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### ZONGE ENGINEERING & RESEARCH ORGANIZATION

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May 5, 1986

Joe Iovenitti  
Diamond Shamrock Geothermal  
3333 Mendocino Ave. #120  
Santa Rosa, Ca. 95401

RECEIVED

MAY 9 1986

TPC - Santa Rosa

Dear Joe:

Enclosed is a quote for the proposed Hawaii geothermal project on the main island of Hawaii. As you have requested, I have quoted a turn-key survey which includes two parts: the mobilization and set-up charges, and the data collection charge (including expenses) on a cost-per-site basis. The figures assume a 30-site Phase I program and 70-site Phase II program; however, the quote can be generalized to the cost of an n-site program (20 sites minimum) as follows: multiply the number of sites times the cost-per-site (for the type of data being acquired), and add to this the "survey set-up and ending" cost.

The quote includes the following assumptions:

1. Phase 1 will be done with full-tensor CSAMT measurements consisting of Ex, Ey, Hx, Hy, and Hz from each of two orthogonal grounded sources, for a total of 10 component measurements per sounding site.
2. Phase 1 will consist of 30 sites. Turn-key quote is good only if the total number of sites occupied in the survey exceeds 20 sites.
3. Phase 2 will be done at Diamond Shamrock's option. Zonge will provide preliminary data interpretation at the conclusion of Phase I in order to help evaluate the feasibility of Phase II work and to determine whether or not full-tensor work is required in Phase II.
4. Sources will be two, orthogonal, grounded dipoles coincident with one another, and suitable for all data acquired on this project. Extra transmitters will incur an additional charge.
5. All working areas are to be permitted by Diamond Shamrock for data collection; this includes permission to drill two-foot electrode holes if necessary. This quote does not include any permitting charges; any such charges will be added to this quote.
6. Frequency range of 0.125 to 4096 Hz (in binary increments) will be used.
7. Diamond Shamrock will provide Zonge Engineering with an exact job start date four calendar weeks prior to that date so that shipping arrangements can be made at the quoted prices.
8. Thirty percent of Phase 1 charges are payable ten days before job start date.
9. Prices quoted for the GDP-16 receiver are contingent upon the availability of that receiver at job start time. Zonge Engineering cannot guarantee availability. Zonge Engineering will make every effort to notify Diamond Shamrock by August 1, 1986 whether or not it can supply the required two GDP-16 receivers.
10. Prices quoted are good through December 31, 1986.
11. Zonge will supply the specified services at the turn-key prices indicated on the cost schedule. ~~This will set the maximum cost to Diamond Shamrock. Zonge will also maintain exact cost records of the survey; if this results in a lesser charge than the turn-key price, Diamond Shamrock will be charged the lower price.~~

Not applicable  
see 12 Nov '86  
Communication  
from Zonge  
JLI

12. Delays in survey progress due to Diamond Shamrock's inability to provide job area access, survey instructions, or essential information needed in the survey will be charged at standby rates to be specified in the project contract.
13. Cost includes two copies of the final report, which includes the following:
  - a) Data discussion and interpretation
  - b) Plan-view, contoured maps of apparent resistivity at all frequencies
  - c) Apparent resistivity pseudosections for all lines obtained
  - d) 1D or 2D models as mutually agreed to by Zonge and Diamond Shamrock (roughly ten models as an upper limit)
  - e) Other information or plots essential to the survey interpretation, as mutually agreed to by Zonge Engineering and Diamond ShamrockThe cost also includes a recommendation session after the survey.


Significant changes in the basic survey assumptions listed above will require a new calculation of costs. Minor changes can be made by mutual agreement between Diamond Shamrock and Zonge. It is our intent to maintain flexibility in accommodating minor changes so as to make the project go as smoothly as possible.

This quote is not a contract; a survey contract will be drawn up once the survey is definite. Quoted prices are firm through the end of 1986. This quote supersedes all prior quotes and discussions regarding survey costs.

I trust you will find the enclosed figures to be clear. If you have any questions or require clarification, please call me at any time.

Thanks for working with us in this, and I hope that things will go smoothly from here. I am certain that you will be pleased with the quality and interpretability of survey once it gets underway.

Sincerely,

  
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Larry Hughes  
Geophysicist



	Scalar	Vector	GDP-12 Partial Tensor	FULL Tensor	GDP-16 Full Tensor
vector \$60/site	-	1800	-	-	-
tensor \$120/site	-	-	3600	3600	3600
<b>EXPENSES</b>	<b>1390</b>	<b>2680</b>	<b>2730</b>	<b>4020</b>	<b>2730</b>
Per diem: 6x\$20x#days	360	720	720	1080	720
2 trucks(2x\$60) 1 car(\$40)	480	960	960	1440	960
House rental: \$100/dx#days	300	600	600	900	600
Gas: \$50/day	150	300	300	450	300
Mailing/telephone costs	100	100	150	150	150
<b>PHASE I PLUS SET-UP</b>	<b>16316</b>	<b>26022</b>	<b>29672</b>	<b>38396</b>	<b>31832</b>
<b>PHASE II (70 sites)</b>	<b>20580</b>	<b>40950</b>	<b>49490</b>	<b>69790</b>	<b>54530</b>

TOTAL JOB-COST EXAMPLES

GDP-12: Full-tensor Phase I plus...	GDP-16: Full-tensor Phase I plus...
Scalar Phase II.....\$ 58,976	Scalar Phase II*.....\$ 52,412
Vector Phase II.....\$ 79,346	Vector Phase II*.....\$ 72,782
Partial tensor Phase II..\$ 87,886	Partial tensor Phase II*..\$ 81,322
Full-tensor Phase II.....\$108,186	Full-tensor Phase II.....\$ 86,362

#Use of GDP-16's subject to availability at the time of the survey

\*In the event that Phase I is done with GDP-16's, the Phase II scalar/vector/partial-tensor measurements will be charged out at GDP-12 rates instead of the normal GDP-16 rates (a break to Diamond Shamrock of 26% on system charge and 200% to 300% on extra-receiver charge)