MINUTE ITEM
This Calendar Item No. C66
was approved as Minute Item
No. 66 by the State Lands
Commission by a vote of 3
to 0 at its 7/6/95
meeting.

CALENDAR ITEM
C66

A 34

S 15

07/06/95
W 24777
S. Sekelsky
Frey

AUTHORIZE EXECUTION OF CONTRACTS TO PROVIDE SERVICES FOR AEOLIAN TRANSPORT STUDIES (WIND TUNNEL TESTING) TO MITIGATE DUST AT OWENS DRY LAKE

APPLICANT: (PARTIES)

Regents of the University of California
Department of Mechanical, Aeronautical and Natural Engineering
University of California
Davis, California 95616

Great Basin Unified Air Pollution Control Board
157 Short Street, Suite 6
Bishop, California 95514

AREA, TYPE LAND AND LOCATION:

Approximately 13,960 acres of State-owned sovereign lands in the dry bed of Owens Lake, Inyo County.

LAND USE:

Experimental mitigation and dust abatement program to limit particulate pollution from the dry bed of Owens Lake.

AB 884: N/A

OTHER PERTINENT INFORMATION:

1. At its May 5, 1992, meeting, the State Lands Commission (SLC) approved a General Permit - Public Agency Use, a Memorandum of Agreement, and Joint Powers Agreement with the Great Basin Unified Air Pollution Control Board (GBUAPCB) for experimental dust mitigation programs on Owens Dry Lake. The subject contracts between the SLC, GBUAPCB, and the University of California Regents (U.C. Davis) provide for the encumbering and transfer of monies to fund the dust mitigation program as outlined in the project description and the GBUAPCB approved budget.

2. At its October 5, 1994, meeting, the GBUAPCB agreed to fund additional aeolian transport studies, a component of the original approved experimental dust mitigation

program, in the amounts of $40,000.00 and $58,440.00. The new funding will allow for further laboratory wind tunnel testing at U.C. Davis using as prototypes, the existing sand fences located on Owens Dry Lake.

3. The Commission, at its May 5, 1992, meeting, also determined that the experimental program, as analyzed in EIR ND 587, State Clearinghouse #92032104 will not have a significant effect on the environment.

EXHIBITS:

A. Land Description
B. Location
C. Agreements

IT IS RECOMMENDED THAT THE COMMISSION:

1. FIND THAT ND 587 WAS ADOPTED BY THE COMMISSION ON MAY 5, 1992, FOR AN EXPERIMENTAL DUST MITIGATION PROGRAM AT OWENS DRY LAKE; THAT IT WAS DETERMINED THAT THE PROGRAM WOULD NOT HAVE A SIGNIFICANT EFFECT ON THE ENVIRONMENT; AND THAT SUCH DOCUMENT AND FINDING APPLY TO THE PROPOSED ACTIVITY.

2. AUTHORIZE THE EXECUTIVE OFFICER, OR HIS DESIGNEE, TO ENTER INTO AND EXECUTE CONTRACTS BETWEEN THE STATE LANDS COMMISSION, GREAT BASIN UNIFIED AIR POLLUTION CONTROL BOARD AND/OR REGENTS OF THE UNIVERSITY OF CALIFORNIA, DAVIS, IN SUBSTANTIALLY THE FORM AS EXHIBIT C ATTACHED HERETO.

EXHIBIT A

All that portion of the following described lands lying waterward of the U.S. meander line of Owens Lake, Inyo County.

T. 16 S., R. 36 E., M.D.B. & M.

Projected Sections 13, 23, 24, 25, 26, 35 & 36

T. 16 S., R. 37 E., M.D.B. & M.

Projected Sections 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35 & 36

T. 17 S. R. 37 E., M.D.B. & M.

Projected Sections 1, 2, 3, 4, 5, 6, 10, 11, 12, 13, 14, 15, 24, 25, 35 & 36

T. 17 S., R. 38 E., M.D.B. & M.

Projection Sections 4, 5, 6, 7, 8, 9, 15, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32 & 33

T. 18 S., R. 37 E., M.D.B. & M.

Projected Sections 1, 2, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, & 34

T. 18 S., R. 38 E., M.D.B. & M.

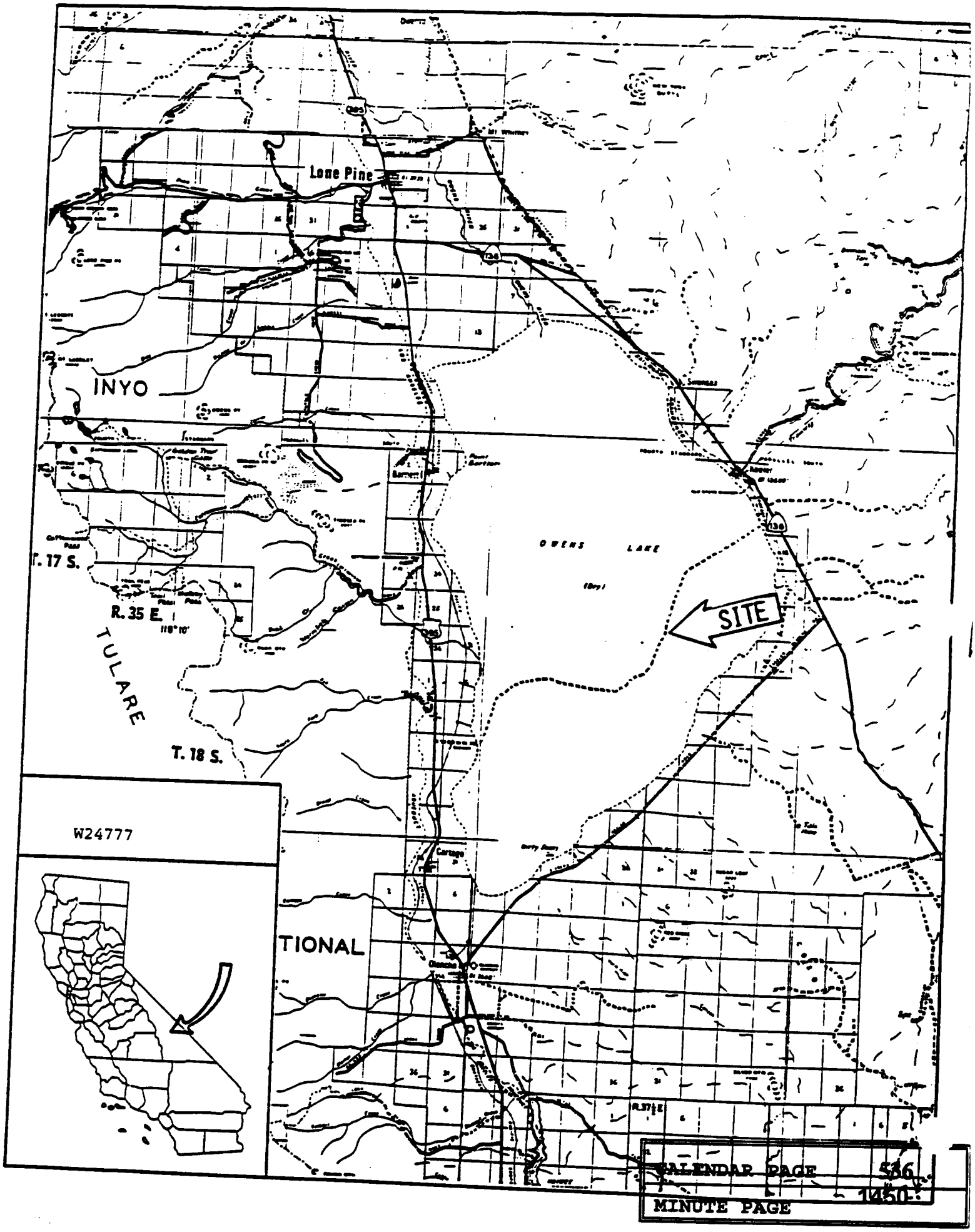
Projected Sections 5, 6, 7, 8, 18 & 19

T. 19 S., R. 37 E., M.D.B. & M.

Projected Sections 4, 5 & 6

Excepting all lands not under the jurisdiction of or presently under lease with State Lands Commission.

