Depth	Volume	Blasting Loss	Net Vol	Tons
Surface	19,448,125					
		14	9,768,254			12,210,318
Top of Rock	18,228,428					
		98	61,208,199	6,120,820	55,085,579	68,856,974
Bottom	16,200,059					

South Pit						
Surface	17,957,888					
		16	10,089,083			12,611,354
Top of Rock	16,092,766					
		94	51,355,147	5,135,515	46,219,632	57,774,540
Bottom	13,409,125					

		Total Fill	**24,821,672**
N. Pit	446.49 Ac.	**Total Rock**	**126,631,514**
S. Pit	412.26 Ac.		
		Total Material	**151,453,187**

Estimated Product Split

Aggregate used to Make Concrete and Asphalt	3/4" Stone	18,118,536		
	3/8" Stone	27,177,803	90,592,678	Tons
	Screenings	45,296,339		
Road Base	Base Rock	**20,787,360**	**Tons**	
Fill Products	Washings	15,271,476		
	Fill Dirt	20,850,205	40,093,149	Tons
	Processed Sand	3,971,468		
	Total Material	151,453,187		

MORRIS DEPEW
ENGINEERS • PLANNERS • SURVEYORS
LANDSCAPE ARCHITECTS

Fort Myers | Gainesville | Tallahassee

October 22, 2009

The Honorable Ray Judah, Chairman
Lee County Board of Commissioners
P. O. Box 398
Fort Myers, FL 33902-0398

Subject: CPA 2008-06 – DR/GR Amendments

Dear Chairman Judah:

On behalf of my client, Troyer Brothers Florida, Inc. (Troyer), I am writing to request the inclusion of the Troyer property as part of the Future Limerock Mining Overlay (proposed Lee Plan Map 14). While Troyer still objects to the adoption of CPA 2008-06, based upon the objections presented at the September 24, 2009 hearing, we are nevertheless attempting to provide the County with an alternative to protect Troyer's rights to the existing resources located upon the Troyer property while recognizing the unique location and attributes of the Troyer property. It is noted that the Troyer property is accessed via SR 82, not Corkscrew Road, and therefore is similar to those parcels already proposed for limerock extraction on the proposed Lee Plan Map 14.

I have taken the liberty of preparing a modified map and have included it as an attachment to this letter. In addition, for the purpose of providing data and analysis in support of the addition of the Troyer property to the Future Limerock Mining Overlay, I have included the Section 3 and Appendix A of the report entitled "Hydrogeology of Troyer Brothers Florida, Inc. with a Mining Impact Analysis, Lee County, Florida" prepared by Missimer Groundwater Science, a Schlumberger Company dated September 2008 demonstrating that significant reserves of the material are extant on the Troyer site.

Thank you for your kind consideration in this matter. I will be in attendance at the hearing on October 28 to address any questions that the Board of Commissioners may have.

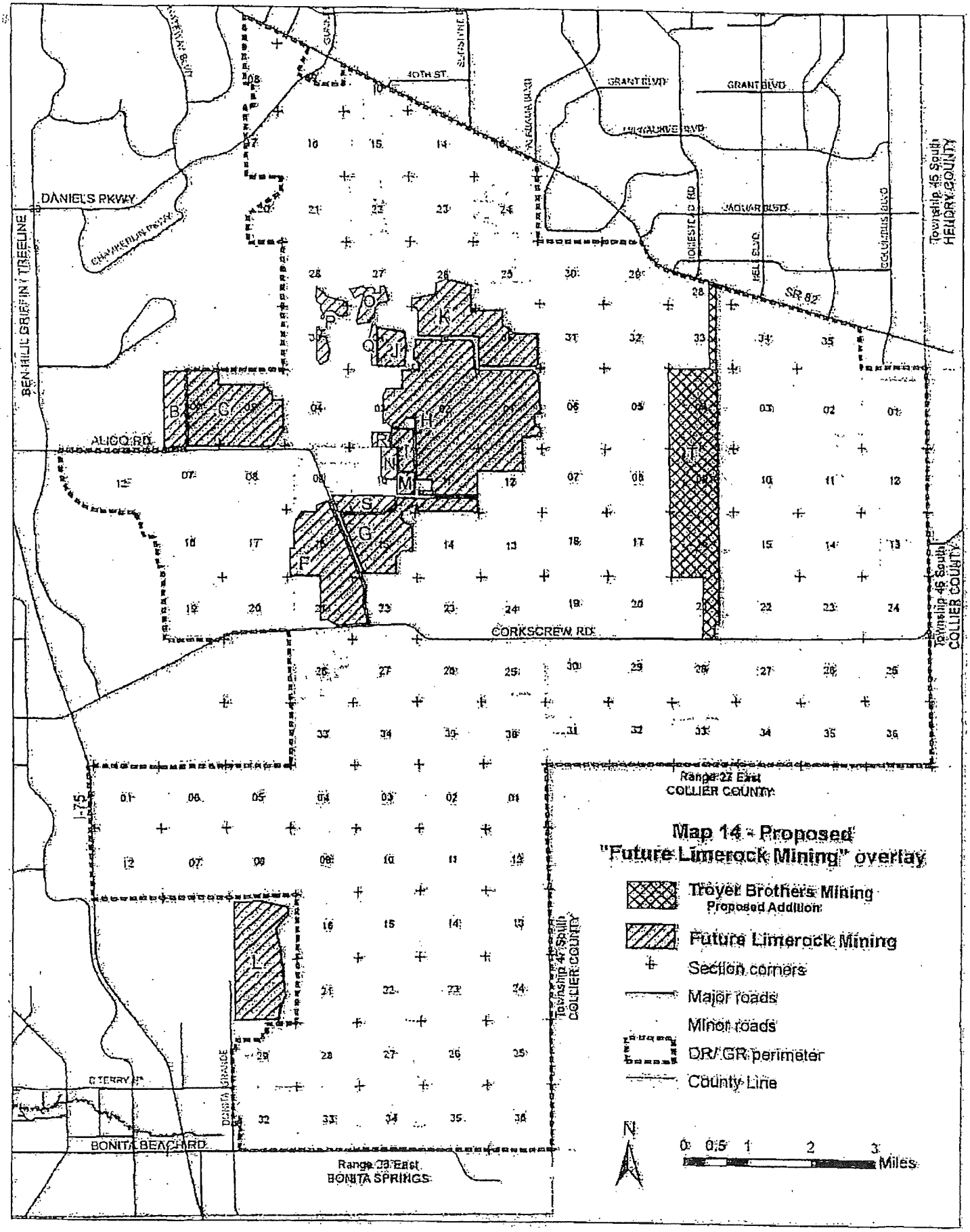
Sincerely,
Morris-Depew Associates, Inc.

David W. Depew By: AM

David W. Depew, PhD, AICP, LEED AP
President

Attachments: Modified Proposed Lee Plan Map 14
Section 3 & Appendix A, "Hydrogeology of Troyer Brothers Florida, Inc. with a Mining Impact Analysis, Lee County, Florida"

cc: Lee County Board of Commissioners
Ms. Mary Gibbs, Director, Lee County Department of Community Development
Mr. Paul O'Connor, Director, Lee County Division of Planning


DANIELS PKWY
BEN HILL GRIFFIN TREELINE
ALICO RD
CORKSCREW RD
I-75
BONITA BEACH RD
40TH ST
GRANT BLVD
SR 82
Township 45 South
HENDRY COUNTY
Township 46 South
COLLIER COUNTY
Township 47 South
COLLIER COUNTY
Range 27 East
COLLIER COUNTY
Range 28 East
BONITA SPRINGS
Map 14 - Proposed
"Future Limerock Mining" overlay
Troyer Brothers Mining
Proposed Addition
Future Limerock Mining
Section corners
Major roads
Minor roads
DR/GR perimeter
County Line
N
0 0.5 1 2 3
Miles

SECTION 3
GEOLOGY

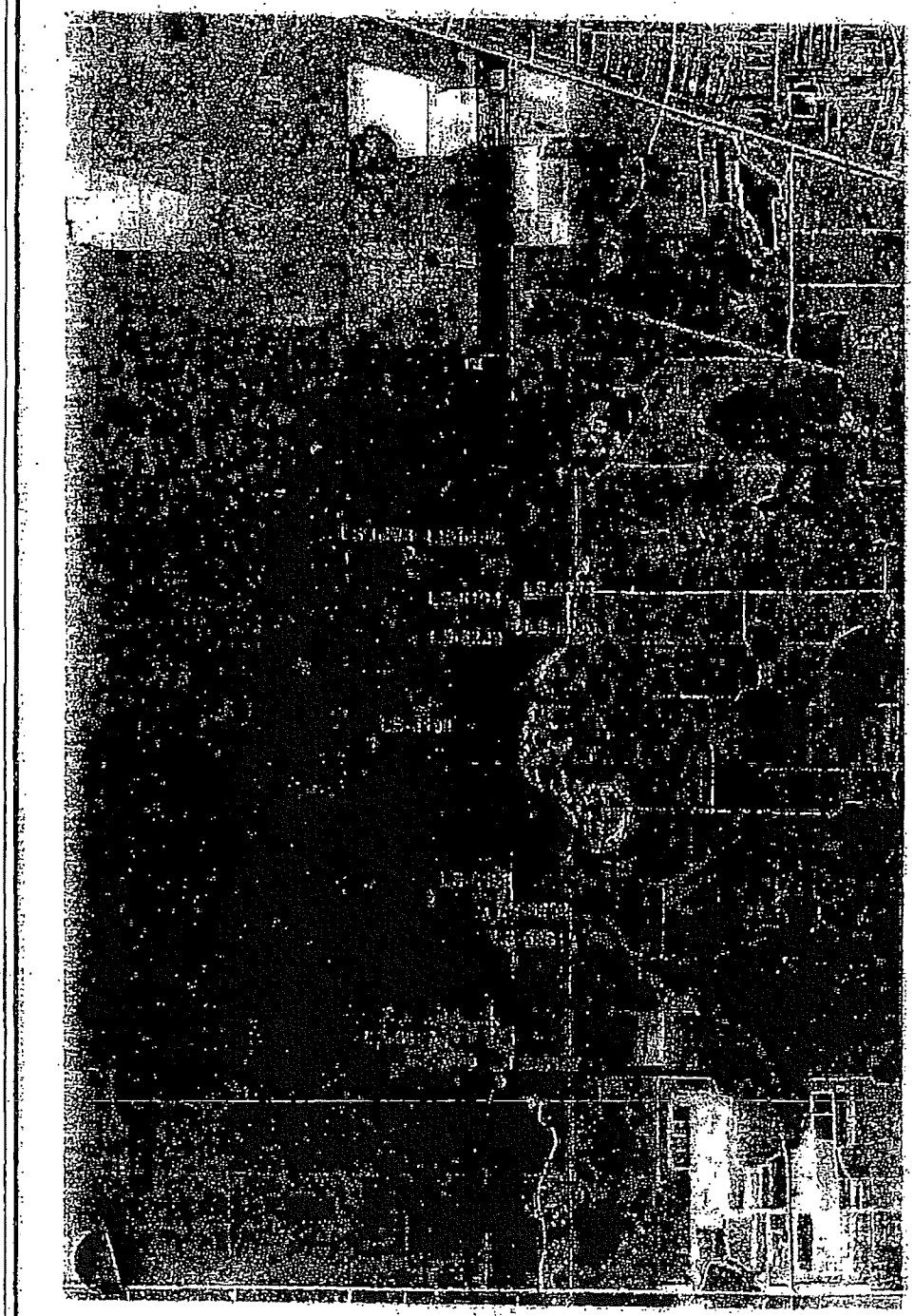
3.1 Introduction

A detailed geologic assessment of the site was made using the sonic drilling technique. Sonic cores were collected through the entire geologic section from land surface to the base of economic benefit, which was defined as the occurrence of a regional lime mud/clay unit (Buckingham Member of the Tamiami Formation). Mining deeper than this unit is not feasible because the material has no economic benefit, and the formation is part of a regional confining unit separating the Surficial Aquifer System from the Intermediate Aquifer System. Breaching the unit would be a violation of rules of the South Florida Water Management District (SFWMD) (F.A.C. Chapter 40e).

In the part of the property evaluated for mining, there were 12 sonic cores collected. In addition, geologic, water quality, and water use data were collected from a total of 13 monitoring and 12 production wells on the site and 2 wells located off-site. Locations of the cores within the proposed mining area are shown in Figure 3-1, and the detailed locations and depths of the on-site wells and cores are given in Table 3-1. The sonic drilling technique was chosen because it allows a high quality core to be collected and a detailed geologic analysis to be made to assess lithologic changes at a resolution of one to two feet. The method also allows rapid collection of data, and the sizes of the cores are sufficient to measure the key aggregate rock properties including Los Angeles abrasion, specific gravity, absorption, and carbonate composition. A large number of samples were collected from all of the cores for physical examination in the laboratory and for measurement of rock properties. A total of 1,679 feet of core was collected and examined.

The locations of the monitoring and production wells completed in the water-table aquifer are shown in Figure 3-2, and those completed into the Sandstone Aquifer are given in Figure 3-3. Descriptions of the cores, geologic logs, geophysical logs, and water quality analyses are contained within the appendices.

Geologic descriptions of the cores were developed by careful examination using a binocular microscope and visual examination of the larger core pieces. The core descriptions contain an assessment of primary lithology, the color based on the Munsell Soil Color Chart, the hardness, the detailed carbonate classification based on the textural classification system of Dunham (1961), identification of index fossils, description of the pore types, and an assessment of sample hydraulic conductivity. The detail of the core descriptions is greater than can be developed from drill cuttings because the cores can be visually analyzed for sedimentary structures and other features that relate to rock properties and the potential for fluid flow. The presence of potential flow channels caused by sediment bioturbation can be recognized and noted.

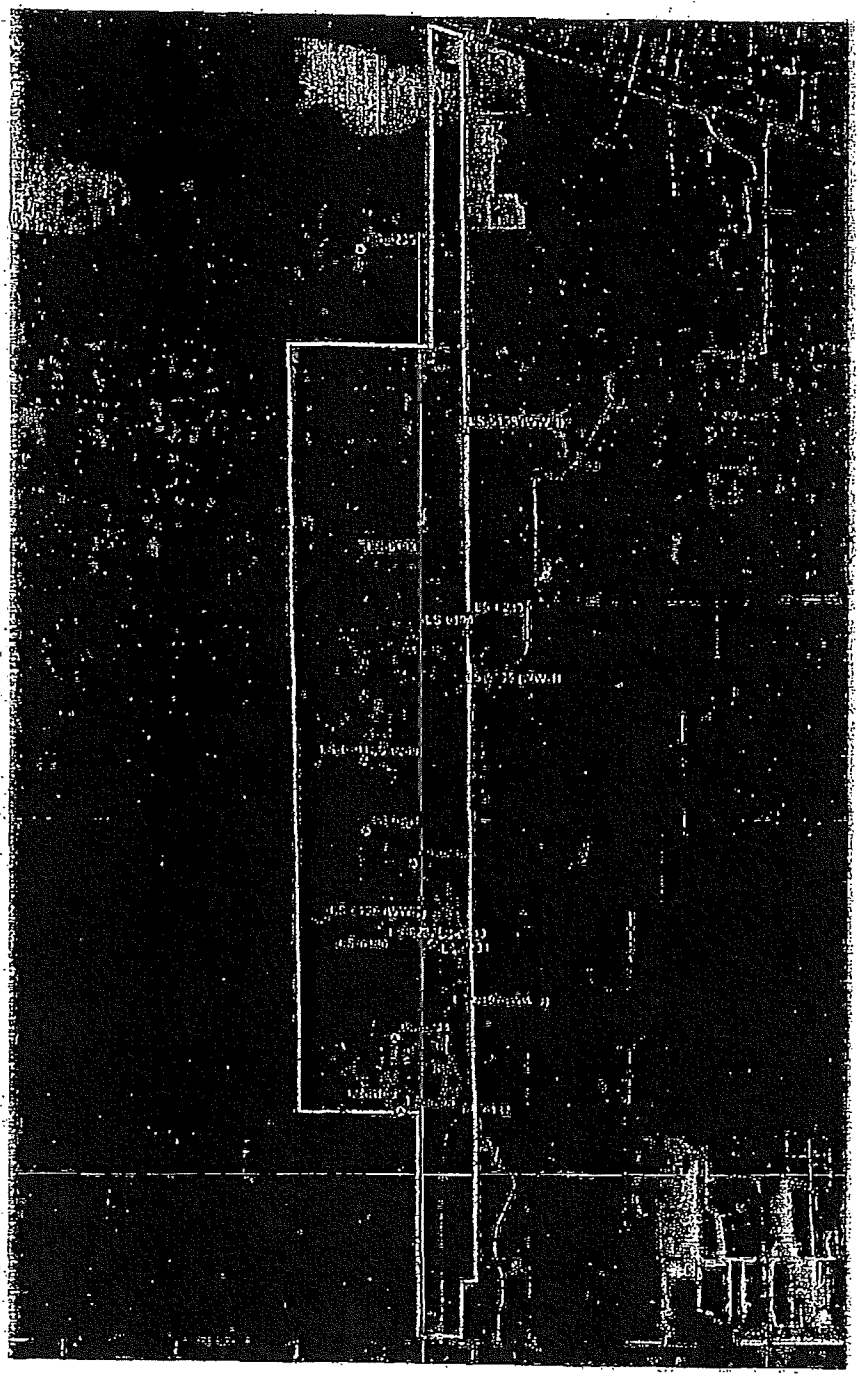


MGS

Figure 3-1
Hydrogeology of Troyer Brothers Florida, Inc.
Core Location Map

Table 3-1. List of On-Site Production Wells, Monitor Wells, and Cores

MGS Well No.	Site Well No.	GPS Coordinates	Total Depth (ft)	Casing Depth (ft)	Diameter (in)	Screened Interval (ft)	Use	Aquifer	Notes
LS-6187	TB-7	N 26 27.881, W 081 37.020	70	65	2	65-70	monitor	Water-table	core to 296
LS-6188	TB-6	N 26 27.925, W 081 37.490	291	281	2	281-291	monitor	Sandstone	core to 296
LS-6189	TB-8	N 26 27.933, W 081 37.492	45	40	2	40-45	monitor	Water-table	core to 46
LS-6190	TB-3	N 26 28.617, W 081 37.592	100	95	2	95-100	monitor	Water-table	core to 176
LS-6191	TB-2	N 26 29.225, W 081 37.592	126	121	2	121-126	monitor	Water-table	core to 146
LS-6192	TB-5	N 26 29.977, W 081 37.435	176	166	2	166-176	monitor	Sandstone	core to 176
LS-6193	TB-1	N 26 29.978, W 081 37.435	65	60	2	60-65	monitor	Water-table	core to 65
LS-6194	TB-4	N 26 29.917, W 081 36.969	50	45	2	45-50	monitor	Water-table	core to 136
LS-6195	WW-1	N 26 29.511, W 81 37.012	NA	NA	2	NA	monitor	Water-table	wetland well
LS-6196	WW-2	N 26 28.681, W 81 37.565	NA	NA	2	NA	monitor	Water-table	wetland well
LS-6197	WW-3	N 26 28.303, W 81 37.051	NA	NA	2	NA	monitor	Water-table	wetland well
LS-6198	WW-4	N 26 30.449, W 81 37.007	NA	NA	2	NA	monitor	Water-table	wetland well
LS-6229	MW-7D	N26 29.736, W081 36.972	200	190	2	190-200	monitor	Sandstone	apt monitor well
LS-6230	MW-7S	N26 29.771, W081 36.974	20	15	2	15-20	monitor	Water-table	apt monitor well
LS-6231	MW-6D	N26 28.550, W081 37.102	110	100	2	100-110	monitor	Water-table	apt monitor well
LS-6232	MW-6S	N26 28.539, W081 37.098	15	10	2	10-15	monitor	Water-table	apt monitor well
LS-6233	8	N 26 31.764, W 81 37.099	240	140	10	140-240	processing	Sandstone	construction per SFWMD permit
LS-6234	9	N 26 31.387, W 81 37.429	240	140	10	140-240	irrigation	Sandstone	construction per SFWMD permit
LS-6235	D1	N 26 31.074, W 81 37.434	41	20	5	20-41	irrigation	Water-Table	construction per SFWMD permit
LS-6236	D2	N 26 31.083, W 81 36.998	240	140	10	140-200	irrigation	Sandstone	construction per SFWMD permit
LS-6237	7	N 26 29.778, W 81 36.982	240	140	10	140-200	irrigation	Sandstone	construction per SFWMD permit
LS-6238	1	N 26 29.504, W 81 37.408	240	140	10	140-200	irrigation	Sandstone	construction per SFWMD permit
LS-6239	2	N 26 29.302, W 81 37.605	240	182	10	182-240	irrigation	Sandstone	construction per SFWMD permit
LS-6240	3	N 26 29.236, W 81 37.413	225	100	10	100-225	irrigation	Water-Table	construction per SFWMD permit
LS-6241	4	N 26 28.965, W 81 37.402	240	77	10	77-240	irrigation	Water-Table	construction per SFWMD permit
LS-6242	5	N 26 28.854, W 81 37.161	223	86	10	86-223	irrigation	Water-Table	construction per SFWMD permit
LS-6243	6	N 26 28.563, W 81 37.089	260	80	10	80-260	irrigation	Water-Table	construction per SFWMD permit
LS-6244	10	N 26 28.186, W 81 37.243	240	140	10	140-240	irrigation	Water-Table	construction per SFWMD permit
LS-6245	11	N 26 27.913, W 81 37.240	240	140	10	140-240	irrigation	Water-Table	construction per SFWMD permit



MGS

Figure 3-2
Hydrogeology of Troyer Brothers Florida, Inc.
Location of Water-Table Aquifer (WTA) Production and Monitoring Wells

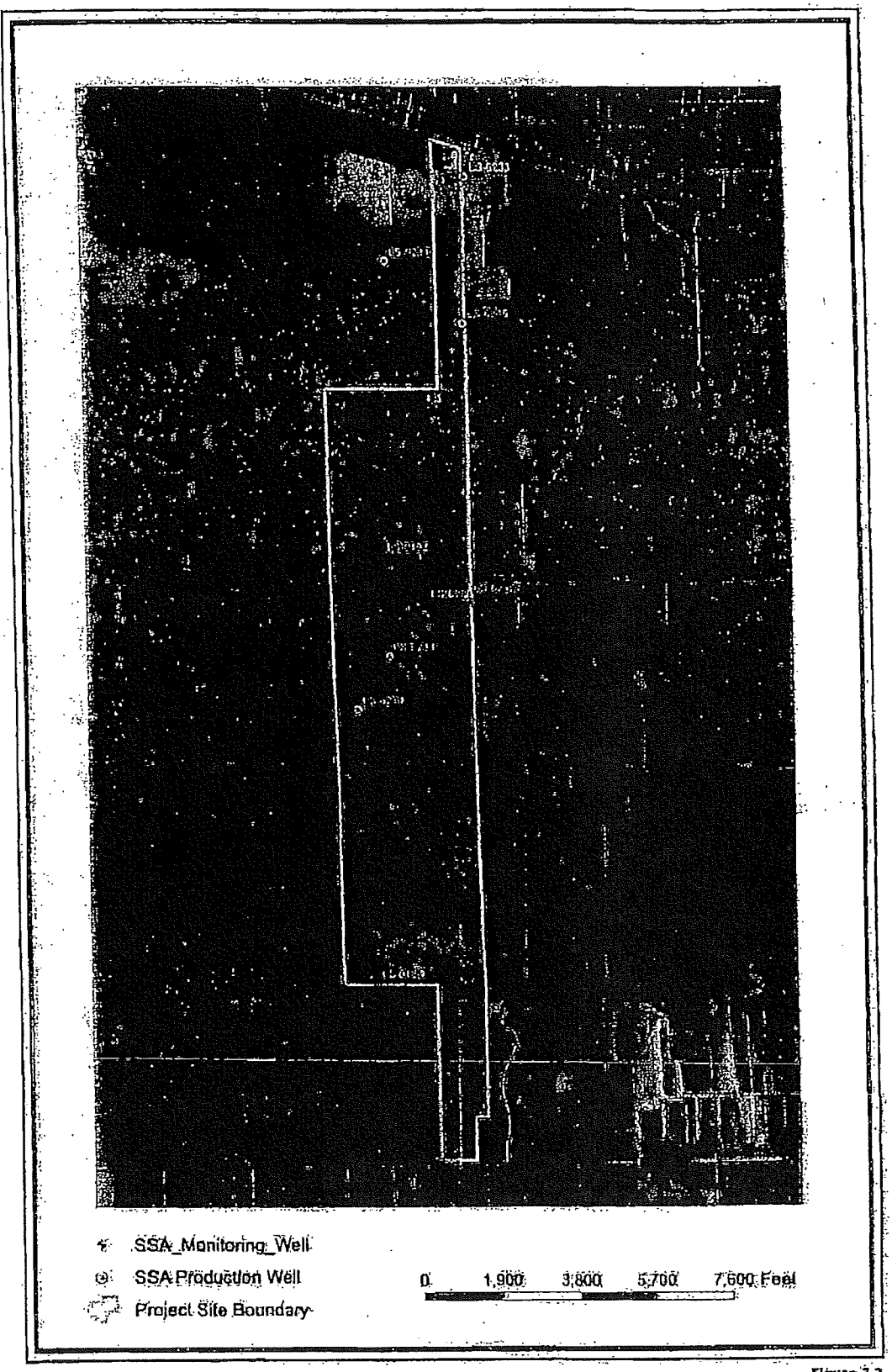


Figure 1-3
Hydrogeology of Troyer Brothers Florida, Inc.
Location of Sandstone Aquifer (SSA) Production and Monitoring Wells

A generalized stratigraphic column for the shallow geologic section is presented in Figure 3-4. This column was adapted from Missimer (2002) and contains the latest stratigraphic terminology as well as the age designation of the rock stratigraphic units as contained in Missimer (2001c). The stratigraphic terminology for the Hawthorn Group was taken from Scott (1988) with member names added based on common usage (Missimer & Associates, Inc., 1978). A second stratigraphic column shows the general geology of the site into the Ocala Formation (Figure 3-5).

