

JOHN WAIHEE
GOVERNOR OF HAWAII



93 MAR -3 10:30
STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

March 1, 1993

John P. Keppler, II
Acting CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

Dona L. Hanaike

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WATER AND LAND DEVELOPMENT

Mr. Brian J.J. Choy, Director
Office of Environmental Quality Control
220 South King Street, 4th Floor
Honolulu, HI 96813

Dear Mr. Choy:

Subject: **Negative Declaration for the Hawai'i Pilot Hole Project Situate at Waiakea, South Hilo, Hawai'i
Tax Map Key:3rd/2-9-01:01 and 41**

The Division of Land Management, Department of Land and Natural Resources, has reviewed all comments received on the following:

**UNIVERSITY OF HAWAII - Request for Right-of-Entry to conduct the Hawai'i Pilot Hole Project on government lands situate at Waiakea, South Hilo, Hawai'i
Tax Map Key:3rd/2-1-09:01 and 41.**

The Draft Environmental Assessment for this project was initially published in the October 23, 1992, OEQC Bulletin.

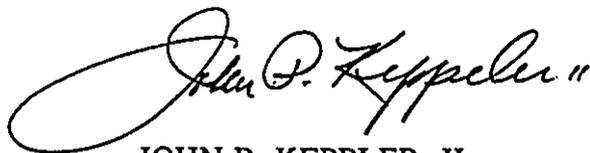
The department has determined that this project will not have any significant environmental effect and has issued a negative declaration. Please publish this notice in the next appropriate OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four (4) copies of the Final Environmental Assessment.

Mr. Brian J.J. Choy, Director
Office of Environmental Quality Control
Negative Declaration for Hawai'i Pilot
Hole Project, Waiakea, S.Hilo, HI
TMK:3rd/2-9-01:01 & 41
Page 2

Should there be any questions, please contact our Hawai'i District Land Agent at
933-4245.

Very truly yours,

A handwritten signature in cursive script that reads "John P. Keppler, II". The signature is written in dark ink and is positioned above the printed name.

JOHN P. KEPPLER, II

c: Hawai'i Land Board Member
Land Management Administrator
Hawai'i District Land Office

1993-03-23-HI-FEA- Hawaii Pilot Hole Project

MAR 23 1993

UNIVERSITY OF HAWAII
School of Ocean and Earth Science and Technology

FINAL ENVIRONMENTAL ASSESSMENT
AND NEGATIVE DECLARATION

HAWAII PILOT HOLE PROJECT
South Hilo District, Island of Hawaii

**FINAL ENVIRONMENTAL ASSESSMENT
AND NEGATIVE DECLARATION**

**HAWAII PILOT HOLE PROJECT
South Hilo District, Island of Hawaii**

Proposed by:

THE UNIVERSITY OF HAWAII

**Ralph T. Horii, Jr.
Vice President for
Finance and Operations**

**Dr. C. B. Raleigh
School of Ocean and Earth
Science and Technology**

March 1992

FINAL ENVIRONMENTAL ASSESSMENT
AND NEGATIVE DECLARATION

PROJECT: HAWAII PILOT HOLE PROJECT

LOCATION: South Hilo District
Island of Hawaii
State of Hawaii

PROPOSING
AGENCY: The University of Hawaii
Vice-President for Finance and Operations
2444 Dole Street
Honolulu, HI 96822

ACCEPTING
AUTHORITY:

CONTACT: Dr. C. Barry Raleigh
School of Ocean and Earth Science and Technology
University of Hawaii at Manoa
2525 Correa Rd.
Honolulu, HI 96822

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Executive Summary

This environmental assessment has been prepared to comply with Section 11-200-5 (b), Environmental Impact Statement Rules, which states that "...when an agency proposes to implement an action to use state or county lands or funds, it shall be subject to the provisions of Chapter 343, Hawaii Revised Statutes, and this chapter"; and, Section 11-200-10 which states that "agencies .. shall prepare an environmental assessment of each proposed action and determine whether the anticipated effects constitute a significant effect in the context of Chapter 343, Hawaii Revised Statutes, and Section 11-200-12."

Description of the Action

The University of Hawaii School of Ocean and Earth Science and Technology, in collaboration with University of California at Berkeley and Cal Tech University, propose to undertake a research pilot hole drilling project. This research will be undertaken in order to test the feasibility of diamond core drilling and sampling submarine and subaerial basalt lavas for chemical analysis.

The proposed location of the drilling effort is adjacent to the Hilo Harbor facility on the Island of Hawaii. The parcels on which the work will occur are TMK 2-1-09-1 and TMK 2-1-09-41. These parcels are within the Urban Land Use Classification and are zoned General Industrial and Open (a portion of 2-1-09-1) under the County Zoning code.

The project will clear a drilling pad and drill and core a small diameter hole to a depth of 600 meters (2000 ft.). The upper 23 m of the hole will be drilled to a diameter of approximately 355 mm (14 in.) and cased with 254 mm (10 in.) casing. A 101 mm diameter hole will be drilled from that depth to 150 m (500 ft.) and reamed to a diameter of 216 mm (8.5 in.) and a temporary casing of 178 mm (7 in.) will be set. Drilling with the 101 mm core bit will then continue to a total depth of approximately 2000 ft.

At the conclusion of drilling, downhole sampling and measurements will be made in the well at periodic intervals.

If the drilling project is successful, and subsequent reviews recommend funding, a subsequent research program will be proposed for this, or a nearby, site to conduct a deep drilling and sampling program.

Summary of Potential Impacts and Mitigating Measures

Geologic Hazards

The lava flow hazards within this area are considered to be low and would allow sufficient time to remove the drilling rig prior to inundation of the site. This area is within the tsunami inundation zone. Tsunamis generated by distant earthquakes would allow sufficient time to secure the hole and remove the drilling rig. Locally generated tsunamis would not allow sufficient time to relocate the rig but, because the wave height associated with these events is generally small in this area, they are unlikely to significantly impact the drill site.

Air Quality

The drill rig will emit diesel exhaust at rates that will be equivalent to or less than those from a typical truck engine. Emissions are believed unlikely to contribute significantly to the existing load of vehicular, marine, and jet exhaust discharges that occur in this area.

Water Quality

The materials used in the drilling process that are likely to be discharged into the shallow aquifers consist of bentonite clay and organic polymer additives that are routinely used in water well drilling. The groundwater beneath the drilling site is believed to be brackish and unfit for consumption. Hence, the proposed action will not have a significant impact on drinking water resources.

There is a very small possibility of leakage of the drilling fluids into the coastal water way during the drilling in the shallow portion of the hole. If this discharge is considered to pose an unacceptable risk, a drilling method can be used over the shallow portion of the hole that will eliminate the need to use drilling mud.

Noise

The drilling rig will be equipped with hospital type mufflers to reduce the noise levels emitted by the drilling rig. In light of the relatively high levels of noise generated by the harbor facilities, traffic on Kalaniana'ole Street, and jet traffic at the General Lyman field, it is unlikely that the drilling program will significantly affect ambient noise levels in this area.

Flora and Fauna

This site has been exposed to extensive disturbance in the past and is routinely impacted by industrial activities that are underway on the adjoining parcels. Hence, it is unlikely that significant natural resources exist at this site nor that the impacts associated with drilling here will impact the existing environment. A botanical survey of the site did not identify sensitive species present here.

Archaeology

These parcels were checked by the staff of the State Historic Preservation Division in January 1992. The land surface was found to be extensively altered with evidence of bulldozing and other activities. This fact makes it unlikely that significant historic sites remain in the project area. No such sites were found by the State Historic Preservation Division. It is, therefore, considered unlikely that any significant impact will occur.

Socio-Economic Impact

The impact of four to six workers commuting into this site is considered to be insignificant relative to the normal traffic through this area. The drilling activities will be limited in duration and will not impact the community lifestyle in the area nor access to the ocean along this coastline. The location of the site, although near Keaukaha and Onekahakaha beach parks, is buffered from these parks by the Keaukaha Wastewater Treatment Facility.

Access and Traffic

The site is located adjacent to Kalaniana'ole Street which is the major traffic artery through the industrial and dock area. The addition of two to four round trips daily to the site will not add measurably to the existing traffic load on this street.

Infrastructure, Utilities, and Services

The only infrastructure that is likely to be impacted by the drilling project is for water supply. An estimated 7,500 gallons per day will be required for drilling mud and water. This volume would be derived from the 6 inch water main that runs parallel to Kalaniana'ole St.

Solid waste volumes are expected to be small and would be disposed of at the Hilo landfill or as otherwise directed by the County of Hawaii or the Department of Land and Natural Resources.

Visual Impacts

The rig will not present a significant contrast to the existing industrial land uses in the area. Further, the preferred drilling site will be shielded by a stand of trees and will not be directly visible from most of the nearby residential areas.

Lighting

The drilling contractor will be informed of the Hawaii Outdoor Lighting Regulations and compliance will be a condition of the contract.

Determination

The proposed action is consistent with past and current land uses in the district within which the project will be undertaken. Any environmental impacts will be short-term in duration and limited in scope. Therefore, based on the significance criteria outlined in Section 11-200-12, Environmental Impact Statement Rules, the University believes that the project, as proposed, would have no significant long-term adverse effects on the environment if the mitigating measures outlined in this environmental assessment, and the conditions that may be imposed upon the project by the Department of Land and Natural Resources and the County of Hawaii Planning Department, are followed and that an Environmental Impact Statement is not required.

I : INTRODUCTION

A. Summary of the Hawaii Pilot Hole Project

The University of Hawaii School of Ocean and Earth Science and Technology, in collaboration with the University of California at Berkeley and Cal Tech University, propose to undertake a pilot hole drilling project in the South Hilo district of the Island of Hawaii. This drilling project is intended to test the feasibility of obtaining samples of rock from a sequence of subaerial and submarine lava flows that form the flanks of Mauna Loa and Mauna Kea volcanoes using core drilling technology.

The drilling program will drill a single hole to a depth of approximately 610 m (2000 ft.) over a period of approximately six weeks and will recover continuous samples of core throughout the interval drilled. Measurements of downhole rock morphology and chemistry, and water chemistry and temperature will be made over a period of several months after completion of drilling. Depending upon the results of this drilling effort, the results of downhole measurements, and funding availability, a separate proposal may be submitted to deepen this hole, or drill a second one in close proximity to that presently proposed, in an effort to sample a much longer sequence of lava flows from Mauna Kea volcano.

B. Background

The unusual conditions that have led to the formation of the Hawaiian Archipelago are widely recognized as providing unique opportunities to study a number of fundamental earth science questions. Included among these are not only the study of volcanic hazards but also the very basic questions of why volcanoes such as those that form Hawaii occur at all and the role that this type of volcanism plays in the planetary evolution process.

The Hawaiian archipelago makes up one of a very few volcanic chains that exist in the world that result from a mantle "hot spot" located tens to hundreds of kilometers below the earth's crust. Current geologic models indicate that the mantle "hot spot", or "plume", that is responsible for the Hawaiian Archipelago has existed for tens of millions of years beneath the ocean floor that forms the Pacific Plate of the earth's crust. During this time, the Pacific Plate has moved slowly northward while the mantle plume has pumped molten magma onto the ocean floor to form the sea mounts and islands that we know as the Hawaiian chain. However, we know very little more about this plume, or "hot spot" than that it exists and appears to be nearly stationary relative to the rest of the planet below its surface crust. A proposal has recently been funded by the National Science Foundation to begin the study of the mantle plume that forms the Hawaiian Hot Spot.