EXHIBIT B



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STATE OF CALIFORNIA

INTERAGENCY AGREEMENT

STD. 13 (REV. 9-89)

EXHIBIT C

NUMBER C9464

..IS AGREEMENT is entered into this 1st day of April, 19 95, by and between the undersigned State Agencies:

Set forth services, materials, or equipment to be furnished, or work to be performed, and by whom, time for performance including the terms, date of commencement and date of completion, and provision for payment per (1225 and 8752-8752.1 SAM.)

Distribution:
- Agency providing services
- Agency receiving services
- Department of General Services (unless exempt from DGS approval)
- Controller

I. The University of California hereby agrees to provide all personnel, labor, materials and equipment necessary to perform the work described in Attachments A and B to that certain contract entered into between the State Lands Commission and the Great Basin Unified Air Pollution Control District, dated April 1, 1995 and entitled "Joint Powers Agreement Between Great Basin Unified Air Pollution Control District and State of California, State Lands Commission For The Provision Of Wind-Tunnel Simulation Services." See Exhibit B.

II. The State Lands Commission agrees to compensate the University a total amount not to exceed $40,000 as consideration for the work performed and in accordance with the cost estimates contained in Exhibit B.

III. The following documents are hereby incorporated and made a part of this Agreement by reference:

A. Exhibit B - "Joint Powers Agreement Between Great Basin Unified Air Pollution Control District and State of California, State Lands Commission For The Provision Of Wind-Tunnel Simulation Services"

B. Exhibit A - Special Provisions.

(Continued on _____ sheets which are hereby attached and made a part hereof)

NAME OF STATE AGENCY RECEIVING SERVICES: State Lands Commission	NAME OF STATE AGENCY PROVIDING SERVICES
ALLED ABOVE (SHORT NAME)	CALLED ABOVE (SHORT NAME)
UTHORIZED SIGNATURE >	AUTHORIZED SIGNATURE ▷
RINTED NAME AND TITLE OF PERSON SIGNING: James F. Trout	PRINTED NAME AND TITLE OF PERSON SIGNING
UND NUMBER AND NAME	FUND NUMBER AND NAME

IOUNT ENCUMBERED BY THIS OCUMENT $ 40,000.00	PROGRAM/CATEGORY (CODE AND TITLE): Calstars Clearing Acct.		FUND TITLE: General		Department of General Services Use Only
IOR AMOUNT ENCUMBERED FOR IS CONTRACT $ 0	(OPTIONAL USE)				
TAL AMOUNT ENCUMBERED TO 40,000.00	ITEM: 3560-001-001	CHAPTER: 139	STATUTE: 1994	FISCAL YEAR: 94/95	
	OBJECT OF EXPENDITURE (CODE AND TITLE): I:4010: O:382 P10131 v:1011-02				

hereby certify upon my own personal knowledge that budgeted funds re available for the period and purpose of the expenditure stated above.

T.B.A. NO.	B.R. NO.	CALENDAR PAGE 537
NATURE OF ACCOUNTING OFFICER	DATE	MINUTE PAGE 1451

Exhibit A - Special Provisions
State Lands Commission - University Of California
Interagency Agreement

1. **Cost:** Upon completion of the work described in Exhibit B the State Lands Commission (Commission) shall pay the University of California (University) an amount equal to the University's cost of performance as computed in accordance with Section 8752 of the State Administrative Manual and in accordance with cost estimates as presented in Exhibit B, and in an amount not to exceed $40,000.

2. **Payments & Invoices:** Payment shall be made monthly upon receipt of an invoice and progress report in triplicate. With respect to the payment period completed, the invoice shall set forth in detail, in accordance with the contract budget, charges for direct costs and overhead costs, including employee fringe benefits; and an itemization of time expended, the classification of personnel involved in such time expenditure, and the salaries and wages for such personnel by monthly, weekly or hourly rates, as appropriate. The invoice shall also contain an itemization of all travel and all equipment purchased from any source with Commission funds, or procured from the State, including the type of equipment, serial number and cost. Any reimbursement for travel expenses incurred under this agreement shall not exceed the rates established by the State Department of Personnel Administration regulations for civil service employees. Nothing herein contained shall preclude advance payments pursuant to Article 1, Chapter 3, Part 1, Division 3, Title 2 of the Government Code.

3. **Audits:**

a. The University shall maintain books, records, documents, and other evidence pertaining to the reimbursable costs, and any matching costs and expenses, and hold them available for audit and inspection by the Auditor General or its successor agency or the Commission for a minimum of four (4) years.

b. The University grants the Commission, upon reasonable prior notice and identification of materials to be examined, permission to examine University records pertinent to direct costs payable under this Agreement solely for the purpose of determining that the direct costs are consistent with those identified in this Agreement.

4. **Retentions:** The Commission may withhold final payment of an amount not to exceed ten (10) percent of the total agreement cost until completion of all work and submission to the Commission of all reports required by the Agreement.

5. **Term & Time Of Performance:** Performance shall not commence until final approval of this Agreement by all necessary State agencies. This Agreement shall be effective from the last of the approval dates and shall remain in effect until June 30, 1994 unless it is terminated sooner under the provisions of this Agreement.

6. **Modification Of Work Program:** Funding for this Agreement comes from the Great Basin Unified Air Pollution Control District (Great Basin). In the event that funding from Great Basin is reduced or cancelled, the Commission reserves the right to modify the work program to reflect such reduction or cancellation of funding.

7. **Termination:**

(a) Each party shall have the right to terminate this Agreement at its sole discretion upon thirty (30) days written notice to the other party. In case of early termination by the Commission, a final payment shall be made to the University upon receipt of an invoice in triplicate and report in triplicate covering services to the termination date. Such payment shall be for all incurred costs including time expended, equipment purchased or utilized to termination at the actual rates incurred including proration of indirect costs. However, the total amount shall not exceed the total contract amount.

(b) Funding of this Agreement comes from the Great Basin In the event that funding from Great Basin fails, is reduced, or is modified, the Commission shall have the option to cancel, reduce, or modify the scope of work in this Agreement upon thirty (30) days written notice to the University.

8. **Information & Research Data:**

a. The University agrees to prepare and submit to the Commission the reports described in Exhibit B at the times designated in said Exhibit B. Copies of such reports shall be submitted to the Great Basin at the same time as those to the Commission.

b. The Commission shall have the right at reasonable times during the term of this Agreement to inspect and reproduce any written or printed matter developed under this Agreement by the University.

c. Any information or research data generated under this Agreement shall become the joint property of the University and the Commission.

d. The University shall be entitled to release or make available reports, informatin or other data prepared or assembled by it pursuant to this Agreement in scientific journals and other publications and at scientific meetings, provided however, that a copy of the publication shall be submitted to the Commission for review and comment forth-five (45) days prior to such publication. Further, the University shall place the following disclaimer statement in a conspicuous place in all such reports or publications:

> The opinions expressed in this publication represent those of the University of California and not necessarily those of the State Lands Commission for whom the work was originally done.

Nothing in this provision shall be construed to limit the right of the Commission to release information obtained from the University or to publish reports, information or data in Commission publications.

9. **Equipment:**

a. Excepting Dantec instruments and attachments, title to all personal property, fixtures and real property improvements purchased with funds under this Agreement shall be in the Commission unless released to the University.

b. The University shall maintain and administer, in accordance with sound administrative and industrial practice, a program for the utilization, maintenance, repair, protection and preservation of Commission equipment so as to assure its full availability and usefulness for the performance of this Agreement or as long as this equipment remains in the control or possession of the University.

c. The University shall provide, with the final invoice, a final equipment inventory to the Commission. Possession and control of personal property shall be delivered to the Commission within thirty (30) days of termination of this Agreement.

10. **Designation of Representatives:** The Commission and the University each hereby name a representative who shall represent it during the term of this Agreement. The Commission or the University may change its representative by notifying the other as provided for in Paragraph 11.