3.2 Pamlico Sand/Fort Thompson Formation

The entire site is covered by a veneer of medium- to fine-grained quartz sand. There is debate in the geologic literature concerning the terminology applied to this unit because it may be related to deposition that occurred during the last major sea level incursion, which is commonly termed the Pamlico Terrace. However, the uppermost recognized major stratigraphic unit in southwest Florida is the Fort Thompson Formation, which is the latest Pleistocene unit deposited about 120,000 years ago (top of unit). This formation corresponds to the Pamlico Terrace; so the sand veneer is likely part of the Fort Thompson Formation and is not the result of another marine depositional episode. The sand was deposited as sea level receded at the end of the Pamlico Terrace event. Also, the Pamlico Terrace only reached an altitude of 25 feet above sea level based on the literature (Puri and Vernon, 1964), but the sands reach an altitude of up to 31 feet above sea level and overlie some crustal limestone deposits that may be Fort Thompson in age. Therefore, the literature definitions in this area of Florida may be incorrect.

Typically, the sand unit contains a number of different lithologies from organic-stained sand at the top to very clean fine sands or clayey sands in the middle to fine sands with some minor shell at the base. A map showing the thickness of the sand veneer is given in Figure 3-6. In several cores, the sand contains laminations indicative of primary deposition in the marine environment. The sand is in direct hydraulic connection with the underlying Fort Thompson, Caloosahatchee, or Tamiami Formation sediments.

3.3 Fort Thompson Formation

The Fort Thompson Formation was originally defined within the Caloosahatchee River area based on the occurrence of various types of molluscan fauna (Dall, 1890-1903, DuBar, 1958). There are distinctive differences in formation lithology between the original stratigraphic section described along the Caloosahatchee River and areas both to the north and south of the river (Missimer, 2001a; Missimer and Tobias, 2004). In areas outside of the Caloosahatchee River basin, the formation commonly consists of medium- to fine-grained quartz sand and shell containing a high percentage of the mollusk Chione cancellata. The unit also forms a "crust" of very hard, shelly limestone, commonly referred to as "caprock."

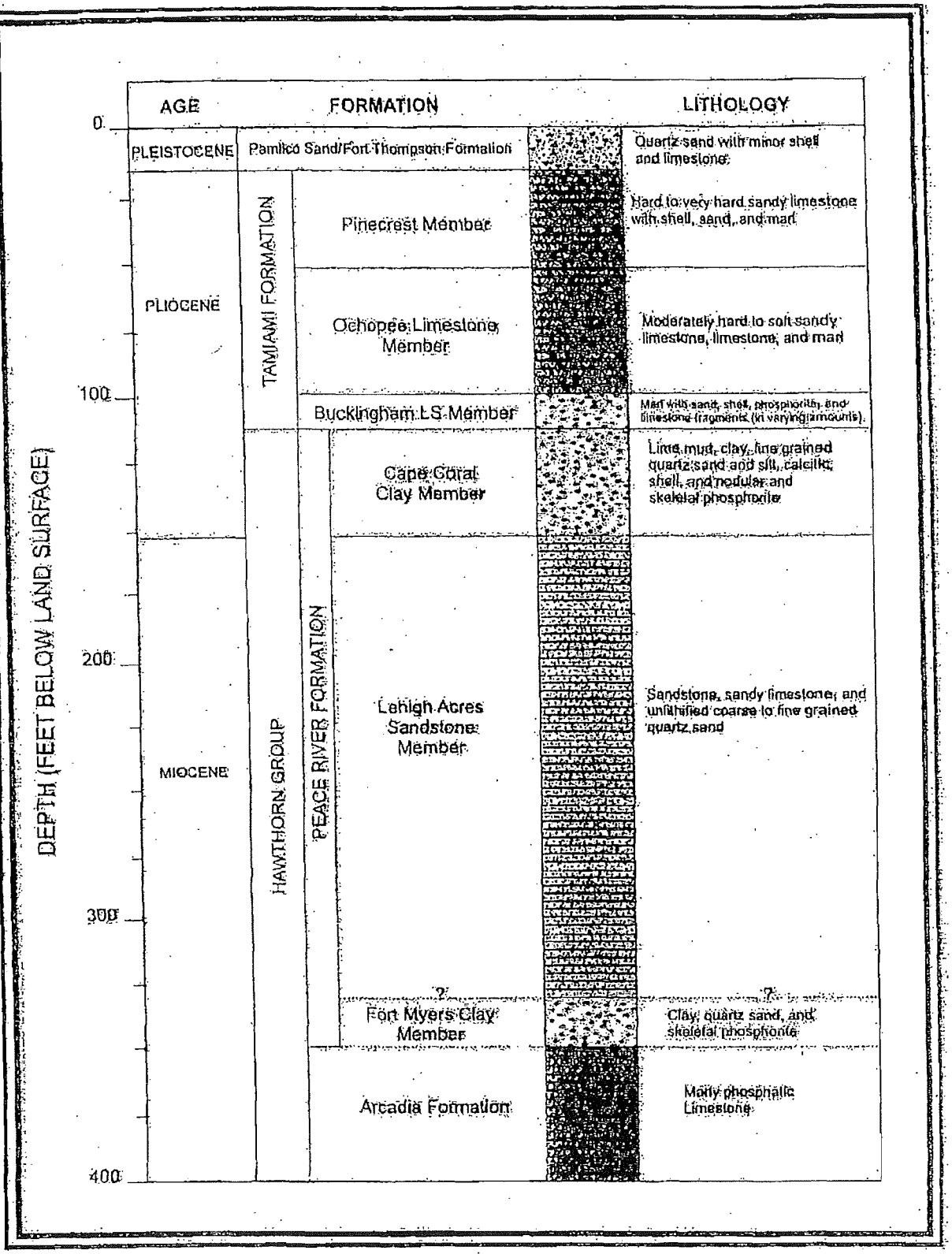


Figure 3-4
Hydrogeology of Troyer Brothers Florida, Inc.
Generalized Site Stratigraphic Column

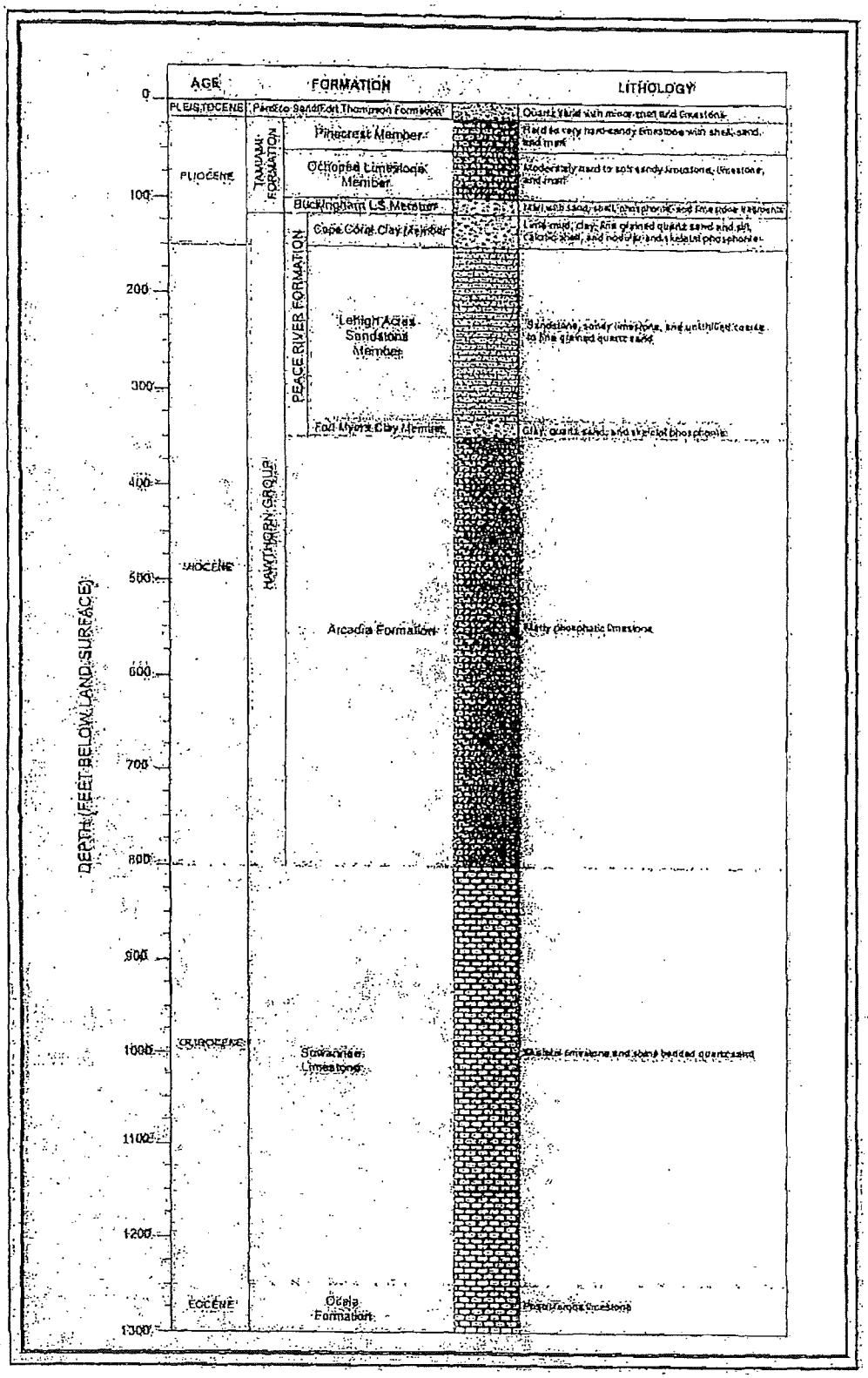


Figure 3-5
Hydrogeology of Troyer Brothers Florida, Inc.
Generalized Site Stratigraphic Column into the Ocala Fm

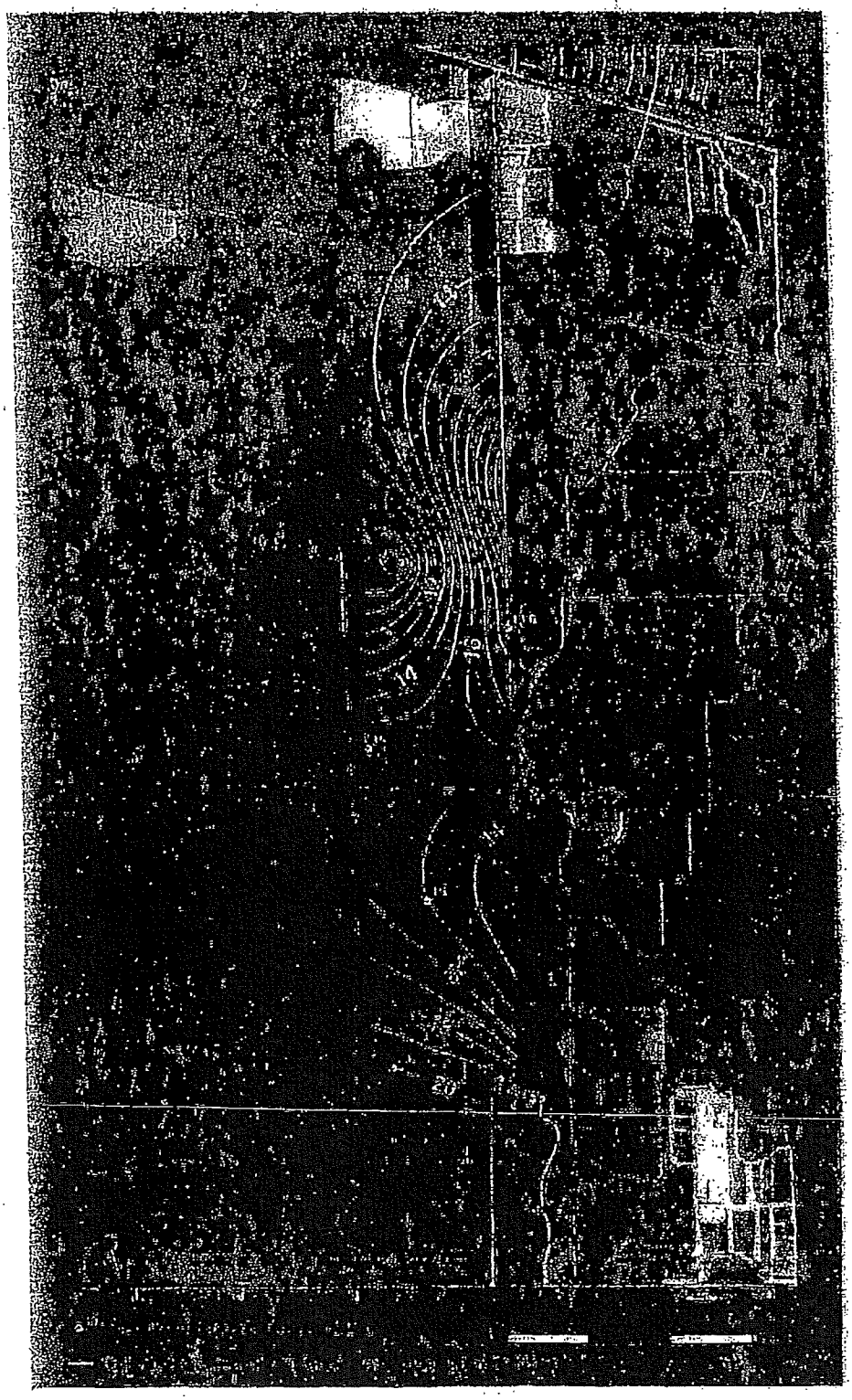


Figure 3-6
Hydrogeology of Treyer Brothers Florida, Inc.
Thickness of the Pamlico Sand/Fort Thompson Formation

Beneath the Troyer Brothers site, the Fort Thompson Formation is primarily a quartz sand unit with a few areas where there is a sandstone containing some aragonitic shell. There is no consistent, predominantly carbonate section of the unit underlying the surficial sands beneath the site. Therefore, the Fort Thompson is not differentiated as a geologic unit in this report, and the surficial sand is considered an approximate thickness of the unit.

3.4 Caloosahatchee Formation

The regional extent of the Caloosahatchee Formation has been open to debate for many years (Hunter, 1978). Again, the original formation was defined within the Caloosahatchee and Peace River basins as well as some areas in the Tampa Bay region and in central Sarasota County. Recent investigations have shown that the Pleistocene/Pliocene boundary runs through the formation, and there are distinctive differences in the molluscan fauna within the formation from the upper Pleistocene section to the underlying Pliocene section. Also, there are faunal similarities between the lower Caloosahatchee Formation and the underlying Pinecrest Member of the Tamiami Formation, which is also Pliocene in age (Missimer, 2001c, 2002). Beneath the Troyer Brothers site, there are lithologies similar to those described within the Caloosahatchee Formation; however, detailed analysis of these reefal and ramp lithologies by Meeder (1987) show the sediments to be contained within the Tamiami Formation. Therefore, no mapping of the Caloosahatchee Formation was necessary beneath the site.

3.5 Tamiami Formation

The Tamiami Formation was first described by Mansfield (1939) and termed the Tamiami limestone. Mansfield (1939) also recognized the overlap in molluscan fauna between the Caloosahatchee Formation and the upper Tamiami Formation and considered them both to be Pliocene in age. Later, Parker and Cooke (1944) renamed the unit the Tamiami Formation and designated the entire unit to be Late Miocene in age. Meeder (1987) contains a detailed history of various changes in the defined stratigraphic limits of the formation. The members of the Tamiami Formation that are detailed in this report were more recently defined by Missimer (1990, 1992, 1993). In central and eastern Lee County, there were four members of the Tamiami Formation recognized in these publications, including in order of stratigraphic position going from top to bottom, the Pinecrest Member, an unnamed member (mostly limestone), the Ochopee Member, and the Buckingham Member. Based on the occurrence of corals and unlithified sand and shell beds within both the Pinecrest and unnamed members, these units are grouped and termed the Pinecrest Member. The other two units are distinctive and are easily mapped.

3.5.1 Pinecrest Member

The Pinecrest Member was originally defined as the "Pinecrest Sand" by Olsson and Harbison (1953). A large number of shell and mixed shell and limestone deposits in the Sarasota County area are also defined as part of the Pinecrest Member of the Tamiami Formation (Allmon, 1992). Meeder (1987) performed detailed stratigraphic and

paleontological analyses on the reefal facies of the Pinecrest Member in central Lee and north-central Collier County.

The Pinecrest Member of the Tamiami Formation contains some of the highest quality limestone within the Troyer Brothers site. The member contains a number of lithologies, but the predominant ones are hard to very hard sandy molluscan wackestone, hard to very hard sandy molluscan packstone, shell and sand, marl with shell and sand, and marl. An isopach map showing the thickness of the Pinecrest Member of the Tamiami Formation is given in Figure 3-7.

3.5.2 Ochopee Member

The Ochopee Limestone Member was named for the original limestone cropping out in the ditches adjacent to the Tamiami Trail (U.S. 41) in Collier County near the town of Ochopee. It was made a formal member of the Tamiami Formation in Hunter (1968) and in Missimer (1992). The Ochopee Limestone Member of the Tamiami Formation is typically a medium hard to soft sandy molluscan wackestone to packstone.

Beneath the Troyer Brothers site, the Ochopee Limestone Member of the Tamiami Formation forms the basal part of the rock that can be used for construction materials. The unit ranges from 63 to 197 feet in thickness over the site. It does contain a variety of different lithologies including sandy molluscan packstone, sandy molluscan wackestone, and marl. Also, there are some parts of the member devoid of quartz sand. A map showing the thickness of the Ochopee Limestone Member of the Tamiami Formation is given in Figure 3-8.

3.5.3 Buckingham Member

The Buckingham Limestone Member of the Tamiami Formation forms the base of the economically viable material beneath the site. The top of this unit is marl consisting of lime mud with varying percentages of fine-grained quartz sand, calcitic shell, nodular and skeletal phosphorite, and limestone rock fragments. The sediment has a low hydraulic conductivity and does not have commercial value. A map showing the depth to the top of the Buckingham Limestone or Marl Member of the Tamiami Formation is given in Figure 3-9. The top of the Buckingham Limestone unit also forms the top of the confining unit between the water-table and Sandstone aquifers beneath the site.

3.6 Hawthorn Group-Peace River Formation

The Early Pliocene and Late Miocene-aged Peace River Formation disconformably underlies the Tamiami Formation beneath the site (Missimer, 2001c). This unit, defined by Scott (1988), is the uppermost formation within the Hawthorn Group. The formation contains a number of stratigraphic members based on substantial changes in lithologic characteristics.

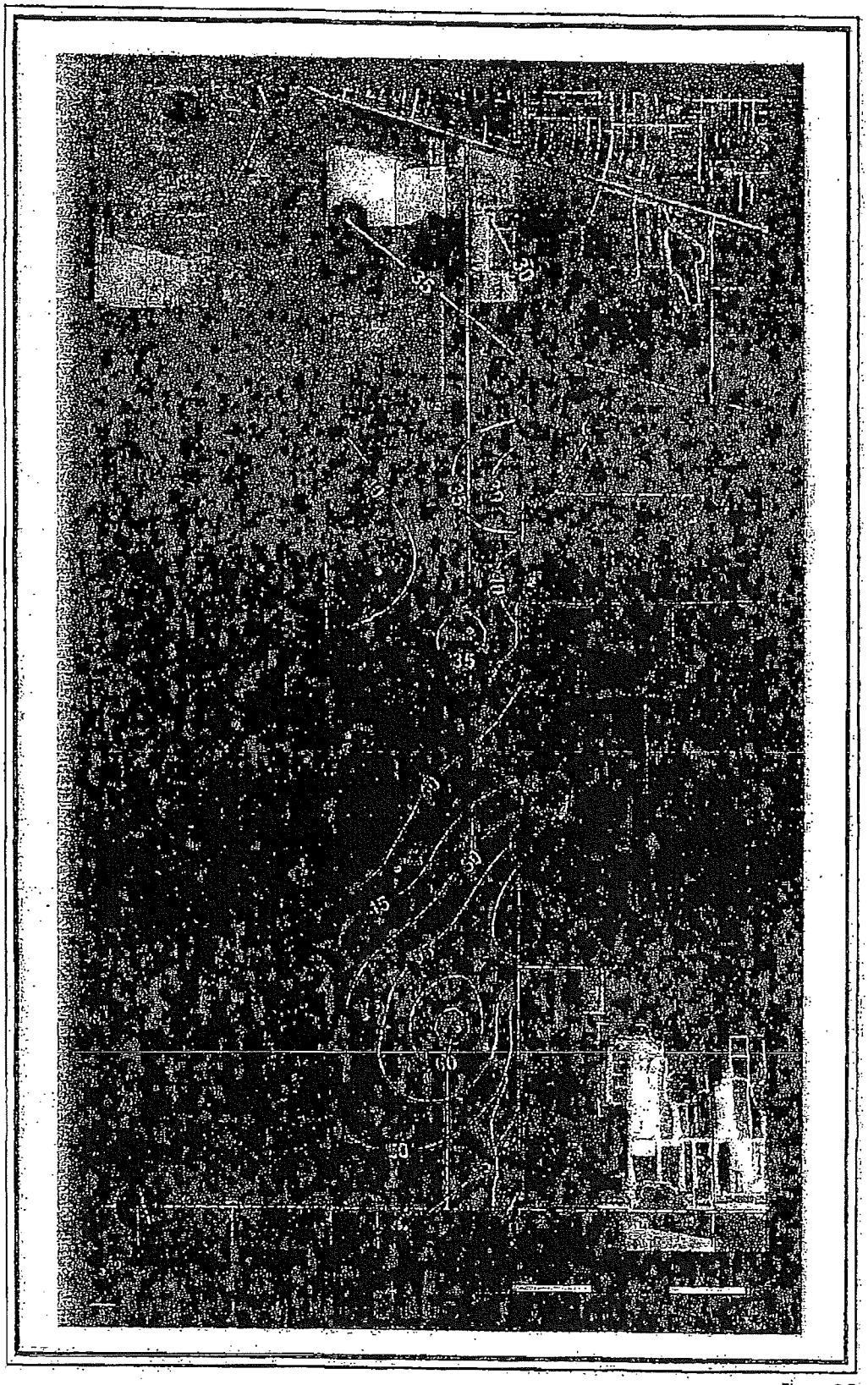


Figure 3-7
Hydrogeology of Troyer Brothers Florida, Inc.
Thickness of the Pinecrest Member of the Tamiami Formation

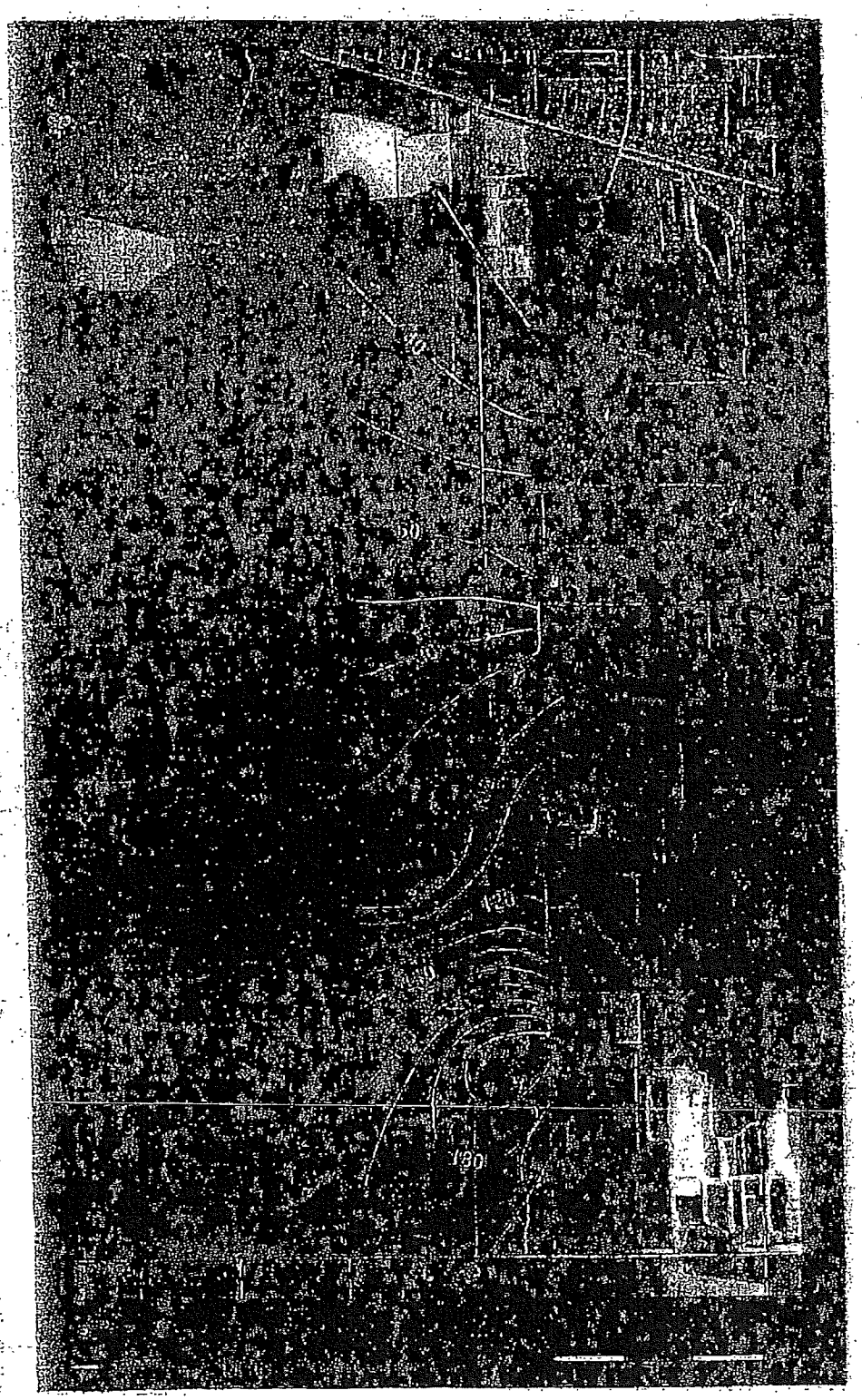


Figure 3-5
Hydrogeology of Troyer Brothers Florida, Inc.
Thickness of the Ochopee Member of the Tamiami Formation

MGS

Figure 3-9
Hydrogeology of Troyer Brothers Florida, Inc.
Depth to the Top of the Buckingham Marl Member of the Tamiami Formation

3.6.1 Cape Coral Clay Member

The uppermost member of the Peace River Formation is termed the Cape Coral Clay Member (Missimer & Associates, Inc., 1978), which is equivalent to another member termed the Alva Clay (Meeder, 1987; Klinzing, 1980). It is a deltaic deposit containing a mix of lime mud, clay, fine-grained quartz sand and silt, calcitic shell, and nodular and skeletal phosphorite (Missimer and Gardner, 1976). It is a regional confining unit between the Surficial Aquifer System and the underlying Intermediate Aquifer System (Missimer and Martin, 2001). Although not important for mining, it separates the underlying Sandstone Aquifer from the Surficial Aquifer System throughout the site; therefore, giving protection to the Intermediate Aquifer System from surface activities.