This program will be a joint effort of the University of Hawaii School of Ocean and Earth Science and Technology, the University of California at Berkeley, and Cal Tech University. The objective of the research is to obtain an extended set of samples of lava flows that have formed a single volcano and that span the majority of its eruptive life. Because this effort will require drilling to a depth of nearly 4.5 km (14,500 ft.) in a rock type for which drilling experience is limited, it has been recommended that a shallow pilot hole be drilled to demonstrate the technical feasibility of drilling through a long sequence of subaerial and submarine lavas using core drilling technology. This Environmental Disclosure Document is being prepared to evaluate the potential environmental impacts of this preliminary drilling effort.

C. Purpose of this Environmental Assessment

This environmental assessment has been prepared to comply with Section 11-200-5 (b), Environmental Impact Statement Rules, which states that "...when an agency proposes to implement an action to use state or county lands or funds, it shall be subject to the provisions of Chapter 343, Hawaii Revised Statutes, and this chapter"; and, Section 11-200-10 which states that "agencies .. shall prepare an environmental assessment of each proposed action and determine whether the anticipated effects constitute a significant effect in the context of Chapter 343, Hawaii Revised Statutes, and Section 11-200-12."

PART II : DESCRIPTION OF THE ACTION

A. General Characteristics of the Project

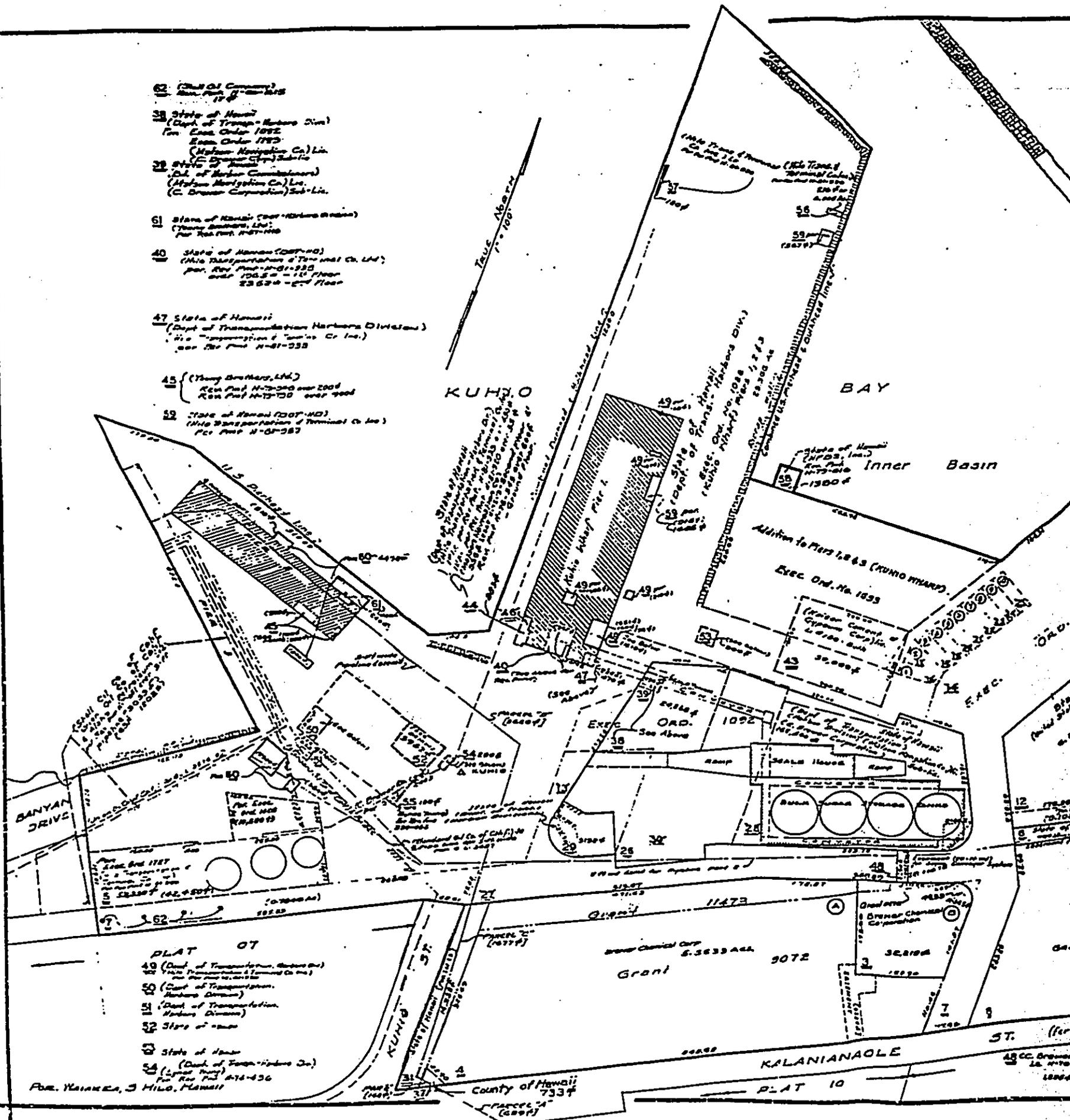
The steps involved in the research program will consist of the following: a 30 m by 60 m (100 ft. by 200 ft.) drilling pad will be cleared and graded; a wellhead slab will be installed; a truck-mounted drill rig will be set up on the wellhead slab; the hole will be drilled to a depth of approximately 610 m (2000 ft.); the drilling rig will be removed and the wellhead will be secured; periodic downhole measurements will be performed in the hole.

B. Site Location

The location of the proposed action is within two State-owned parcels of land at TMK 2-1-09-1 and 2-1-09-41 (Fig. 1). The precise location of the hole within these parcels will be based upon recommendations by the Department of Land and Natural Resources under the conditions of a Right of Entry permit that will be requested from that agency. The total land area of these parcels is approximately 3.9 and 3.3 acres respectively. Both are

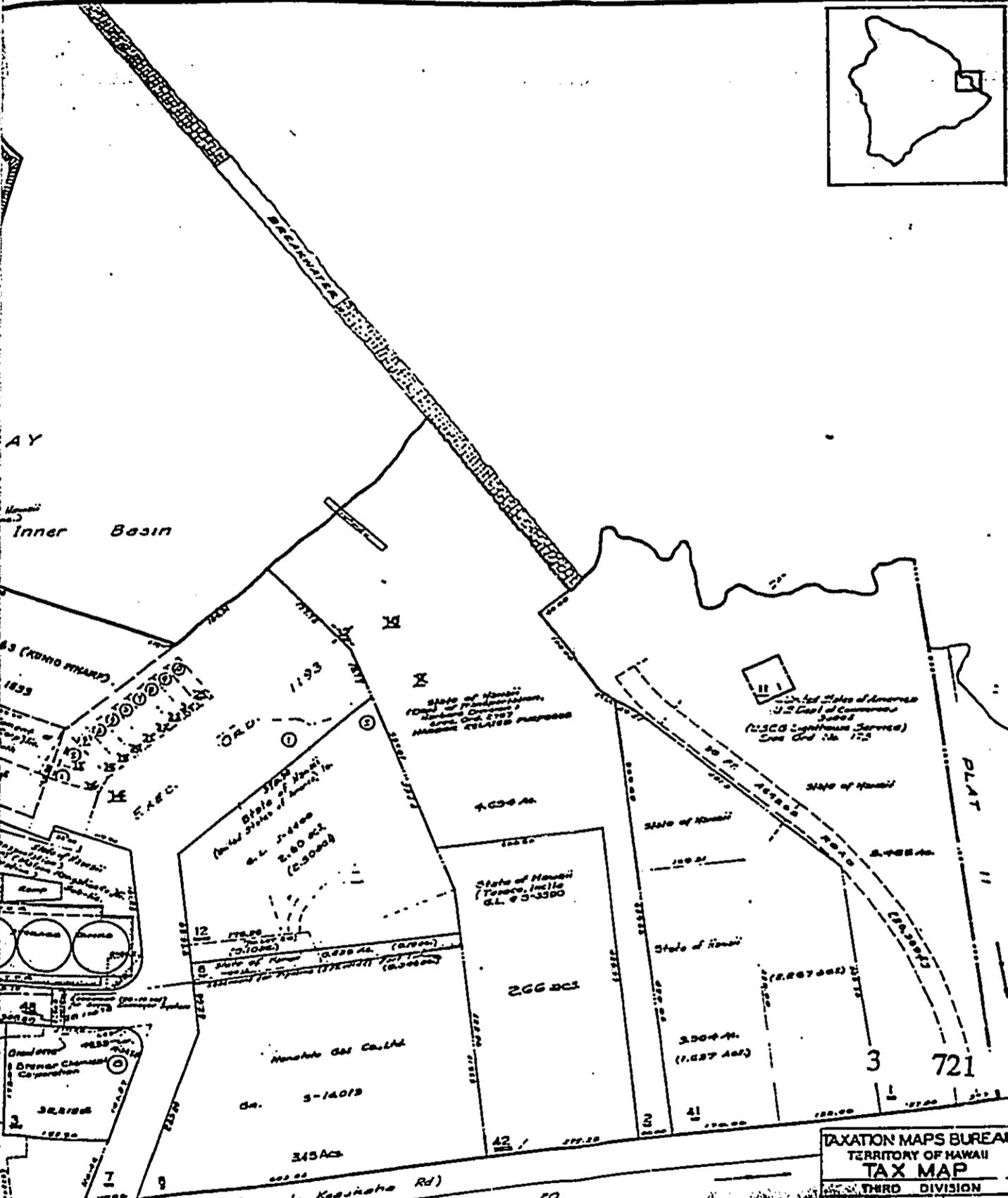
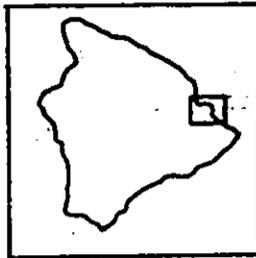
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- 62 (State of Hawaii) (Dept. of Transportation) (Honolulu, Hawaii) (See Plat No. 17)
- 58 State of Hawaii (Dept. of Transportation) (Honolulu, Hawaii) (See Plat No. 18)
- 57 State of Hawaii (Dept. of Transportation) (Honolulu, Hawaii) (See Plat No. 19)
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- 40 State of Hawaii (Dept. of Transportation) (Honolulu, Hawaii) (See Plat No. 21)
- 47 State of Hawaii (Dept. of Transportation) (Honolulu, Hawaii) (See Plat No. 22)
- 45 (Thyng Brothers, Ltd.) (Honolulu, Hawaii) (See Plat No. 23)
- 52 State of Hawaii (Dept. of Transportation) (Honolulu, Hawaii) (See Plat No. 24)



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CC Brewer Co
Honolulu, Hawaii
1950



AOLE ST. (formerly Kaula Rd) PLAT 20
Dropped parcels, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

TAXATION MAPS BUREAU
TERRITORY OF HAWAII
TAX MAP
THIRD DIVISION
SEC. PLAT
2 1 09
CONTAINING PARCELS
SCALE: 1 IN. = 100 FT.

SUBJECT TO CHANGE

owned by the State of Hawaii. These parcels are zoned Urban/General Industrial and Urban/Open (a portion of TMK 2-1-09-1) and are located between the Hilo dock facility and the Keaukaha Wastewater treatment plant.