The Commission's representative for technical matters shall be:

Mr. Steve Sekelsky
State Lands Commission
1807 13th Street
Sacramento, CA 95814

The Commission's representative for contractual matters shall be:

Mr. David Brown
State Lands Commission
1807 13th Street
Sacramento, CA 95814

The University's representative for technical matters shall be:

Mr. Bruce R. White
Mechanical, Aeronautical and
Materials Engineering Department
Univeristy of California
Davis, CA 95616

The University's representative for contract matters shall be:

Ms. Louise Ivey
Office of Research
410 Mrak Hall
University of California, Davis
Davis, CA 95616

11. **Notice:** Any notice, communication, amendments, additions, or deletions to this Agreement, including change of address of either party during the term of this Agreement, which the Commission or the University shall be required or may desire to make shall be in writing and may be personally served or sent by prepaid first class mail to the respective parties as follows:

Commission: Owens Lake Project Coordinator
State Lands Commission
1807 13th Street
Sacramento, CA 95814

University: Ms. Louise Ivey
Office of Research
410 Mrak Hall
University of California
Davis, CA 95616

12. **Disputes:** Except as otherwise provided in this Agreement, any dispute concerning a question of fact arising under or relating to the performance of this Agreement which is not disposed of by agreement shall be decided by the Commission's representative, who shall reduce his decision to writing and shall transmit a copy thereof to the University. The decision of the Commission's representative shall be deemed final and conclusive unless, within thirty (30) days from the date of receipt of such copy, the University transmits to the Commission a written appeal. Said appeal shall be supported with specificity. In connection with any appeal proceeding under this clause, the University shall be afforded an opportunity to be heard before the State Lands Commission and to offer evidence in support of its appeal. Pending the final resolution of any such dispute, the University shall proceed diligently with the performance of this Agreement and in accordance with the written decision of the Commission's representative which is the subject of the University's appeal.

IV. In the event of an inconsistency in this Agreementm, the inconsistency shall be resolved by giving precedence in the following order:

A: Interagency Agreement/Form 13.

B: Exhibit A.

C: Exhibit B.

JOINT POWERS AGREEMENT BETWEEN GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT AND STATE OF CALIFORNIA, STATE LANDS COMMISSION FOR THE PROVISION OF WIND-TUNNEL SIMULATION SERVICES

INTRODUCTION

WHEREAS, the Great Basin Unified Air Pollution Control District (hereinafter referred to as "District") has the need for the Research and Development services of the State of California State Lands Commission (hereinafter referred to as "State"), and in consideration of the mutual promises, covenants, terms, and conditions hereinafter contained, the parties hereby agree as follows:

TERMS AND CONDITIONS

1. **SCOPE OF WORK:**

The State shall furnish to the District, those services and work set forth in Attachment A, attached hereto and by reference incorporated herein.

Services and work provided by the State under this Agreement will be performed in a manner consistent with the requirements and standards established by applicable federal, state, and county laws, ordinances, regulations, and resolutions. Such laws, ordinances, regulations, and resolutions include, but are not limited to, those which are referred to in this Agreement.

2. **TERM:**

The term of this Agreement shall be from April 1, 1995 to May 31, 1996 unless sooner terminated as provided below.

3. **CONSIDERATION:**

A. **Compensation** - District shall pay State in accordance with the Schedule of Fees (set forth as Attachment B) for the services and work described in Attachment A which are performed by State.

B. **Travel and per diem** - Costs of all travel and per diem which State incurs in providing services and work under this agreement are included in the compensation to be paid to State in the Schedule of Fees (Attachment B). State will not be entitled to any additional compensation for travel expenses or per diem incurred by State in performing this Agreement.

C. **No additional consideration** - Except as expressly provided in this Agreement, State shall not be entitled to, nor receive, from District, any additional

consideration, compensation, salary, wages, or other type of remuneration for services rendered under this Agreement. Specifically, State shall not be entitled, by virtue of this Agreement, to consideration in the form of overtime, health insurance benefits, retirement benefits, disability retirement benefits, sick leave, vacation time, paid holidays, or other paid leaves of absence of any type or kind whatsoever.

D. **Limit upon amount payable under Agreement** - The total sum of all payments made by the District to State for services and work performed under this Agreement, shall not exceed **$40,000.00** (hereinafter referred to as "contract limit"). District expressly reserves the right to deny any payment or reimbursement requested by State for services or work performed which is in excess of the contract limit.

E. **Billing and payment** - Billing and Payment will be in accordance with the Schedule of Fees (set forth as Attachment B).

F. **Federal and State taxes** -

(1) District will not withhold any federal or state income taxes or social security from any payments made by District to State under the terms and conditions of this Agreement.

(2) District has no obligation to withhold any taxes or payments from sums paid by District to State under this Agreement. Payment of all taxes and other assessments on such sums is the sole responsibility of State. District has no responsibility or liability for payment of State's taxes or assessments.

4. **WORK SCHEDULE:**

State's obligation is to perform, in a timely manner, those services and work identified in Attachment A. State will coordinate with District to insure that all services and work will be performed within the time frame set forth by District.

5. **REQUIRED LICENSES, CERTIFICATES, AND PERMITS:**

State will be responsible for ensuring that any licenses, certificates, or permits required by the federal, state, county, or municipal governments for the services and work described in Attachment A, are procured and valid at the time State begins performance of this Agreement. Further, during the term of this Agreement, State must ensure that such licenses, certificates, and permits remain in full force and effect. Licenses, certificates, and permits may include, but are not limited to, driver's licenses, professional licenses or certificates, and business licenses. Such licenses, certificates, and permits will be procured and maintained in force at no expense to the District. State will provide District, upon beginning performance of this Agreement, with evidence of current and valid licenses, certificates and permits which are required to perform the services identified in

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Attachment A. Where there is a dispute between State and District as to what licenses, certificates, and permits are required to perform the services and work identified in Attachment A, District reserves the right to make such determinations for purposes of this Agreement.

6. **OFFICE SPACE, SUPPLIES, EQUIPMENT, ETC:**

State shall provide such office space, supplies, equipment, vehicles, reference materials, and telephone service as is necessary for State to provide the services identified in Attachment A to this Agreement. District is not obligated to reimburse or pay State, for any expense or cost incurred by State in procuring or maintaining such items. Responsibility for the costs and expenses incurred by State in providing and maintaining such items is the sole responsibility and obligation of State.

7. **DISTRICT PROPERTY:**

A. **Personal Property of District** - Any personal property such as, but not limited to, protective or safety devices, badges, identification cards, keys, etc. provided to State by District pursuant to this Agreement are, and at the termination of this Agreement remain, the sole and exclusive property of District. State will use reasonable care to protect, safeguard and maintain such items while they are in State's possession. State will be financially responsible for any loss or damage to such items, partial or total, which is the result of State's negligence.

B. **Products of State's Work and Services** - Any and all compositions, publications, plans, designs, specifications, blueprints, maps, formulas, processes, photographs, slides, video tapes, computer programs, computer disks, computer tapes, memory chips, soundtracks, audio recordings, films, audio-visual presentations, exhibits, reports, studies, works of art, inventions, patents, trademarks, copyrights, or intellectual properties of any kind which are created, produced, assembled, compiled by, or are the result, product, or manifestation of, State's services or work under this Agreement are, and at the termination of this Agreement remain, the sole and exclusive property of the State. However, State hereby grants to District an irrevocable non exclusive right to use any such products for any District purpose without payment of any further compensation or requirement of prior State approval.

8. **WORKERS' COMPENSATION:**

State shall provide worker's compensation coverage, in the legally required amount, for all State's employees utilized in providing work and services pursuant to this Agreement. By executing a copy of this Agreement, State acknowledges its obligations and responsibilities to its employees under the California Labor Code, and warrants that State has complied and will comply during the term of this Agreement with all provisions of the California Labor Code with regard to its employees. Further, State will ensure that any

contractor whom it engages to perform work or services under this Agreement will provide workers' compensation coverage for its employees.

9. **INSURANCE:**

A. **General Liability** - State shall procure, and maintain during the entire term of this Agreement, a policy of general liability insurance or a self insurance program which covers all the work and services to be performed by State under this Agreement. Such insurance policy or a self insurance program will have a per occurrence combined single limit coverage of not less than $6,000,000.00. Such policy or a self insurance program will not exclude or except from coverage any of the services and work required to be performed by State under this Agreement. Any policy of insurance will be issued by an insurer authorized to sell such insurance by the State of California, and having at least a "Best's" policyholder's rating of "A" or "A+." District will be named as "an additional named insured" on this policy. State will provide the District with evidence of a self insurance program or a copy of the policy and a certificate of insurance showing the District as "an additional named insured" and indicating that the policy will not be terminated, canceled, or modified without thirty (30) days written notice to the District.