3.6.2 Lehigh Acres Sandstone Member

The Lehigh Acres Sandstone Member is a Late Miocene-aged unit consisting of sandstone, sandy molluscan packstone, packstone, and unlithified coarse to fine-grained quartz sand (Missimer and Martin, 2001). This member forms what is termed the Sandstone Aquifer beneath the site. The Sandstone Aquifer is currently a source of water supply for irrigation and may be used for certain industrial applications associated with future mining activities.

3.6.3 Intermediate Lithologic Units

Within certain structures located on the southern part of the property, there are some additional limestone and sandstone units that are water-bearing. These units have not been formally defined with member names. Some exist beneath the Lee County Corkscrew Road Wellfield and may be present beneath the southern portion of the property. These units may be additional sources of water supply.

3.6.4 Fort Myers Clay Member

The Fort Myers Clay Member is the basal unit of the Peace River Formation and lies immediately above the Arcadia Formation. It is characterized by flat-bedding and contains a mixture of clay, quartz sands, and nodular and skeletal phosphorite. It has an overall low hydraulic conductivity.

3.7 Hawthorn Group-Arcadia Formation

The Arcadia Formation lies disconformably beneath the Peace River Formation. In the area beneath Troyer Brothers Florida, Inc., Lehigh Farms, it is known to be a marly phosphatic limestone. Attempts in the past to obtain irrigation water from this unit on this site were unsuccessful, and wells were drilled to greater depths. The limestone commonly developed within the top of the formation, which contains the Mid-Hawthorn Aquifer, is not productive beneath the site. Even deeper limestone units, which commonly form the Lower Hawthorn Aquifer, produce low yields in this area. The low productivity of this unit has also been observed at the C-43 aquifer storage and recovery test site located in

western Hendry County near the Lee County line (personal communication, SFWMD). Therefore, past agricultural water users drilled deep wells into the Ocala Formation to obtain irrigation water.

3.8 Suwannee Limestone

The geology of the Suwannee Limestone in the vicinity of the site is known solely from the few agricultural wells drilled for pasture irrigation during development of the nearby Baum Ranch located 1.5 miles to the east (near Old Corkscrew Plantation). The formation consists primarily of limestone, which is predominantly skeletal grainstones and packstones. Although the formation is Early Oligocene in age, it contained bedded quartz sand, which caused well construction problems. One of these wells, LM-797, was the first well in southern Florida shown to contain bedded quartz sand. Overall, the limestones within the formation did not have high values of hydraulic conductivity.

3.9 Ocala Formation

In 1974, three wells were originally drilled into the Ocala Formation to the east of site. The geology of the formation consisted of limestone, which was predominantly coarse grainstones and packstones.

Appendix A

Core Descriptions

TABLE A-1 Geological Log LS-6187
Troyer Brothers – TB-7

Location:
NW ¼, NE ¼, Sec. 21, Township 45 South, Range 27 East
Lee County Florida
Lat. 26° 27.881', Long. 81° 37.020'

Depth (ft bls)	Lithology
0 – 1	SAND, pinkish white (7.5YR 8/2), quartz, medium to fine grained, moderately sorted, subrounded, trace of organic material, medium hydraulic conductivity.
1-1.5	SAND, white (5Y 8/1), quartz, fine grained, moderately sorted, subrounded, medium hydraulic conductivity.
1.5 – 2	SAND, very dark gray (5Y 3/1), quartz, medium to fine grained, moderately sorted, subrounded, medium hydraulic conductivity.
2 -3.5	SAND, very dark grayish brown (2.5Y 3/2), quartz, medium to fine grained, moderately sorted, subrounded, trace of organic material, medium hydraulic conductivity.
3.5 – 5	SAND, dark gray (5Y 4/1), quartz, medium to fine grained (more fine grains), moderately sorted, subrounded, trace of organic material, medium to low hydraulic conductivity.
5 – 8	SAND, pale olive (5Y 6/3), quartz, medium grained, moderately sorted, subrounded, medium hydraulic conductivity.
8– 9	SAND, olive gray (5Y 5/2), quartz, medium grained, moderately sorted, subrounded, medium hydraulic conductivity.
9 – 12	SAND, pale yellowish (5Y 8/2), quartz, fine to very fine grained, moderately sorted, subrounded, medium hydraulic conductivity.
12 – 14.3	SAND, light brownish gray (2.5Y 6/2), quartz, fine grained, well sorted, subrounded, medium hydraulic conductivity.
14.3 – 19.5	LIMESTONE, pale yellow (5Y 8/2), packstone, shell fragments and coral fragments, medium hardness, some macropores (mostly intergranular pores), low hydraulic conductivity.

TABLE A-1 Geological Log LS-6187
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
19.5 – 23.5	MARL, pale yellow (5Y 8/4), sandy marl with 50% coral fragment and shell fragments (bivalve and gastropod), large piece of coral lithified with small pores (intragranular pores), fragments of shells, sandy mollusks, medium hardness, medium to high hydraulic conductivity.
23.5 – 25	MARL, pale yellow (5Y 8/3), light gray (5Y 7/1), 90% marl with about 10% hard, shelly, low macroporosity wackstone: 15% medium grained quartz sand, rare pores, low hydraulic conductivity.
25 – 30	MARL, light gray (5Y 7/2), 90% marl, 10% coral fragments and shells (lithified), low hydraulic conductivity.
30 – 33	MARL, gray (5Y 6/1), Marl and sandy molluskcan wackestone, about 75% of interval is marl, 25% is wackestone: hard, 15% quartz sand, some moldic and intergranular pores, low hydraulic conductivity.
33 – 34	LIMESTONE, light olive gray (5Y 6/2), quartz fossil wackestone/ packstone and marl, 85% limestone to 15% sticky marl, wackstone/packstone is very hard, 10-15% medium to fine grained quartz sand, over 50% small shell fragments; rare pores, medium to low hydraulic conductivity.
34 – 51	MISSING SAMPLES, likely sand and shell as below.
51 – 53	SAND and SHELL, light gray (5Y 7/2), little to no silt, over 70% shell fragments (bivalve and gastropod), sand is primarily fine to medium grained quartz, medium hydraulic conductivity.
53 – 54.5	SAND, light gray (5Y 7/1), marly and clayey sand (sticky) with approximately 5% shells, low hydraulic conductivity.
54.5– 56	LIMESTONE, light gray (5Y 7/2), sandy molluscan packstone/wackestone, very hard, 12-15% medium to fine grained quartz sand, 5-10% phosphorite, large pieces of shell fragments, abundant moldic and intergranular pores, medium to high hydraulic conductivity.
56 – 61	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, very hard, 10-15% medium grained quartz sand, 10% phosphorite, dense and heavy, some shell fragments, some small pores (intergranular pores), medium hydraulic conductivity.
61 – 62	MARL, light gray (5Y 7/2), sandy marl, soft, 5-6% phosphorite, small shells (10% fragments), medium hydraulic conductivity.

TABLE A-1 Geological Log LS-6187
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
62 – 76	LIMESTONE, light gray (5Y 7/2), sandy skeletal wackestone, moderately hard, less dense than above, 12-15% medium to fine grained quartz sand, over 10% phosphorite, abundant macropores medium to low hydraulic conductivity.
76 – 78	LIMESTONE, light gray (5Y 7/2), sandy wackestone, hard, light (density), 5-10% medium grained quartz sand, 5-10% phosphorite, , 15-20% silt and mud, moderate sized moldic pores, medium hydraulic conductivity.
78 – 79	LIMESTONE, light olive gray (5Y 6/2), sandy skeletal wackestone and mudstone, medium hardness, 5-8% phosphorite, abundant macropores, medium hydraulic conductivity.
79-86	LIMESTONE, light olive gray (5Y 7/2), wackestone and mudstone, hard, about 60% to 40% ratio, relatively light, relatively light, 5% phosphorite, some macroporosity, medium to low hydraulic conductivity.
86 – 86.5	MARL, light greenish gray (10Y 8/1), sandy, clayey sediments, reacted to acid, light density, soft, 30-50% small pieces of shell fragments, 20-25% silt and mud, 20-25% medium grained quartz sand, medium to low hydraulic conductivity.
86.5 – 89	LIMESTONE, light yellowish brown (2.5Y 6/1), mudstone, very hard, dense, 1-5% fine grained quartz sand, 1-2% phosphorite, little visible pores, low hydraulic conductivity.
89 – 95.2	LIMESTONE, greenish gray (10Y 6/1), sandy molluscan packstone/wackestone, light (density), moderately hard, 5-8% fine grained quartz sand, some barnacles preserved, small bioturbated channels (small), 10-15% wackestone, medium hydraulic conductivity.
95.2 – 96	SAND, light greenish gray (10Y 8/1), silty sand, 2-5% phosphorite, 15-20% medium to fine grained quartz sand, medium to low hydraulic conductivity.
96 – 116	LIMESTONE, greenish gray (10Y 6/1), sandy molluscan wackestone/packstone, medium hardness, dense, 10-15% fossiliferous wackstone and remainder packstone some lithified shells, few pores except for small moldic pores, medium hydraulic conductivity.
116 – 118.5	LIMESTONE, light greenish gray (10Y 7/1), sandy molluscan wackestone, hard, dense, moldic porosity, no phosphorite, no aragonite preserved, 15-20% fine grained quartz sand, low hydraulic conductivity.

TABLE A-1 Geological Log LS-6187
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
118.5- 122	MARL and SAND, light greenish gray (5GY 8/1) to very dark gray (2.5Y 3/1), for the more organic deposits, silty sand, approximately 50%:50% distribution of sand and marl. Small fragments of shells and snails located in darker gray organic sediments, 15-20% medium grained quartz sand, medium to high hydraulic conductivity, freshwater deposits.
122 – 126	LIMESTONE, light greenish gray (10Y 7/1), sandy wackestone, hard, 10% medium to fine grained quartz sand, abundant moldic pores, no aragonite, no channel burrows, medium hydraulic conductivity; trace of marl.
126 – 135	LIMESTONE, light greenish gray (10Y 8/1), sandy molluscan wackestone/packstone, very hard, no aragonite remaining, 10% nodular phosphorite, moldic porosity, medium to low hydraulic conductivity.
135 – 146	LIMESTONE, light brownish gray (2.5Y 6/2), sandy molluscan wackestone, very hard, abundant bioturbated channels and moldic pores, molds of shells and snails (no aragonite remaining), 5-10% nodular phosphorite, high hydraulic conductivity.
146 – 153.5	LIMESTONE, light greenish gray (5GY 8/1), sandy molluscan wackestone, very hard, many less shell molds compared to above, no aragonite remaining, moldic pores and some inter-granular burrows)—small.
153.5 – 156	LIMESTONE, light gray (2.5Y 7/2), sandy molluscan wackestone, very hard, no aragonite remaining, moldic pores and some intergranular burrows –mostly small in size, medium hydraulic conductivity.
156 – 161	LIMESTONE and MARL, light brownish gray (2.5Y 6/2), sandy wackestone and lime mud, hard to moderately hard, no aragonite preserved, nodular phosphorite, 60% of interval is marl, medium to low hydraulic conductivity.
161 – 166	LIMESTONE, light gray (5Y 7/2), sandy skeletal wackestone, hard to moderately hard, 5-10% nodular phosphorite, no aragonite remaining, abundant moldic and intergranular pores, medium hydraulic conductivity, limestone is 90% of interval, 10% marly sand, light gray (5Y 7/2).
166 – 171	LIMESTONE, light olive gray (5Y 6/2), sandy skeletal wackestone, hard, 10-15% mudstone infilling vugs and moldic pores, abundant intergranular pores, 5% nodular phosphorite, no aragonite remaining, medium hydraulic conductivity.
171 – 188	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, hard, abundant moldic and intergranular pores, some vugs, 5-10% nodular

TABLE A-1 Geological Log LS-6187
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
	phosphorite, no aragonite remaining, medium to high hydraulic conductivity.
188 – 200	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, hard, intergranular pores and moldic pores, some channel porosity and vugs, less grains (more matrix than above), 1% nodular phosphorite, no aragonite remaining, medium to high hydraulic conductivity.
200 – 209.5	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, hard, intergranular pores, some vugs and moldic pores, some lithified shells and oysters, less dense relative to above, high hydraulic conductivity.
209.5 – 212	LIMESTONE and MARL, light gray (5Y 7/2), sandy molluscan wackestone, hard, intergranular and moldic porosity, 1% nodular phosphorite, no aragonite remaining, some mudstone filling vugs and burrows, medium to high hydraulic conductivity.
212 – 218	LIMESTONE, light greenish gray (10Y 8/1), sandy molluscan wackestone, medium hard to hard, some intergranular and moldic pores, but less than above, more sand and silt, 1% nodular phosphorite, no aragonite remaining, medium to high hydraulic conductivity.
218 – 220.5	LIMESTONE with MARL, light greenish gray (10Y 7/1), sandy molluscan wackestone/packstone, hard, some moldic and intergranular porosity, no aragonite remaining, medium to high hydraulic conductivity, 90% of interval is limestone, 10% marl, pale grayish yellow (10Y 7/2).
220.5 – 226	MARL, light gray (5Y 7/2), lime mud with 30% medium to fine grained quartz sand, <5% calcitic shell fragments, low hydraulic conductivity.
226 – 236	LIMESTONE with MARL, light olive gray (5Y 6/2), sandy molluscan wackestone, moderately hard, moldic and intergranular porosity, 5-10% medium to fine grained quartz sand, no aragonite remaining, mostly medium to low hydraulic conductivity, 90% of interval is limestone.
236 – 246	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, moderately hard to soft, some trace of phosphorite, some calcitic shells, relatively low hydraulic conductivity.
246 – 256	LIMESTONE, pale yellow (5Y 8/2), sandy molluscan wackestone, hard, abundant moldic and intergranular porosity, no aragonite remaining, 1-2% nodular phosphorite, 5% medium to fine grained quartz sand, high hydraulic conductivity, trace amount of marl.

TABLE A-1 Geological Log LS-6187
Troyer Brothers – TB-7

Depth (ft bls)	Lithology
256 – 260	LIMESTONE with MARL, grayish brown (10YR 5/2), mudstone to wackestone, moderately hard to hard, some moldic and intergranular porosity, 5-8% medium to fine grained quartz sand, no aragonite remaining, medium to low hydraulic conductivity, limestone is 85% of interval, marl 15%.
260 – 261.5	MARL, olive gray (5Y 4/2), lime mud containing very fine sand to silt, phosphorite, and some calcitic shell fragments, low hydraulic conductivity.
261.5 – 263	MARL, gray (5Y 6/1), lime mud mixed composition of clay, phosphorite, calcitic shell fragments, and medium to fine grained quartz sand; low hydraulic conductivity.
263 – 272	LIMESTONE, light gray (5Y 7/1), silty wackestone (90%), hard, 10% of marl with mixed composition of fine silt, clay and medium to fine grained quartz sand, low hydraulic conductivity.
272 – 273.5	CLAY, olive gray (5Y 5/2), mixed composition of clay and medium to fine quartz sand, low hydraulic conductivity.
273.5 – 276	MARL, dark olive gray (5Y 4/2), mixed composition of fine sand and silt, clay, shell fragments, phosphorite, and 15-20% medium to fine grained quartz sand and 1-3% carbonate sand, more siltier than above, low hydraulic conductivity.
276 – 279	MARL, olive (5Y 5/3), mixture of clay, shells, phosphorite, and some poorly lithified mudstone (soft), low hydraulic conductivity.
279 – 282	LIMESTONE and MARL, olive (5Y 5/3), mudstone and marl, with the ratio of 50% to 50%, mudstone is moderately hard to soft, while marl is similar to the composition of above: mixed composition of clay, shell, phosphorite, 10-15% fine grained sand and 1% carbonate sand, more siltier than above layer, low hydraulic conductivity.
282 – 286	SANDSTONE, pale olive (5Y 6/3), borderline limestone/sandstone, moderately hard to hard, is a mixture of sand, silt, and sandstone rock, medium to fine grained quart sand (20-25%), fine silt (10-15%), some oyster shells (5%), some intergranular and little moldic porosity, no aragonite remaining, medium hydraulic conductivity.
286 – 296	MISSING SAMPLE, mostly like the sample above.

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Location: SW ¼, SW ¼, Sec. 16, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 27.925', Long. 81° 37.490'

Depth (ft bls)	Lithology
0 – 0.5	SAND, very dark grayish brown (10YR 3/2), quartz, medium to fine grained, moderately sorted, subrounded, trace of phosphorite, 5-10% carbonate grains, medium hydraulic conductivity.
0.5 – 1	SAND, dark gray (2.5Y 4/1), quartz, medium to fine grained, moderately sorted, subrounded, 5-10% phosphorite, medium hydraulic conductivity.
1 – 1.5	SAND, dark grayish brown (10YR 4/2), medium to fine grained quartz sand, mostly subrounded, trace of phosphorite (<2%), medium hydraulic conductivity.
1.5 – 4	SAND, brown to dark brown (10YR 4/3 to 10YR 3/3), quartz, mostly medium to fine grained, subrounded, trace of phosphorite (5-10%), some carbonate grains, medium hydraulic conductivity.
4 – 4.5	SAND, dark yellowish brown (10YR ¾), quartz, medium to fine grained, subrounded, some darker organic material, 5-10% phosphorite, medium hydraulic conductivity.
4.5 – 8.5	SAND, light gray (5Y 7/1), quartz, medium to fine grained, rounded to subrounded, mixed with <5% darker organic material, trace of carbonate grains and phosphorite (<5%), medium hydraulic conductivity.
8.5– 10.5	SAND, grayish brown (2.5Y 5/2), quartz, medium to fine grained (more fine grains), subrounded, 5% phosphorite, 10% carbonate grains, medium hydraulic conductivity.
10.5 – 28	MISSING SAMPLE, likely sand and/or marl.
28 – 29	MARL, olive yellow (2.5Y 6/8), mixed composition of sand, silt, clay, small pieces of shell and lime mud, 40% medium to fine grained quartz sand, medium to low hydraulic conductivity.
29 – 32	LIMESTONE, light gray (5Y 7/2), mixed layer of mudstone and wackestone, very hard, very little intergranular porosity, some moldic porosity, no aragonite remaining, less than 1% nodular phosphorite, some

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
	shell fragments, for wackestone, some vuggy and channel porosity, medium hydraulic conductivity.
32 – 34.5	MARL and LIMESTONE, light gray (2.5Y 7/1), mixed composition of shells, gastropods, ostracods, 30% silty clay, 10-15% phosphorite, 20-25% medium to fine grained sand, 80% of interval is marl; limestone (20%), wackestone, very hard, some shell fragments, no aragonite remaining, 5% phosphorite, some intergranular and moldic porosity, very dense, medium hydraulic conductivity.
34.5 – 36	MARL, light gray (2.5Y 7/1), mixture of small shell fragments, silt, clay, lime mud, medium to fine grained quartz sand, trace of phosphorite, low hydraulic conductivity.
36 – 38	LIMESTONE and MARL, light greenish gray (5GY 7/1), sandy molluscan wackestone, moderately hard, abundant moldic and intergranular porosity, 15-20% medium to fine grained quartz sand, no aragonite remaining, 5-10% phosphorite, medium to high hydraulic conductivity.
38 – 38.5	MARL, light gray (2.5Y 7/1), mixed composition of small shell fragments, sand and silt, clay, lime mud, and approximately 10% medium to fine grained quartz sand, fresh water snails present, low hydraulic conductivity.
38.5 – 43	LIMESTONE, pale yellow (2.5Y 8/2), sandy molluscan wackestone, medium hardness, shelly, abundant moldic pores, intergranular pores, vugs, and channel porosity, high hydraulic conductivity.
43 – 43.5	LIMESTONE, pale yellow (2.5Y 8/2), sandy molluscan wackestone/packstone, medium hardness, abundant moldic pores, intergranular pores, vugs and channels, no aragonite remaining, high hydraulic conductivity.
43.5 – 46	MISSING SAMPLE, likely limestone.
46 – 47	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, moderately hard to hard, some moldic and intergranular porosity, less porous than above, some large shell fragments, medium hydraulic conductivity.
47 – 56.5	LIMESTONE, light greenish gray (10Y 7/1), sandy molluscan wackestone, moderately hard to hard, some moldic and intergranular porosity, 20-30% medium to fine grained quartz sand, nodular phosphorite, no aragonite remaining, medium hydraulic conductivity.

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
56.5 – 57.5	LIMESTONE, light greenish gray (10Y 7/1), sandy molluscan wackestone to mudstone, moderately hard to hard, abundant moldic and intergranular pores, some vugs (some infilled), 10-15% medium to fine grained quartz sand; hydraulic conductivity varies from high to low.
57.5 – 58.5	LIMESTONE, yellowish brown (10YR 5/4), mostly well packed mudstone with 20% sandy molluscan wackestone, hard, little or no moldic or intergranular pores for the mudstone, 5-10% nodular phosphorite, no aragonite remaining, very low to medium hydraulic conductivity.
58.5 – 60	LIMESTONE, light brownish gray (2.5Y 6/2), very sandy molluscan wackestone, moderately hard, very shelly, very high moldic and intergranular porosity, no aragonite remaining, some marl, medium to high hydraulic conductivity.
60 – 61	LIMESTONE with MARL, light gray (2.5Y 7/1), sandy molluscan wackestone, moderately hard, high intergranular and moldic porosity, 20-30% medium grained quartz sand, no aragonite remaining, some small vugs, medium to high hydraulic conductivity, limestone is 80% of interval; 20% marl, light gray (2.5Y 7/1).
61 – 70.5	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, hard, high intergranular and moldic porosity, 30% medium to fine grained quartz sand, some vuggy and channel porosity, 5-10% nodular phosphorite, no aragonite remaining, high hydraulic conductivity.
70.5 – 71.5	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone and light olive brown (2.5Y 5/2) mudstone (50% to 50%), hard, wackestone contains 20% quartz, has intergranular and moldic porosity, no aragonite remaining, mostly medium to low hydraulic conductivity.
71.5 – 75.5	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, hard, moderate to high intergranular porosity, medium moldic porosity, few vugs, 20-30% medium to fine grained quartz sand, 1% nodular phosphorite, no aragonite remaining, medium hydraulic conductivity.
75.5 – 76.3	LIMESTONE, pale yellow (5Y 7/3), sandy molluscan wackestone, hard, high intergranular porosity, medium to high moldic porosity, 5% nodular phosphorite, no aragonite, abundant oyster fragments coated with precipitated sand and silt, 20-30% large to medium grained quartz sand, medium hydraulic conductivity.
76.3 – 89	LIMESTONE, pale yellow (5Y 8/2), sandy molluscan wackestone, very hard, very high moldic porosity, high intergranular porosity, some small

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
	vugs, 10-15% medium to fine grained quartz sand, some nodular phosphorite, abundant shell molds, no aragonite remaining, high hydraulic conductivity.
89 – 92	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone/ packstone, medium hard to hard, high moldic and intergranular porosity, some vugs, no channel, 20% medium to fine grained quartz sand; shells and snails lithified and well set in the matrix; no aragonite preserved, 1% nodular phosphorite, high hydraulic conductivity.
92 – 95.5	LIMESTONE, pale olive (5Y 6/3), sandy molluscan wackestone/ packstone, hard, high inter-granular porosity, medium moldic porosity, no vug or channel; 20-25% medium to fine grained quartz sand, 5% pore-lining phosphorite, no aragonite, medium hydraulic conductivity.
95.5 – 98	LIMESTONE, light yellowish brown (2.5Y 6/3), sandy molluscan wackestone/packstone, hard, high intergranular and moldic porosity, no vug and channel, 20-30% medium to fine grained quartz sand, very large pieces of oysters were founded coated with precipitated sandy materials; 5-10% nodular phosphorite, 1% pore-lining phosphorite, no aragonite preserved, medium hydraulic conductivity.
98 – 115.5	LIMESTONE, light yellowish brown (2.5Y 6/3), sandy molluscan wackestone and mudstone, hard to soft, high intergranular and moldic porosities, no vug and channel, 20-30% medium to fine grained quartz sand, very large pieces of oysters were founded coated with precipitated sandy materials; 5-10% nodular phosphorite, 1% pore-lining phosphorite, no aragonite preserved, medium hydraulic conductivity.
115.5 – 120	LIMESTONE, pale olive (5Y 6/4), sandy molluscan wackestone, moderately hard to soft, high intergranular and moldic porosity, some vugs, no channel, 30-35% medium to fine grained quartz sand, very large oyster shells lithified and coated with sandy materials, formed heavy relatively dense rock, 1-5% nodular phosphorite, no aragonite, medium hydraulic conductivity.
120 – 127	LIMESTONE, olive gray (5Y 5/2), sandy molluscan wackestone, moderately hard to soft, high intergranular and modlic porosity, some vugs and channels, which were half filled by sandy deposits on top, 25-30% medium to fine grained quartz sand, 5% fine silt, no phosphorite and aragonite, medium to high hydraulic conductivity.