C. Site Preparation

A drill pad having dimensions of approximately 30 m by 60 m will have to be cleared and levelled for location of the truck mounted rig, drilling fluid tanks, drill-pipe laydown area, and for access to supply vehicles. A wellhead pad will be prepared by digging a 2 m by 2 m (6 ft. by 6 ft.) cellar to a depth of approximately 1.5 m (4 ft.). A steel reinforced concrete pad, having dimensions of 4 m by 4 m (12 ft. by 12 ft.), will be poured to form a stable base for the rig; at this time a concrete pad will also be prepared as a cover for the wellhead cellar.

D. Drilling Operations

The drilling rig to be used for this project will be similar to the Universal 1500, truck mounted diamond coring rig (Fig. 2). The rig has a self-contained power train and uses a 230 hp diesel engine to generate its own hydraulic and electrical power. The rig will be set up and anchored on the wellhead pad as shown in Figure 3. Ancillary equipment that will be installed on the drilling pad include: skid mounted drilling fluid tanks and pumps, a water tank, a supplies trailer, and a cuttings sump.

The drilling program will consist of three phases of drilling that will be run consecutively and will be conducted on a 24 hour per day schedule. The first phase will be to core drill to a depth of approximately 23 m (75 ft.) using a 101 mm (4 in.) core drill. At 23 m (75 ft.), core drilling will be suspended and the hole will be reamed to approximately 355 mm (14 in.) using a rotary drill to total depth. Surface casing will then be cemented into the open section of the hole. Core drilling will recommence and a 101 mm (4 in.) hole will be drilled to a depth of 150 m (500 ft.). The hole will again be reamed to a diameter of 8.5 in. and a 7 in. casing will be set (cemented) from the surface to 150 m. Coring will again be undertaken after completion of the casing program and will continue to a total depth of approximately 610 m (2000 ft.). At the completion of the drilling program, a valve will be welded onto the wellhead and the wellhead pad will be secured.

During the drilling process, fluids will be pumped down the hole to cool and lubricate the drill string and bit. We will use a bentonite based drilling fluid to which organic polymers have been added to increase lubricity and viscosity. However, we have the capability to drill using seawater over some portions of the hole in order to prevent contamination of the recovered core with drilling mud residue. The drilling fluids will be circulated down the string and those that return will be cycled through a "mud

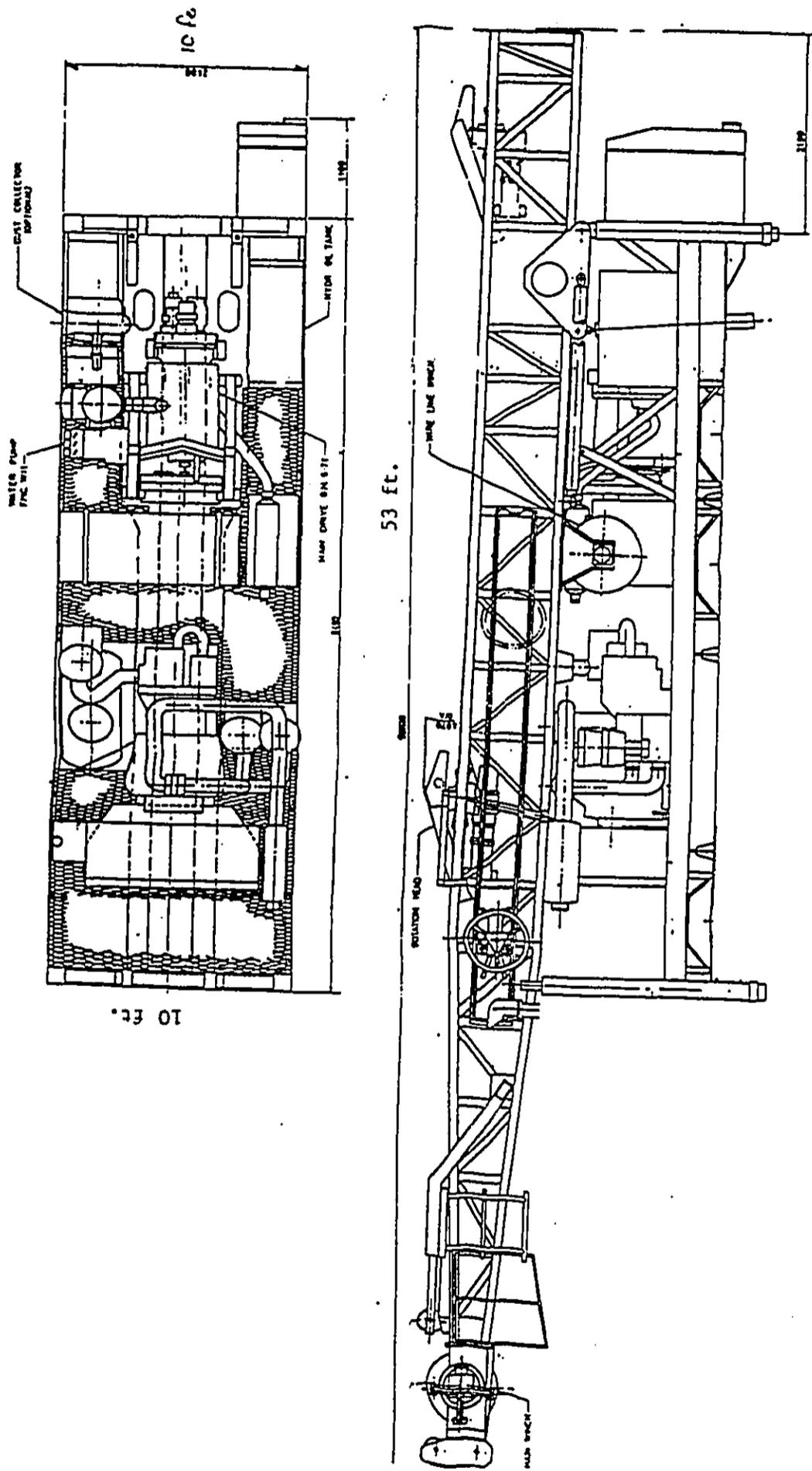


Figure 2. The Universal 1500 rig design. Mast is 53 ft. high when deployed for drilling operations.

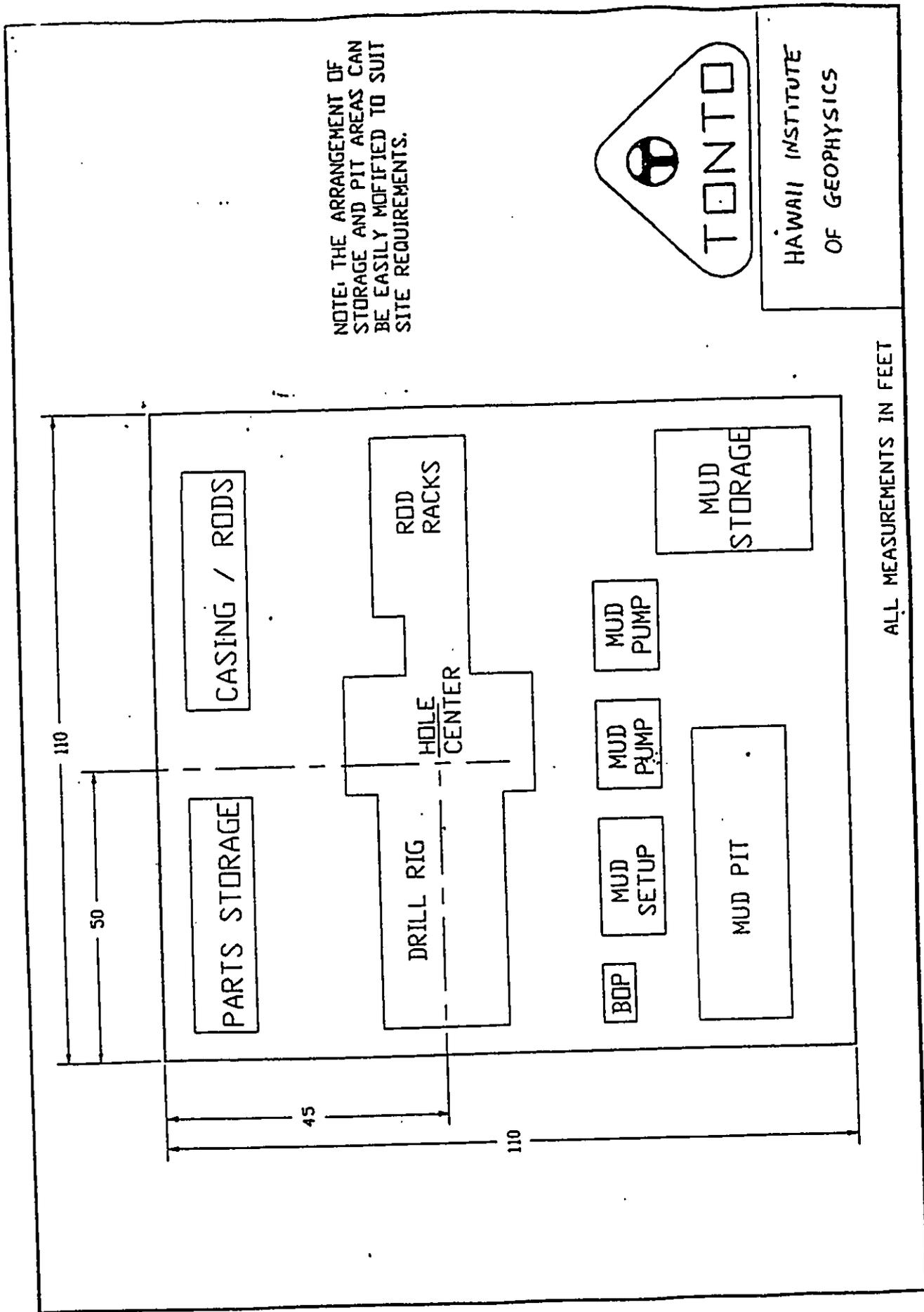


Figure 3. Site layout for Universal 1500 core drilling rig.

tank", to allow rock particles to be removed, and then will be recycled down the hole. Drill cuttings recovered from the hole will be stock-piled at the site in a cuttings sump and will be disposed of in the County of Hawaii landfill or, if deemed appropriate, will be disposed of as grade material at the site.

As discussed below, we will also have as an option to drill the first 23 m of the hole using cable drilling technology rather than core drilling. This option can be pursued if, during the environmental and permit review process, this method is recommended in order to eliminate any possibility of loss of drilling fluids to the shallow groundwater that might be discharged to the coastal waters adjacent to this site.

During and subsequent to completion of the drilling program, a series of measurements will be performed in the well at intervals of a few days to a few months. During the drilling operation, maximum reading thermometers will be run into the hole at least once per day. Fluid chemistry samples during drilling will be obtained at the water table and at intervals down the hole as deemed necessary by the drilling supervisor. Other geophysical measurements may also be made during and after the drilling program is completed. These measurements will be made by lowering various instruments into the well on a wireline cable that is controlled by a truck mounted winch. Each set of measurements may require that the truck be set up at the site for periods of up to 24 hours. The measurements to be made may include: measurements of the downhole temperatures, fluid flow within the well, the location and orientation of fractures in the rocks, and variations in the chemical composition of the rock units down the length of the hole.

E. Access

Access to the site would be via existing roadways; an unimproved road enters the state-owned parcel from Kalaniana'ole Street. This road was installed during construction of the Hilo breakwater and is currently used to maintain the breakwater as well as fishermen for access to the bay. It is of an adequate width to accommodate the drill rig anticipated for use in this project. We propose to clear the drilling pad adjacent to this access road or at a very short distance (<100 ft.) from it.