B. **Business Auto** - If State utilizes a motor vehicle in performing any of the work or services identified in Attachment A (Scope of Work), State shall cover such vehicle operations by a self insurance program or procure and maintain in force throughout the duration of this Agreement, a business auto liability insurance policy with minimum coverage levels of $300,000.00 per occurrence, combined single limit for bodily injury liability and property damage liability. The coverage shall include all State owned vehicles and all hired and non-owned vehicles used in performing under this Agreement.

Evidence of a self insurance program or a certificate of insurance shall be provided to the District at least ten (10) days prior to the start of work under this Agreement. Any policy shall contain a provision prohibiting the cancellation or modification of said policy except upon thirty (30) days prior written notice to the District.

C. **Professional Liability** - If State or any of its employees is required to be professionally licensed or certified by any agency of the State of California in order to perform any of the work or services identified in Attachment A (Scope of Work), State shall cover such professional liability with a self insurance program or shall procure and maintain in force throughout the duration of this Agreement, a professional liability insurance policy with a minimum coverage level of $1,000,000.00. Evidence of the self insurance program or proof of such insurance shall be provided to District at least ten (10) days prior to the start of any work by State.

10. STATUS OF STATE:

All acts of State, its agents, officers, and employees, relating to the performance of this Agreement, shall be performed as independent contractors, and not as agents, officers, or employees of District. State, by virtue of this Agreement, has no authority to bind or incur any obligation on behalf of District. Except as expressly provided in Attachment A, State has no authority or responsibility to exercise any rights or power vested in the District. No agent, officer, or employee of the District is to be considered an employee of State. It is understood by both State and District that this Agreement shall not under any circumstances be construed or considered to create an employer-employee relationship. As an independent contractor:

A. State shall determine the method, details, and means of performing the work and services to be provided by State under this Agreement.

B. State shall be responsible to District only for the requirements and results specified in this Agreement, and except as expressly provided in this Agreement, shall not be subjected to District's control with respect to the physical action or activities of State in fulfillment of this Agreement.

C. State, its agents, officers, and employees are, and at all times during the term of this Agreement shall, represent and conduct themselves as independent contractors, and not as employees of District.

11. DEFENSE AND INDEMNIFICATION:

State shall defend, indemnify, and hold harmless District, its agents, officers, and employees from and against all claims, damages, losses, judgments, liabilities, expenses, and other costs, including litigation costs and attorney's fees, arising out of, resulting from, or in connection with, the performance of this Agreement by State, or State's agents, officers, or employees. State's obligation to defend, indemnify, and hold the District, its agents, officers, and employees harmless applies to any actual or alleged personal injury, death, or damage or destruction to tangible or intangible property, including the loss of use. State's obligation under this paragraph extends to any claim, damage, loss, liability, expense, or other costs which is caused in whole or in part by any act or omission of the State, its agents, employees, supplier, or any one directly or indirectly employed by any of them, or anyone for whose acts or omissions any of them may be liable.

State's obligation to defend, indemnify, and hold the District, its agents, officers, and employees harmless under the provisions of this paragraph is not limited to, or restricted by, any requirement in this Agreement for State to procure and maintain a self insurance program or a policy of insurance.

To the extent permitted by law, District shall defend, indemnify, and hold harmless State, its agents, officers, and employees from and against all claims, damages, losses,

judgments, liabilities, expenses, and other costs, including litigation costs and attorney's fees, arising out of, or resulting from, the active negligence, or wrongful acts of District, its officers, or employees.

12. **RECORDS AND AUDIT:**

A. **Records** - State shall prepare and maintain all records required by the various provisions of this Agreement, federal, state, and municipal law, ordinances, regulations, and directions. State shall maintain these records for a minimum of four (4) years from the termination or completion of this Agreement. State may fulfill its obligation to maintain records as required by this paragraph by substitute photographs, microphotographs, or other authentic reproduction of such records.

B. **Inspections and Audits** - Any authorized representative of District shall have access to any books, documents, papers, records, including, but not limited to, financial records of State, which District determines to be pertinent to this Agreement, for the purposes of making audit, evaluation, examination, excerpts, and transcripts during the period such records are to be maintained by State. Further, District has the right, at all reasonable times, to audit, inspect, or otherwise evaluate the work performed or being performed under this Agreement.

13. **NONDISCRIMINATION:**

During the performance of this Agreement, State, its agents, officers, and employees shall not unlawfully discriminate in violation of any federal, state, or local law, against any employee, or applicant for employment, or person receiving services under this Agreement, because of race, religion, color, national origin, ancestry, physical handicap, medication condition, marital status, age, or sex. State and its agents, officers, and employees shall comply with the provisions of the Fair Employment and Housing Act (Government Code section 12900, et seq.), and the applicable regulations promulgated thereunder in the California Code of Regulations. State shall also abide by the Federal Civil Rights Act of 1964 (P.L. 88-352) and all amendments thereto, and all administrative rules and regulations issued pursuant to said act.

14. **CANCELLATION:**

This Agreement may be canceled by District without cause, and at will, for any reason by giving to State thirty (30) days written notice of such intent to cancel. State may cancel this Agreement without cause, and at will, for any reason whatsoever by giving thirty (30) days written notice of such intent to cancel to District.

15. **ASSIGNMENT:**

State may subcontract this Agreement, or any part of it, with the express written consent of District. State shall not assign any monies due or to become due under this Agreement without the prior written consent of District.

16. **DEFAULT:**

If the State abandons the work, or fails to proceed with the work and services requested by District in a timely manner, or fails in any way as required to conduct the work and services as required by District, District may declare the State in default and terminate this Agreement upon five (5) days written notice to State. Upon such termination by default, District will pay to State all amounts owing to State for services and work satisfactorily performed to the date of termination.

17. **WAIVER OF DEFAULT:**

Waiver of any default by either party to this Agreement shall not be deemed to be waiver of any subsequent default. Waiver or breach of any provision of this Agreement shall not be deemed to be a waiver of any other or subsequent breach, and shall not be construed to be a modification of the terms of this Agreement unless this Agreement is modified as provided in paragraph twenty-four (24) below.

18. **CONFIDENTIALITY:**

State agrees to comply with the various provisions of the federal, state, and county laws, regulations, and ordinances providing that information and records kept, maintained, or accessible by State in the course of providing services and work under this Agreement, shall be privileged, restricted, or confidential. State agrees to keep confidential all such information and records. Disclosure of such confidential, privileged, or protected information shall be made by State only with the express written consent of the District.

19. **CONFLICTS:**

State agrees that it has no interest, and shall not acquire any interest, direct or indirect, which would conflict in any manner or degree with the performance of the work and services under this Agreement.

20. **SEVERABILITY:**

If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement, or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

21. **FUNDING LIMITATION:**

A. The ability of District to enter this Agreement is based upon available funding from various sources. In the event that such funding fails, is reduced, or is modified, from one or more sources, District has the option to cancel, reduce, or modify this Agreement, or any of its terms within ten (10) days of its notifying State of the cancellation, reduction, or modification of available funding. Any reduction or modification of this Agreement made

pursuant to this provision must comply with the requirements of paragraph 23 (Amendment).

B. This agreement shall not be effective until it has been approved by the Department of General Services.

22. **ATTORNEY'S FEES:**

If either of the parties hereto brings an action or proceeding against the other, including, but not limited to, an action to enforce or declare the cancellation, termination, or revision of the Agreement, the prevailing party in such action or proceeding shall be entitled to receive from the other party all reasonable attorney's fees and costs incurred in connection therewith.

23. **AMENDMENT:**

This Agreement may be modified, amended, changed, added to, or subtracted from, by the mutual consent of the parties hereto, if such amendment or change is in written form and executed with the same formalities as this Agreement, and attached to the original Agreement to maintain continuity.

24. **NOTICE:**

Any notice, communication, amendments, additions, or deletions to this Agreement, including change of address of either party during the terms of this Agreement, which State or District shall be required, or may desire, to make, shall be in writing and may be personally served, or sent by prepaid first class mail to, the respective parties as follows:

Great Basin Unified Air Pollution Control District
157 Short Street
Bishop, California 93514

State Lands Commission
1807 13th Street
Sacramento, California 95814

25. **DESIGNATION OF AGREEMENT REPRESENTATIVE:**

The Commission and District hereby name a representative who shall represent his or her agency regarding this Agreement. Each agency may change its representative by notifying the other agency as provided for in Paragraph 24.