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
127 – 132	LIMEMUD, light brownish gray (10YR 6/2), mixed composition of sand, silt, clay, and oyster shells; sand is approximately 40-45% fine grained quartz sand and silt; 25-30% calcitic shells, 1% phosphorite, low hydraulic conductivity.
132 – 137	LIMESTONE and LIMEMUD, yellowish brown (10YR 5/4), wackestone and limemud; wackestone is about 85% of the interval, moderately hard to soft; limemud (15%) mixed composition of 35% - 40% medium to fine grained quartz sand and silt, 30-35% calcitic shells, found oysters and barnacles, 1% phosphorite, low hydraulic conductivity.
137 – 151	LIMESTONE, light brownish gray (2.5Y 6/2), sandy molluscan wackestone, hard, high intergranular and moderate to low moldic porosity, little vugs and channel porosity, 10-15% medium and fine grained quartz sand, shark tooth, lithified shells and sandy materials settled on top of oyster shells, formed this type of rock, 5% nodular phosphorite, 1% pore-lining phosphorite, no aragonite trace, medium to low hydraulic conductivity.
151 – 156	Missing sample, mostly like the formation above.
156 – 162	MARL, light olive gray (5Y 6/2), clayey marl with mixed composition of 40% medium to fine grained quartz sand and silt, silty and stiff, 30 – 35% calcitic shells, 1% pore-lining phosphorite, low hydraulic conductivity.
162 -166	LIMESTONE, light olive gray (5Y 6/2), sandy molluscan wackestone, hard, high intergranular and moldic porosity, some vugs, no distinctive channel, 30% medium to fine grained quartz sand, 5% nodular phosphorite, no aragonite, some large pieces of oyster shells lithified and coated with sandy molluscan precipitates, medium to high hydraulic conductivity.
166 – 180	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, moderately hard to hard, high intergranular, low moldic porosity, no vug and channel, 15-20% medium to fine grained quartz sand, 10-15% fine silt, more silty look than above layer core, medium to low hydraulic conductivity.
180 – 184	LIMESTONE and MARL, light gray (5Y 7/2), mixed formation of wackestone (65%) and marl (35%); for the limestone, it is hard, primarily sandy molluscan wackestone with 20% medium to fine grained quartz sand, 5-10% pore-lining nodular phosphorite, trace of aragonite, good intergranular and moldic porosity, some vugs, no distinctive channels;

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
	for the marl, it is mainly limemud with mixed composition of 40-45% medium to fine grained sand and silt, 10-15% calcitic shells, 5-10% nodular phosphorite, wackestone should have pretty high hydraulic conductivity , with the mixture of marl, the hydraulic conductivity of this layer is mostly medium level.
184 – 186	Missing sample, mostly similar to the formation above.
186 – 195	LIMESTONE and MARL, light olive gray (5Y 6/2), sandy molluscan wackestone (85%) and marl (15%), medium intergranular and low moldic porosity, no vug or channel porosity here, moderately hard, 20-25% medium to fine grained quartz sand, some calcitic shells and some large oyster shells infilled by sandy molluscan sediment inside (almost shell beds), 1% nodular phosphorite, medium hydraulic conductivity.
195 – 196	LIMESTONE, light olive brown (2.5Y 5/4), sandy molluscan wackestone (mixed with 10% mudstone), hard, blackish lithified oyster shells coated by layers of brownish silt, mud and sand, very dense, no phosphorite and no aragonite, 40-45% medium to fine grained sand, some intergranular porosity, as well as moldic porosity, high hydraulic conductivity.
196 – 198.5	LIMESTONE, pale yellow (2.5Y 7/3), wackestone and mudstone, moderately hard, 20-30% medium to fine grained quartz sand and silt (20-30%), moderate to low macro porosities (vuggy and channels'), medium to low intergranular porosity, no phosphorite, no aragonite, high hydraulic conductivity.
198.5 – 200	MARL/CLAY, grayish brown (2.5Y 5/2), silty marl and clay with 20-50% very fine grained quartz sand and silt, which has more silt than sand; 5-6% nodular phosphorite, 1-2% calcitic shells, foraminifera for its skeletal grain type, low hydraulic conductivity.
200 – 201.5	MARL, light gray (2.5Y 7/1), shelly marl with mixed composition of 40-45% shell fragments, 10-15% clay, 5-10% nodular phosphorite, calcitic shells, stiff, low hydraulic conductivity.
201.5 – 215	LIMESTONE, gray (5Y 6/1), mudstone and sandy molluscan wackestone, hard to moderately hard, 25-35% medium to fine grained quartz sand (mostly fine), no phosphorite and no aragonite, medium intergranular porosity and low moldic porosity, little vuggy porosity, no channel porosity, medium to low hydraulic conductivity.

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
215 – 216	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone, hard, 30-40% medium to fine grained quartz sand, 10-15% nodular phosphorite (fine to silty), no aragonite, low to medium moldic porosity, high intergranular porosity, no vuggy or channel porosities, some calcitic shells (15-20%), medium to high hydraulic conductivity.
216 – 223.5	Sample missing, mostly like sample below.
223.5 – 226	LIMESTONE, pale yellow (5Y 7/3), mudstone, moderately hard to soft, some lithified shells and calcitic shells as well (5-8%), 5-10% nodular phosphorite, no aragonite preserved, low macro porosity, low hydraulic conductivity.
226 – 237	MARL and CLAY, light olive gray (5Y 6/2), silty marl/clay with 30-50% fine grained quartz sand and silt (mostly silt), 10% nodular shells, foraminifera grain type, low hydraulic conductivity.
237 – 246	CLAY, olive (5Y 4/2), silty clay with mixed composition of 50-60% calcitic shells, 10-15% clay, 15-20% silt, 10-12% nodular and pore-lining phosphorite, trace of top-set and fore-set boundary deposits, medium hydraulic conductivity.
246 – 260	CLAY, dark grayish brown (2.5Y 4/2), clay, stiff, 10-15% nodular phosphorite, 1% calcitic shells, skeletal grain type tends to be like foraminifera, low hydraulic conductivity.
260 – 261	CLAY, very dark gray (5Y 3/1), clay composed of 30-45% shells, 10-15% clay, 10-20% fine sand and silt, shells are mostly white, 10-15% nodular phosphorite, some other black organic materials, mostly plants debris, low hydraulic conductivity.
261 – 276	CLAY, dark olive gray (5Y 3/2), clay mixed with some fine quartz silt, 1% nodular phosphorite, stiff and brittle, some calcitic shells (1%), very thinly laminated, very low hydraulic conductivity.
276 – 277.5	CLAY, dark olive gray (5Y 3/2), silty clay composed of 20-35% medium to fine grained quartz sand and silt, 20-25% nodular phosphorite, 1-2% calcitic shells, foraminifera, softer than previous core, medium to low hydraulic conductivity.
277.5 – 282	SANDSTONE, light gray (5Y 7/1) and light olive gray (5Y 6/2), calcareous sandstone (65%) and sand (35%), hard, coral molds and shell molds, 30-40% medium to fine grained quartz sand, 5-6% nodular and skeletal phosphorite, medium to high moldic porosity, bioturbated, no distinctive channels, medium hydraulic conductivity.

TABLE A-2 Geological Log LS-6188
Troyer Brothers – TB-6

Depth (ft bls)	Lithology
282 – 286	SAND, white (5Y 8/1), quartz, medium to fine grained (mostly fine grained), moderately sorted, subrounded, 15-20% phosphorite, 5-8% calcitic shells, medium hydraulic conductivity.
286 – 296	MISSING SAMPLE, likely similar to the above formation.

TABLE A–3 Geological Log LS-6190
Troyer Brothers – TB-3

Location: NW ¼ NW ¼, Sec. 16, Township 46 South, Range 27E
Lee County Florida
Lat. 26° 28.617', Long. 81° 37.332'

Depth (ft bls)	Lithology
0 – 4.0	SAND, very dark gray (5 Y 3/1), quartz, medium to fine grained, medium sorting, subrounded, 1% phosphorite, medium hydraulic conductivity.
4.0 – 8.5	SAND, dark yellowish brown (10 YR 3/6), quartz, medium to fine grained, moderately sorted, subrounded, 5-10% phosphorite, medium hydraulic conductivity.
8.5 – 15.0	SAND, brown (10 YR 4/3), quartz, medium to fine grained, moderately sorted, subrounded, 1% phosphorite, trace of carbonate grains, medium hydraulic conductivity.
15.0 – 18.0	LIMESTONE, light gray (2.5 Y 7/1), sandy molluscan wackestone, hard and dense, 1% phosphorite, no aragonite, burrows infilled with mudstone material, some moldic porosity, low intergranular porosity, medium to low hydraulic conductivity.
18.0 – 23.0	LIMESTONE, light gray (2.5 Y 7/2), sandy molluscan wackestone, hard, 1-5% aragonite, no phosphorite, moldic and intergranular porosity, vuggy porosity, 5 -10% fine grained quartz sand, medium hydraulic conductivity.
23.0 – 25.0	LIMESTONE, pale yellow (2.5 Y 8/2), mudstone/wackestone, hard, dense, trace of quartz sand, some channel and vuggy porosity, little or no moldic and intergranular pores, medium to low hydraulic conductivity.
25.0 – 26.0	LIMESTONE, pale yellow (2.5 Y 8/2), sandy molluscan wackestone, moderately hard, 15--20% fine to very fine grained quartz sand, some silt, no phosphorite, 5 -8% aragonite, moldic and intergranular porosity, channel and vuggy porosities, medium to high hydraulic conductivity.
26.0 – 30.0	LIMESTONE and LIMEMUD, brown (10 YR 5/3) and very pale brown (10 YR 7/3), mudstone and limemud; mudstone---brownish color, hard, and dense, 1% phosphorite, 15% aragonite, moldic and vuggy porosities, channel porosities, little intergranular porosity; limemud---very pale brownish color, 30-40% medium to fine grained quartz sand, 30--40% shells and corals, some clay, medium to low hydraulic conductivity.

TABLE A–3. Geological Log LS-6190
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
30.0 – 34.0	LIMEMUD, very pale brown (10 YR 7/3), limemud with mixed composition of 25–35% fine to very fine grained quartz sand and silt, 40 -50% shells and corals, 10–15% mudstone fragments, trace of phosphorite and aragonite, high hydraulic conductivity.
34.0 – 37.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluscan wackstone, hard and dense, 1-5% aragonite, 1% phosphorite, moldic porosity is high, intergranular porosity is low, some vuggy porosity, some calcitic shells, medium to low hydraulic conductivity.
37.0 – 40.0	CLAY and LIMESTONE, light gray (5 Y 7/1), marly clay and mudstone, hard, clay is stiff, while the mudstone is hard, clay and mudstone ratio is about 80% to 20%, trace of aragonite, no phosphorite, little/no visible porosity, low hydraulic conductivity.
40.0 – 41.5	LIMESTONE and LIMEMUD, light gray (5 Y 7/1), mudstone and limemud, mudstone (55-60%) is hard and low porosity, while limemud (40-45%) composed of over 50% fine to very fine grained quartz sand and silt, no aragonite and phosphorite, very silty, low hydraulic conductivity.
41.5 – 43.0	LIMEMUD, white (5 Y 8/1), limemud composed of 40–50% fine to very fine grained quartz sand and silt, trace of phosphorite, 1–5% shell fragments, low hydraulic conductivity.
43.0 – 44.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone/mudstone, hard, 1-5% aragonite, no phosphorite, low intergranular and moldic porosity, 15–20% fine to very fine grained quartz sand and silt, vuggy porosity, bioturbated, burrows infilled with bluish wackestone, some marl (<15-10%) low hydraulic conductivity.
44.0 – 46.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone, moderately hard, 15-20% medium to fine grained quartz sand, no aragonite and phosphorite, intergranular and moldic porosity, vuggy porosity, medium to low hydraulic conductivity.
46.0 – 48.0	LIMEMUD and LIMESTONE, light olive gray (5 Y 6/2) and pale yellow (2.5 Y 8/2), limemud (70-80%) and sandy molluscan wackestone (15-20%); sandy molluscan wackestone: moderately hard, 5 -10% nodular phosphorite, 4 - 8% pore-lining phosphorite, very shelly, moldic porosity and intergranular porosity; for the pale yellowish limemud, it is composed of 60–65% shells (gastropods, ostracods), some calcitic shells, 1-5% phosphorite, 20-30% medium to fine grained quartz sand, medium hydraulic conductivity overall.

TABLE A–3. Geological Log LS-6190
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
48.0 – 50.5	LIMEMUD, grayish brown (2.5 Y 5/2), limemud with composition of 60–70% shells, 30-35% medium to fine grained quartz sand and silt, gastropods, medium hydraulic conductivity.
50.5 – 51.5	LIMEMUD, light olive brown (2.5 Y 5/3), mixed composition of 60–65% shells, 30-35% fine to very fine grained quartz sand and silt, 1-5% phosphorite, gastropods and coral fragments, medium to high hydraulic conductivity.
51.5 – 54.5	CLAY, very dark gray (5 Y 3/1), clay with 40-50% medium to fine grained quartz sand and silt, 20-25% shells, 5–8% phosphorite, 5–10% blackish organic materials (mostly plants debris), low hydraulic conductivity.
54.5 – 55.5	MARL/CLAY, light gray (5 Y 7/2), clayey limemud with 50-60% fine to very fine grained quartz sand and silt, 10–20% shells, 5-10% phosphorite, and some small fragments of limestone rock, low hydraulic conductivity.
55.5 – 59.5	LIMESTONE and LIMEMUD, gray (5 Y 6/1), sandy molluscan wackestone (80-85%) and limemud (15-20%), hard, 20–25% medium to fine grained quartz sand, 1% nodular phosphorite, no aragonite, moldic and intergranular porosity, as well as some vuggy porosity, bioturbated, some burrows infilled with sandy wackestone/packstone materials, limemud is less than 15%, medium hydraulic conductivity.
59.5 – 66.0	MISSING SAMPLE, likely similar to the formation above.
66.0 – 75.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone, hard, 1–5% phosphorite, no aragonite, 15–20% fine to very fine grained quartz sand and silt, medium moldic and intergranular porosities, medium vuggy porosity, medium hydraulic conductivity.
75.0 – 78.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone/mudstone, hard, 15–20% medium to fine grained quartz sand, 1–5% phosphorite, no aragonite, moldic and intergranular porosities, some vuggy porosity, medium hydraulic conductivity.
78.0 – 79.5	LIMEMUD, light gray (5 Y 7/1), clayey limemud with 50-55% medium to fine grained quartz sand and silt, 25–35% shells, 5–10% phosphorite, medium to low hydraulic conductivity.
79.5 – 81.0	LIMESTONE, light gray (5Y 7/1), mudstone/sandy molluscan wackestone,

TABLE A–3. Geological Log LS-6190
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
	hard, some medium to fine grained quartz sand, some carbonate grains, some moldic, intergranular and vuggy porosities, no channel, 5-10% pore-lining and nodular phosphorite, medium hydraulic conductivity.
81.0 - 84.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone, hard, 20–25% medium to fine grained quartz sand, 5–8% pore-lining and nodular phosphorite, good intergranular and vuggy porosities, some moldic porosity, medium hydraulic conductivity.
84.0 – 86.0	LIMESTONE and LIMEMUD, pale yellow (5 Y 8/3) and light yellowish brown (2.5 Y 6/4), mudstone and limemud; limemud—pale yellowish color, composed of 50–60% medium to fine grained quartz sand and silt, 20-30% mudstone fragments, 5-10% phosphorites; mudstone—yellowish brown, little visible pores, except few vugs, hard and dense, low hydraulic conductivity.
86.0 – 90.0	LIMESTONE, light gray (2.5 Y 7/1), sandy molluscan wackestone, moderately hard, 10% fine grained quartz sand, some carbonate grains, 1–5% phosphorite, no aragonite, some vuggy, moldic, intergranular porosities, medium hydraulic conductivity.
90.0-90.5	LIMEMUD, light brownish gray (2.5 Y 6/2), limemud/marly clay with 55–65% medium to fine grained quartz sand, 25–30% shells, 1% phosphorite, low hydraulic conductivity.
90.5 – 99.0	LIMESTONE, light gray (5 Y 7/2), sandy molluscan wackestone/ packstone, medium hardness, 10-15% fine to very fine grained quartz sand, no phosphorite, and no aragonite, high intergranular porosity, medium moldic and vuggy porosities, medium hydraulic conductivity.
99.0 – 105.0	LIMESTONE, light gray (5Y 7/2), sandy molluscan wackestone/packstone, medium hardness, 10% fine grained quartz sand, no phosphorite and no aragonite, high moldic and intergranular porosities, some vuggy porosity, medium to high hydraulic conductivity.
105.0 – 112.0	LIMESTONE, light gray (5 Y 7/1), sandy molluscan wackestone, medium hardness, 15–20% medium to fine grained quartz sand, 1–5% phosphorite, trace of aragonite, medium high moldic and intergranular porosities, some vuggy porosity , medium hydraulic conductivity.
112.0 – 116.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluscan wackestone, hard, large pieces of oyster shells coated with sandy and silty sediments, ostracods, and some barnacles, high inter-granular porosity, medium

TABLE A–3. Geological Log LS-6190
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
	moldic porosity, no channel, medium hydraulic conductivity.
116.0 – 133.0	LIMESTONE, pale olive (5 Y 6/3), sandy molluscan wackestone, pale yellow (2.5 Y 8/2), medium hardness, 1-5% phosphorite, large oyster shells coated with sandy molluscan sediments, no aragonite, medium intergranular, vuggy, and moldic porosities, medium hydraulic conductivity.
133.0 – 136.0	Missing sample (mostly similar to the layer beneath it).
136.0 – 138.0	LIMEMUD, olive yellow (2.5 Y 6/6), limemud with mixed composition of 60–70% fine to very fine grained quartz sand and silt, 10% shells, 10–15% carbonates grains, 1-5% phosphorite, low hydraulic conductivity.
138.0 – 142.0	LIMEMUD, olive gray (5 Y 5/2), limemud with 30% shells (mostly are oyster shells), 40–50% medium to fine grained quartz sand and silt, 1–5% phosphorite, less than 10% limestone fragments (mostly wackestone), some calcitic shells, low hydraulic conductivity.
142.0 – 148.0	LIMESTONE, pale yellow (5 Y 7/4), sandy molluscan wackestone, soft to moderately hard, 1-5% phosphorite, no aragonite, some carbonate grains (< 10%) as well as quartz sand, some intergranular, moldic, and vuggy porosities, no channel, medium to low hydraulic conductivity.
148.0 – 149.0	LIMESTONE and LIMEMUD, light gray (5 Y 7/1), hard, wackestone (90%) and limemud (10%)---with 30% shells, 40–50% fine to very fine grained quartz sand and silt; wackestone—hard, low moldic porosity, no aragonite, low hydraulic conductivity.
149.0 – 156.0	Missing sample (mostly like the sample above).
156.0 – 159.0	LIMEMUD and LIMESTONE, light olive gray (5 Y 6/2), limemud (30-40%) and wackestone (65%), limemud—mixed composition of 40% shells (fragments of large oysters), 40% fine to very fine grained quartz sand, 1% phosphorite; wackestone—hard, low moldic porosity, mostly associated with oyster fragments, low hydraulic conductivity.
159.0 – 168.0	MARL, light gray (5Y 7/2), silty marl with mixed composition of 40–50% fine to very fine grained quartz sand and silt, 20% wackestone fragments, low hydraulic conductivity.
168.0 – 169.0	MARL and LIMESTONE, olive (5 Y 5/3), mixed composition of clayey marl (over 60-70%), fragments of mudstone (< 30-40%), 5–8%

TABLE A–3. Geological Log LS-6190
Troyer Brothers – TB-3

Depth (ft bls)	Lithology
	nodular phosphorite, the percentage of clay increase as the increase of depth, low hydraulic conductivity.
169.0 – 176.0	MARL, olive (5 Y 5/3), silty and clayey marl, stiff, 60-65% very fine grained quartz sand and silt, 5-8% nodular phosphorite, 5% shells (in thin lenses), low hydraulic conductivity.

TABLE A–4 Geological Log LS-6191
Troyer Brothers – TB-2

Location: NW ¼ SW ¼, Sec. 9, Township 46 South, Range 27E
Lee County Florida
Lat. 26° 29.225', Long. 81° 37.592'

Depth (ft bls)	Lithology
0 – 2.2	SAND, very dark gray (10 YR 3/1), quartz, medium to fine grained, moderately sorted, subrounded, 1-5% phosphorite, 5-8% carbonate grains, medium hydraulic conductivity.
2.2 - 5.0	SAND, pale yellow (2.5 Y 8/3), quartz, medium to fine grained, medium sorted, subrounded, 1-2% phosphorite, medium hydraulic conductivity.
5.0 - 6.0	SAND, light brownish gray (10 YR 6/2), quartz, medium to fine grained, mixed with 10-15% fine sand and silt, 20-25% blackish organic materials, mostly plants debris; no trace of phosphorite, medium to low hydraulic conductivity.
6.0 – 7.5	SAND, dark grayish brown (10 YR 4/2), quartz, medium to fine grained, moderately sorted, subrounded, 1-5% phosphorite, 1% carbonate grains, medium hydraulic conductivity.
7.5 – 8.5	SAND, very pale brown (10 YR 8/2), quartz, medium to fine grained, moderately sorted, subrounded, 5% phosphorite, medium hydraulic conductivity.
8.5 – 10.7	SAND, light gray (10 YR 7/2), quartz, medium to fine grained, moderately sorted, subrounded, 20-25% very fine sand and silt, 5-8% phosphorite, medium to low hydraulic conductivity.
10.7 – 12.7	SAND, light brownish gray (10 YR 6/2), quartz, medium to fine grained, moderately sorted, subrounded, 5-10 % very fine sand and silt, 2-5% phosphorite, medium to low hydraulic conductivity.
12.7 – 15.0	SAND, white (5 Y 8/1), quartz, medium to fine grained, mostly are fine grained, moderately sorted, subrounded to somewhat rounded, 5 – 8% phosphorite, medium hydraulic conductivity.
15.0 – 16.0	SAND, light brownish gray (10 YR 6/2), quartz, medium to fine grained, moderately sorted, subrounded, 5-10 % very fine sand and silt, 5% phosphorite, 1% calcitic shells, medium to low hydraulic conductivity.

TABLE A–4. Geological Log LS-6191
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
16.0 – 16.2	LIMESTONE, pale yellow (2.5 Y 8/4), sandy skeletal wackstone, moderately hard, high intergranular porosity, and high vuggy porosity, no phosphorite or aragonite, medium to high hydraulic conductivity.
16.2 – 19.6	SAND and SHELL, pale yellow (2.5 Y 8/2), mixed composition of 35-45% shells, 55-65% medium to fine grained quartz sand and silt, no trace of phosphorite, medium hydraulic conductivity.
19.6 - 22	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackstone, hard, dense, 50-55% shells settled in the rock, 20 – 30 % medium grained quartz sand, medium intergranular and moldic porosity, low vuggy porosity, and no channel porosity, no trace of phosphorite, medium hydraulic conductivity.
22 – 24	LIMESTONE, pale yellow (2.5 Y 7/4) and grayish brown (2.5 Y 5/2), mixed layer of sandy molluskan wackstone (pale yellow), and mudstone (grayish brown), moderately hard to hard; sandy molluskan wackstone- 25-35% medium to fine grained quartz sand, 5% nodular phosphorite, high intergranular and moldic porosity, high vuggy porosity; mudstone- low intergranular porosity, little or no moldic, vuggy pores; overall, high hydraulic conductivity for the wackstone and low hydraulic conductivity for the mudstone part.
24 – 27.4	LIMESTONE, grayish brown (2.5 Y 5/2) and light gray (2.5 Y 7/2), mixed layer of muddy wackstone and sandy molluskan wackstone (light gray), hard; for the wackstone-30-40 % fine sand and silt, 45–55% small shells, 5–10% nodular phosphorite, little or no vuggy porosity, some intergranular and moldic porosity; for sandy wackstone- 20-25% medium to fine grained quartz sand, bioturbated, 30–40% shells, some trace of phosphorite, some gastropods, high intergranular and moldic porosity, high vuggy porosity; overall, the hydraulic conductivity of this layer changes from high to low with the transition of sandy molluskan wackstone to lower depth muddy wackstone.
27.4 – 27.7	LIMESTONE, brown (10 YR 5/3), mudstone / sandy molluskan wackstone (mostly mudstone), very hard, 1- 5% medium grained quartz sand, trace of aragonite, dense, some open burrows (mostly on the wackstone side), vertically oriented, very little visible pores on the mudstone part, but high moldic and intergranular porosity in the wackstone; overall, medium to low horizontal hydraulic conductivity, medium vertical hydraulic conductivity.

TABLE A–4. Geological Log LS-6191
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
27.7 – 28.7	LIMESTONE, pale yellow (2.5 Y 8/3), sandy molluskan wackstone, medium hardness, 1 -5 % fine grained quartz sand, 1 – 2 % pore-lining phosphorite, very high intergranular porosity, medium moldic porosity, and some channel porosity, very shelly and grainy look, high hydraulic conductivity.
28.7 – 31.1	LIMESTONE, light gray (5 Y 7/2), sandy skeletal wackstone, hard, 1% fine to very fine grained quartz sand, no phosphorite, very high intergranular and intragranular porosity, less shells compared with above layer sample, bioturbated, medium to vuggy porosity, less dense than previous core, high horizontal hydraulic conductivity, medium to high vertical hydraulic conductivity.
31.1 – 34.0	LIMESTONE, pale yellow (2.5 Y 8/2), muddy wackstone, moderately hard, no phosphorite, no aragonite, 15 – 20% fine sand and silt, little intergranular and moldic pores, some vug pores (some were filled by fine sand and mud), low hydraulic conductivity.
34.0 – 34.7	LIMESTONE, pale yellow (5 Y 8/2), sandy molluskan wackstone, hard, 5 – 10 % fine to very fine grained quartz sand, no phosphorite, trace of aragonite, medium moldic and intergranular porosity; some small burrows, bioturbated, partially infilled by sandy and silty precipitates, 5 – 8% fine sand / silt, medium to low hydraulic conductivity.
34.7 – 35.3	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, very hard, dense, 10 – 15 % medium to fine grained quartz sand, no phosphorite, no aragonite, some calcitic shells, 15 – 20 % very fine sand / silt, some vugs and burrows, partially infilled by sandy and shelly sediments, medium moldic porosity, medium to low hydraulic conductivity.
35.3 - 36	Sample missing (most likely similar to the sample below)
36 – 38.5	SAND and SHELL, light gray (5 Y 7/1), composition: 70 – 80% shells, 20 - 25% medium to fine grained quartz sand, 5 – 10 % fine silt, some traces of phosphorite, very high hydraulic conductivity.
38.5 – 40.2	MARL and minor LIMESTONE , light gray (5 Y 7/1), sandy skeletal wackstone, moderately hard, 10 – 15 % medium to fine grained quartz sand, 1 % phosphorite (pore-lining), no aragonite, 40 – 50% shells, good intergranular porosity, bioturbated, some large burrows, vertically open; overall, relatively high vertical hydraulic conductivity, medium to low horizontal hydraulic conductivity.