F. Infrastructure

It will be necessary to provide water to the drilling rig for the preparation of drilling mud and to flush cuttings from the hole during periods when no drilling mud is used. Our expected need for these purposes is in the range of 7,500 gallons of water per day.

We will have two options open to us for water supply. The first is if we are required to drill with seawater, we propose to run a line to Hilo Bay and draw seawater to the site using a

gasoline driven water pump. When we are able to drill with mud or fresh water, we would propose to use county water supplied by the 6 inch diameter county water line that runs along the Kalaniana'ole St. The installation of a temporary water line to the site will be coordinated with the Hawaii County Department of Water Supply and the Department of Land and Natural Resources.

The drill rig will supply its own electrical power and will rely on cellular telephone for communications and hence hard-wired connections to neither the local utility grid nor to the telephone system will be required.

Liquid and solid waste will be disposed of as appropriate for the material concerned. Sanitary waste will be handled by a local contractor for the duration of the project. Drilling waste will consist of rock cuttings and cement cuttings. These will be disposed of either in the County landfill or will be used as site restoration material as directed by DLNR and the County of Hawaii.

G. Schedule

Drilling operations are expected to begin in early August 1992 or as soon thereafter as permitting allows. The duration of the drilling operations are expected to be approximately four to six weeks with periodic downhole measurements to be made for a period of at least one year after completion of drilling.

H. Follow-on Work

If the results of the proposed drilling program indicate that it is technically feasible to drill a deeper hole, a proposal will be submitted to the National Science Foundation for funding of a deep hole to be drilled in close proximity to the currently funded hole. Should that proposal be funded, a separate Environmental Assessment will be prepared for that project.

Part III : DESCRIPTION OF THE EXISTING ENVIRONMENT

A. The Physical Environment

Climate

Long-term climatological information exists for the Hilo Airport located immediately adjacent to the proposed drilling site. A compilation of this data indicates (Table 1) that the mean annual temperature has a daytime average of 81°F and a nighttime average of 66°F. Annual rainfall is approximately 128 in. per year with maxima of about 13.5 in. and 14.9 in. during, respectively, March and November and minima of about 9.4 in. and 6.5 in. during January and July respectively. Wind speed and direction vary diurnally with maximum wind speeds of about 4.5 mph occurring during the middle of the day and minimum wind speeds during the evening hours.

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Temperature °F													
Normals													
-Daily Maximum	79.5	79.0	79.0	79.7	81.0	82.5	82.8	83.3	83.6	83.0	80.9	79.5	81.2
-Daily Minimum	63.2	63.2	63.9	64.9	66.1	67.1	68.0	68.4	68.0	67.5	66.3	64.3	65.9
Precipitation (inches):													
Water Equivalent													
-Normal	9.42	13.47	13.55	13.10	9.40	6.13	8.68	10.02	6.63	10.01	14.88	12.86	128.15
-Maximum Monthly	32.24	45.55	49.93	43.24	25.01	15.50	28.59	26.42	14.36	26.10	35.72	50.82	50.82
-Minimum Monthly	0.36	0.58	0.88	2.93	1.18	1.80	3.83	2.66	1.59	2.40	2.33	0.28	0.28
Wind:													
Mean Speed (mph)	7.5	7.7	7.6	7.4	7.3	7.1	6.9	6.8	6.7	6.7	6.8	7.2	7.2

Table 1. Normal, Mean, and Extreme meteorological data for Hilo Hawaii.

Wind direction is from the Northeast during the daylight hours and shifts to Mauna Loa drainage winds from the Northwest and West during the nighttime hours (Fig. 4).

Geology

The geology of the area proposed for drilling is composed of relatively young basaltic rocks derived from lava flows of Mauna Loa volcano. Soil thicknesses in this area are minimal, amounting to no more than a few inches. The subsurface geology is not known in detail, but probably consists of alternating layers of basalt lava flows interspersed with deposits of coralline sand and reef rock from earlier, now buried shorelines of Hilo Bay. Within the subsurface stratigraphy we expect to find a transition from Mauna Loa lava flows to those originating from Mauna Kea volcano. At the present time our best estimates place this transition somewhere below the target depth of the proposed hole. However, because the currently estimated depth is little more than speculation, the results of this hole will provide substantially better data with which to make such an assessment.

One of the major criteria in choice of this site for a drilling target is the avoidance of alteration of the subsurface lava flows by hydrothermal activity. Hence, the site is located as far away from the rift zones of either Mauna Kea or (to the extent known) Mauna Loa. We do not anticipate encountering thermal activity of any kind in this hole and hope to avoid any evidence of past active thermal alteration of the lava flows sampled.

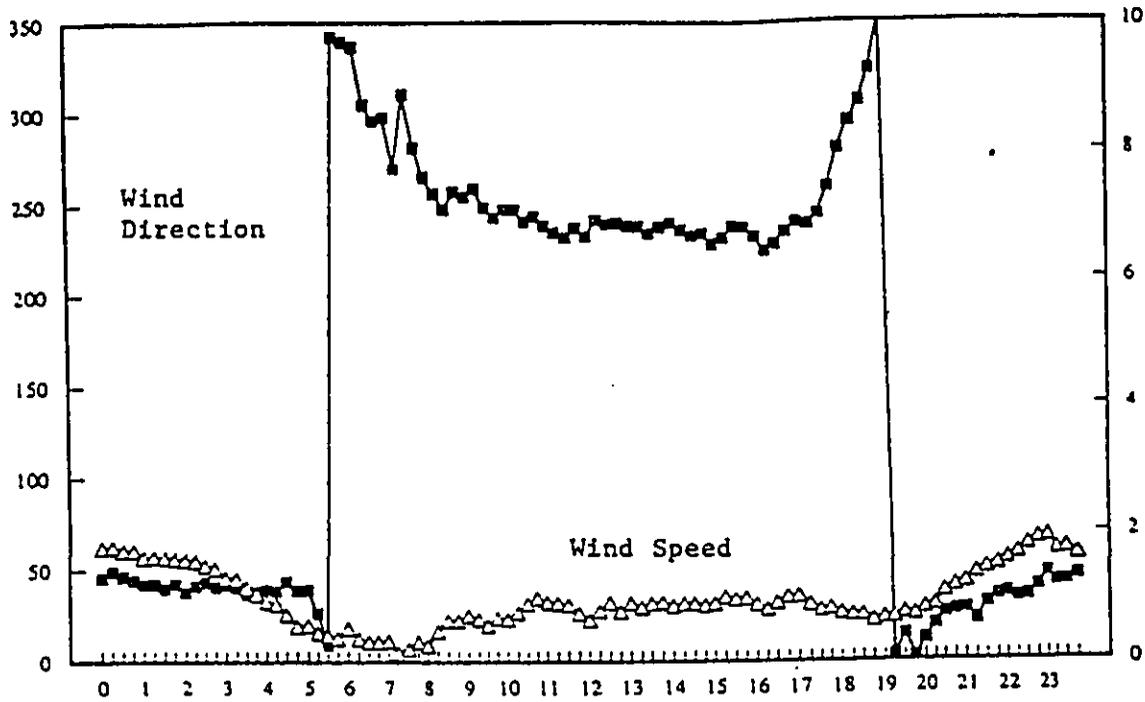
The topography of the proposed site is very gently sloping and has almost certainly been modified by grubbing and grading associated with the installation of the harbor facility and the breakwater. The elevation of the site ranges from sea level to approximately ten feet or less at the in-shore boundary.

Geologic Hazards

The proposed drilling site is within Lava Flow Hazard Zone 3 as identified by Helicker in the USGS publication "Volcanic and Seismic Hazards on the Island of Hawaii (U.S.G.P.O. # 1990-259-799). This zone encompasses virtually all of Hilo and much of the lower flanks of Mauna Loa volcano. If a lava flow were to threaten Hilo, there would be more than adequate time to secure the hole and remove the drilling rig to a safe location.

The proposed site is, however, located within the boundaries of the tsunami hazard zone at Hilo. In the event of a tsunami generated outside of Hawaii during the drilling project, there would be adequate time to disconnect the rig from the drill string, lower the drilling mast, and remove the vehicle to a site outside the coastal flooding zone. If a tsunami is generated by a local earthquake, it is unlikely that there would be sufficient time to remove the drill rig. Rig personnel should, however, have adequate time to evacuate the site. Rig personnel will be instructed in the

station9



station9

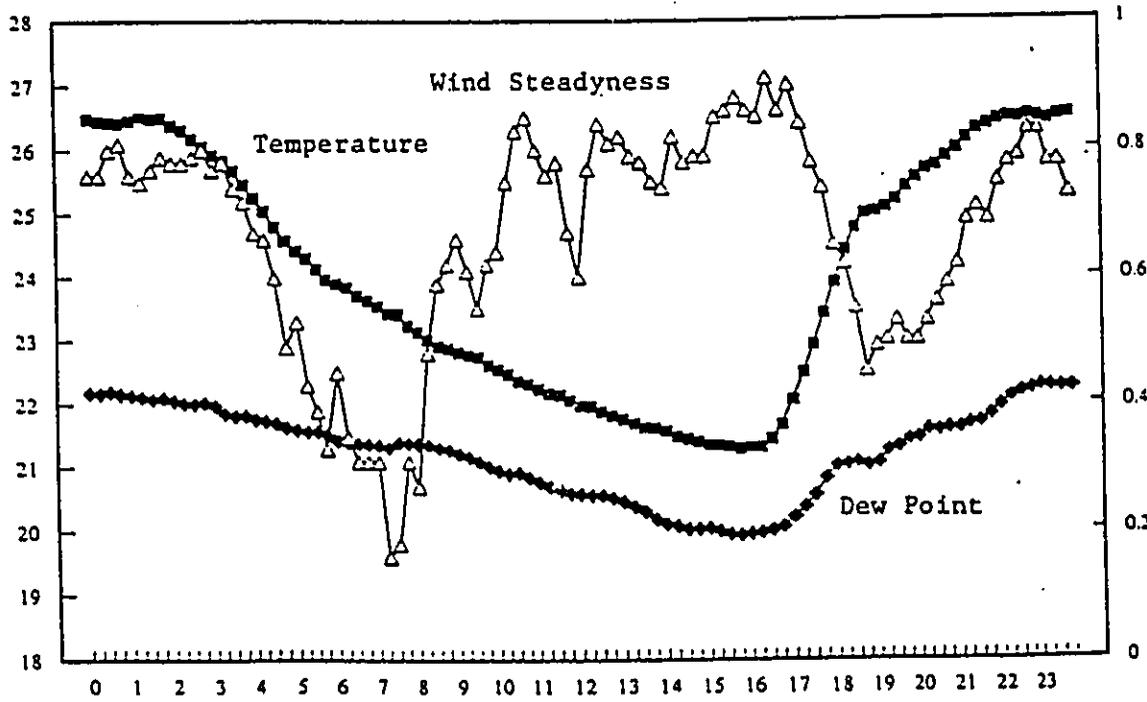


Figure 4. Meteorological data for Keaukaha vicinity of Hilo, Hawaii.

procedures to follow in the event of a strong local earthquake.