COMMISSION'S REPRESENTATIVE SHALL BE:
Steve Sekelsky

DISTRICT'S REPRESENTATIVE SHALL BE:
Theodore D. Schade

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26. **ENTIRE AGREEMENT:**

This Agreement contains the entire agreement of the parties, and no representations, inducements, promises, or agreements otherwise between the parties not embodied herein or incorporated herein by reference, shall be of any force or effect. Further, no term or provision hereof may be changed, waived, discharged, or terminated, unless the same be in writing executed by the parties hereto. /////

IN WITNESS THEREOF, THE PARTIES HERETO HAVE SET THEIR HANDS AND SEALS THIS 5th DAY OF April, 19 95.

DISTRICT	STATE
By: Ellen Hardebeck	By: _____
Dated: April 5, 1995	Dated: _____

APPROVED AS TO FORM AND LEGALITY:

_____
District Counsel

9503162

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ATTACHMENT A

JOINT POWERS AGREEMENT BETWEEN GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT AND STATE OF CALIFORNIA, STATE LANDS COMMISSION FOR THE PROVISION OF WIND-TUNNEL SIMULATION SERVICES

TERM: From: April 1, 1995 To: May 31, 1996

SCOPE OF WORK

The tasks to be performed and the deliverables to be provided by the State are described below. A protocol for the proposed work dated December 1994 entitled "Protocol for Numerical Simulation of Particle Saltation (1995)" has been prepared by Bruce R. White and Hyon-Mann Greg Cho of the University of California, Davis. Said protocol is attached and shall herein be made part of this agreement.

Tasks

1. June 1, 1995 - September 1 1995 - Using the Davis Atmospheric Boundary Layer Wind Tunnel (ABLWT), identify the significant parameters influencing wind flow characteristics in the wake of sand fences and arrays, and develop empirical equations for the velocity profiles and surface shear stress behind the fences as a function of those parameters. Develop a numerical model that will predict sand transport rates and the sand collection efficiency of fences and fence arrays as a function of those parameters (tentatively identified as porosity, ratio of fence height to roughness height, orientation to wind direction, array spacing, gaps under fencing and gaps in the array, ratio of fence length to fence height, and amount of sand build-up on the fence).

2. September 1, 1995 - November 1, 1995 - Construct a simulation of the Davis Owens Lake sand fence array and a number of other array spacings and use the Davis ABLWT to produce wind-field parameters in and around the array. Use these parameters in the numerical model to compare model outputs of sand flux and dune shape with those measured in the field in order to validate the model.

3. November 1, 1995 - February 1, 1996 - Run the validated model for particle sizes and wind velocities characteristic of Owens Lake. Predict where dunes will form downwind of fences depending on parameters of fence and array design.

4. February 1, 1996 - April 1, 1996 - Use the model to predict sand transport rates and saltation suppression effectiveness for various fence and array design parameters. Optimize these parameters to minimize saltation and predict what the optimum effectiveness would be.

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Deliverables

By May 1, 1996 deliver to the District a final report which contains a) the optimum design of a single fence to minimize sand transport, an estimate of the sand transport reduction effectiveness of the design and a description of how the effectiveness of the fence varies as a function of the parameters listed in Task 1, b) the optimum design of an array of fences, the saltation reduction efficiency of that array, and a description of how the effectiveness of the array varies as a function of the parameters listed in Task 1, and c) a copy of the numerical model and source code on disk with instructions for use.

PROGRESS REPORTS

The term of the contract is 14 months, from April 1, 1995 to May 31, 1996. The State shall submit project progress reports that describe project activity a minimum of one report every three months (quarterly). The District may require the State to provide in-person verbal project progress reports at public meetings.

ATTACHMENT B

AGREEMENT BETWEEN
GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
AND STATE OF CALIFORNIA, STATE LANDS COMMISSION
FOR THE PROVISION OF
WIND-TUNNEL SIMULATION SERVICES

TERM: From: April 1, 1995 To: May 31, 1996

SCHEDULE OF FEES

Payment for work to be performed shall be on a lump sum basis. State shall submit to the District invoices for payment according to the schedule below. Upon timely receipt of the statement by the fifth day of the month, District shall make payment to the State by the last day of the month. **In no case shall the total amount payable to the State for the work performed under this agreement exceed $40,000.**

Payment #	Amount	Payable
1	$10,000.00	Upon execution of this Agreement by both the State and the District.
2	$30,000.00	Upon submittal of the final report described in Attachment A to the District and acceptance of said report in writing by the District.

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Protocol for Numerical Simulation of Particle Saltation (1995)

Prepared by

Bruce R. White
Hyon-Mann Greg Cho

Department of Mechanical and Aeronautical Engineering
University of California

December 94

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I. Introduction

The trajectories and movement of particle by an aeolian (wind blown) process is a complex phenomenon. The previous experimental and numerical simulations for both Earth and Martian atmospheres carried out by White (1974) and Iversen (1973), based on the classical work by Bagnold (1941), made possible the present formulation of the process. In this project, two-dimensional particle flow in a turbulent boundary layer without a viscous sublayer is to be calculated and applied to saltation transport around the Owens Lake sand fences.

The effect of lift force on the initiation of particle motion has long been known to have a significant role in the process. The lift force functions were developed from the analytical work of Saffman (1965) for a single particle in a simple flow. The lift functions are consequently modified by empirical factors to model wall physics and to match the limited experimental data available for Earth.

Once the equations of motion are established the particle flow problem can be numerically solved accurately if the flow field is known. Here, the results from wind-tunnel measurements will be scaled to field conditions and used in the calculations.

The path of the trajectory for a single particle will be calculated for sand fences that are superimposed on the Owens Lake turbulent boundary layer flow. Several solutions of the particle's motion will be calculated to construct the effect of the sand-fence parameters.

II. Problem Formulation and Review (June 95 - July 95)

As the flow of a gas over a surface of solid particle is increased from a slow speed there occurs a continuous particle movement which is caused by net summation of forces exerted on the particle by fluid flow. These saltating particles are subjected to three major forces: the weight of the particle which moves the particles down toward the surface; a lift force, which is predominant near the surface and moves the particle upward away from the surface and it is caused by the pressure distribution on an individual particle's surface; and. lastly the viscous flow resistance force or drag.

Less dominant forces such as the interparticle forces, the Magnus force, the apparent mass force will be neglected for the present case, since the effects of these forces are not great and have negligible affect on the calculation of particle pathlengths.

Assuming the particle is to be solid spherical shape of constant density, the drag and lift coefficients are formulated as follows:

Lift $$L = \frac{1}{8} C_L \pi \rho D_p^2 V_r^2$$

Drag $$D = \frac{1}{8} C_D \pi \rho D_p^2 V_r^2$$

The values of drag coefficient Cd are calculated empirically from the equations listed in Appendix A.

III. Numerical Method and Programming (August 95- September 95)

The equations of motion for particle motion will be solved by numerical computing techniques which employs the use of a scientific subroutine package called Node. The solution of the set of first-order differential equations with initial conditions will be obtained by using the predictor-corrector equations based on a Runge-Kutta solver. The solution techniques to the equations have wide range of stability. The necessary back points are initially calculated with the Runge-Kutta-Gill single-step method. The corrector procedure is not iterated. Node has the ability to automatically check the solution's accuracy at each step and change the step size to meet the specified accuracy of the user.

Particle trajectory calculations are initiated with a particle height of one-half diameter above the plane surface, which has been previously determined to be the most effective height of accurate numerical simulation (White, 1974).

A final output of the program, after the iteration criterion is met, will be a trajectory of a single particle of a given size and density under a specified friction velocity in the atmospheric boundary layer. This trajectory will provide a characteristic jump length or path length of particles being calculated.

IV. Comparison to Field Measurements (October 95 - November 95)

Using the wind direction distribution and dune formation data from the measurements at the Owens Lake, a comparison of numerically calculated results to field observed results will be made. Utilizing the data and the results of the numerical and experimental analysis, simulation of sand dune formation far downstream of the sand fence will be possible and it may be then compared with the existing dune formations on the Owens Lake far downstream of the existing sand fence.

To obtain velocities and friction predictions with the same conditions as the full-scale measurements around dune, it will be necessary to account for the effect of a multiple fence array and the intermediate-stage fence flow (see Fig. 1 and Fig. 2). The wind-tunnel measurements will be performed for the same fields conditions such that the numerical solutions may be combined with the wind-tunnel data to construct comparable cases and results with the field data.