TABLE A–4. Geological Log LS-6191
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
40.2 – 40.6	LIMESTONE, dark yellowish brown (10 YR 4/4), wackstone / mudstone, very hard, 15 – 20% medium to fine grained quartz sand, 1-2 % pore-lining phosphorite, 5 – 8 % nodular phosphorite, no aragonite, 25 – 30% very fine sand / silt, some shells (10 -15%), small moldic pores, medium to low ntergranular pores, medium vuggy porosity, low hydraulic conductivity.
40.6 - 42.6	MARL, light brownish gray (10 YR 6/2), mixed composition of 30 – 35% shell, 35-40% medium to fine grained quartz sand and silt, some shells are calcitic shells no phosphorite, some grastropods, low hydraulic conductivity.
42.6 – 45.0	MARL with LIMESTONE, grayish brown (2.5 Y 5/2) marl -85%, sandy molluskan wackstone, grayish brown (2.5 Y 5/2), very hard, dense, 10 -15 % fine grained quartz sand, 1-5 % pore-lining phosphorite, 1% nodular phosphorite, no aragonite, little to no intergranular pores, some good size moldic pores, no vugs or larger channels. 20 -25% calcitic shells; marl is composed of 20 -25% fine grained quartz sand and silt, shells, gastropods, no trace of phosphorite, low hydraulic conductivity.
45.0 – 47.0	SHELL and SAND, light gray (2.5 Y 7/1), composition: 60 – 70% shells, 25 – 30% medium to fine grained quartz sand and silt, 5 – 8% phosphorite, barnacles, gastropods, very high hydraulic conductivity.
47.0 – 49.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone, 15 – 20% medium to fine grained quartz sand, hard, 10 – 15% pore-lining phosphorite, 5 - 10% nodular phosphorite, medium intergranular pores, large channels and good sizes of vugs, high hydraulic conductivity.
49.0 – 52.2	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone /mudstone, hard, 10 -15% medium to fine grained quartz sand, high intergranular porosity, medium to high moldic porosity, some pore-lining phosphorite (< 2%), with depth increases, wackstone appeared to be more muddy look, small moldic pores, and little grains, medium to low hydraulic conductivity.
52.2 – 54.0	MARL, light yellowish brown (2.5 Y 6/3), mixed composition of 30 – 40% fine to very fine grained quartz sand and silt, 5 – 8% phosphorite, 1 – 5 % calcitic shells, low hydraulic conductivity.
54.0 – 56.0	Missing sample (most likely similar to the sample above).
56.0 – 60.5	LIMESTONE, gray (5 Y 6/1), sandy molluskan wackstone, very hard, 10 – 15% medium to fine grained quartz sand, some large moldic pores, and

TABLE A–4. Geological Log LS-6191
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
	open burrows; some calcitic shells, some blackish sediments, mostly from oyster shells, 1% nodular phosphorite, no aragonite, medium to high hydraulic conductivity.
60.5 – 61.0	LIMESTONE, gray (5 Y 6/1), sandy molluskan wackstone, medium hard to hard, 10- 15 % medium to fine grained quartz sand, no trace of phosphorite and aragonite high moldic and intragranular porosity, bioturbated, some burrows were infilled by sandy materials, high hydraulic conductivity.
61.0 – 62.5	MARL, olive gray (5 Y 5/2), mixed composition of 30 – 40% medium to fine grained quartz sand and silt (mostly fine grained), 20 -30% shells, 5 - 10% phosphorite, low hydraulic conductivity.
62.5 – 63.7	MARL and LIMESTONE, greenish gray (10 Y 6/1), composition: 25 – 30 % medium to fine grained quartz sand and silt, 40 – 50% shells, some large gastropods, barnacles, not as silty as the layer above, medium to low hydraulic conductivity. Limestone is a sandy molluscan wackestone, hard.
63.7 – 65.0	LIMESTONE, bluish black (5B 2.5/1), sandy molluskan wackstone, moderately hard, 20 – 25% medium to fine grained quartz sand, trace of phosphorite, no aragonite, some moldic and intergranular porosities, bioturbated, burrows infilled with grayish sandy molluskan materials, medium hydraulic conductivity.
65.0 – 66.0	LIMESTONE, white (5 Y 8/1), sandy molluskan wackstone, moderately hard to hard, no phosphorite, some aragonite (1 – 2%), 20 – 25% medium to fine grained quartz sand, medium to small moldic pores, medium intergranular pores, no distinctive vugs or channels, medium to low hydraulic conductivity.
66.0 – 69.0	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, hard, 1% phosphorite, no aragonite, 30 -35% medium to fine grained quartz sand, some calcitic shells, medium moldic and intergranular pores, medium level moldic and intergranular porosities, medium size of vugs, medium hydraulic conductivity.
69.0 – 70.0	LIMESTONE, light greenish gray (10 Y 7/1), sandy molluskan wackstone, 10 -15% medium to fine grained quartz sand, no phosphorite, and no aragonite, large moldic and intergranular pores, bioturbated, some burrows were infillled with grainy packstone, high hydraulic conductivity.
70.0 – 71.5	LIMESTONE, greenish black (5 G 2.5/1), sandy molluskan wackstone, moderately hard, 10 -15% medium to fine grained quartz sand., high

TABLE A–4. Geological Log LS-6191
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
	intergranular and moldic porosities and high vuggy porosity, very grainy, no phosphorite and aragonite, high hydraulic conductivity.
71.5 – 79.0	LIMESTONE, light brownish gray (2.5 Y 6/2), sandy molluskan wackstone, hard, 15 – 20% medium to fine grained quartz sand, moldic and intergranular porosity, no channels, some vuggy porosity, 5 – 10% nodular phosphorite, 1 – 5% aragonite, medium hydraulic conductivity.
79.0 – 83.2	LIMESTONE, olive (5 Y 5/3), sandy molluskan packstone / wackstone, hard, 10% fine to very fine grained quartz sand, high moldic and intergranular porosities, good channel and vuggy porosities, 1 - 5% nodular and pore-lining phosphorite, high hydraulic conductivity.
83.2 – 88.0	LIMESTONE, pale yellow (5 Y 8/2), sandy molluskan wackstone, moderately hard, 15 -20% medium to fine grained quartz sand, trace of aragonite, 5 -10% nodular and pore-lining phosphorite, moldic and intergranular porosity, some vugs, no distinctive channels, medium moldic and inter-granular porosities, medium hydraulic conductivity.
88.0 – 90.0	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, 20% medium grained quartz sand, moderately hard to soft, no aragonite, 1 - 5% phosphorite, moldic and intergranular porosities, trace of corals, vuggy porosity, medium to high hydraulic conductivity.
90.0 – 96.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone, 10 – 20% fine to very fine grained quartz sand, moderately hard to soft, 1% nodular phosphorite, 1 - 5% aragonite, moldic, interganular and vuggy porosities, medium hydraulic conductivity.
96.0 –100.0	MARL, olive gray (5Y 5/2), mixed composition of 50 – 60% medium to fine grained quartz sand and silt, 10 -20% shells, no phosphorite and aragonite, some clay, low hydraulic conductivity.
100- 112.5	LIMESTONE and MARL, pale yellow (5Y 7/4), sandy molluskan wackstone / packstone, moderately hard to soft, 10 -15% fine to very fine grained quartz sand, 1% aragonite, no phosphorite, moldic, intergranular and vuggy porosity, medium to high hydraulic conductivity.
112.5-116.0	LIMESTONE, pale olive (5 Y 6/3), sandy molluskan wackstone, moderately hard to soft, 25% - 30% fine to very fine grained quartz sand and silt, 10 -15% phosphorite, no aragonite, calcitic shells, moldic and intergranular porosities, medium to low hydraulic conductivity.

TABLE A–4. Geological Log LS-6191
Troyer Brothers – TB-2

Depth (ft bls)	Lithology
116.0 -119.0	CLAY and MARL, pale olive (5Y 6/3), mixed composition of 60 – 70% fine to very fine grained quartz sand and silt, 15 – 20% shells, 5% phosphorite, no aragonite, low hydraulic conductivity.
119.0 – 120.5	MARL, pale olive (5 Y 6/4), composed of 40 - 50% fine to very fine grained quartz sand and silt, 15 - 25% shells, some dolosilt and clay, 1% aragonite, 1 – 2% phosphorite, low hydraulic conductivity.
120.5 – 124.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone / packstone, moderately hard, 10 - 15% medium to fine grained quartz sand, 5 - 10% pore-lining and nodular phosphorite, 1 – 5% aragonite, high moldic and interganular porosities, medium to high hydraulic conductivity.
124.0 – 126.5	LIMESTONE, yellowish brown (10 YR 5/4), mudstone, hard, dense, trace of quartz sand, little to no visible porosity, low hydraulic conductivity.
126.5 – 129.0	LIMESTONE, pale yellow (5 Y 8/3), sandy molluskan wackstone / packstone, 10 -15% fine to very fine grained quartz sand, 5 -10% phosphorite, no aragonite, high moldic and interganular porosity, high hydraulic conductivity.
129.0 – 132.0	LIMESTONE, pale olive (5 Y 6/3), sandy molluskan wackstone, soft, 20 – 25% medium to fine grained quartz sand, 5 -10% phosphorite, no aragonite, moldic and intergranular porosity, medium hydraulic conductivity.
132.0 – 139.0	LIMESTONE, pale yellow (5 Y 7/3), sandy molluskan wackstone, hard, 10 - 15% medium to fine grained quartz sand (more fine grains), 8 -15% phosphorite, 1% aragonite, higher moldic porosity compared with above sample, intergranular and vuggy porosities, medium to high hydraulic conductivity.
139.0 – 146.0	MARL, pale yellow (5 Y 7/4), composed of 50 -60% medium to fine grained quartz sand and silt, 10 -15% phosphorite, 1 - 2% carbonate grains, clay, no aragonite, low hydraulic conductivity.

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Location: NW ¼ SW ¼, Sec. 4, Township 46 South, Range 27E
Lee County Florida
Lat. 26° 29.977', Long. 81° 37.435'

Depth (ft bls)	Lithology
0 – 2.0	SAND, yellowish brown (10 YR 5/6), quartz, medium to fine grained, moderately sorted, subrounded, 5-10% phosphorite, some carbonate grains, medium hydraulic conductivity.
2.0 – 4.5	SAND and SILT, light gray (10 YR 7/2) and brownish yellow (10 YR 6/6), quartz, moderately sorted, subrounded, 60 – 70% light gray medium to fine grained quartz sand and silt, 20 – 25% brownish yellow, medium to fine grained quartz sand and silt (mostly medium grained), 10 – 15% blackish organic materials (decomposed plants), medium to low hydraulic conductivity.
4.5 – 6.0	SAND and SILT, light gray (10 YR 7/2), composition: 60 – 70% medium to fine grained quartz sand and silt, 15 – 20% shells, 5% blackish organic materials (from decomposed plants), 5 – 10% phosphorite, low hydraulic conductivity.
6.0 – 7.3	SAND, brownish yellow (10 YR 6/6), quartz, medium to fine grained, moderately sorted, subrounded, 5 – 8% phosphorite, very silty, 5% shells, medium to low hydraulic conductivity.
7.3 – 9.0	LIMESTONE, pale yellow (5 Y 7/3), sandy molluskan wackstone, hard, dense, 25 – 30% fine grained quartz sand, 1 – 5% nodular phosphorite, little intergranular porosity, some moldic and vuggy porosity, low hydraulic conductivity.
9.0 – 11.0	LIMESTONE, light gray (10 YR 7/2), sandy molluskan wackstone, hard, 10 -15% very fine grained quartz sand, 1% phosphorite, little intergranular porosity, lithified shells (contribute to over 40 – 50% of the rock), some moldic and vuggy porosities, low hydraulic conductivity.
11.0 – 13.0	SHELL and SAND, pale yellow (2.5 Y 8/2), 80% shells, 10–15% medium to fine grained quartz sand, 5 – 10% phosphorite, some gastropods, medium to high hydraulic conductivity.

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
13.0 – 15.0	SHELLY SAND and LIMESTONE, light gray (5 Y 7/2) and pale yellow (2.5Y 8/2), sandy molluskan wackstone (30%) and shelly sand (70%); wackstone --- hard, 5% very fine grained quartz sand, 1 – 5% nodular phosphorite, little intergranular porosity, some moldic and vuggy porosity; SHELL and SAND--- mixed composition of 70 – 75% shells, 1 – 5% phosphorite, 15 – 20% medium to fine grained quartz sand and silt, some gastropods, calcitic shells; overall, medium to low hydraulic conductivity.
15.0 – 18.5	SAND and LIMESTONE, light gray (5 Y 7/2), composed of 30 % fine to very fine grained quartz sand, 60% wackstone fragments, 10% shells, 1- 2% phosphorite, low hydraulic conductivity.
18.5 – 20.2	SHELL and SAND, pale yellow (2.5 Y 8/2), shell and sand, composition: 70 – 80% shells (sizes vary a lot), 10 – 15% medium to fine grained quartz sand, 5% phosphorite, some carbonate grains, high hydraulic conductivity.
20.2 – 23.0	LIMESTONE, light gray (5 Y 7/1), sandy skeletal wackstone / packstone, moderately hard, high moldic and inter-granular porosity, some vuggy porosity, no aragonite, medium to high hydraulic conductivity.
23.0 – 24.0	LIMESTONE, pale yellow (5 Y 8/3), sandy molluskan wackstone, hard, less moldic porosity than previous layer core, some intergranular and vuggy porosity (very low level), 5% nodular phosphorite, some trace of aragonite, low hydraulic conductivity.
24.0 – 25.0	LIMESTONE, pale yellow (2.5 Y 8/2), lithified coral reef and wackestone, moderately hard, 1 –5% nodular phosphorite, 5–8% aragonite, some quartz sand and carbonate sand, high hydraulic conductivity.
25.0 – 28.0	SAND (90%), light gray (5Y 7/2), very fine grained with 5 % shell fragments and LIMESTONE (5%), light gray (5 Y 7/2), sandy molluskan wackstone, hard, 5 –10% nodular phosphorite, 1% aragonite, moldic and intergranular and some vuggy porosity, some calcitic shells, medium hydraulic conductivity.
28.0 – 32.0	LIMESTONE, pale yellow (2.5 Y 7/3), sandy molluskan wackstone, hard to very hard, 1% phosphorite, trace of aragonite, vuggy, intergranular, and moldic porosities, high density of shell fragments in the rock (over 60 – 70%), medium hydraulic conductivity.
32.0 – 33.0	LIMESTONE, dark brown (10 YR 3/3), mudstone, hard, 1% phosphorite, little visible porosity, trace of fine grained quartz sand, low hydraulic

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
	conductivity.
33.0 – 35.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone / mudstone, hard, 1% phosphorite, no aragonite, some vuggy and moldic porosities, low intergranular porosity, low hydraulic conductivity.
35.0 – 36.0	LIMESTONE, pale yellow (2.5 Y 7/3), coral and sandy wackstone, moderately hard, no phosphorite, trace of aragonite, 50% corals, 40 – 50% sandy coral-rich wackstone, some coral pores infilled with sand, high hydraulic conductivity.
36.0 – 37.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackstone, moderately hard, 1% nodular phosphorite, no aragonite, some fine grained quartz sand (10 – 15%), very high channel porosity, medium high moldic and vuggy porosities, medium intergranular porosity, high hydraulic conductivity.
37.0 – 38.5	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackstone, moderately hard, 1 – 5% aragonite, 1% phosphorite, trace of fine grained quartz sand, high intergranular and moldic porosity, some vuggy pores, no channels, some calcitic shells, medium to high hydraulic conductivity.
38.5 – 41.0	LIMESTONE, light yellowish brown (10 YR 6/4), mudstone, hard and dense, no aragonite, no phosphorite, some medium size vugs and small channels trending from the top of the sampled core to little or no visible pores at the bottom end, medium to very low hydraulic conductivity.
41.0 – 41.8	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackstone, hard to very hard, 1% phosphorite, no aragonite, 5 – 8% fine to very fine grained quartz sand, some moldic, intergranular and vuggy porosities (relatively low), low hydraulic conductivity.
41.8 – 42.1	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, hard, dense, 1% phosphorite, no aragonite, shells composed of over 50 – 60% of the wackstone rock, some moldic, intergranular porosities, low hydraulic conductivity.
42.1 – 42.6	SHELL and SAND, light gray (10 YR 7/2), mixed composition of: 50 – 60% shells (mostly pale yellow in color), some gastropods, 1% phosphorite, 40 – 50% fine to very fine grained sand and silt.
42.6 – 50.0	LIMESTONE (70%) and MARL (30%), pale yellow (2.5 Y 8/2) mudstone and marl, moderately hard to soft, dense, 5% pore-lining phosphorite, trace

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
	of aragonite, 20 – 30% fine to very fine grained quartz sand and silt in the marl, some burrows infilled with medium grained quartz sand, a few vuggy pores, low hydraulic conductivity.
50.0 – 51.0	LIMESTONE (60%) and MARL (40%), light gray (2.5 Y 7/2), marl- mixed composition of 60 – 70% fine to very fine grained quartz sand and silt, 5 – 8% phosphorite, some bryozoan fragments, trace of aragonite; wackstone / mudstone - very hard, dense, 1 – 5% phosphorite, 1 – 5% aragonite, some vuggy pores, low hydraulic conductivity.
51.0 – 51.2	LIMESTONE (80%) and MARL (20%), light gray (5Y 7/1), marl (20%) composition : 40% fine grained quartz sand and silt, 10 -12% shell and 50% lime mud; wackestone fragments -80% (phosphorite rich), low hydraulic conductivity.
51.2 – 53.2	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackstone, moderately hard, 1% nodular and pore-lining phosphorite, 1% aragonite, 10 –15% fine to very fine grained quartz sand and silt, some calcitic shells, medium high vuggy porosity, medium intergranular porosity, some moldic and potentially small channels, medium to low hydraulic conductivity.
53.2 – 54.8	LIMESTONE, light gray (5 Y 7/1) and very dark greenish gray (5 G 3/1), moderately hard, trace of phosphorite and aragonite, 10 -12% fine to very fine grained quartz sand and silt, bioturbated, burrows infilled with light grayish sandy molluskan wackstone; some moldic, intergranular and vuggy porosities, some potential channels, medium to high horizontal hydraulic conductivity, medium vertical hydraulic conductivity.
54.8 – 55.0	LIMESTONE, very dark greenish gray (5 G 3/1), sandy molluskan wackstone, hard to very hard, 8 -12% nodular phosphorite,5 -10 % pore-lining phosphorite, 15 – 20% fine infilled with light grayish color sandy and shelly wackstone units, some moldic, intergranular, and vuggy porosities, overall, fairly low hydraulic conductivity.
55.0 – 56.0	Missing sample – likely limestone.
56.0 – 65.7	LIMESTONE, dark greenish gray (10 Y 4/1), sandy molluskan wackstone, hard, 5% phosphorite, no aragonite, trace of fine grained quartz sand, high density of large lithified shells (over 50%), some burrows infilled with bluish shells and sandy materials, moderately high moldic, intergranular, and vuggy porosities, medium to high hydraulic conductivity.
65.7 – 73.0	LIMESTONE, pale yellow (2.5 Y 8/2), sandy molluskan wackstone,

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
	medium hardness, 15 – 20% medium to fine grained quartz sand, 5 – 10% phosphorite, 1% aragonite, large oyster shells coated with sandy molluskan precipitates, high moldic, intergranular, and vuggy porosities, medium to high hydraulic conductivity.
73.0 – 76.0	LIMESTONE and MARL, light gray (2.5 Y 7/2), sandy molluskan wackstone and marl; sandy molluskan wackstone (85 – 90%) -10 –15% phosphorite, some aragonite, moderately hard, large intergranular porosity, some moldic and vuggy porosity; marl (10 - 15%) — 10 – 15% fine to very fine grained quartz sand and silt, 20 – 30% shells, some phosphorite; overall, medium to low hydraulic conductivity.
76.0 – 79.5	LIMESTONE, light gray (2.5 Y 7/1), sandy molluskan wackstone, 1 –5% phosphorite, trace of aragonite, some intergranular, moldic and vuggy porosities, 20 – 30% medium to fine grained quartz sand and silt (mostly fine grained), 1% phosphorite; overall, low hydraulic conductivity.
79.5 – 85.0	LIMESTONE, greenish gray (10 Y 5/1), sandy molluskan wackstone, 1% phosphorite, little moldic, intergranular and some vuggy porosities, hardness varies from soft to moderately hard.
85.0 – 86.0	Missing sample (most likely similar to the sample above)
86.0 – 92.3	LIMESTONE, pale yellow (5 Y 7/3), sandy molluskan wackstone, hard to moderately hard, 1 – 3% phosphorite, some large oyster shells lithified and coated with sandy and silty molluskan sediments, high intergranular porosity, some moldic and vuggy porosities, medium to low hydraulic conductivity.
92.3 – 96.0	Missing sample
96.0 – 98.5	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, moderately hard, 10 – 15% phosphorite (mostly pore-lining), no aragonite, large oyster shells composed over 30% of the wackstone, moldic, intergranular and vuggy porosities, medium to low hydraulic conductivity.
98.5 – 100.3	LIMESTONE and MARL, light olive gray (5 Y 6/2), sandy molluskan wackstone (90%), marl (10%); sandy molluskan wackstone -similar to the above layer wackstone, moderately hard to soft, 15% phosphorite, no aragonite, but more silty component than above layer sample, intergranular and some moldic porosity; Marl- 50 – 60% medium to fine grained quartz sand, 15 - 20% shells, some phosphorite; overall, low hydraulic conductivity.

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
100.3 – 104.5	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackstone, moderately hard, dense, some fine grained quartz sand, 1 – 5% nodular phosphorite, no aragonite, large oyster shells composed over 40% of the wackstone rock, lithified coral fragments, moldic and intergranular porosities, medium to low hydraulic conductivity.
104.5 – 105.5	LIMESTONE, light brownish gray (2.5 Y 6/2), mudstone, hard, dense, from top the bottom of the core, first is a transition layer from sandy wackstone to mudstone, little visible pores, 1% nodular phosphorite, some trace of aragonite, low hydraulic conductivity.
105.5 – 106.0	LIMESTONE, light yellowish brown (2.5 Y 6/3), sandy molluskan wackstone, moderately hard, no phosphorite, trace of aragonite, 10 – 15% fine to very fine grained quartz sand and silt, intergranular, moldic and vuggy porosities, medium to low hydraulic conductivity.
106.0 – 112.0	LIMESTONE, pale olive (5 Y 6/3), sandy molluskan wackstone / packstone, medium hardness, 10 - 15% phosphorite, 1 – 5% aragonite, very high intergranular porosity, high hydraulic conductivity.
112.0 – 116.0	Missing sample
116.0 – 119.5	LIMESTONE and MARL, light gray (5 Y 7/2), sandy molluskan wackstone (65 – 75%), marl (25 – 35%); sandy wackstone — soft to moderately hard, 10% phosphorite, no aragonite, low inter-granular and moldic porosity; marl- 30 – 40% medium to fine grained quartz sand and silt, some phosphorite; overall, low hydraulic conductivity.
119.5 – 128.5	MARL, pale yellow (5Y 7/4), lime mud with mixed composition of 70 – 80% fine to very fine grained quartz sand and silt, 10 – 15% phosphorite, 5– 8% small shell fragments, low hydraulic conductivity.
128.5 – 133.0	CLAY, dark olive gray (5Y 3/2), clay mixed composition of 60 – 70% fine to very fine grained quartz sand and silt, 10 -15% phosphorite, 10 -12% shells, very low hydraulic conductivity.
133.0 – 136.0	CLAY, dark olive gray (5 Y 3/2), clay with mixed composition of 70 -80% fine to very fine grained quartz sand and silt (mostly silt), 10% nodular phosphorite, 15 -20% shells, very low hydraulic conductivity.
136.0 – 140.0	CLAY, very dark gray (5 Y 3/1), clay, composition: 75 – 80% fine to very fine grained quartz sand and silt, 8 – 12% nodular phosphorite, 5 – 8%

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
	shells, very low hydraulic conductivity.
140.0 – 149.2	CLAY, dark olive gray (5 Y 3/2), clay, composition: some fine quartz silt, some dolosilt, 1% phosphorite, 1 – 2% calcitic shells, very low hydraulic conductivity.
149.2 – 149.5	SHELL and SILTY SAND, white (5 Y 8/1) and olive gray (5 Y 4/2), shells (50 – 60%) and sand (35 – 45%), 10 – 15% phosphorite, some aragonite, shells and mostly decomposed fragments, some calcitic shells, sand is mostly medium to fine grained quartz sand and silt, medium hydraulic conductivity.
149.5 – 161.0	CLAY, dark olive gray (5 Y 3/2), clay, composed of 30 – 40% medium to fine grained quartz sand and silt, mostly fine grained, 5 – 10% shells, 8 – 10% phosphorite, some aragonite, low hydraulic conductivity.
161.0 – 161.5	CLAY and SHELL, dark olive gray (5 Y 3/2), clay and shells, composition: 40 - 45% shells, 4 0 – 50% medium to fine grained quartz sand and silt, 15 – 20% phosphorite, some calcitic shells, low hydraulic conductivity.
161.5 – 164.0	CLAY, olive gray (5 Y 4/2), clay composed of 65 – 75% fine to very fine grained quartz sand and silt, 20 – 30% decomposed shells in the form of fine to very light grayish color sediments, 15 – 20% phosphorite, low hydraulic conductivity.
164.0 – 166.0	SANDSTONE (75%) and SAND (25%), light greenish gray (5 GY 7/1), sandy molluskan wackstone, hard, 10 -15% nodular phosphorite, 1 - 5% aragonite, 70 – 75% medium to fine grained quartz sand, some shells lithified and coated with sandy molluskan sediments, intergranular and moldic porosities, little vuggy pores, and no channel, medium to low hydraulic conductivity.
166.0 -167.0	SANDSTONE, light gray (5 Y 7/1), very sandy molluskan wackstone / packstone, hard, 1 – 5% phosphorite, 1 -5% aragonite, 65 – 75% medium to fine grained quartz sand, lithified shells composed over 50% of the rock, medium intergranular and moldic porosities, medium hydraulic conductivity.
167.0 – 172.5	SANDSTONE and SAND, light gray (5 Y 7/1), very sandy molluskan wackstone, soft to moderately hard, 5 – 8% phosphorite, trace of aragonite, 70 – 75% medium to fine grained quartz sand (mostly medium grained), much less lithified shells that above layer core, some intergranular porosity, very few moldic pores, low hydraulic conductivity.