Hydrology

The hydrology is quite simple in the immediate vicinity of the proposed drilling. Because the site is located immediately adjacent to the coast, the groundwater will be brackish to pure seawater. The high permeability of the coastal rocks will result in a groundwater level being at local sea level and will also allow efficient tidal pumping of the basal lens. Hence it can be anticipated that there will be substantial intrusion of saline water into the groundwater below the site. The hydraulic gradient will, however, be toward the ocean in this area and there is likely to be substantial brackish water outflow along the coastal zone here. It is, however, possible that major discharges of brackish water will be encountered if large diameter lava tubes are present below the site. At the present time we have no way of determining the presence of these tube systems at this location.

As noted above, this site was chosen to be as far as possible away from the rift zones of Mauna Loa or Mauna Kea in order to avoid the possibility of modification of the lava chemistry by hydrothermal alteration processes. Hence we do not expect to encounter thermal fluids in the present drilling program.

Noise

Noise levels are controlled by the industrial nature of the surroundings of the proposed site. The Hilo airport runway ends less than one-half mile from the site; the commercial dock abuts the site; Kalaniana'ole Street, the major artery through the area, is less than 150 m (500 ft.) away from the proposed drill pad.

Natural sources of noise include surf breaking on the outer flanks of the breakwater and along the coastline not protected by the breakwater. Wind and heavy rain would also periodically be significant natural sources of noise in the area. Current Hawaii County guidelines for noise restrict noise levels to 55 dBA during daylight hours and 45 dBA during nighttime.

B. The Biological Environment

A biological assessment of the proposed site has been conducted by W. Char and Associates. The findings of this work are attached as Appendix A and can be summarized as follows: The site has been heavily impacted by prior anthropogenic activity and the vegetation is dominated primarily by alien species. Although there are limited numbers of native plant species present on the site, none are listed as threatened or endangered species. "There is very little of botanical interest on the site and ... the proposed project should not have a significant negative impact on the botanical resources."

C. Archaeology

These parcels were checked by the staff of the State Historic Preservation Division in January 1992. The land surface was found to be extensively altered with evidence of bulldozing and other activities. This fact makes it unlikely that significant historic sites remain in the project area. No such sites were found by the State Historic Preservation Division.

D. The Socio-Economic Environment

The proposed site is located in an Urban Land Use district and has been designated "General Industrial" within the County of Hawaii zoning code. It is located in the coastal area bordering the city of Hilo. The population of Hilo is approximately 46,000 persons and its industrial area encompasses several large tracts of land adjacent to the main airport and along State Highway 11, the main roadway out of Hilo toward the south. The proposed site for the drilling project is bounded by the Hilo commercial docking facility to the west, a petroleum storage area to the south, and the Hilo/Keaukaha sewage treatment facility to the east. The northern boundary of the parcel is the coastline facing Hilo Bay.

The nearest residential area is Keaukaha, located about 150 m to the south across Kalaniana'ole St. from the proposed site. This area is controlled by the Department of Hawaiian Home Lands and is comprised of sparsely distributed, older to recent, modest sized homes occupied by predominantly long-time residents of Hilo. The density of housing is relatively low closest to Kalaniana'ole St. and increases with distance back from this street. Lyman Field, the main airport for east Hawaii is located south of this area.

It should also be noted that, at the present time, the coastal portion of the parcel proposed for the drilling project is occupied by a several temporary shelters comprised of tents, abandoned cars and vans, and assorted scavenged building materials. Occupancy of these shelters appears to range from occasional to full-time although none of the shelters appears to have been authorized for construction or occupancy there by any state or county agency.

The nearest park facilities are located along the coastline to the east where Keaukaha and Onekahakaha Beach Parks are located at distances of 350 m (1200 ft.) and 1.6 km (1 mi.) respectively.

Infrastructure and Utilities

The main roadway through the industrial district is Kalaniana'ole St. that runs adjacent to the project site and leads into the main business district of the city of Hilo. This roadway also carries rights of way for power, telephone, and a 6 in. diameter county water main. Wastewater treatment facilities are

located adjacent to the proposed site.

All other infrastructure expected for a city having a population of 50,000 (fire protection, hospital, industrial and fuel supply houses, etc.) are easily accessible from the site.

Part IV : POTENTIAL IMPACTS AND MITIGATING MEASURES

A. Introduction

The proposed project is for purposes of scientific research only. Samples of rock and water will be recovered from the proposed drill hole and measurements of rock properties and subsurface conditions will be made in the hole after its completion. As such, the environmental impacts from the proposed action are transitory in nature: the drilling rig will be on site for a period of up to six weeks and subsequent measurements in the hole will require that a logging truck be sporadically parked at the site for a few hours to a few days during periods of downhole measurement. The only ancillary impact that may result from the proposed action would be subsequent drilling at or near this site. A deep drill hole will only be undertaken if the results of this effort indicate that deep drilling will be technically feasible and scientifically rewarding. The likelihood of the follow-on drilling is further conditioned upon the availability of funding from the National Science Foundation.

The areas of surface disturbance at this site will be limited in area and, to the extent possible, will be confined to areas in which ground disturbance has already occurred during prior use of the site. We have also been informed that this area may also be considered for long term expansion of the harbor facility or for use as a public boat ramp. Hence, future disturbance of the site may very well obliterate any minor disturbance that the proposed project would create.

B. Geology and Soils

There will be some clearing and leveling of the ground surface to provide a stable surface for the drilling rig and ancillary equipment. The gentle slope that exists at the site will enable us to perform this work with a minimum of disturbance to the natural contour and renders it unlikely that the changes made will perceptibly impact normal rainfall runoff or percolation patterns.

The geologic hazards identified indicate that the threat of tsunami inundation of the site is the most significant hazard at the proposed site. In the event of tsunami generation at substantial distances from Hawaii (e.g. Alaska, North or South America), there will be adequate time to secure the hole and remove the drilling rig from the site prior to inundation. Although locally generated tsunamis are unlikely to provide time for

anything but evacuation of the site by drilling personnel, such events have generally resulted in relatively modest wave heights in Hilo Bay. Further, the location of the proposed site behind the Hilo breakwater may provide some measure of protection from these small events.

The geologic hazard posed by lava flow is minimal. In the unlikely event of such a threat there will be adequate time to secure the hole and remove the drilling rig prior to the site being affected by volcanic activity from Mauna Loa Volcano.

C. Air Quality

The air quality impacts arising from this project will include minor dust mobilization during clearing and diesel exhaust emissions associated with the clearing equipment and the drilling rig. Given the high rainfall at the site, dust mobilization is likely to be minimal. However, if dust becomes a problem, water can be sprayed over the exposed portions of the site to minimize the dust generation. The emission rate of diesel exhaust will be less than or equivalent to that produced by a standard 40' trailer truck. The diesel engines on the rig will be operated at constant speed and, hence, the engine will burn much more cleanly than an equivalent motor that accelerates and decelerates in its normal mode of operation. The rate of these emissions within the industrial district will not contribute detectably to the existing load of exhaust generated by harbor operations, discharges from jet engines using the nearby airport, and the routine traffic of heavy trucks using Kalaniana'ole Street.

D. Water Quality

The water underlying the site is believed to consist of very brackish water derived from tidal mixing of seawater with natural freshwater coastal discharge. Below this layer is believed to lie saline seawater that has infiltrated into the deeper basalts by tidal action. The proximity to the coast can be taken to indicate that the water quality does not meet EPA drinking water standards and, hence, the proposed drilling will not affect a source of underground drinking water.

The drilling operation does have the potential to release drilling mud into the rock formation around the drill hole. The mud to be used in the proposed project will be composed of a mixture of bentonite clay particles and organic additives derived from plant material (guar gum). They are non-toxic and, because they are used in the drilling of water wells for potable supplies, they are not considered to pose a significant health hazard.

During the drilling of the shallow portion of the hole there is a slight chance that this mud could migrate into the waters of Hilo Bay. We believe, however, that, as the mud is mixed with the

brackish groundwater at this site, the mud particles will tend to coagulate and precipitate out within the rock matrix and not escape to the bay water. In order to minimize the opportunity for mud losses in the shallow portion of the hole, we have also designed the hole to have solid casing installed at a depth of approximately 23 m (75 ft.). Below this depth, it is unlikely that discharge of mud to the bay could occur since the nearest horizontal distance to a potential ocean discharge is approximately 1100 m (3600 ft.).

In the event of extreme concerns regarding possible contamination of bay water the drilling plan could be modified to allow us to use cable drilling down to the first casing point. Because this method does not use drilling mud, even the remote possibility of mud loss to bay waters will be eliminated.

After completion of the shallow portion of the well, casing will be installed and grouted over the first 23 m of the hole. This casing will preclude any possibility of mixing of deeper saline water with the shallow brackish water underlying the site.

One positive impact of the proposed drilling will be an opportunity to sample the shallow groundwater immediately up-gradient of the coastal waters. Samples of fluid from this hole will provide us with data regarding the nutrient load being carried into the Hilo Bay as a result of non-point-source groundwater contamination associated with residential and agriculture related land uses located inland of the proposed well. Even though there may be no significant levels of discharge, the data will verify that fact and will serve as a baseline by which to evaluate future changes as the regional population increases.

E. Noise

Noise will be generated by both heavy equipment during the site preparation process and by the drilling rig during the drilling operation. The former activities will be conducted during daylight hours only using a single bulldozer with intermittent truck deliveries of cinders and concrete for levelling and grading the drill pad. The impact of this noise source will be trivial relative to the existing truck, jet, and boat traffic that frequents this area.

Noise associated with drilling will be continuous since drilling operations will be on a twenty four hour a day schedule. The drilling rig will be equipped with "hospital-type" mufflers to minimize the level of engine noise generated. Engine noise can be reduced to less than 65 dBa at 30 m (100 ft.).

The noise receptors of greatest concern are the residential dwellings located across Kalaniana'ole Street from the proposed site. The presence of a stand of tall trees that are present between the proposed site and the fuel oil storage facility located

on the north side of Kalaniana'ole Street will effectively break up the sound and serve as a natural shield between the rig and the residential area. Furthermore, the presence of anthropogenic and natural sources of noise in this area will, in many cases be far more intrusive than that produced by the rig. These sources include: vehicle noise on Kalaniana'ole Street; jet traffic on the airport runway, noise generated by activities at the harbor that will include truck and equipment noise as well as that from ship and tug operations. The presence of a nearly constant source of noise generated by surf breaking on the coastline will also serve to mask the low drone of the drill rig. Hence, we believe that the drilling noise will have minimal impacts on the ambient noise level within the residential area.

Other noise receptors of possible concern are the users of the Keaukaha and Onekahakaha Parks. The former is closer to the proposed drill site, at a distance of nearly 350 m (1200 ft.), but is buffered from it by the Keaukaha sewage treatment facility. Because these beach parks are used predominantly during daylight and early evening hours, we believe that the normal daytime vehicle and jet traffic noise will effectively drown out the noise generated by the drilling rig.

F. Flora And Fauna

The attached botanical report did not identify any significant negative impacts resulting from the proposed action on the botanical resources on this site.

G. Archaeology

In light of the finding by the Historic Preservation Division that no significant historic sites are present within the parcels proposed for this project, that division has indicated that the proposed work in these parcels will have "no effect" on significant sites.

H. Socio-Economic

There will be four to six workers engaged in the drilling operation: two shifts of two workers each with one foreman and one helper. It is our intent that some of the workers will be local residents of the Island of Hawaii and, hence, will be able to commute by car to the drill site. Any workers that are brought in from off island or out of state will reside in local hotels.

Local contractors and suppliers will be used for all general utility supplies as we do not believe that the completion of this well will be so specialized as to require importation of non-standard materials from off island.