V. Performance of the Program (December 95- February 96)

A number of different particle sizes to be calculated will be chosen from the particle size distributions obtained from the Owens Lake playa. Separately, a wide range of wind velocities will be calculated to account for the variable Owens Lake wind.

The full-scale wind data also will be combined into the program to construct ideal dune formations far downstream as computer outputs under the assumed conditions. However, an attempt to construct an ideal dune formation with the computational and experimental results alone would result in for a static solution and only be partially compatible in the field case, since the dune formation from computational/wind-tunnel results represents only instant in time; whereas the dune formation in field is dynamic and thus continuously changing.

VI. Data Analysis and Applications on the Sand-fence Measurements (March 96 - April 96)

Using the particle size distributions taken from Owens Lake, the results from the computer calculations will provide the jump lengths of particles at the positions where the friction velocity were determined via physical modeling techniques. These jump lengths will be subjected to the comparison/confirmation with the jump length obtained from an analytical approach.

The non-dimensional jump lengths as a function of downstream position of the sand fence normalized with the jump length at undisturbed condition will show the effects of the sand fence parameters. Thus, it will be possible to analytically optimize the "best" sand fence array for suppressing saltation and thus dust production. The normalized sand transport rate also will be calculated from the analytical approach.

Comprehensive solutions of the computer program over the range of Owens Lake particle sizes and friction velocities will be basis for analysis to validate the wind-tunnel measurements and the construction of the dune formation geometry far downstream of the sand fences for the specified input conditions.

The solutions of the multiple fence array case also will be analyzed to identify influencing parameters (i.e., interdistance between fences) for optimum design of multiple array and will be compared with full-scale dune in terms of the parameters identified.

The results of the sand fence measurements in the wind tunnel (the previous first year phase) and the numerical solutions (the second year phase), will complete small-scale analysis for the design of sand fence array. A future project which was previously proposed as the third phase of the Owens Lake sand fence simulation will involve the large-scale wind tunnel measurements, which will require a topological wind-tunnel model of the Owens Lake for optimum design of large-scale sand fence array or arrays.

VII. Summary and Final Report (May 96)

Combining the numerical modeling of the Owens Lake particle movement and the physical modeling of sand fence flow together with the existing field measurements data. specific recommendations for the design of the optimum sand fence and sand fence array, or arrays will be given in the final report.

A detailed review of sand fence research will ensure the present techniques for this project will utilize the most published results available. The comprehensive wind-tunnel measurements and analysis will identify significant parameters influencing the wind flow characteristics in the wake of sand fences and thus will quantify these influence of the parameters on the wake flow. An numerical modeling of particle dynamics will confirm the validity of an analytical transport model, which will use the wind-tunnel data. The transport model will predict sand transport rate and determine the effectiveness of sand fence design parameters and sand fence array, or arrays in terms of amount of sand movement as a function of the individual parameters.

The multiple sand fence array and intermediate-stage fence flow will be tested in the wind tunnel and accounted for the analysis for the predictions of the sand transport.

Fig. 1 A Schematic Diagram for the Analysis of the Interspace (Distance Between Fences)

It is proposed to construct sand fences of 50% porosity, each with 33% bottom gap fences with a scaled height of 6 cm as illustrated below for testing in the wind tunnel in support of numerical particle solutions proposed.. For the evaluation of interspace between fences, set measurements that span 110 fence heights (scaled length of 660 cm of full-scale length of 660 feet) in which the velocities can be measured for direct comparison to the existing field fence array (Fig. 1.1).