TABLE A–5 Geological Log LS-6192
Troyer Brothers – TB-5

Depth (ft bls)	Lithology
172.5 – 176.0	SANDSTONE (65%) and SAND (35%), light greenish gray (10 Y 8/1), very sandy molluskan wackstone, hard, 15 – 20% phosphorite, 70 – 75% medium to fine grained quartz sand (mostly fine grained), some moldic and intergranular porosities, medium to low hydraulic conductivity.

TABLE A–6 Geological Log LS-6194
Troyer Brothers – TB-4

Location: SW ¼ SE ¼, Sec. 4, Township 46 South, Range 27E
Lee County Florida
Lat. 26° 29.917', Long. 81° 36.969'

Depth (ft bls)	Lithology
0 – 2.5	SAND, dark yellowish brown (10 YR 4/4), quartz, medium sorting, medium to fine grained, subrounded, 2 – 4% phosphorite, some organic materials (plant roots, etc.) but less than 10%, medium hydraulic conductivity.
2.5 – 3.6	SAND, dark grayish brown (10 YR 4/2), quartz, medium to fine grained, medium sorting, subrounded, 1 - 3% phosphorite, some carbonate grains, medium hydraulic conductivity.
3.6 – 4.7	SAND, bluish black (5 PB 2.5/1), quartz, medium to fine grained, medium sorting, subrounded, 1% phosphorite, a few carbonate grains, medium hydraulic conductivity.
4.7 – 5.6	SAND, very dark gray (10 YR 3/1), quartz, medium to fine grained, medium sorting, subrounded, some phosphorite and carbonate grains, medium hydraulic conductivity.
5.6 – 10.5	SAND, dark reddish gray (2.5 YR 3/1), quartz, medium to fine grained, moderately sorted, subrounded, 1 – 5% phosphorite, 10 – 15% blackish organic material (mostly decomposed plants), medium hydraulic conductivity.
10.5 – 11.5	SAND, reddish brown (5YR 5/4), quartz, medium to fine grained, medium sorting, subrounded, 1 – 2% phosphorite, medium hydraulic conductivity.
11.5 – 13.5	SAND and SILT, grayish brown (10 YR 5/2), quartz, medium to very fine grained, medium sorting, mostly subrounded, some are rounded, 1% phosphorite, 5% brownish organic materials (mostly from decomposed plants), medium to low hydraulic conductivity.
13.5 – 16.0	SAND, yellowish brown (10 YR 5/4), quartz, medium to fine grained, medium sorting, subrounded, 1% phosphorite, 1% blackish organic materials (decomposed plant leaves), medium hydraulic conductivity.
16.0 – 17.6	SAND, very pale brown (10 YR 7/3), quartz, medium to fine grained quartz sand, moderately sorted, subrounded, 2 – 4% phosphorite, 5 – 8% small

TABLE A–6. Geological Log LS-6194
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
	shell fragments, 5 – 8% decomposed plants, medium hydraulic conductivity.
17.6 – 18.6	SAND and SHELL, pale yellow (2.5 Y 8/2), 70 – 75% shells, 20 –25% medium to fine grained quartz sand and silt, 1% phosphorite, some gastropods and ostracods, medium to high hydraulic conductivity.
18.6 – 20.0	LIMESTONE, pale yellow (2.5 Y 8/2), sandy wackestone, hard, 1% phosphorite, no aragonite, some fine grained quartz sand, low intergranular and moldic porosities, low vuggy porosity, low hydraulic conductivity.
20.0 – 21.2	LIMESTONE, pale yellow (2.5 Y 8/2), sandy molluscan wackestone, hard, 1% phosphorite, no aragonite, moldic, intergranular and vuggy porosities, much more shells than previous layer core, medium hydraulic conductivity.
21.2 – 22.0	SHELL with minor SAND, light gray (2.5 Y 7/2), mixed composition of 80 – 90% of shells, 10 – 20% fine to very fine grained quartz sand and silt, 2 – 4% phosphorite, some calcitic shells, medium hydraulic conductivity.
22.0 – 24.5	LIMESTONE, pale yellow (2.5 Y 7/3), sandy molluscan wackestone, moderately hard, 1% phosphorite, trace of aragonite (mostly < 2%), some fine grained quartz sand, high moldic and intergranular porosity, lithified shells (made up to over 60 – 70% of the wackestone rock), high hydraulic conductivity.
24.5 – 26.0	LIMESTONE, dark grayish brown (2.5 Y 4/2), sandy molluscan wackestone, moderately hard, less than 2% phosphorite, some aragonite, some light greenish gray (10 Y 8/1) color sandy molluscan wackestone materials filled the burrows of the dark grayish brown color wackestone, some vuggy porosity, as well as moldic porosity, little intergranular porosity, medium to low hydraulic conductivity.
26.0 – 28.0	LIMESTONE, pale yellow (2.5 Y 8/3), very sandy molluscan wackestone, soft to medium hardness, trace of phosphorite and aragonite, shells and decomposed shell fragments contributed to 70 – 75% of the rock, gastropods and some calcitic shells were found, medium high moldic and intergranular porosities, medium to high hydraulic conductivity.
28.0 – 29.0	LIMESTONE, pale yellow (2.5 Y 8/2), very sandy/shelly wackstone, soft to moderately hard, 1 – 2% nodular phosphorite, trace of aragonite, 70 – 80%

TABLE A–6. Geological Log LS-6194
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
	shells and decomposed fragments (much smaller than above layer sample, large pieces are rare), some calcitic shells, some intergranular, moldic, and vuggy porosities, medium hydraulic conductivity.
29.0 – 32.2	SAND and SHELL, light gray (2.5 Y 7/2), mixed composition of 70 – 80% shells, 20 – 25% medium to fine grained quartz sand, 1 – 5% phosphorite, 1 – 5% brownish organic material (probably from decomposed plants), some calcitic shells, medium hydraulic conductivity.
32.2 – 33.0	LIMESTONE, light gray (2.5 Y 7/2) sandy molluskan wackstone (90%); 10% sand medium to fine grained quartz sand and silt; sandy molluskan wackestone, moderately hard, trace of phosphorite, some lithified shells coated with sandy and shelly sediments, some moldic and intergranular porosity, medium to low hydraulic conductivity.
33.0 – 34.2	SAND and SHELL, light gray (2.5 Y 7/2), mixed composition of 45-50 % shells, 45 -50% medium to fine grained quartz sand and silt, 5 – 8% phosphorite, medium to high hydraulic conductivity.
34.2 – 36.0	Missing sample (likely sand and shell).
36.0 – 37.2	SAND, light brownish gray (2.5 Y 6/2), 75-85% fine to very fine grained quartz sand and silt, 10 – 15% fine fragments of shells, 5 –10% phosphorite, medium to low hydraulic conductivity.
37.2 – 38.0	SHELL and SAND, light gray (2.5 Y 7/2), 75 – 80% shells and 15 – 20% medium to fine grained quartz sand, trace of phosphorite, some calcitic shells, high hydraulic conductivity.
38.0 – 38.6	SHELL and SAND, light gray (2.5 Y 7/2), 60 -70% shells (larger than previous layer's), 15 – 20% fine to very fine grained quartz sand and silt, 5 – 10% sandy molluskan wackstone fragments, 1 – 5% corals (infilled with sandy materials), 1 – 5% phosphorite, medium to low hydraulic conductivity.
38.6 – 39.0	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackestone, hard, relatively dense, no phosphorite, moldic porosity, likely bioturbated, burrows infilled with sandy molluskan wackstone and some blackish sandy wackstone, little intergranular pores, medium to low hydraulic conductivity.
39.0 – 39.1	LIMESTONE, light gray (2.5 Y 7/1), sandy molluskan wackestone, soft to moderately hard, relatively dense, some phosphorite, some moldic porosity; overall, low hydraulic conductivity.

TABLE A-6. Geological Log LS-6194
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
39.1 – 43.2	LIMESTONE, light yellowish brown (2.5 Y 6/4), mudstone, hard, dense, some trace of quartz sand, little or no visible pores, very low hydraulic conductivity. Trace amount of marl.
43.2 – 48.0	LIMESTONE, light gray (5 Y 7/2), sandy molluskan wackestone and lithified corals, moderately hard, no phosphorite, vuggy, moldic and some intergranular porosities, some fine to very fine grained quartz sand and silt, lithified corals, infilled with sandy sediments, medium to high hydraulic conductivity.
48.0 – 49.5	LIMESTONE, light brownish gray (2.5 Y 6/2), shelly packstone is soft, 80% shells, 10 – 15% fine grained quartz sand and silt, high intergranular, moldic and vuggy porosities, high hydraulic conductivity.
49.5 – 51.0	LIMESTONE and MARL, pale yellow (2.5 Y 7/3), 85 – 90% mudstone, 10 – 15% marl; mudstone- hard, no phosphorite, some small moldic and intergranular porosity, some vuggy and channel pores as well, medium to low hydraulic conductivity.
51.0 – 53.3	LIMESTONE and MARL, light gray (5 Y 7/2), sandy molluskan wackstone (60 – 70%) and marl (30 – 40%); wackstone - hard, 1 – 5% phosphorite, trace of aragonite, 70 – 75% lithified shells made up the rock, some moldic porosity; marl - 50 – 60% shells, 30 – 35% medium to fine grained quartz sand and silt, 5 -10% balckish wackstone fragments, low hydraulic conductivity.
53.3 – 54.0	MARL, light brownish gray (2.5 Y 6/2), lime mud with mixed composition of 30 - 40% coral fragments, 30 – 35% shells, 20 – 30% medium to fine grained quartz sand and silt, trace of phosphorite, some calcitic shells, medium hydraulic conductivity.
54.0 – 55.2	MARL, pale yellow (2.5 Y 8/2), lime mud with mixed composition of mud and some fine grained quartz sand and silt, 10 – 15% shells, 5 – 8% phosphorite, 5 -10% fragments of wackestone, low hydraulic conductivity.
55.2 – 56.0	Missing sample (most likely marl)
56.0 – 61.0	MARL and LIMESTONE, gray (5 Y 5/1), 80% marl and 20% sandy molluskan wackstone; wackstone: moderately hard; marl- medium to fine grained quartz sand and silt, 5 – 8% phosphorite, some lithified shells, intergranular, moldic and vuggy porosity, medium hydraulic conductivity.

TABLE A–6. Geological Log LS-6194
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
61.0 – 66.0	MARL, olive gray (5Y 4/2), lime mud with mixed composition of 30 – 40% medium to fine grained quartz sand and silt, 30 -40% shelly wackestone fragments, some phosphorite, 25 –35% shells, low hydraulic conductivity.
66.0 – 74.7	MARL, olive gray (5 Y 5/2): composition: 60 – 70% shells, 30 –35% medium to fine grained quartz sand and silt, 5 – 8% phosphorite, low hydraulic conductivity.
74.7 – 77.0	LIMESTONE and MARL, light olive gray (5Y 6/2) and light gray (5Y 7/2), sandy molluskan wackestone (70 – 80%) and marl (20 -30%); wackestone - hard, 3 – 5% phosphorite, very high moldic porosity, some intergranular porosity; Marl — 50 - 60% medium to fine grained sand and silt, 15 – 20% shells, some phosphorite, medium hydraulic conductivity.
77.0 – 82.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan wackestone, moderately hard, dense, some fine to very fine grained quartz sand and silt, 10 – 15% phosphorite, intergranular moldic and vuggy porosity, medium to low hydraulic conductivity.
82.0 – 96.0	Missing sample (likely marl and/or limestone).
96.0 – 101.0	MARL and LIMESTONE, light gray (5 Y 7/2), wackestone (50%) hard and marl (50%) with mixed composition of 50 -60% medium to fine grained quartz sand and silt (mostly medium grained), 10-15% shells, 5 -10% phosphorite, low hydraulic conductivity.
101.0 – 109.0	LIMESTONE (90%), light gray (5 Y 7/2), wackestone, hard, low hydraulic conductivity; Marl (10%)- composed of 40 – 50% fine to very fine grained quartz sand and silt, 30 – 40% oyster shells' fragments, some phosphorite, low hydraulic conductivity.
109.0 – 110.5	LIMESTONE, light gray (5 Y 7/2), sandy wackestone, 30 - 40% medium to fine grained quartz sand and silt, 10 – 15% phosphorite, 15 – 25% shells, low hydraulic conductivity.
110.5 – 116.0	MARL, light gray (5 Y 7/2), composed of lime mud with 70 – 75% fine grained quartz sand and silt, 8 -10% phosphorite, 10 - 20% shells, low hydraulic conductivity.
116.0 – 124.0	LIMESTONE, light olive gray (5 Y 6/2), sandy molluskan packstone, moderately hard, 15 – 20% phosphorite, very grainy, high moldic intergranular, and possibly channel porosities, high hydraulic conductivity.

TABLE A–6. Geological Log LS-6194
Troyer Brothers– TB-4

Depth (ft bls)	Lithology
124.0 – 125.0	LIMESTONE, light gray (5 Y 7/1), sandy molluskan packstone / wackestone, moderately hard, 10 -15% phosphorite, aragonite (2 – 5%), high intergranular, moldic and vuggy porosities, medium to high hydraulic conductivity.
125.0 – 130.0	LIMESTONE, light gray (5 Y 7/1), sandy molluskan wackestone, moderately hard, 15 – 18% phosphorite, some fine grained quartz sand, high moldic, intergranular, and vuggy porosities, medium to high hydraulic conductivity.
130.0 – 131.5	LIMESTONE (60%) as above MARL (40%), light olive gray (5Y 6/2), lime mud with 70 – 75% medium to fine grained sand and silt (mostly fine grained), 10 -12% shells, 10 -15% phosphorite, low hydraulic conductivity.
131.5 – 136.0	MARL, olive gray (5 Y 5/2), clay and lime mud with 50 – 60% fine to very fine grained quartz sand and silt, 20 -25% phosphorite, 5 -10% fine shell fragments, low to very low hydraulic conductivity.

TABLE A–7 Geological Log LS-6229
Troyer Brothers – MW7D

Location: SW¼, SE ¼, Sec. 4, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 29.756', Long. 81° 36.972'

Depth (ft bls)	Lithology
0 – 4	SAND very pale brown (10YR 8/2), fine quartz sand, moderate to poorly sorted, sub-rounded, 1-2% phosphorite nodules, less than 1% iron staining, medium intergranular porosity, medium hydraulic conductivity.
4 – 5.5	SAND, brown (10YR 5/3), fine quartz sand, moderately sorted, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity.
5.5 – 10.3	SAND, pale brown (10YR 6/3), fine quartz sand, moderate poorly sorted, sub-angular, 1% phosphorite nodules, trace iron staining, medium intergranular porosity, medium hydraulic conductivity.
10.3 – 14.1	SAND, light brownish gray (10YR 6/2), fine to very fine quartz sand, moderately well sorted, sub-angular, 1-2% clay, 1% phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity.
14.1 – 15.9	SAND, white (2.5Y 8/1), fine to very fine quartz sand, sub-rounded, moderate to poorly sorted, 1-3% phosphorite nodules, 1% shell fragments, most aragonite remaining, medium intergranular porosity, medium hydraulic conductivity.
15.9 – 16.3	SAND, mottled pale yellow (5Y 8/2) and dark grayish brown (10YR 3/6), fine to very fine quartz sand, 3-5% iron staining, 3% shell fragments, trace phosphorite nodules, moderately well sorted, sub-angular, medium intergranular porosity, medium hydraulic conductivity.
16.3 – 17.4	MARL, pale yellow (2.5 Y 8/2), 65-70% fine quartz sand, sub-rounded, moderately well sorted, 25-30% shells and shell fragments (Turitella), 2-5% lime mud, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity.
17.4 – 18.2	LIMESTONE, sandy wackestone, hard, pale yellow (2.5Y 8/3), 10-15% fine quartz sand, lime mud matrix, ~15% whole shell and fragments, most aragonite remaining, gastropod and bivalve molds, low moldic porosity, low hydraulic conductivity.

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
18.2 – 20.0	LIMESTONE, sandy fossil wackestone, medium hard, gray (5Y 6/1), 30-35% fine quartz sand, ~20% lime mud, large bivalve fossils, ~45% whole shell and fragments, ~20% aragonite remaining, medium moldic porosity, medium hydraulic conductivity.
20.0 – 21.5	SAND, pale yellow (2.5Y 8/2), fine to very fine quartz sand, whole shell and fragments (Chione), lime mud, 2-3% phosphorite nodules, intergranular porosity, medium hydraulic conductivity.
21.5 – 23.5	MARL, pale yellow (2.5Y 8/2), ~30% fine quartz sand, lime mud, shell fragments, ~50% aragonite remaining, some lithified pieces, medium intergranular porosity, moderate/low hydraulic conductivity.
23.5 – 26.0	MARL, light gray (5Y 7/1), ~50% quartz sand, ~30% whole shell and fragments, ~20% lime mud, much calcite replacement, ~20% aragonite remaining, medium intergranular porosity, medium to low hydraulic conductivity.
26.0 – 29.0	MARL, light gray (5Y 7/2), ~50% fine quartz sand, ~30% whole shell and fragments (Turitella), ~20% lime mud, most aragonite remaining, intergranular porosity, medium hydraulic conductivity.
29.0 – 30.0	MARL, same as above with small slightly lithified pieces.
30.0 – 33.0	MARL, light gray (2.5Y 7/1), ~20% fine quartz sand, ~10% lime mud, ~70% shells, most aragonite remaining, mostly whole bivalve shells, medium intergranular porosity, medium hydraulic conductivity.
33.0 – 34.5	MARL, light gray (2.5Y 7/2) with limestone (wackestone lithics), hard, ~50% sand, ~15% lime mud, 30-35% shells, most aragonite remaining, mostly bivalves, trace phosphorite nodules, very low channel porosity, medium hydraulic conductivity.
34.5 – 36.4	LIMESTONE, skeletal sandy wackestone, medium hard, pale yellow (2.5Y 7/3), ~30% sand, ~20% lime mud, ~50% shell, mostly bivalves, some gastropods, most aragonite remaining, some calcite replacement, low moldic and intergranular porosity, low hydraulic conductivity.
36.4 – 37.0	LIMESTONE, skeletal wackestone, hard, light yellowish brown (2.5Y 6/3), ~20% quartz sand, ~30% shell fragments, most aragonite remaining, 20-

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
	30% calcite replacement, 2-5% phosphorite nodules, lime mud, calcite filled mold/burrows, low moldic porosity, low hydraulic conductivity.
37.0-37.3	LIMESTONE, sandy molluscan wackestone, very hard, dark gray (2.5Y 4/1) and pale yellow (2.5Y 8/3), ~10% fine quartz sand, less than 10% shells, 20-30% aragonite remaining, irregular calcite replacement throughout, low moldic and channel porosity, low hydraulic conductivity.
37.3 – 37.8	LIMESTONE, sandy molluscan wackestone, very hard, dark gray (2.5Y 3/1) and pale yellow (2.5Y 8/2), ~5% fine quartz sand in lime mud matrix, ~10% whole shell and fragments in calcite matrix, bivalves (Chione) and few gastropods, ~20% aragonite remaining, some calcite and spar replacement, low moldic porosity, low vuggy porosity with calcite spar lining, low hydraulic conductivity.
37.8 – 39.5	LIMESTONE, clayey wackestone, soft, white (2.5Y 8/1), mostly lime mud with ~50% hard lithic fragments of sandy wackestone, [wackestone, hard, gray (2.5Y 6/1) and pale yellow (2.5Y 8/2), calcite replaced shell molds, 5-7% filled cavities with laminated rim, very low moldic porosity], low intergranular porosity, low/very low hydraulic conductivity.
39.5-43.2	LIMESTONE, wackestone, hard, light gray (2.5Y 7/1) and pale yellow (2.5Y 8/2), replaced shell casts, less than 1% aragonite remaining, mostly bivalves and coral, some spar lining, medium moldic and intergranular porosity, medium hydraulic conductivity.
43.2 – 43.5	LIMESTONE, skeletal wackestone, dark gray (2.5Y 4/1), very hard, ~15% whole shell and fragments with less than 20% aragonite remaining, mostly bivalves and gastropods, some spar lining, low moldic porosity, low hydraulic conductivity.
43.5 – 46.0	SAMPLE MISSING.
46.0 – 47.0	LIMESTONE, mudstone, gray (2.5Y 6/1), very hard, 5-10% shell molds and casts, almost no aragonite remaining, mostly bivalves, medium moldic and intragranular porosity, medium hydraulic conductivity.
47.0 – 49.2	LIMESTONE, wackestone, light gray (2.5Y 7/2), hard, 2-3% fine quartz sand, ~10% very small molds, most molds lined with calcite spar, mostly gastropods and bivalves, medium moldic and channel porosity, medium hydraulic conductivity.

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
49.2 – 51.3	LIMESTONE, mudstone/wackestone, light gray (2.5Y 7/1), hard, 3-5% very fine quartz sand, ~5% whole shells and fragments, mostly bivalves (Chione) and gastropods (Turitella), ~30% aragonite remaining, medium moldic and intergranular porosity, medium/low hydraulic conductivity.
51.3 – 53.1	LIMESTONE, mudstone, soft with hard limestone lithics: mudstone, pale yellow (2.5Y 8/2), lime mud, 2-3% fine quartz sand, 2-3% shell fragments, ~20% aragonite remaining; limestone, fossil wackestone, light brownish gray (2.5Y 6/2), hard, ~20% whole shell, calcite replacement, ~20% aragonite remaining, low moldic porosity, very low hydraulic conductivity.
53.1 – 56.2	LIMESTONE, fossil wackestone, gray (5Y 6/1), ~10 fine sand in lime mud matrix, ~10% whole and fragmented shells, molds and casts, ~5% aragonite remaining, some calcite spar, medium moldic and vuggy porosity, medium hydraulic conductivity.
56.2 – 58.7	LIMESTONE, molluscan wackestone, gray (10YR 5/1), hard, ~25% whole shell and fragments, ~30% aragonite remaining, medium moldic, channel and intragranular porosity, medium hydraulic conductivity.
58.7 – 59.8	LIMESTONE, skeletal wackestone/packstone, gray (2.5Y 6/1), hard 30-40% shell fragments, some whole shells, bivalves (Chione) and gastropods (Turitella), ~20% aragonite remaining, much calcite replacement, some calcite spar lining, medium moldic and vuggy porosity, medium hydraulic conductivity.
59.8 – 61.7	LIMESTONE, wackestone, very hard, gray (2.5Y 6/1), large and small shell molds, no aragonite remaining, mostly bivalves, low moldic porosity, low hydraulic conductivity.
61.7 – 65.6	LIMESTONE, skeletal wackestone, hard, light yellowish brown (2.5Y 6/3), fragment and whole shell molds, 2-3% aragonite remaining, larger molds lined with calcite spar, medium moldic porosity, medium hydraulic conductivity.
65.6 – 66.8	LIMESTONE, wackestone, medium hard, light gray (5Y 7/2), small shell molds and casts, no aragonite remaining, some calcite replacement, most molds replaced with lime mud and lined with calcite spar, trace phosphorite nodules, medium moldic porosity medium to low hydraulic conductivity.

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
66.8 – 69.5	LIMESTONE, same as above.
69.5 – 75.3	LIMESTONE, mudstone, soft, light gray (5Y 7/2), small molds and casts, no aragonite remaining, casts replaced with lime mud, 1-2% phosphorite nodules, medium intergranular and low moldic porosity; low hydraulic conductivity.
75.3 – 77.0	LIMESTONE, same as above.
77.0 – 85.5	LIMESTONE, same as above.
85.5 – 86.2	LIMESTONE, mudstone, light gray (5Y 7/2), 5-10% fine quartz sand in lime mud, 1-2% phosphorite nodules, medium intergranular porosity, low hydraulic conductivity.
86.2 – 96.4	SAMPLE MISSING.
96.4 – 97.7	LIMESTONE, skeletal mudstone, medium soft, light gray (5Y 7/2), lime mud, no aragonite remaining, trace calcite replacement, 2-3% phosphorite nodules, high moldic porosity, medium hydraulic conductivity.
97.7 – 100.4	LIMESTONE, same as above with large whole replaced shells,
100.4 – 102.3	LIMESTONE, skeletal wackestone , medium soft, pale yellow (5Y 7/2), lime mud, shells completely replaced with lime mud, ~30% oyster shells, medium moldic porosity, medium to low hydraulic conductivity.
102.3 – 105.3	LIMESTONE, molluscan mudstone, medium soft, pale olive (5Y 6/3), lime mud, shell molds replaced with lime mud, no aragonite remaining, few oysters, trace phosphorite nodules and needles, medium moldic porosity, medium hydraulic conductivity.
105.3 – 109.3	LIMESTONE; mudstone, medium hard with hard oyster shells, light olive gray (5Y 6/2), lime mud, ~1% phosphorite nodules, small shell molds, ~10% large oyster shells, low moldic porosity, low hydraulic conductivity.
109.3 – 114.2	LIMESTONE, skeletal wackestone, hard, light gray (5Y 7/2), lime mud, 2-3% phosphorite needles and nodules, small shell molds, bivalves and gastropods, no aragonite remaining, ~5% oyster shells, ~1% limestone lithics, some peloids replaced with lime mud, medium mold porosity, medium hydraulic conductivity
114.2 – 116.0	SAMPLE MISSING.