The limited nature and short duration of the project makes it

unlikely that the demand on the local labor pool or on local suppliers of material will have more than a mild positive impact resulting from the added business activity in Hilo.

The only other socio-economic impacts that arise from the drilling project are considered to be those associated with the added scientific activity occurring on the Big Island and the information derived from the analysis of the cores and water samples derived from the hole. It is likely that there will be visits by a number of scientists to the project site and to the core storage facility (currently planned to be at the Hawaiian Volcano Observatory). Aside from a slight increase in economic activity at the local hotels, these visits will afford increased opportunities for interaction of the staff of the Geology Department and the Center for Study of Active Volcanoes at U.H. Hilo with scientists conducting state-of-the-art research in the earth sciences. These interactions may be both directly beneficial, in terms of information exchange, and indirectly important by generating interest in geoscience problems of local interest such as those associated with volcanic hazards, coastal subsidence, or long-term sea level changes.

The direct products of the investigations associated with this research hole include:

1) Studies of the recurrence interval of lava flows reaching the coast line in the vicinity of Hilo. This type of information is essential in defining the actual long-term lava flow hazards that exist for the city.

2) Analysis of water compositions beneath the coastal area. Water chemistry data can yield information on the rates of freshwater loss from the shallow groundwater lens along this coastline and can indicate whether up-slope discharges of waste water are having an impact on the groundwater or bay water quality.

3) Seismic analyses that can be performed in the hole may also be able to yield information on the potential for seismic damage on the lower flanks of Mauna Loa.

I. Access and Traffic

The increased usage of Kalaniana'ole Street as a result of this project is estimated to amount to an average of approximately auto round trips, for crew changes and drilling management, and one truck round trip, for supplies, per day. Although car-pooling will be encouraged wherever practical, the limited number of added vehicles transitting this industrial area is considered to have no detectable impact on traffic movement or road way usage.

J. Infrastructure and Utilities

The only utility that will be affected by the proposed project is the water supply used for drilling operations. We anticipate a maximum usage of approximately 7,500 gallons per day

that would be derived from the county water supply. In that this is a relatively small volume of water usage with respect to most industrial activities, and is of only a temporary nature, we believe that the impact on public water supplies will be minimal. Water lines currently exist within close proximity to the proposed drilling site and hence will require the installation of only a temporary water line that will be removed at the completion of the project. As noted above, there is also a possibility of using sea water for some of the drilling activities which may reduce the demands of the project.

Sanitary wastes will be dealt with using contractor supplied chemical toilets and, hence, no impacts are anticipated from these services.

K. Public Facilities and Services

The limited duration and scope of the proposed activity is considered unlikely to have any detectable impact on schools, hospitals, fire protection, police protection, or other public services of this nature.

There will be some solid waste generated by the incoming materials and supplies and the drill cuttings. This waste will be disposed of either at the Hilo landfill or at another location as directed by the state and county permitting agencies.

L. Aesthetics

The visual impact of the project will be associated with the presence of the drill rig and lighting for nighttime operations. Because the rig will be shielded from the residential area by trees, we do not believe that the rig will be visible from most of the residential area. Although more distant view-planes may be able to see the rig, its location in an industrial area is likely to make its presence insignificant.

M. Light Impacts

Lighting on the rig will be shielded according to the Hawaii County Lighting Code to minimize its impact on adjoining properties and harbor activities. The presence of these lights adjacent to the harbor is again likely to render their impacts insignificant compared to the existing environment.

Part V : ASSESSMENT

The potential impacts of the proposed Continental Scientific Drilling Program Pilot Hole Project have been fully disclosed in this Environmental Assessment. Any negative environmental effects from this activity are believed to be limited in scope and in duration. Therefore, based on the significance criteria outlined

in Section 11-200-12, Environmental Impact Statement Rules, the University of Hawaii believes that the project, as proposed, would have no significant adverse effect on the environment and that no Environmental Impact Statement is required.

This assessment of no significant impact is conditioned on the fact that UH (SOEST) will strictly adhere to the mitigating measures outlined in the environmental assessment and to conditions that may be imposed upon the project in the drilling permit, the right of entry issued by DLNR, and the SMA permit issued by the Hawaii County Planning Department.

PART VI : RESULTS OF PROJECT ENVIRONMENTAL REVIEW PROCESS

The above Environmental Assessment was distributed for agency review in early October, 1992 and a notice and summary of the project was published by the State Office of Environmental Quality Control on October 23, 1992. In response to circulation of the Assessment, three agencies provided comment on the proposed project; no comments were received from the public by OEQC, DLNR, or the University with respect to the proposed project.

The Office of Environmental Quality Control offered the following (summarized) comments:

1) The proposed project is located in a Special Management Area and, hence, should be reviewed by County of Hawaii, Planning Department regarding the SMA permit; the Department of Land and Natural Resources, Commission on Water Resource Management must be consulted regarding a well drilling permit;

2) A list of agencies consulted must be disclosed in the Environmental Assessment;

3) A new form exists and should be used for future publication of project summaries.

The County of Hawaii Planning Department offered the following (summarized) comments:

1) The proposed project is within the County's Special Management Area (SMA) and that relevant County rules must be complied with; and that shoreline setback requirements will have to be met in locating the proposed hole;

2) Concern was expressed regarding the potential for disturbance to nearby residences in Keaukaha from noise that will be generated by the drilling activity; a request is made for more information regarding "hospital type" mufflers; it is recommended that the drilling operation be placed as far from the front property boundary as possible;

3) Lighting will have to comply with the Electrical Code and that the Building Department be consulted;

4) It was observed that shelters along the coastal portion of the property appear to be permanently occupied; it was noted that residential use of the property is not permitted under County zoning rules.

The Department of Hawaiian Home Lands offered the following (summarized) comments:

1) Concern was expressed that noise generated by the drilling would have the potential for disturbing the residents of the (Keaukaha) community that exists across Kalaniana'ole St. from the proposed project site; it was suggested that an environmental assessment may be needed to address this concern and other (unnamed) potential impacts; it was further suggested that noise levels be monitored and that drilling activity be restricted to specific hours to minimize disturbance to the community.

PART VII : RESPONSE TO AGENCY COMMENTS

Office of Environmental Quality Control

1) The proposed project has been discussed with several agencies (see below) including the County of Hawaii Planning Department and the Department of Land and Natural Resources, Division of Water Resources Management. We are aware of the requirement for an SMA permit and have discussed the submittal of an SMA petition with representatives of the Planning Department. This process must, however, follow the completion of the Environmental Assessment process.

2) A list of agencies that have been consulted was omitted from the original assessment through an oversight. The agencies that have been consulted to date are listed in PART IX : AGENCIES CONSULTED below.

3) The new form is acknowledged and will be used for future submittals.

County of Hawaii Planning Department

1) The location of the proposed project within the SMA is acknowledged. We will consult with the County of Hawaii regarding shoreline setback prior to specifying the precise location of the proposed drill-hole.

2) We are aware of the concern regarding possible noise disturbance of the community. We have met with members of the community at a regularly scheduled Keaukaha/Panaewa Community Association meeting to describe the project and to inform them of our activities. At that meeting we discussed their concerns regarding noise and other issues. We will also be meeting individually with residents directly across Kalaniana'ole St. from the proposed project site to also discuss noise concerns with them.

The reference to "hospital type" mufflers refers to high-attenuation muffling devices that can be placed on combustion engines. These devices are also referred to as "critical" mufflers or "40 dB" mufflers. Technical data on this type of muffler is attached in Appendix B.

The recommendation by the Planning Department that the project be set back as far from Kalaniana'ole St. as possible is acknowledged. It is our intent to locate the drilling site as far from Kalaniana'ole St. as is allowed under the requirements of the shoreline setback noted in 1) above.

We would also point out, however, that there are several mitigating conditions that already exist with respect to the noise concerns expressed.

A. Although the primary rationale for choosing the proposed site as our drilling target were scientific, the existing environment - including noise - at this location was also a major consideration. This site is in an industrial area and is located in close proximity to the Hilo wharf. The latter facility operates on a twenty-four hour basis with heavy machinery, trucks, diesel engines, and portage equipment in use whenever a barge is being loaded or unloaded. On several evening visits to the site, the portage equipment and their back-up alarms were clearly audible at the site as well as on Kalaniana'ole St. We believe that we can abate noise generation from our equipment to reduce noise from our operations to be less intrusive than those that currently exist in the area.

B. We have analyzed the site in terms of the likelihood that noise will propagate toward the residential area. Our preferred location is on the interior portion of the property (toward the ocean) that consists of cut and fill. We have been informed that the cut portion was formed when the area was mined for rock during construction of the breakwater. Mauka of this area is a bank or berm that was left after the mining operation. In our discussions with a noise consultant, it was indicated that the existing contour will substantially reduce propagation of ground level noise toward the residential area. The mauka buffer is heavily wooded with large trees which will further assist in shielding the community from noise propagation. It is also important to consider that, during the most sensitive hours of operation - 22:00 hrs to 06:00 hrs, the prevailing wind pattern is toward the ocean. As indicated on page 6 and in Figure 4 of the EA, the drainage winds occur at night that bring air from the upper Mauna Loa slopes toward the ocean. This wind pattern will further inhibit sound propagation from the proposed drill site toward the community.

C. An analysis of drilling noise generated during an earlier drilling project suggests that disturbance to residents should be minimal. We attach a letter from Darby and Associates, noise consultants, who performed noise level measurements at a residence in Puna during drilling of the SOH-1 drill hole. The measurements were made during the early morning hours when the rig was performing some of its noisiest operations - withdrawing the drill string from the hole. The residence was located up-wind from the rig and was shielded from the rig by a pre-existing rock and soil berm. The rig was not audible at the residence during the hours of the survey. We acknowledge that the circumstances are not identical to those at the proposed site: the distance between the dwelling and rig is greater (approximately 1000 ft. versus 600 ft. in our case), however, the intervening space is not wooded, as is the case for our proposed site, and the rig in the former case is substantially larger than that proposed in the present project.

D. There are several strategies that can be applied toward mitigation of the noise generated by the drilling project. We have

committed to the installation of "critical type" mufflers on the drilling rig and are committed to working with the community residents nearest to the drilling target to minimize disturbance to them from our operations.

In summary, we believe that the potential for significant disturbance to the residential community from the proposed operations is relatively small and that, with adequate communication with the affected residents, we will be able to minimize the potential impacts on their environment.

3) The requirement that lighting comply with County building ordinances is acknowledged. We will consult with that department prior to mobilization of the drilling rig.

4) The petitioner is aware of the shoreline activities at this site. We have met with representatives of the area and informed them of our plans to conduct drilling in this area.

Department of Hawaiian Home Lands

1) The concern for noise impacts is acknowledged and is responded to above. For the reasons described above, we do not believe that the potential for noise impacts from the proposed project justify the execution of an Environmental Impact Statement. The limited scope and short duration of the proposed project and the absence of any other significant impacts brought forth during the environmental review process, further indicates that an Environmental Impact Statement is not required by the proposed project. The recommendation that noise levels be monitored is acknowledged. We have no objection to documenting the existing noise environment in the area and evaluating the impacts of our operations on the existing environment. However, if our operations are not found to contribute significantly to the existing noise environment, and there are no objections from the community regarding our operations, we would suggest that continuous monitoring through the project will simply represent an unnecessary expenditure of already limited research funds.

The recommendation that drilling be restricted to specific hours is acknowledged. We submit that this type of restriction should be exercised only as a last resort for the following reasons:

A) Cessation of drilling operations for extended periods of time incurs the risk that the walls of the hole could collapse with the result that the drill string is trapped in the hole or that the hole is lost. Either situation will result in substantial added expense to the project and could result in a failure to achieve the objectives of the program.

B) Although cessation of drilling will reduce the rate of drilling the hole, it will not commensurately reduce the cost of drilling since we will be paying for the rig on a day-rate basis. Hence, daily stoppage of drilling will substantially increase the cost of the hole.

C) There are several other sound mitigation measures that, if necessary, could effectively reduce noise propagation into the community. Many of these strategies are more cost effective, and

pose less of a risk to the success of the project, than interrupting drilling on a daily basis.

Part VIII : DETERMINATION

The potential impacts of the proposed Continental Scientific Drilling Program Pilot Hole Project have been fully disclosed in this Environmental Assessment. Any negative environmental effects from this activity are believed to be limited in scope and in duration. Therefore, based on the significance criteria outlined in Section 11-200-12, Environmental Impact Statement Rules, the University of Hawaii believes that the project, as proposed, would have no significant adverse effect on the environment and that no Environmental Impact Statement is required.

This assessment of no significant impact is conditioned on the fact that UH (SOEST) will strictly adhere to the mitigating measures outlined in the environmental assessment and to conditions that may be imposed upon the project in the drilling permit, the right of entry issued by DLNR, and the SMA permit issued by the Hawaii County Planning Department.

Part IX : AGENCIES CONSULTED

UNITED STATES GOVERNMENT:

Department of Transportation - U.S. Coast Guard, Office of Aids to Navigation
Department of Interior - U.S. Geological Survey, Hawaiian Volcano Observatory and Water Resources Division

STATE OF HAWAII:

Department of Land and Natural Resources - Division of Land Management; Division of Water Resources Management; Historic Sites Division
Department of Transportation - Harbors Division, Honolulu Office; and Hilo Harbor Master's Office
Department of Health - Safe Drinking Water Branch
Department of Hawaiian Home Lands - Hilo Office
University of Hawaii - Environmental Center

COUNTY OF HAWAII:

Planning Department
Public Works - Wastewater/Solid Waste
Water Supply Department

COMMUNITY ORGANIZATIONS:

Keaukaha-Panaewa Community Association
Hue Ho'o Mau
Au Puni O Hawaii

APPENDIX A

Botanical Assessment Survey

BOTANICAL ASSESSMENT SURVEY
HAWAI'I PILOT HOLE PROJECT
HILO DISTRICT, ISLAND OF HAWAI'I

by

Winona P. Char
CHAR & ASSOCIATES
Botanical Consultants
Honolulu, Hawai'i

Prepared for: University of Hawai'i
Hawai'i Institute of Geophysics

February 1992

BOTANICAL ASSESSMENT SURVEY
HAWAI'I PILOT HOLE PROJECT
HILO DISTRICT, ISLAND OF HAWAI'I

INTRODUCTION

The Hawai'i Pilot Hole project site consists of approximately 7.2 acres, composed of two state-owned parcels (TMK: 2-1-09-1 and 2-1-09-41). The parcels are zoned "Urban/Industrial" and are located between the Hilo dock facility and the Keaukaha wastewater treatment plant. Access onto the site is via an existing unimproved road which enters the state-owned parcels from Kalaniana'ole Avenue; the road is used to maintain the Hilo breakwater which adjoins the subject parcels.

Field studies to assess the botanical resources found on the proposed Hawai'i Pilot Hole Project were conducted on 06 February 1992. The primary objectives of the survey were to: 1) provide a general description of the major vegetation type(s); 2) search for threatened and endangered plant species protected by federal and state endangered species laws; and 3) identify any areas of potential botanical concern.

A walk-through survey method was used. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium and for comparison with the most recent taxonomic literature. Notes were made on plant associations and distribution, substrate types, drainage, exposure, etc. The flowering plant names are in accordance with Wagner et al. (1990); the ferns follow Lamoureux (1984).

DESCRIPTION OF THE VEGETATION

Vegetation on the project site consists of a mixed forest composed almost exclusively of introduced or alien tree species, 30 to 60 ft. tall. Fronting Kalaniana'ole Avenue is a row of coconut palms (Cocos nucifera); a small stand of swamp mahogany (Eucalyptus robusta) is found by the entrance to the access road. The remainder of the property is covered primarily by ironwood trees (Casuarina equisetifolia) with scattered stands of other tree species; these include false kamani or Chinese almond (Terminalia catappa), bingabing (Macaranga mappa), gunpowder tree (Trema orientalis), melochia (Melochia umbellata), guarumo (Cecropia obtusifolia), Chinese banyan (Ficus microcarpa), and octopus tree (Schefflera actinophylla). Hala or pandanus (Pandanus tectorius) and hau (Hibiscus tiliaceus), two species native to the Hawaiian Islands and the Pacific area, are also found on the site.

Understory vegetation is generally dense except for along the shoreline area where there is more human activity. In addition to the saplings of the tree species mentioned above, there are shrubs such as guava (Psidium guajava), Christmas berry (Schinus terebinthifolius), strawberry guava (Psidium cattleianum), and Odontonema strictum.

Ground cover is variable. Low mats of wedelia (Wedelia trilobata) are common along the access road and the shoreline areas. Where the tree cover is more open and also along some portions of the access road, California grass (Brachiaria mutica) forms thick mats. Scattered through the California grass, in a few places, are plants of umbrella sedge (Cyperus alternifolius). White shrimp plant (Justicia petonica) is locally abundant in open, sunny areas along the access road. In most places though, the ground cover consists of seedlings of the tree and shrub species mentioned above, leaf litter, and a mixture of ferns, herbs, and small

shrubs (subshrubs) such as hairy sword fern (Nephrolepis multiflora), lauwa'e fern (Phymatosorus scolopendria), thimbleberry (Rubus rosaefolius), maile hohono (Ageratum houstonianum), etc.

Climbing up trunks of trees and draping over shrubs are two native vines, koali-'awania (Ipomoea indica) and ka'e'e (Mucuna gigantea), and an introduced vine, maile-pilau (Paederia scandens). Golden pothos vine or taro vine (Epipremnum pinnatum) is found on the swamp mahogany trees fronting the property.

DISCUSSION AND RECOMMENDATIONS

The vegetation on the project site is dominated primarily by introduced or alien species. A few native species such as hau, hala, koali-'awania, and ka'e'e are found on the site. None of the plants occurring on the site are officially listed threatened and endangered species nor are any proposed or candidate for such status (U.S. Fish and Wildlife Service 1989, 1990). The native species found on the site can be found in similar environmental habitats throughout the islands.

There is very little of botanical interest on the site and given the findings above, the proposed project should not have a significant negative impact on the botanical resources. There are no botanical reasons to impose any restrictions, impediments or constraints to the proposed project.

LITERATURE CITED

- Lamoureux, C. H. 1984. Checklist of Hawaiian pteridophytes. Unpublished manuscript.
- U.S. Fish and Wildlife Service. 1989. Endangered and threatened wildlife and plants. 50 CFR 17.11 & 17.12.
- _____. 1990. Endangered and threatened wildlife and plants; Review of plant taxa for listing as Endangered and Threatened Species; Notice of review. Federal Register 55(35): 6184-6229.
- Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. 2 vols. University of Hawai'i Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publication 83.

APPENDIX B

Technical Specifications on Critical Muffler Devices

Special "400" Level Exhaust Silencers

ENCL. 1 (1 of 2)

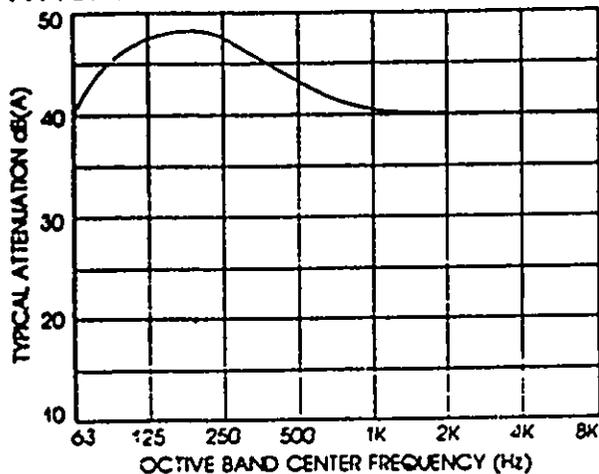
UNITED STATES PATENT OFFICE



BACKPRESSURE ON ENGINE
MUST BE CONSIDERED.

MAX = 27" H²O

TYPICAL ATTENUATION CURVE dB(A)



"F" Mounting Flange
Standard in sizes 4" to 14". Drilling matches
125/150# ASA standard.

Application:

Nelson Special "400" Level Silencers are designed to reduce total engine exhaust noise 35-45dB(A). These silencers are recommended where ambient noise is low and a high degree of silencing is necessary.

Construction:

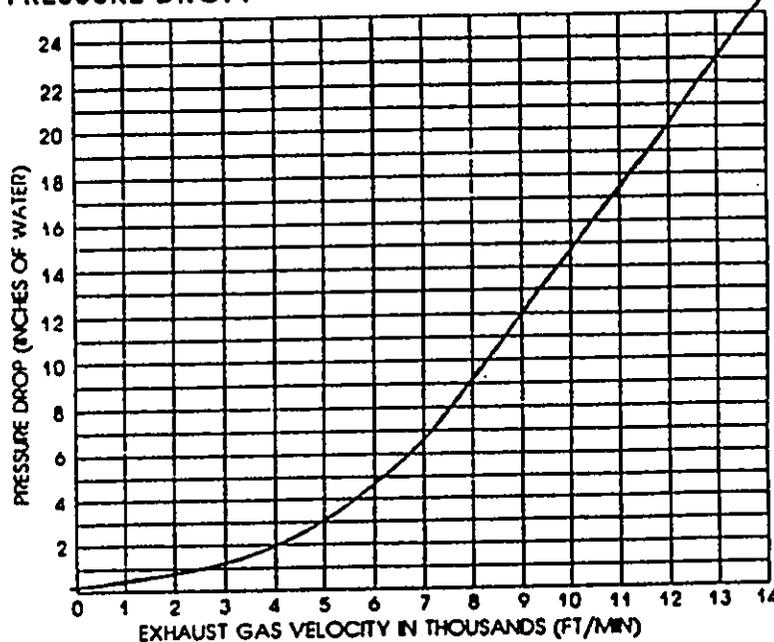
Mild Steel: Nelson silencers over 26.1 O.D. are fabricated of mild steel as standard material. Maximum operating temperature is 1100°F.

Aluminized Steel: Nelson silencers through 26.1 O.D. are fabricated of aluminized steel as standard materials. This material has better resistance to corrosion. Maximum operating temperature is 1250°F.

Silicon Aluminum Paint: Nelson silencers through 26.1 O.D. are given a coat of high heat resisting silicon aluminum paint.

Gray Primer: Nelson silencers over 26.1 O.D. are given a coat of high heat resisting gray primer as standard paint.

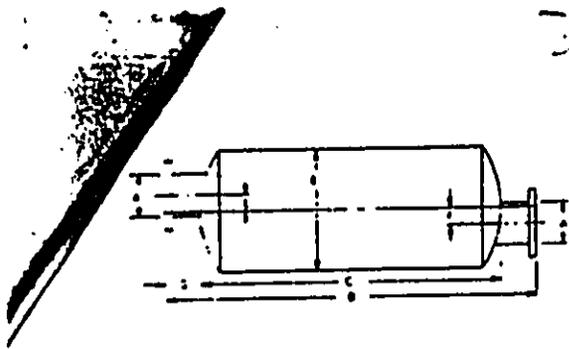
PRESSURE DROP:



Note: When figuring pressure drop for side inlet or middle side inlet add 3" H₂O to back pressure shown on above curve.