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
116.0 – 123.7	LIMESTONE, skeletal wackestone, hard, light gray (5Y 7/2), large and small shell and peloid molds and casts, most casts replaced with lime mud, no aragonite remaining, 2-3%, calcite replacement, 1-2% phosphorite nodules, trace spar lining, medium/high moldic porosity, medium hydraulic conductivity.
123.7 – 126	SAMPLE MISSING.
126 – 127.9	LIMESTONE, mudstone, soft, light olive gray (5Y 6/2), slightly indurated lime mud, ~2% shells, no aragonite remaining, few shell molds (mostly gastropods) replaced with lime mud, very low moldic porosity and low intergranular porosity, low hydraulic conductivity.
127.9 – 136	LIMESTONE, same as above.
136 – 139	MARL, dark gray (5Y 4/1), 15-20% very fine quartz sand, 5-7% phosphorite nodules, ~10% shell fragments, ~60% lime mud, medium intergranular porosity, medium to low hydraulic conductivity.
139-148	MARL, olive (5Y4/3), ~30% very fine quartz sand, ~10% phosphorite nodules, trace forams, trace shell fragments, ~60% lime mud, medium intergranular porosity, medium to low hydraulic conductivity.
148 – 150	MARL, dark olive, gray (5Y 3/2), ~30% very fine quartz sand, 10-15% phosphorite nodules, some nodules platy and some pebble sized, 5-10% shell fragments with ~20% aragonite remaining, trace clear fibrous material (looks like salt precipitate), ~45% lime mud, medium intergranular porosity, medium hydraulic conductivity.
150 – 156	LIMESTONE, mudstone, olive gray (5Y 4/2), soft, lenses of sand and shell fragments, ~5% fine quartz sand, 3-5% shell fragments, 2-3% phosphorite nodules, medium intergranular porosity, low hydraulic conductivity.
156 – 157	LIMESTONE, fossil wackestone, dark olive gray (5Y 3/2), soft, ~35% lime mud, 50-60% fossil shell fragments, 2-3% aragonite remaining, 3-5% phosphorite nodules, medium intergranular porosity, med hydraulic conductivity.
157 – 169	LIMESTONE, mudstone, soft, olive gray (5Y 4/2), ~5% very fine quartz sand, trace phosphorite nodules, ~10% centric diatoms, ~85% lime mud, medium intergranular porosity, low hydraulic conductivity

TABLE A – 7. Geological Log LS-6229
Troyer Brothers – MW-7D

Depth (ft bls)	Lithology
169 – 170.5	LIMESTONE with MARL: limestone, mudstone, medium hard, olive (5Y 5/3), ~1% phosphorite nodules, ~1% calcite filled pores, low intergranular porosity; marl, black (5Y 2.5/2), ~30% fine quartz sand, 15-20% phosphorite nodules, ~30% shell fragments, 2-5% aragonite remaining, medium/low intergranular porosity, medium to low hydraulic conductivity.
170.5 – 178	LIMESTONE, skeletal wackestone, hard, white (5Y 8/1), shell molds and casts, mostly bivalves and gastropods, 2-3% oyster shells, trace calcite spar, large and small whole and fragments shells, shell replaced with lime mud, no aragonite remaining, medium moldic porosity medium hydraulic conductivity.
178 – 181.5	LIMESTONE, sandy wackestone, medium hard, ~5% fine quartz sand, ~10% carbonate sand, 1-2% phosphorite nodules, some shell molds and casts replaced with limestone, trace aragonite remaining, medium to low moldic porosity, medium/low hydraulic conductivity.
181.5 – 187	LIMESTONE, skeletal wackestone, pale yellow (5Y 8/2), hard, shell molds and casts, mostly bivalves and gastropods, casts replaced with limestone, calcite and quartz sand in lime mud matrix, 2-3% quartz sand, ~20% calcite with 5% spar lining, no aragonite remaining, high moldic porosity, high hydraulic conductivity.
187 – 192	SAND, light gray (5Y 7/2), ~40% fine quartz sand, poorly sorted, sub-rounded, 5-10% phosphorite nodules, 5-10% carbonate sand, ~40% lime mud, trace calcite replaced shell fragments, medium intergranular porosity, medium/low hydraulic conductivity.
192 – 199	SAND, same as above with ~5% shell fragments.
199 – 200	SAND, light olive gray (5Y 6/2), 60-70% fine quartz sand, moderately well sorted, sub-rounded, ~1% phosphorite nodules, ~2% shell fragments, ~30% lime mud, medium intergranular porosity, medium to low hydraulic conductivity.

TABLE A–8. Geological Log LS-6230
Troyer Brothers – MW7S

Location: SW ¼, SE ¼, Sec. 4, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 29.771', Long. 81° 36.874'

Depth (ft bls)	Lithology
0 – 0.8	SAND, light olive brown (2.5Y 5/3), fine/very fine quartz sand, moderately poorly sorted, sub-rounded, slightly indurated, ~10% silt, ~50% iron staining, few rootlets, trace shell fragments, medium intergranular porosity, some organics, medium hydraulic conductivity
0.8 – 2.4	SAND, grayish brown (2.5Y 5/2), very fine quartz sand, moderate sorted, sub-rounded, ~5% silt, 2-3% iron staining, trace rootlets, trace phosphorite nodules, ~2% organic, medium hydraulic conductivity
2.4 – 4.5	SAND, pale yellow (2.5Y 8/2), very fine quartz sand, moderate well sorted, s-rounded, 2-3% iron staining, less than 1% phosphorite nodules, trace rootlets, medium hydraulic conductivity
4.5 – 5.5	SAND, grayish brown (2.5Y 5/2), fine/very fine quartz sand, ~5% lime mud, 2-3% shell fragments, bivalves, ~20% aragonite remaining, ~1% phosphorite nodules, trace organics, ~1% iron staining, medium/low hydraulic conductivity
5.5 – 7.1	SAND, brown (10YR 5/3), very fine quartz sand, moderately well sorted, sub-rounded, trace phosphorite nodules, trace shell fragments, 2-3% clay, medium intergranular, medium hydraulic conductivity
7.1 – 9.4	SAND, light grayish brown (10YR 6/2), very fine quartz sand, moderately well sorted, sub-rounded, 2-3% large shell fragments, 2-3% clay, slightly indurated, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity
9.4 – 11.1	MARL, white (10YR 8/1), fine/very fine quartz sand, moderately sorted, sub-rounded, ~50% whole shell and fragments, ~50% aragonite remaining, 1-2% phosphorite nodules, medium hydraulic conductivity
11.1 – 13.3	MARL, grayish brown (10YR 5/2), ~30% very fine quartz sand, 5-10% lime mud, trace iron staining and phosphorite nodules, ~60% whole shell and fragments, ~50% aragonite remaining, bivalves, medium intergranular porosity, medium hydraulic conductivity

TABLE A–8. Geological Log LS-6230
Troyer Brothers – MW7S

Depth (ft bls)	Lithology
13.3 – 17.6	MARL, pale yellow (2.5 8/2), a heterogeneous mixture of quartz and carbonate sand in lime mud with 20-30% whole shell and fragments, ~50% aragonite remaining, medium intergranular porosity, medium hydraulic conductivity
17.6 – 18.0	MARL, gray (2.5 6/1), heterogeneous mix of quartz and carbonate sand in lime mud with 20-30% whole shell and fragments, mostly bivalves and gastropods, some calcite replacement, medium intergranular porosity, medium hydraulic conductivity

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Location: SW¼, NE ¼, Sec. 16, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 28.550', Long. 81° 37.102'

Depth (ft bls)	Lithology
0 -2	SAND, dark olive gray (5Y 3/2), fine to very fine quartz sand, moderately well sorted, sub-rounded, trace rootlets, iron staining and phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity.
2 – 3.2	SAND, brown (10YR 5/3), very fine quartz sand, moderately well sorted, sub-rounded, trace iron staining, phosphorite nodules and organics, medium intergranular porosity, medium hydraulic conductivity.
3.2 – 6.3	SAND, dark yellowish brown (10YR 4/4) with very dark brown (10YR 2/2) organic lenses (wood?), sub-rounded, moderately well sorted, 35-50% organic material, ~5% clay, trace phosphorite nodules and iron staining, medium intergranular porosity, medium hydraulic conductivity.
6.3 – 8.7	SAND, white (2.5Y 8/1), very fine quartz sand, sub-rounded, moderately well sorted, clean, ~2% phosphorite nodules, ~1% rootlets, trace iron staining, medium intergranular porosity, medium hydraulic conductivity.
8.7 – 9.3	SAND, pale yellow (5Y 8/2), very fine quartz sand, sub-rounded, moderately well sorted, 1-2% phosphorite nodules, trace rootlets, medium intergranular porosity, medium hydraulic conductivity.
9.3 – 13.8	SAND, light gray (5Y 7/1), very fine quartz sand, moderately well sorted, sub-rounded, ~1% phosphorite nodules, trace iron staining, 1-2% clay, medium intergranular porosity, medium hydraulic conductivity.
13.8 – 14.0	SAND, mottled light gray (5Y 7/1), and dark olive brown (5Y 3/3), very fine quartz sand, sub-rounded, moderately well sorted, trace phosphorite nodules, 1-2% organics, medium intergranular porosity, medium hydraulic conductivity.
14.0 – 18	SAMPLE MISSING.
18.0 – 18.5	MARL, light gray (2.5Y 6/3), very fine quartz sand, moderately well sorted, sub-rounded, ~5% lime mud, 5-7% shell fragments, ~30% aragonite remaining, ~1% phosphorite nodules, medium intergranular porosity, medium/low hydraulic conductivity.

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Depth (ft bls)	Lithology
18.5 – 20.2	MARL, pale yellow (2.5Y 8/2), ~45% fine quartz sand, moderately well sorted, sub-rounded, ~30% carbonate sand, 10-15% lime mud, ~10% shell fragments, ~20% aragonite remaining, trace phosphorite nodules, medium intergranular porosity, medium-low hydraulic conductivity.
20.2 – 21.9	LIMESTONE, skeletal wackestone, light yellowish brown (2.5Y 6/3), hard, ~30% gastropod and bivalve molds and casts, 5-10% aragonite remaining, medium-low moldic and vuggy porosity, low hydraulic conductivity.
21.9 – 22.6	LIMESTONE, molluscan wackestone, pale yellow (2.5Y 8/2), very small bivalve molds and casts, ~2% aragonite remaining, ~2% carbonate sand, calcite spar lining in few molds, irregular calcite replacement of matrix material, medium-low mold and vuggy porosity, medium hydraulic conductivity.
22.6 – 22.9	LIMESTONE, skeletal wackestone, grayish brown (2.5Y 4/2), ~40% shell molds and casts, bivalves and gastropods, 5-10% aragonite remaining, ~2% fine sand, medium moldic porosity, medium hydraulic conductivity.
22.9 – 25.5	LIMESTONE, wackestone, pale yellow (5Y 8/2), small bivalves molds, trace forams, no aragonite remaining, 2-3% sand, trace calcite spar, low moldic porosity, low hydraulic conductivity.
26.7 – 27.4	LIMESTONE, skeletal wackestone, medium hard, white (5Y 8/1) with very hard ~2%, light gray (5Y 7/1) limestone lenses, containing ~1% spar replacement, 5-10% sand, 30-40% shell molds and casts, most replaced with calcite, ~10% aragonite remaining, medium moldic and vuggy porosity, medium hydraulic conductivity.
27.4 – 29.1	LIMESTONE, molluscan wackestone, hard, light gray (5Y 7/1), 2-3% sand, ~30% shell molds and casts, 3-5% aragonite remaining, Chione, low moldic porosity, low hydraulic conductivity.
29.1 – 31.3	LIMESTONE, skeletal wackestone, very pale brown (10Y 7/4), very hard, 3-5% calcite replaced carbonate sand, appears to have a slight fabric, ~20% shell, ~30% aragonite remaining, mostly gastropods and some bivalves, 30-40% of molds and cavities lined with spar, medium moldic and vuggy porosity, medium-low hydraulic conductivity.
31.3 – 32.4	LIMESTONE, sandy skeletal wackestone, light gray (5Y 7/2), 40-50% carbonate sand, ~20% whole shell and fragments, bivalves and gastropods,

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Depth (ft bls)	Lithology
	~20% aragonite remaining, some calcite spar replacement of molds and matrix material, very low moldic porosity, very low hydraulic conductivity.
32.4 – 33	SAND, pale yellow (5Y 8/2), poorly sorted, sub-angular, slightly indurated, 60-70% carbonate sand, 20-25% whole shell and fragments, mostly bivalves with some gastropods, 10-15% lime mud, 1-2% phosphorite nodules, medium intergranular porosity, medium-low hydraulic conductivity.
33 – 38	SAMPLE MISSING.
38 – 39.2	SAND, pale yellow (5Y 8/2), 60-70% carbonate sand, poorly sorted, sub-angular, ~30% shell fragments, trace phosphorite nodules, 1-2% quartz sand, ~5% lime mud, medium intergranular porosity, medium hydraulic conductivity.
39.2 – 42.9	LIMESTONE, molluscan wackestone/packstone, hard, light olive brown (5Y 6/2), ~40% carbonate sand, ~40% whole shell and fragments, mostly bivalves, ~20% aragonite remaining, ~10% lime mud, ~10% calcite replacement of matrix material, some large corals, medium moldic and high/medium intragranular porosity, medium/high hydraulic conductivity.
42.9 – 45.8	LIMESTONE, sandy skeletal wackestone, pale yellow (5Y 8/3), 40-50% carbonate sand, 20-30% shell fragments, mostly bivalves and gastropods, 5-10% aragonite remaining, ~20% lime mud, trace calcite spar grain replacement, low moldic porosity, low hydraulic conductivity.
45.8 – 48.7	LIMESTONE, molluscan wackestone, hard, light gray (2.5Y 7/1), 30-40% carbonate sand, 20-30% whole shell and fragments, ~20% aragonite remaining, some molds lined with spar, ~2% calcite grain replacement, rare gastropods, low moldic porosity, low hydraulic conductivity.
48.7 – 49.4	LIMESTONE, wackestone, light gray (5Y 7/1), very hard, 2-3% carbonate sand with intraclasts of previous limestone, 5-10% whole shell and fragments, mostly bivalves, ~5% aragonite remaining, trace spar lining of molds, low moldic porosity, low hydraulic conductivity.
49.4 – 56	SAMPLE MISSING.

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Depth (ft bls)	Lithology
56 – 59.9	LIMESTONE, mudstone, pale yellow (5Y 8/2), hard, 5-10% shell molds and casts, no aragonite remaining, trace spar lining and phosphorite needles, low moldic porosity, low hydraulic conductivity.
59.9 – 64.3	LIMESTONE, sandy mudstone, pale yellow (5Y 8/2), ~10% sand, ~5% shell molds and casts, no aragonite remaining, sparse oyster shells, medium-low moldic porosity, low hydraulic conductivity.
64.3 – 64.5	SAND, gray (5Y 5/1), a heterogeneous mixture of carbonate sand, shell fragments, silt and clay, ~20% shell, ~20% aragonite remaining, medium intergranular porosity, low hydraulic conductivity.
64.5 – 65.0	LIMESTONE, skeletal wackestone , gray (5Y 6/1), ~5% sand, ~30% shell molds and casts, 2-3% aragonite remaining, bivalves (Chione) and gastropods (Turitella), trace phosphorite nodules, medium-high moldic porosity, medium-high hydraulic conductivity
65.0 – 67	SAMPLE MISSING.
67 -68.8	LIMESTONE, sandy wackestone, soft, light gray (5Y 7/1), 10-15% carbonate sand, 20-25% quartz sand, ~3% shell fragments, ~10% aragonite remaining, trace phosphorite nodules, lime mud matrix, medium intergranular porosity, medium-low hydraulic conductivity.
68.8 – 72.7	LIMESTONE, sandy molluscan wackestone, soft, gray (5Y 5/1), ~50% heterogeneous mix of quartz and carbonate sand, ~20% shell fragments, ~20% aragonite remaining, Chione, trace phosphorite nodules, medium intergranular porosity, low vuggy porosity, medium hydraulic conductivity.
72.7 – 75.1	LIMESTONE, skeletal wackestone, hard, light gray (5Y 7/2), ~10% sand, ~15% shell molds and casts, trace aragonite remaining, ~50% bivalves, ~50% disc shaped calcite replaced fossils (echinoderms?), sparse lenses of abundant sand, medium-low moldic porosity, low hydraulic conductivity.
75.1 – 76	LIMESTONE, sandy wackestone, medium hard, gray (5Y 5/1), heterogeneous mix of quartz and carbonate sand in a lime mud matrix, ~1% phosphorite nodules, ~1% shell fragments, ~5% aragonite remaining, medium intergranular porosity, medium-low hydraulic conductivity.

TABLE A–9. Geological Log LS-6231
Troyer Brothers – MW6D

Depth (ft bls)	Lithology
76 – 76.4	LIMESTONE, molluscan wackestone, soft, light gray (5Y 7/2), heterogeneous mix of carbonate sand and shells (bivalves) in a lime mud matrix, ~40% shell, ~5% aragonite remaining, medium intergranular porosity, low hydraulic conductivity.
76.4 – 78	LIMESTONE, hard, gray (5Y 6/1), trace sand, 5-10% shell molds and casts, no aragonite remaining, low moldic porosity, low hydraulic conductivity.
78-87	LIMESTONE, molluscan wackestone, hard, gray (5Y 6/1) and dark gray (2.5 Y 4/1), ~3% sand, 5-7% shell fragments, ~5% aragonite remaining, calcite replacement of shell and matrix material, trace spar lining of molds, medium-low moldic porosity, low hydraulic conductivity.
87 – 89	SAND, pale yellow (2.5 8/1), fine carbonate sand, poorly sorted, sub-angular-sub-rounded, ~2% coarse shell fragments, ~10% aragonite remaining, silt and lime mud, intergranular porosity, medium-low hydraulic conductivity.
89 – 90.8	LIMESTONE, molluscan wackestone, medium hard, light olive gray (5Y 6/2), 60-70% carbonate sand in lime mud matrix, ~20% shell molds and casts, ~5% aragonite remaining, no aragonite remaining, medium moldic and intergranular porosity, medium hydraulic conductivity.
90.8 – 108	LIMESTONE, skeletal wackestone, medium hard, light gray (5Y 7/2), ~1% sand, ~20% small shell molds and casts, bivalves and gastropods, no aragonite remaining, medium moldic porosity, medium-low hydraulic conductivity.
108 – 110	LIMESTONE, skeletal wackestone, hard, light gray (5Y 7/2), ~1% sand, 50-60% large shell molds and casts, bivalves and gastropods, no aragonite remaining, some calcite replacement, high moldic porosity, high hydraulic conductivity.

TABLE A–10. Geological Log LS-6232
Troyer Brothers – MW6S

Location: SW ¼, NE ¼, Sec. 16, Township 46 South, Range 27 East
Lee County Florida
Lat. 26° 28.554, Long. 81° 37.098'

Depth (ft bls)	Lithology
0 – 0.8	SAND, very dark grayish brown (2.5Y 3/2), very fine quartz sand, moderately well sorted, sub-rounded, rootlets, 3-5%phs nodules, ~2% iron staining, medium intergranular porosity, medium hydraulic conductivity
0.8 – 2.4	SAND, light brownish gray (10YR 6/2), very fine quartz sand, moderately sorted, sub-rounded, ~1% organics (wood?), ~2% phosphorite nodules, trace iron staining, medium intergranular porosity, medium hydraulic conductivity
2.4 – 4	SAND, dark brown (10YE 3/3), very fine quartz sand, moderately well sorted, sub-rounded, ~1% organics, ~50% iron staining, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity
4 – 5	SAND, dark grayish brown (10YR4/2), fine/very fine quartz sand, moderately well sorted, sub-rounded, ~1% phosphorite nodules, trace iron staining, medium intergranular porosity, medium hydraulic conductivity
5 – 6	SAND, black (10YR 2/1), fine quartz sand, moderately poorly sorted, sub-rounded, ~3% phosphorite nodules, ~5% clay, ~5% organics, medium intergranular porosity, medium hydraulic conductivity
6 – 7	SAND, very dark grayish brown (10YR 3/2), very fine quartz sand, moderately sorted, sub-rounded, rootlets, 10-15% silt and clay, 2-3% iron staining, trace phosphorite nodules, medium intergranular porosity, medium hydraulic conductivity
7 – 8.8	SAND, very pale brown (10YR 7/3), fine/very fine quartz sand, well sorted, sub-rounded, ~1% phosphorite nodules, some pieces slightly indurated, medium intergranular porosity, medium hydraulic conductivity
8.8 – 11.8	SAND, while (5Y 8/1), fine quartz sand, moderately well sorted, sub-rounded, 1-2% phosphorite nodules, clean, medium intergranular porosity, medium hydraulic conductivity

TABLE A–10. Geological Log LS-6232
Troyer Brothers – MW6S

Depth (ft bls)	Lithology
11.8 – 14.6	SAND, light gray (2.5Y 7/2), very fine quartz sand, moderately well sorted, sub-rounded, 1%phs nodules, trace iron staining, clean, moderately indurated, medium intergranular porosity, medium hydraulic conductivity
14.6 – 15	SAND, light gray (5Y 7/2), fine quartz sand, ~1% phosphorite nodules, trace, iron staining, well sorted, sub-rounded, slightly indurated, medium intergranular porosity, medium hydraulic conductivity

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December 16, 2009

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Re: Lee County Amendment 09-1 CPA 2008-00006-DR/GR

Gentlemen:

On November 18, 2009, Lee County ("County") transmitted its 09-1 proposed Comprehensive Plan Amendment package ("Amendment"), also identified as CPA 2008-00006 DR/GR Study Implementation, to the Department of Community Affairs ("DCA") for review. The Amendment proposes significant changes to the Lee Plan including to the Future Land Use Element, Future Land Use Map Series; Community Facilities and Service Element, Conservation and Coastal Management Elements.

Our clients, the Troyer Brothers Florida, Inc. ("Troyer"), participated in proceedings before Lee County and interposed objections to the Amendment at that time. Troyer's existing uses and those proposed in pending applications will be adversely affected if the Amendment is adopted as proposed.

The Amendment proposes addition of Map 24, the Historic Surface and Groundwater Levels overlay to the Future Land Use Map series, amendment of Policy 1.4.5 and a new Policy 1.7.14. Together the proposed map and policies require every applicant for a rezoning or development order within the Density Reduction Groundwater Recharge Area ("DR/GR") to affirmatively:

> ...demonstrate compatibility with *maintaining* surface and groundwater levels at their historic levels (except as provided in Policies 30.1.3 and 30.3.3) utilizing hydrologic modeling, the incorporation of increased

ATTACHMENT
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> storage capacity, and inclusion of green infrastructure.[1] The modeling must also *show* that no adverse impacts will result to upstream, downstream, and adjacent property. Offsite mitigation can be utilized, and may be required, to demonstrate this compatibility. Historic wet-season water depths and hydroperiods are depicted on Map 24, based on detailed analyses of 1953 aerial photography. Additional evidence as to historic levels may be submitted during the rezoning or development review processes. (emphasis added)

These requirements to "maintain" a historic water level and to "show" no adverse impacts to upstream, downstream and adjacent property (even though it is apparent that 1953 water levels have been substantially altered in 50 years) are directly in conflict with each other. Those applicants that cannot make both demonstrations simultaneously (i.e., all applicants) will be required to provide undefined off-site mitigation to offset unspecified adverse impacts. This provision is vague and lacking in articulated standards and so cannot be rationally and consistently applied.

Failure to Consult with State Agencies with Water Resources Expertise

The County failed to consult or coordinate with either the South Florida Water Management District ("SFWMD") or Florida Department of Environmental Protection ("FDEP") with regard to its decision to seek restoration of conditions that have not existed for over 50 years and which may be inconsistent with current water policies and goals. In fact, numerous portions of the Amendment address local water resources and wetlands, yet the County did not consult with the agencies charged with implementing the State Water Resource Policy and with the water use and environmental resource permitting programs under Chapter 373, F.S., - the SFWMD and FDEP. *See Florida States § 373.0361, 373.036, F.S.* It does not appear that any of the many volumes of water resources and wetlands data available in the public records of SFWMD or FDEP were consulted in preparing the Amendments or the reports that purport to underlie the amendments. Therefore, it is clear that the Amendments are not supported by relevant and appropriate data as required by Rule 9J-5.005(2)(a) and Sections 163.3177(6) and (8), F.S.

As further detailed below, it is clear that these portions of the Amendment also have the potential to conflict with the permitting requirements of the FDEP and the SFWMD.

Adverse Effects to On-Site and Off-Site Wetlands and Properties

[1] Note the exceptions provided in Policies 30.1.3 and 30.3.3 relate to mining within the proposed Future Limerock Mining Overlay and the development of mixed-use communities. While Troyer has applications pending for limerock mining, its parcel is located outside the proposed Overlay. Therefore neither exception is facially applicable to Troyer's existing agricultural use. Further, as drafted, it is unclear whether the provisions of the referenced exceptions could be applied to effect a less stringent standard than that being proposed for non-mining/non-mixed use community lands.