Sample Specification:

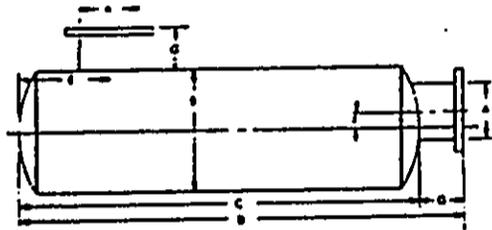
The silencer is to be a Nelson Special "400" Level Exhaust Silencer constructed of aluminized steel (26.1 inch body diameter and smaller) or mild steel (larger than 26.1 inch body diameter) with all welded construction and suitable for mounting in any position. The silencer shall be complete with the following Nelson accessories: _____



Model Number	A Nominal Inlet Dia	B Body Dia O.D.	C Body Length	D Over All Length	2 of 2		G Inlet Length
					E Offset To C/L	F Offset To C/L	
41440	4"	14.1	67.0	75.0	4.0	4.0	4.0
41450	5"	16.1	74.0	82.0	4.7	4.7	4.0
41460	6"	18.1	85.0	93.0	5.0	5.0	4.0
41480	8"	26.1	91.0	99.0	0	0	4.0
41482	10"	30.1	104.0	112.0	0	0	4.0
41484	12"	36.1	130.0	138.0	0	0	4.0
41486	14"	42.1	131.0	139.0	0	0	4.0

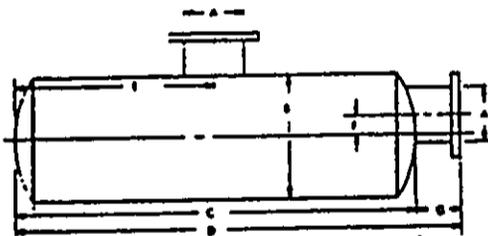
ENCL. 1 (2 of 2)

TYPE 3



Model Number	A Nominal Inlet Dia	B Body Dia O.D.	C Body Length	D Over All Length	E Offset To C/L	F Offset To C/L	G Inlet Length
43450	5"	16.1	74.0	78.0	6.7	4.7	4.0
43460	6"	18.1	85.0	89.0	8.2	5.0	4.0
43480	8"	26.1	91.0	95.0	10.5	0	4.0
43482	10"	30.1	104.0	108.0	12.0	0	4.0
43484	12"	36.1	130.0	134.0	13.8	0	4.0
43486	14"	42.1	131.0	135.0	15.6	0	4.0

TYPE 4



Model Number	A Nominal Inlet Dia	B Body Dia O.D.	C Body Length	D Over All Length	E Offset To C/L	F Offset To C/L	G Inlet Length
44850	5"	16.1	73.7	77.7	36.9	4.7	4.0
44860	6"	18.1	84.9	88.9	42.4	5.0	4.0
44880	8"	26.1	91.0	95.0	45.5	0	4.0
44882	10"	30.1	104.0	108.0	52.0	0	4.0
44884	12"	36.1	129.7	133.7	64.8	0	4.0
44886	14"	42.1	131.3	135.3	65.6	0	4.0



Nelson Muffler
 P.O. Box 428 - HWY 51 West
 Stoughton, WI 53589
 Area (608) 873-4200
 Telex 265-433

* Inlet & outlet offset from centerline of silencer as shown
 in dimension E & F.

APPENDIX C

Noise Analysis for Universal 5000 Rig
at SOH-1 Drill Site



#89-10
November 14, 1990

University of Hawaii
Hawaii Natural Energy Institute
2540 Dole St., Holmes Hall #206
Honolulu, Hawaii 96822

Attention: Mr. Art Seki

Subject: Noise Level Measurements During Tripping Out at SOH #1
on November 10, 1990

Dear Art:

Noise level measurements were made from about 3:45 am to 5:30 am near SOH #1 while the drilling rig was tripping out from about 4,000 feet. The measurement locations are shown in Figure 1 and were all on the edge of the highways except for Location D in the visitors parking lot of HGPA.

The sounds from SOH operations were audible at Locations A, B and F and were characterized by periodic high speed diesel engine and/or winch sounds and occasional impact sounds. See Table I. At Location A, a few low-frequency, rumbling sounds from the ORMAT rig were audible and distinguishable from the SOH activities.

SOH rig sounds were not audible (and, therefore, not measurable) at Locations C, D, E, and G. However, a single shout was heard at Location G coming from the direction of the SOH rig.

The ORMAT rig could be heard at Locations D and E being characterized: low-frequency rumbles from the drilling rig itself, muffled diesel generators, and occasional impact sounds. It is understood that the ORMAT rig was drilling at less than 300 feet.

At no location did either of the rigs exceed the allowable noise levels in the County Geothermal Noise Guidelines.

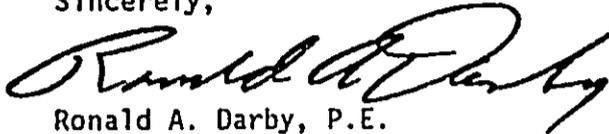
University of Hawaii
November 14, 1990

#89-10
Page 2

During the measurement period there was either no wind, or very light wind; and occasional misting and/or light rain. The cloud cover opened occasionally.

These manual measurements can be compared to the noise charts from the three automatic monitoring stations and analyzed with meteorological data when they become available to see if typical nighttime conditions prevailed.

Sincerely,



Ronald A. Darby, P.E.

RAD/ld.8rpt

Encl.

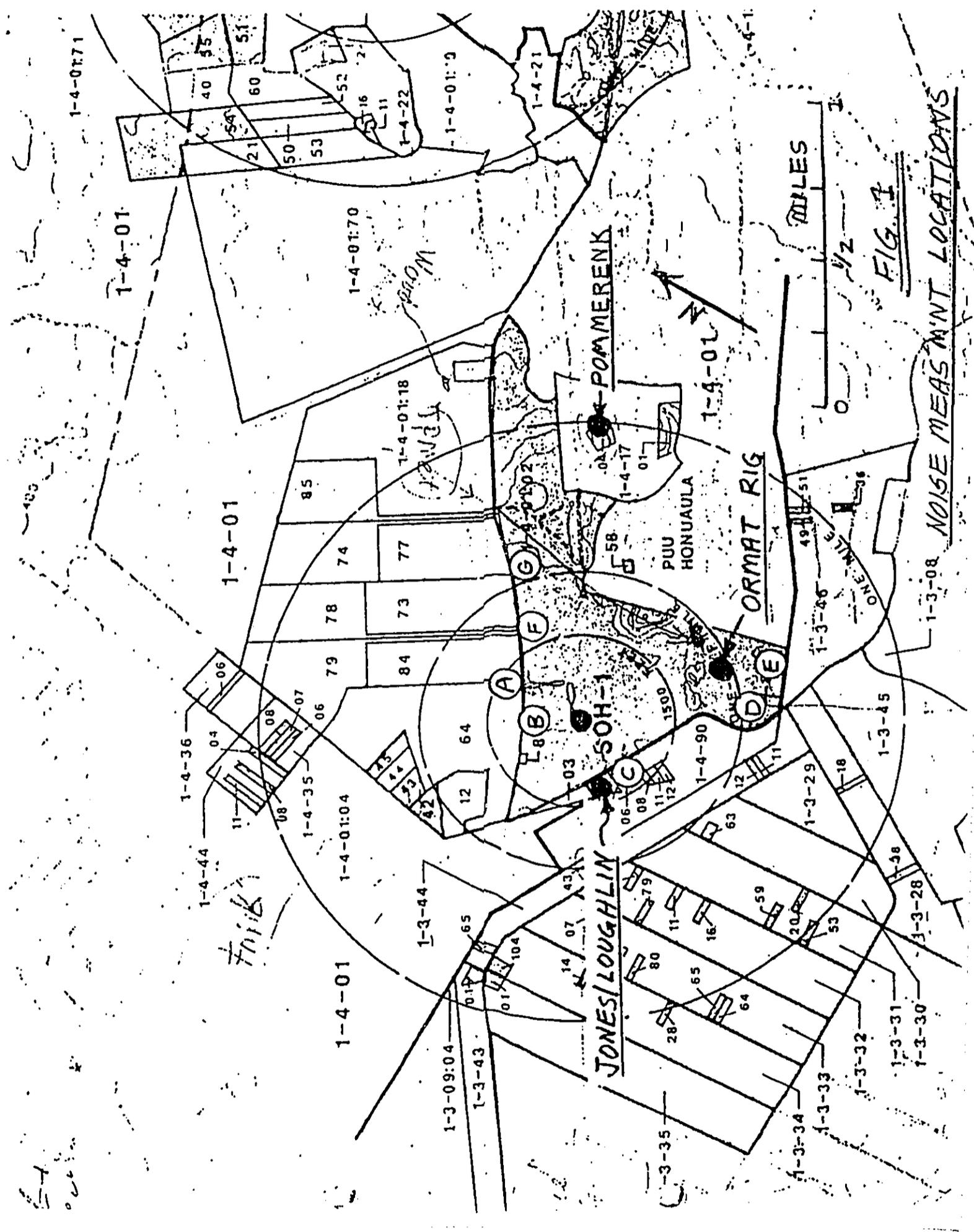


TABLE I - Summary of Noise Level Measurements Made on November 10, 1990
Along County Roads Near SOH #1 Geothermal Rig While Tripping Out

Location	Description	Time	Leq (2 min)	Lmax	Lmin	Comments
A	Main Entrance Road	0351	40.8	47.5	34.3	SOH sounds controlling.
B	CPA* to SOH #1	0417	41.1	45.9	30.3	SOH sounds controlling.
		055	42.0**	42.0	30.2	(See Figure 2)
C	Near Jones/Loughlin	0430	-	-	-	No rigs were audible.
D	HGPA Visitor Center	0437	39.8	52.2	35.0	ORMAT rig sounds audible.
E	CPA* to ORMAT Rig	0455	39.5	48.8	33.8	ORMAT rig sounds audible.
F	0.2 Miles from Main Entrance Road	0516	41.5	50.8	33.3	SOH slightly audible.
G	0.4 Miles from Main Entrance Road	0520	30.0	30.0	30.0	No rigs audible. Ocean surf sounds controlling.

*CPA - Closest Point of Approach

**L10 - The level exceeded 10% of the time as opposed to Leq (2 min) which is the energy average over 2 minutes.

AMBIENT NOISE SURVEY DATA SHEET

FIGURE 2

POSITION: _____
 ENGINEER: _____
 DAY OF WEEK: Sat DATE: 11/10/90 TIME: BEGIN 5:10^{am} FINISH: _____
 CAL: BEGIN 5:04 FINISH: _____

JOB NO. 89-10

NOTES AND SKETCH:
Pull-off to SOH #1
Trip out

RD Darby

SKY: Moon visible
 WIND: 0
 dBA L₁₀: _____
 LIMITS, dBA: _____

Location B

Total # Samples	Upper Limit	L ₁₀	Lower Limit
<u>50</u>	1st	5th	10th
100	5th	10th	17th
150	8th	15th	23rd
200	12th	20th	29th
250	16th	25th	35th
300	20th	30th	41st
350	25th	35th	47th

sample from the top