The Amendment is not supported by relevant and appropriate data and analysis, fails to react in an appropriate way to available data as required by Rule 9J-5.005(2)(a), F.A.C., and Sections 163.3177 (6) and (8), F.S. and fails to establish meaningful and predictable standards for the use and development of land in violation of Rule 9J-5.005(6), F.A.C. because:

- 1953 aerials are used as the baseline for "historic" water levels that developments of all types, including mining, are required to meet within the DR/GR in Southeast Lee County. (See Map 24 attached hereto.) The only justification we can see for the use of the 1953 aerials as a baseline is they may have been the best quality photographs that could be located. There is otherwise no justification provided for attempting to reestablish 1953 conditions. This is not reliable, valid data to support the Amendment.

- Restoration to 1953 conditions will likely cause flooding or backwater effects on off-site properties, contrary to ERP requirements, as well as State Water Policy. (*See e.g.*, §373.414(1)(a)1, 3, F.S.; Fla. Rule Admin. Code 40E-4.301(a)-(c)). While additional evidence of "historic" conditions may be provided, the reference continues to mandate restoration to a single point in time (i.e. 1953) hydrologic conditions, and the Amendment arbitrarily defines "historic" as 1953 conditions.

- The hydrologic study used by the County was based only on office review of 1953 aerial photography with no ground truthing. Therefore, use of those aerials as data and analysis cannot be considered scientifically accurate and would be unacceptable as a part of the permitting process by the SFWMD, FDEP or County itself.

- Establishment of water surface elevations known as the wet season water table or control elevation is governed by the SFWMD or FDEP based on rules of the state. Currently the control elevation is based on current conditions, not "historic" conditions dating back to 1953. Attempting to reverse decades of effects caused by multiple causes both on and off a parcel is simply unsustainable and unjustifiable.

- The County failed to provide data and analysis regarding whether the proposed "maintenance of historic water levels" will provide any real merit or benefit to what may already be a well functioning system. This data and analysis is essential to determine whether the Amendment is appropriate as proposed.

- One result of the proposed Amendment is that water flows could be reduced to downstream areas which have designed and permitted wetland

flowway communities that would be impacted as a result of the reduced drainage.

- From an engineering standpoint, it appears to be virtually impossible to restore these elevations without impacts to adjacent properties, since the restoration requires that water be added to the system along with the removal of the causes of the water level changes since 1953.

- The portion of the Amendment which creates the mining overlay - the area of the County approved for mining through 2030 – is based on an underlying assumption that there will be "wall to wall" mining meaning that the excavation pit footprint will encompass essentially all of the mine property, including flood plains, wetlands and areas, which would be subject to setbacks pursuant to FDEP and SFWMD rules. As such, the Amendment ignores existing data and analysis from publicly available sources with regard to the location of environmental resources and directly conflicts with rules of the State.

Additional discussion of these matters is presented in Attachment 8 of the County Transmittal Package to DCA, the SFWMD and FDEP specifically, in correspondence and exhibits submitted on behalf of Cemex Construction Materials Florida, LLC.

Inconsistent with ERP/Water Use Regulatory Framework

- The Amendment attempts to impose regulatory hurdles on activities within wetlands and surface waters and/or pertaining to consumptive use of water that conflict with the policies and regulations adopted by the DEP and SFWMD, notwithstanding Lee's long-standing policy to extend deference to the substantial expertise of DEP and SFWMD with respect to such issues. Specifically:

  - Policy 114.1.1 is amended to add a requirement that mitigation for wetland impacts resulting from mining in the Overlay must be offset by mitigation within Southeast Lee County. This geographic constraint is in conflict with state statutes and regulatory policies recognizing the importance of watershed-wide, regionally significant mitigation and conflicts with state law allowing for mitigation banks and other regionally significant off-site mitigation. See § 373.3135, F.S.

  - Policy 114.1.2 is amended to remove a restriction on the ability of the County to independently review impacts to wetlands if those impacts are specifically authorized by a DEP or SFWMD dredge and fill permit or exemption. The County will now for the first time independently review impacts from development in wetlands. The

County has not adopted policies to establish appropriate standards and criteria for this review. Therefore, the Amendment fails to establish meaningful and predictable standards for the use and development of land and fails to provide meaningful guidelines for the content of more detailed land development and use regulations in violation of Rule 9J-5.005(6).

- The Amendment conflicts with state statutes governing permitting of impacts within wetlands and surface waters by declaring that limerock mining has effects on the surrounding area that cannot be offset by mitigation. See Policy 30.1.1; cf § 373.414(1)(b), F.S.

CONCLUSION

We hope the information provided in this letter assists you in discharging SFWMD's responsibility to prepare an agency comment letter to DCA consistent with the requirements of Section 163.3184(4), F.S. We respectfully request that SFWMD object to the Amendment for the reasons outlined above.

Please feel free to contact us with any questions or concerns.

Sincerely,

Susan L. Stephens
Vinette D. Godelia

cc: Carol Wehle
Rick Cantrell

MORRIS DEPEW
ENGINEERS • PLANNERS • SURVEYORS
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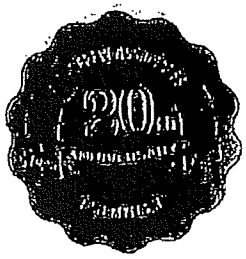

To: Ms. Vinette Godelia, Esq.
From: Jodi Joseph, AICP
Date: December 14, 2009
RE: TROYER BROTHERS EXCAVATION
Lee County Comprehensive Plan Amendment CPA2008-06

Table 1(b) Year 2030 Allocations of the Lee County Comprehensive Plan (Lee Plan) sets forth commercial and residential land use allocations for the county at large, and for each of the county's individual planning communities. The population projection for unincorporated Lee County in 2030 is 495,000[i]. For the Southeast Lee County Planning Community (a.k.a. Planning Community #18), the table allocates a total population of 1,270 persons within its 81,249 acres for the year 2030.

Proposed CPA2008-06 proposes the creation of a Transfer of Development Rights (TDR) program within the SE Lee County Planning Community. The study entitled *Transferable Development Rights in Southeast Lee County* included in the transmittal document as Attachment 5 "analyzes the feasibility of a transferable development rights program and provides detailed designs for potential Rural Villages and Mixed-Use Communities[ii]." The plan would create mixed use villages and rural villages consisting of commercial, civic and residential uses at various nodes throughout the SE Lee County Planning Community to which development rights are transferred.

While the transmittal document allows for as many as 9,000 TDRs to be created within the SE Lee County Planning Community, it is not clear exactly to which planning community the TDRs would be transferred. With only 114 households or a total population of only 265 persons remaining within the SE Lee County Planning Community[iii], the creation of any one mixed use or rural village in this planning community without a commensurate increase in population allocation for the planning community on Table 1(b) of the Lee Plan results in an internal inconsistency in the Lee Plan.

At the transmittal hearings, the Board of County Commissioners (BOCC) discussed the notion of increasing the "multiplier" of any TDR that is transferred out of the SE Lee County Planning Community, e.g., in instances where a TDR was transferred from SE Lee County to a Mixed Use Overlay area in Lee County. The BoCC discussed adding a footnote to Table 1(a) of the Lee Plan (Summary of Residential Densities) but did not discuss how such a TDR program could be accomplished within the constraints of the population densities allocated within Table 1(b). Table 1(b) is specifically addressed in the transmittal document for CPA2008-06, but only for

the accounting of mining acreage to be created by the Future Limerock Mining overlay map. The population increase that would be necessitated to make the creation of rural or mixed use villages viable is not addressed in the transmittal document.

What also has not been programmed into the amendments is the expansion of infrastructure necessary to serve the rural villages that are shown on the Rural Overlay. Clearly the densities and intensities of use are at a level at which central utilities will be required. Policy 53.1.5 states, "No county development order under the Land Development Code for a residential development more intense than 2.5 dwelling units per gross acre, for a commercial development of more than 30,000 square feet of gross floor area, or for any industrial plant of more than 30,000 square feet of gross floor area, will be issued in any franchised or certificated water service area, or within Lee County Utilities' future service area, unless potable water service, at the minimum acceptable level of service, is available at the property line, or surety is given that it will be installed prior to occupancy. This policy will in no way exempt any development of any size from meeting the levels of service required for concurrency under Policies 53.1.2 and 95.1.3." Likewise Policy 56.1.5 indicates, "County development regulations will be amended to specify that no county development order under the Development Standards Ordinance for a residential development more intense than 2.5 dwelling units per gross acre, or for any commercial or industrial development that generates more than 5,000 gallons of sewage per day, will be issued in any franchised or certificated sanitary sewer service area, without a connection to such service if capacity is available at the minimum acceptable level of service anywhere within 1/4 mile of the development. This policy will in no way exempt any development of any size from meeting the levels of service required for concurrency under Policies 56.1.2 and 95.1.3." Policy 53.2.1 indicates that, "County development regulations will be amended to specify that no building permit under the Land Development Code will be issued in a franchised or certificated water service area, or within Lee County Utilities' future service area, unless potable water supply will be available to meet current and projected growth demands, or surety is given that it will be available prior to occupancy. This policy does not exempt development of any size from meeting the levels of service required for concurrency under Policies 53.1.2 and 95.1.3." This is further reinforced by Policy 43.2.1 stating, "Through county development regulations, require that developments with a Suburban Area density or higher provide the following as needed, all of which will meet the Americans with Disability Act requirements:

- Bus accommodations such as dedicated transfer/loading areas, adequate lane widths and turn-arounds;
- Bus shelters with route information displays;
- Bicycle storage areas near major bus stops; and
- Walkways for access to bus stops."

Additionally, Policy 67.3.4 states, "The County will forward all applications for rezonings and comprehensive plan amendments that increase density on the Future Land Use Map to the School District for review. The County will inform the School District of the affect of proposed amendments upon school capacity." There is no indication that either the CIE or the Schools

element has been updated to provide for the establishment of the Rural Villages, creating the possibility for internal inconsistencies resulting from adoption of the amendments.

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[i] Table 1(b) of the Lee Plan Year 2030 Allocations provides a total population distribution of 495,000. Chapter I of the Lee Plan (Vision Statement) notes that the projected population in 2030 is 979,000. The difference must lie within the exclusion of the population of incorporated municipalities (Cape Coral, Fort Myers, Fort Myers Beach, Bonita Springs and Sanibel).

[ii] Potential densities are illustrated on Pages 3.10-11 of the report, but each strategy results in population allocations that exceed the 2030 build-out population allocation of 1,270 for SE Lee County Planning Community. Details such as potential allowable residential density and non-residential intensities are not identified in the report.

[iii] During recent quasi-judicial proceedings, Planning Staff stated that the SE Lee County Planning Community has grown to 435 households. According to census data, the average household size in Lee County is 2.31 persons. Applying this average household size to the 435 existing households in this planning community, the current population is 1,005 persons in the SE Lee County Planning Community. If the current comprehensive plan is to accommodate 1,270 persons, then, only 265 more persons (or 114 households) may be constructed in the SE Lee County planning community.

MEMORANDUM
FROM THE
OFFICE OF COUNTY ATTORNEY

DATE: July 7, 2009

TO: Board of County Commissioners

FROM: David M. Owen
County Attorney

RE: **Potential Legal Issues Relating to the Proposed Revisions to the Comprehensive Plan Based on the Dover Kohl Study, CPA 2008-06**

My office has reviewed the proposed Comprehensive Plan Amendments for Southeast Lee County pertaining to planning for the Density Reduction/Groundwater Resource Area prepared by Dover Kohl & Partners. We have identified and are outlining several legal issues that may arise from the currently proposed changes to the Plan:

1. Vision Statement for Southeast Lee County.

The Vision Statement for Southeast Lee County references a restoration of existing farm lands. It is unclear in the text as to who will be responsible for restoring existing farmlands. If it will be the County, what is the funding source for the restoration effort? By what vehicle will this be accomplished? Lee Plan Policy 158.6.1 requires that the County assess the financial impact of new regulations on the local economy before adopting new regulations that will potentially impose new costs to taxpayers. What is the estimated cost/economic impact to the farm lands property owners for implementing restoration as envisioned by the proposed text?

Agricultural activities are typically not subject to local permitting. If existing farming operations will be required to alter a property's configuration such that less area is available for existing agricultural pursuits, the requirement may likely expose the County to potential liability under the Bert J. Harris Private Property Protection Act (Bert J. Harris Act) or to claims of taking by inverse condemnation.

2. Future Land Use Policy 1.2.2., Tradeport.

The proposed text stating that limerock mining may be approved through planned developments within the Tradeport Future Land Use category may be problematic. It creates an inconsistency within the Lee Plan. Mining is not similar to the character of development anticipated within the Tradeport category. The Lee Plan authorizes uses characterized as employment centers consisting primarily of commerce, light industrial, research, and lodging in this category. The conversion of Tradeport classified properties to mining use is not consistent with the objective of the Tradeport Future Land Use category, which is to expand the County's

ATTACHMENT

RE: **Potential Legal Issues Relating to the Proposed Revisions to the Comprehensive Plan Based on the Dover Kohl Study, CPA 2008-06**

employment base and provide support to the Airport. Development within the Tradeport classification is encouraged to include a mixture of land uses that are described in Policy 1.2.2.

The County added more than 1,400 acres to the Tradeport category south of the Airport in 1994 to ensure adequate land would be available to promote the expansion of the County's employment base. *(See Lee Plan Policy 2.4.4.)* The loss of those nearly 1,400 acres of Tradeport classified lands to mining activities is not proposed for recoupment elsewhere. Lee Plan Policy 158.3.5 requires the County to ensure that adequate land is allocated in the Lee Plan to meet future commercial, industrial, agricultural, and residential needs of its residents. In order to be consistent with the Economic Element of the Lee Plan, the proposed plan amendment will need to address the potential loss of approximately 1,400 acres of land to mining activities that are currently classified for Tradeport uses.

3. Policy 1.4.5. and Policy 1.7.14.

The proposed revisions to these policies state that land use in the DR/GR must be compatible with maintaining surface and ground water at historic levels, now identified as the depths and hydroperiods based on the Kevin Erwin analysis of 1953 conditions. To the extent 1953 conditions no longer exist, the use of the word "*maintaining*" in the first sentence of the policy creates an impression that existing surface and groundwater levels may not be degraded. However, the reference to the 1953 conditions later in the policy implies an affirmative obligation to "restore" existing conditions rather than simply maintain them.

The obligation to restore is confirmed by the proposed additions to the text of Policy 1.7.14., which states in the Erwin Report and detailed analysis of 1953 aerials that they *will be the basis for determining compliance with Policy 1.4.5.* It is clear that the expectation is that new development must restore surface and groundwater depth and hydroperiods to 1953 conditions..

If restoration to 1953 conditions is the intended result, then there is a legal issue with regard to how the restoration of water depths and hydroperiods will affect upstream and downstream property owners. Other property owners may likely be impacted if existing development approvals or farming operations were designed based on existing conditions.

If the restoration of historical flows impacts upstream and downstream property owners, this impact may likely subject the County to liability under a possible claim of inverse condemnation. Recent case law from of the Florida First District Court of Appeals advises that alteration of existing water flow patterns creates liability on the local government, *even if the changes in water patterns are to restore historic conditions*, if the alterations of the existing conditions result in negative impacts to other property owners. *(See also Policy 30.1.3., which reiterates the requirement to restore depths and hydroperiods to 1953 levels.)*

RE: Potential Legal Issues Relating to the Proposed Revisions to the Comprehensive Plan Based on the Dover Kohl Study, CPA 2008-06

It is also unclear who will perform the restoration on agricultural properties currently in operation on the date of the proposed Plan amendment. Is the restoration requirement applicable only to new Agricultural operations, or is it intended to apply to existing operations as well? If the restoration of flows, etc., impact areas that could otherwise be placed into active agricultural use, will this adversely impact the "right-to-farm" as protected by Florida Statutes? Typically, agricultural operations are not subject to the local development permitting process. There is a question as to how the restoration requirement to be implemented. It is not clear who will be responsible for performing the restoration referenced in connection with agricultural properties.

4. Policy 1.4.5.2.c. - Density Reduction Groundwater Resource Policy

Proposed language in subsection c, may expose the County to liability under the Bert J. Harris Act. Existing mines are not subject to the extinguishment of residential density for lake areas mined. The application of the proposed language to existing mining operations will result in a loss of development expectations that exist today. Further, the exclusion of mining lakes from the area considered for the purposes of calculated residential density differs from the standard that is applicable elsewhere in the County, where man-made lakes are typically considered in the calculation of residential density. The proposed text in Policy 30.3. reiterates that mining activity extinguishes the property owner's right to utilize lake area for the calculation of density on the property. This loss of post mine development potential may likely expose the County to liability under the Bert J. Harris Act on existing operations and may possibly subject the County to liability on future proposed operations as well.

The following text within Proposed Policy 1.4.5.2.c should be deleted from consideration:

> *c. Residential uses, other than a single bonafide caretaker's residence or a resident manager's unit, are not permitted in conjunction with private recreational uses or mining activities. Residential density associated with land zoned Private Recreational Facility will be extinguished and cannot be transferred, clustered, or otherwise assigned to any property in accordance with Policy 16.2.3. Residential density of mined land will be extinguished unless it is transferred to an eligible property in accordance with Policy 30.3.3.*

The text regarding Private Recreational Facilities is unnecessary. The last sentence does not recognize post mining density approval existing at this time as discussed above. It also does not account for the market factors and future Commission vision(s) that may prevail in the future, when post mining development approvals will be actually sought.

RE: Potential Legal Issues Relating to the Proposed Revisions to the Comprehensive Plan Based on the Dover Kohl Study, CPA 2008-06

5. Policy 1.4.5.d. (Policy *1.7.12 and Map 14).*

Subsection d. of Policy 1.4.5. states that sufficient land exists near a traditional Alico Road corridor to meet the regional demand for limerock to 2030. However, Map 14 includes approximately 1,400 acres in the Tradeport category (mentioned previously in Paragraph 2., above), as well as significant acreage in the DR/GR proximate to the University Community that is owned by persons who have expressed no intention to pursue mining. Certain areas south of Alico Road, if mined as recommended by proposed Map 14, will impact existing communities and the University. This potential impact is contrary to Goal 10 of the Lee Plan, which discourages the approval of natural resource extraction operations, if adverse effects on surrounding land uses cannot be minimized or eliminated.

Map 14 should be modified to remove the above referenced areas from the classification of "preferred mining". The removal of this property will likely require the designation of new/additional other lands in order to maintain the representation that sufficient land is designated to meet the region's need for limerock to 2030.

6. Policy 1.7. Public Acquisition Overlay.

This policy states that the Public Acquisition Overlay does not restrict the use of land "in and of itself," but this is less clear in the policies under Goal 30. It would be helpful to reiterate the point in the Objectives and Policies that follow Goal 30.

7. Policy 1.7.13. - Rural Residential Overlay (Map 17); Policy 30.2.3.2.(c). and references to Transferred Development Rights

These policies and Map identify Mixed Use Communities along State Route 82 (SR 82) as a preferred area to cluster development of commercial, industrial, and residential uses. These Mixed Use Communities are also identified as potential receiving sites for Transferred Development Rights ("TDR's") created within the DRGR. The goal of concentrating development within nodes along the south side of the SR 82 corridor is first stated in Policy 1.7.13 by reference to Map 17 and then reiterated in Policy 30.2.3.2.(c). SR 82 currently operates below the adopted level of service on all segments. For this reason, no development orders or building permits can be issued along this corridor unless construction of improvements to widen SR 82 are included in the first three years of the FDOT five-year work program. As of today, there is only a PD&E Study underway for improvements east of Lee Boulevard. No funds are identified in the five or ten-year work program for right-of-way acquisition, permitting or construction. Moreover, Lee Plan Map 3A (2030 Financially Feasible Transportation Plan) does not reflect improvements to SR 82 until 2030. Finally, the MPO Long Range Transportation Plan does not include

RE: Potential Legal Issues Relating to the Proposed Revisions to the Comprehensive Plan Based on the Dover Kohl Study, CPA 2008-06

improvements to SR 82 east of Lee Boulevard as a financially feasible improvement by 2030. Given these facts, it is not reasonable to assume the development of Mixed Use Communities along SR 82, because permitting cannot be achieved within the current planning horizon of the Lee Plan.

Regarding the proposed creation and use of TDRs, it is our understanding that the details of the TDR program will be released shortly in the form of a report. Once our office has had an opportunity to review this report, further adjustments to the proposed Lee Plan Policies may be necessary to ensure the viability of the TDR program.

8. Proposed Policy 30.1.1. - Proposed Policy for Limerock Mining

This policy may potentially subject the County to claims under the Bert J. Harris Act. Policy 30.1.1. states that new and expanded limerock mines will be allowed *only in the areas identified on Map 14*. Mining will be precluded in other areas until there is a "clear necessity" to do so and Map 14 is amended through the comprehensive plan amendment process. Exposure to liability under the Bert J. Harris Act arises from restricting other areas containing material suitable for limerock mining within Southeast Lee County from mining pursuits. These properties are precluded from limerock mining unless it can be established there is a "clear necessity" to expand the areas already designated for mining on Map 14. The Lee Plan must be amended to change Map 14 to include the property before an application to mine may be considered by the County.

Further, to the extent Map 14 designates property that is not currently mined as preferred mining areas, it is important to establish that there is sufficient credible data (soil borings, etc.) to substantiate the designation of those properties as suitable for mining.

9. Proposed Policy 30.1.4., Subsections 1 through 3. - Limerock Mining

These new policies may negatively impact the ongoing efforts to achieve settlement of the current Florida Rock lawsuit. Settlement discussions are currently underway to achieve a resolution and the proposed policies are inconsistent with the direction of those discussions.

Proposed Policy 30.1.4.1. limits an existing mine with development order approval from amending the development order to dig a larger pit on the property. The County may face challenges under the Bert J. Harris Act, since the right to apply for an expansion of a mine footprint is currently available under our existing regulations.

RE: Potential Legal Issues Relating to the Proposed Revisions to the Comprehensive Plan Based on the Dover Kohl Study, CPA 2008-06

The text in proposed Policy 30.1.4.2. is not consistent with the text in 30.1.4.1. The new Land Development Code regulations combine zoning and development order processes into one permitting procedure for mining operations.

10. Policy 30.2.4. - Restoration of Critical Lands in Southeast Lee County.

There is no identified funding source for the proposed restoration effort. In what permitting context does Lee County have the ability to impose restoration on property that is not seeking approval to mine pursuant to Map 14? Agricultural operations do not require local permits for the most part. If scattered large lot residential development continues in the areas outside of preferred mining, there is no identified means for accomplishing the restoration of those lands. Lee Plan Policy 158.6.1 requires an assessment of the financial impact of proposed regulations prior to adopting the new regulation. Has the financial impact to private property owners been performed and analyzed? If the County is to bear some or all of the cost of that restoration, there is no proposed funding source for this restoration effort.

11. Policy 30.3.5. - Proposed Policy for Residential Mixed Use Development

Proposed Policy 30.3.5. states that Lee County will establish *and fund* a DR/GR TDR bank that will offer to purchase development rights for resale. Again, a funding source for this program has not been identified.

These are some initial legal issues that need to be addressed by staff and the Board as they proceed with the consideration of the Lee Plan amendments proposed by Dover Kohl & Partners. We will address them in additional detail as the Comprehensive Plan revisions progress.

DMO/dm

xc: Andrea Fraser, Deputy County Attorney
John Renner, Chief Assistant County Attorney
Donna Marie Collins, Chief Assistant County Attorney
Dawn Perry-Lehnert, Assistant County Attorney
Karen B. Hawes, Interim County Manager
Mary Gibbs, Director, Department of Community Development
Paul O'Connor, Director, Planning Division
Wayne Daltry, Director, Smart Growth

Florida Department of Transportation

CHARLIE CRIST
GOVERNOR

801 North Broadway Avenue
Bartow, Florida 33830

STEPHANIE C. KOPELOUSOS
SECRETARY

February 26, 2010

The Honorable Tammy Hall, Chairman
Lee County Board of County Commissioners
Post Office Box 398
Fort Myers, Florida 33902-0398

RE: Adopted Lee County Comprehensive Plan CPA 2008-06 - FDOT Comments on Implementing the DR/GR Study

Dear Commissioner Hall:

The Florida Department of Transportation has reviewed the County's recently adopted comprehensive plan which incorporates the recommendations of the report *Prospects for Southeast Lee County: Planning for the Density Reduction/Groundwater Resource Area* and offers the following comments.

1. The amendment establishes a transfer of development rights (TDR) program for large contiguous and smaller non-continuous tracts in the DR/GR that, when implemented, will promote "significant" commercial and civic land uses in four future receiving areas on S.R. 82 in east Lee County. Two of these designated Mixed-Use Communities are located along sections of S.R. 82 that do not currently meet the adopted level of service (LOS) standard for the Florida Strategic Intermodal System (SIS). The other two designated receiving areas are located along sections of S.R. 82 that are not projected to meet the adopted LOS standards by the year 2030.

   As you know, there are currently no FDOT, MPO, or Lee County financially feasible plans to construct capacity improvements on S.R. 82 in east Lee County. Therefore, adoption of any land use policies resulting in development that adds trips to these portions of S.R. 82 necessitates the County implement strategies to address current and projected LOS deficiencies.

2. The State of Florida needs to consider the sourcing of aggregates *(aka crushed stone)* on a statewide basis as FDOT is the State's largest user of this resource. In the development of this plan amendment, Lee County Staff, the DRGR Advisory Committee and the "*Prospects for Southeast Lee County – Planning for the Density Reduction/Groundwater Resource Area (DRGR)*" Report *(Dover Kohl DRGR Report)* did not consider aggregate production from a statewide perspective as required by Chapter 337.0261(3) Florida Statutes.

cc: Commissioner Bob Janes, District 1
Commissioner Brian Bigelow, District 2
Commissioner Ray Judah, District 3
Commissioner Frank Mann, District 5
Debbie Hunt, FDOT Assistant Secretary, Intermodal Systems Development
Kevin Thibault, FDOT Assistant Secretary, Engineering and Operations
Mary Gibbs, Lee County Director of Administration
Scott Gilbertson, Director, Lee County DOT
Kathleen Neill, Director, Office of Policy Planning
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Thomas Wright, Chief Counsel, District 1
Johnny Limbaugh, Director, Southwest Area Office
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