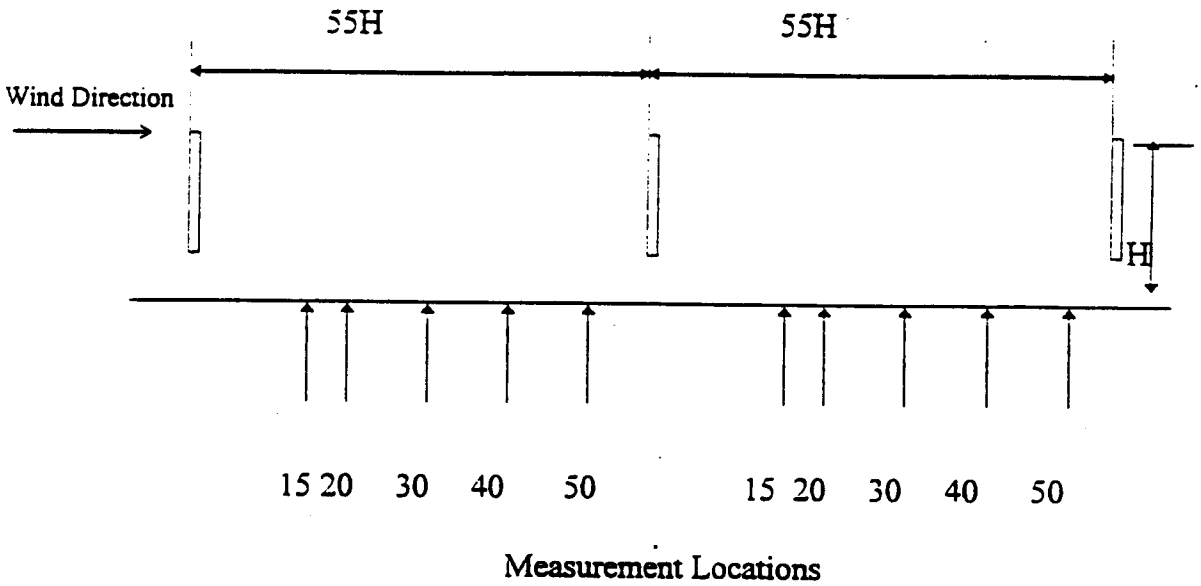

Fig. 1.1 The interspace of 55H

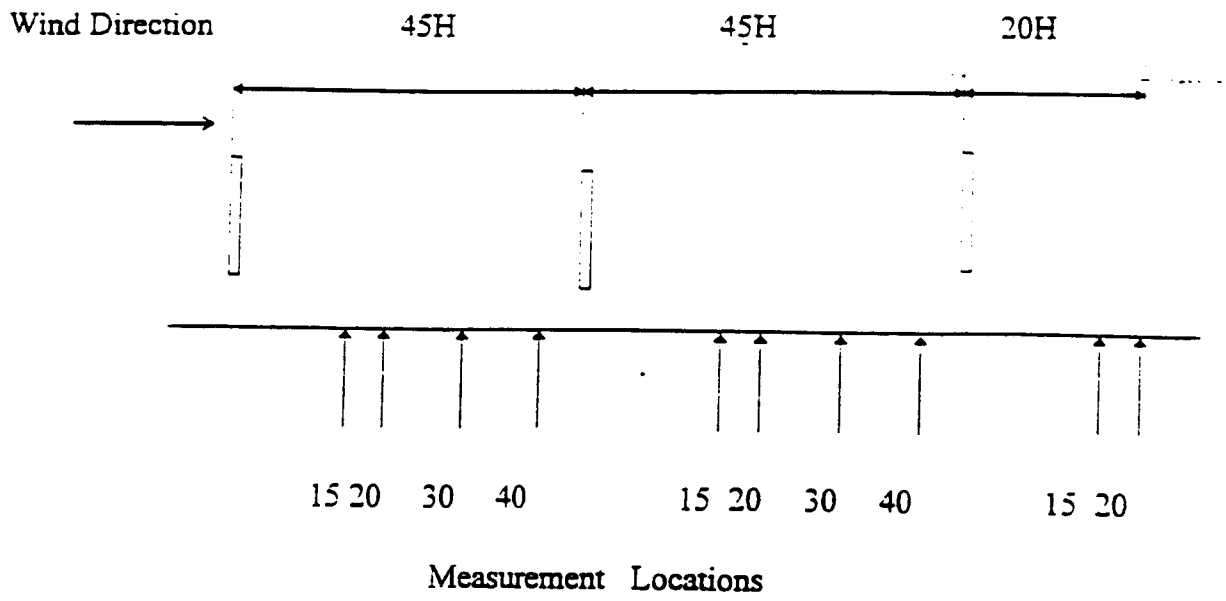

Fig. 1.2 The interspace of 45H

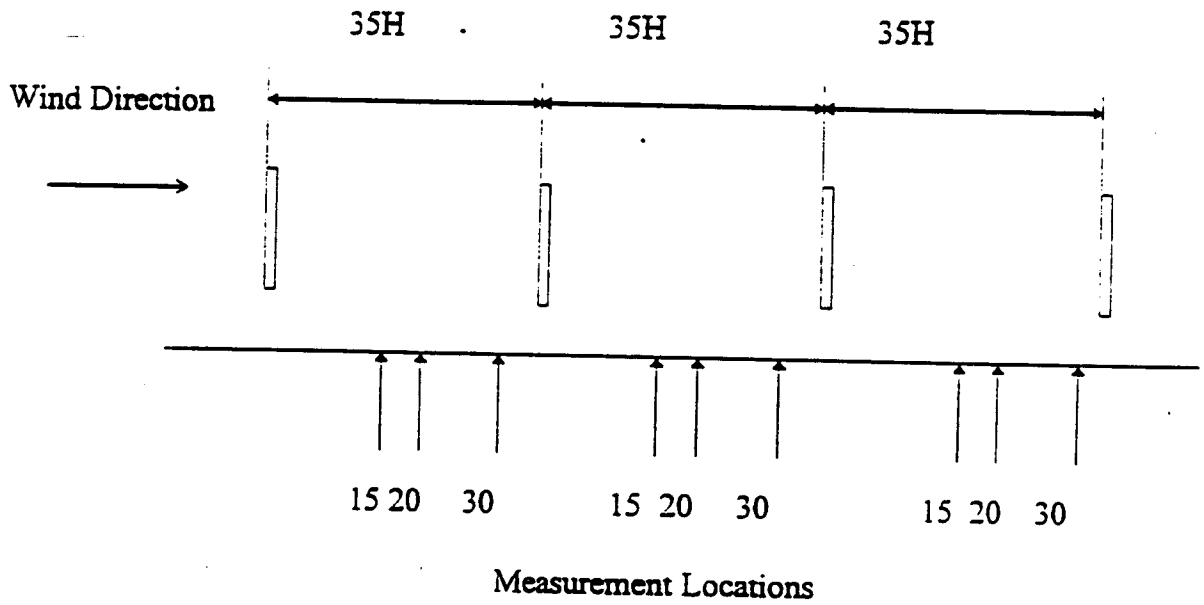

Fig. 1.3 The interspace of 35H

Fig. 2 A Schematic Diagram for the Analysis of the Intermediate-stage Sand Fence Flow

For the evaluation of the efficiency changes due to the intermediate stage. three intermediate-stage sand fences of 50% porosity, and 33% bottom gap with height 10 cm has been constructed and tested for use in the numerical solutions.

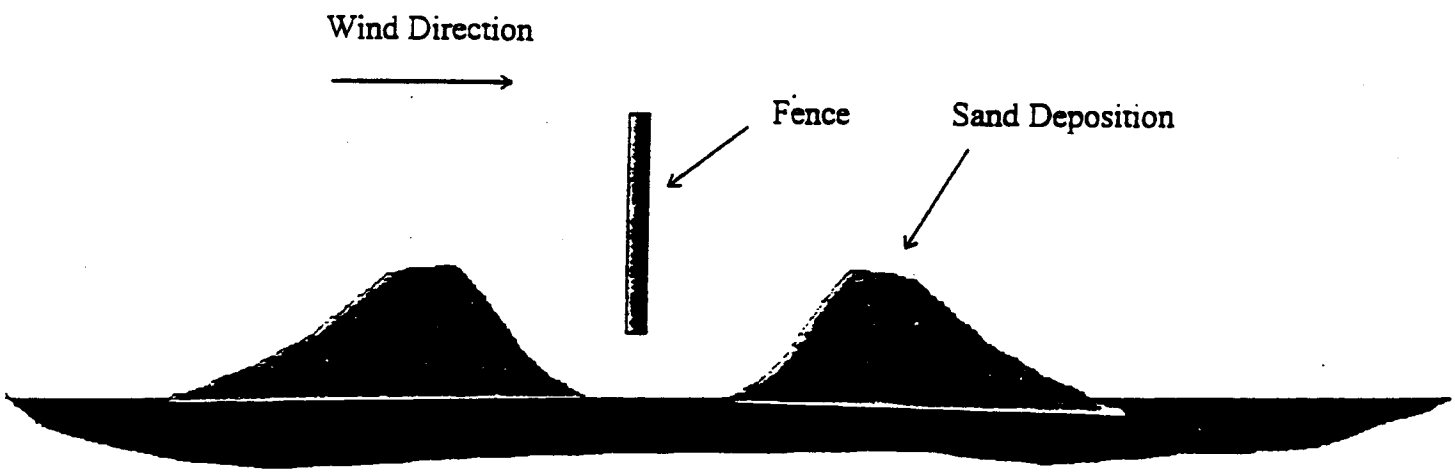

Fig. 2.1 The initial stage:

1) Sand dune build-up based on the sand dune measurement for UC Davis fence placed in the field in December 1993 (field data)

2) Measurements of the downstream (15H, 20H, 30H, 40H, 50H) positions

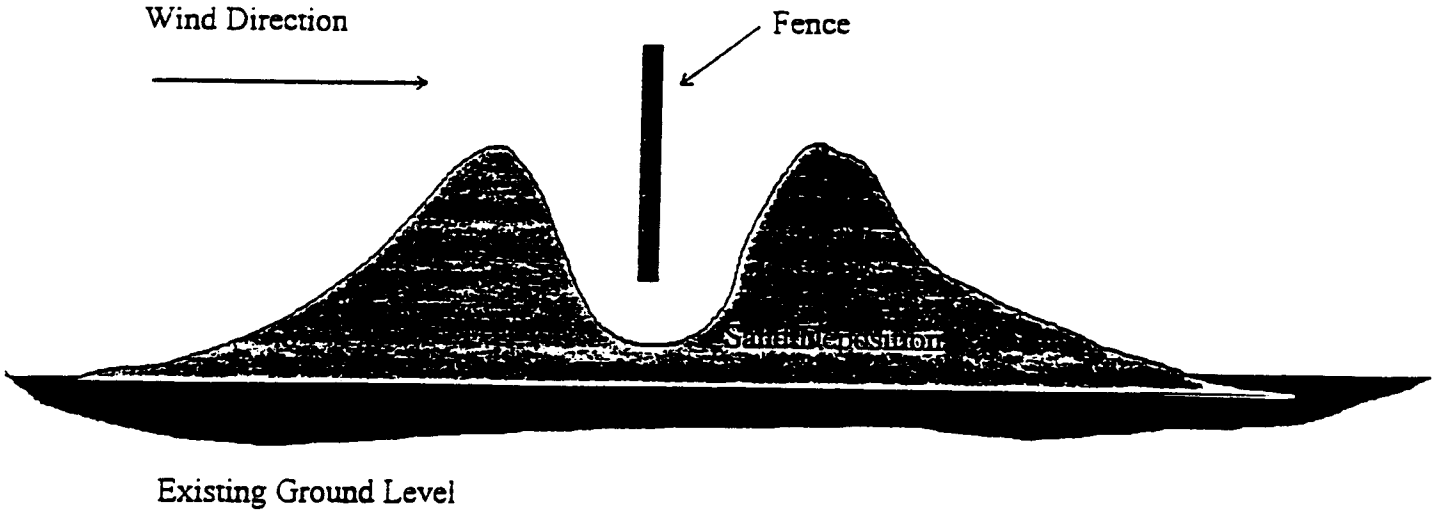

Fig.2.2 The Second Stage:

1) Sand dune build-up based on the sand dune measurement on April 1994

2) Measurements of the downstream (15H, 20H, 30H, 40H, 50H) positions

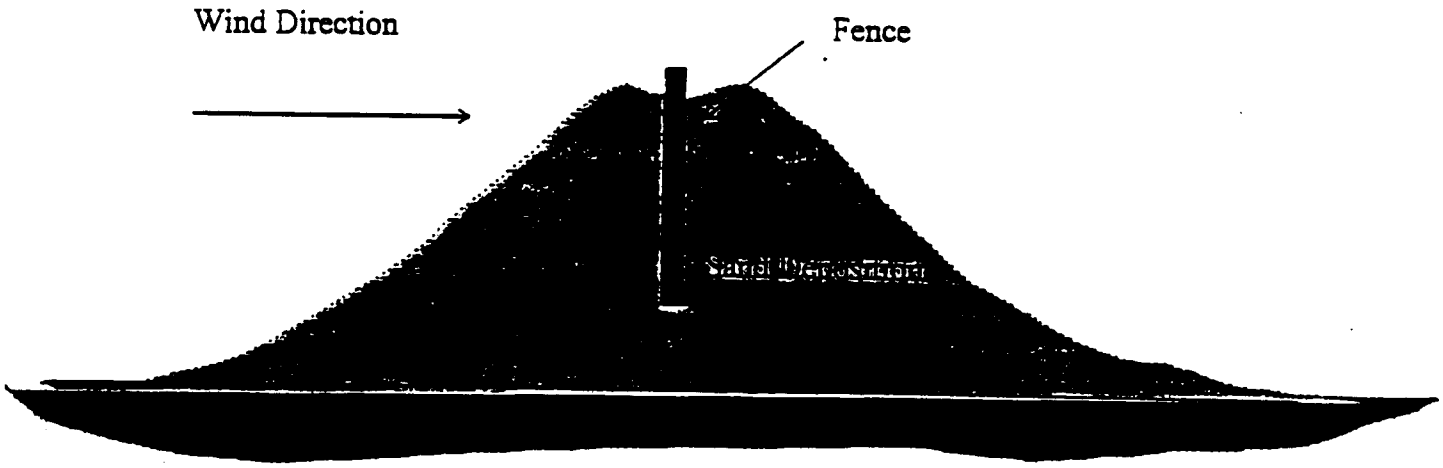

Fig.2.3 The Final Stage:

1) Sand dune build-up based on the sand dune measurement in the Owens Lake in the future(by Great Basin Air Quality Control District or Cahill's Group); otherwise, a general type of dune field will be constructed.

2) Measurements on the downstream (15H, 20H, 30H, 40H, 50H) positions

INTERAGENCY AGREEMEN.

STD. 13 (REV. 9-89)

NUMBER C9165

` AGREEMENT is entered into this 1st day of April, 19 95,
.nd between the undersigned State Agencies:

Set forth services, materials, or equipment to be furnished, or work to be performed, and by whom, time for performance including the terms, date of commencement and date of completion, and provision for payment per (1225 and 8752-8752.1 SAM.)

Distribution:
- [ ] Agency providing services
- [ ] Agency receiving services
- [ ] Department of General Services (unless exempt from DGS approval)
- [ ] Controller

I. The University of California hereby agrees to provide all personnel, labor, materials and equipment necessary to perform the work described in Attachments A and B to that certain contract entered into between the State Lands Commission and the Great Basin Unified Air Pollution Control District, dated February 2, 1995 entitled "Joint Powers Agreement Between Great Basin Unified Air Pollution Control District and State of California, State Lands Commission For The Provision Of Wind-Tunnel Simulation Services." See Exhibit B.

II. The State Lands Commission agrees to compensate the University a total amount not to exceed $58,440 as consideration for the work performed and in accordance with the cost estimates contained in Exhibit B.

III. The following documents are hereby incorporated and made a part of this Agreement by reference:

A. Exhibit B - "Joint Powers Agreement Between Great Basin Unified Air Pollution Control District and State of California, State Lands Commission For The Provision Of Wind-Tunnel Simulation Services"

B. Exhibit A - Special Provisions.

Continued on _____ sheets which are hereby attached and made a part hereof)

AME OF STATE AGENCY RECEIVING SERVICES: State Lands Commission	NAME OF STATE AGENCY PROVIDING SERVICES
ALLED ABOVE (SHORT NAME)	CALLED ABOVE (SHORT NAME)
UTHORIZED SIGNATURE >	AUTHORIZED SIGNATURE ▷
INTED NAME AND TITLE OF PERSON SIGNING: James F. Trout	PRINTED NAME AND TITLE OF PERSON SIGNING
ND NUMBER AND NAME	FUND NUMBER AND NAME

OUNT ENCUMBERED BY THIS CUMENT: $ 58,440.00	PROGRAM/CATEGORY (CODE AND TITLE): Calstars Clearing Acct.		FUND TITLE: General		Department of General Services Use Only
OR AMOUNT ENCUMBERED FOR S CONTRACT: $ 0	(OPTIONAL USE)				
AL AMOUNT ENCUMBERED TO E: 58,440.00	ITEM: 3560-001-001	CHAPTER: 139	STATUTE: 1994	FISCAL YEAR: 94/95	
	OBJECT OF EXPENDITURE (CODE AND TITLE): I:4010: O:382 P10131 v:1011-02				

by certify upon my own personal knowledge that budgeted funds re available for the period and purpose of the expenditure stated above.

T.B.A. NO.	B.R. NO.	
NATURE OF ACCOUNTING OFFICER	DATE	

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Exhibit A - Special Provisions
State Lands Commission - University Of California
Interagency Agreement

1. **Cost:** Upon completion of the work described in Exhibit B the State Lands Commission (Commission) shall pay the University of California (University) an amount equal to the University's cost of performance as computed in accordance with Section 8752 of the State Administrative Manual and in accordance with cost estimates as presented in Exhibit B, and in an amount not to exceed $58,440.00.

2. **Payments & Invoices:** Payment shall be made monthly upon receipt of an invoice and progress report in triplicate. With respect to the payment period completed, the invoice shall set forth in detail, in accordance with the contract budget, charges for direct costs and overhead costs, including employee fringe benefits; and an itemization of time expended, the classification of personnel involved in such time expenditure, and the salaries and wages for such personnel by monthly, weekly or hourly rates, as appropriate. The invoice shall also contain an itemization of all travel and all equipment purchased from any source with Commission funds, or procured from the State, including the type of equipment, serial number and cost. Any reimbursement for travel expenses incurred under this agreement shall not exceed the rates established by the State Department of Personnel Administration regulations for civil service employees. Nothing herein contained shall preclude advance payments pursuant to Article 1, Chapter 3, Part 1, Division 3, Title 2 of the Government Code.

3. **Audits:**

a. The University shall maintain books, records, documents, and other evidence pertaining to the reimbursable costs, and any matching costs and expenses, and hold them available for audit and inspection by the Auditor General or its successor agency or the Commission for a minimum of four (4) years.

b. The University grants the Commission, upon reasonable prior notice and identification of materials to be examined, permission to examine University records pertinent to direct costs payable under this Agreement solely for the purpose of determining that the direct costs are consistent with those identified in this Agreement.

4. **Retentions:** The Commission may withhold final payment of an amount not to exceed ten (10) percent of the total agreement cost until completion of all work and submission to the Commission of all reports required by the Agreement.

5. **Term & Time Of Performance:** Performance shall not commence until final approval of this Agreement by all necessary State agencies. This Agreement shall be effective from the last of the approval dates and shall remain in effect until June 30, 1994 unless it is terminated sooner under the provisions of this Agreement.

6. **Modification Of Work Program:** Funding for this Agreement comes from the Great Basin Unified Air Pollution Control District (Great Basin). In the event that funding from Great Basin is reduced or cancelled, the Commission reserves the right to modify the work program to reflect such reduction or cancellation of funding.

7. **Termination:**

(a) Each party shall have the right to terminate this Agreement at its sole discretion upon thirty (30) days written notice to the other party. In case of early termination by the Commission, a final payment shall be made to the University upon receipt of an invoice in triplicate and report in triplicate covering services to the termination date. Such payment shall be for all incurred costs including time expended, equipment purchased or utilized to termination at the actual rates incurred including proration of indirect costs. However, the total amount shall not exceed the total contract amount.

(b) Funding of this Agreement comes from the Great Basin In the event that funding from Great Basin fails, is reduced, or is modified, the Commission shall have the option to cancel, reduce, or modify the scope of work in this Agreement upon thirty (30) days written notice to the University.

8. **Information & Research Data:**

a. The University agrees to prepare and submit to the Commission the reports described in Exhibit B at the times designated in said Exhibit B. Copies of such reports shall be submitted to the Great Basin at the same time as those to the Commission.

b. The Commission shall have the right at reasonable times during the term of this Agreement to inspect and reproduce any written or printed matter developed under this Agreement by the University.

c. Any information or research data generated under this Agreement shall become the joint property of the University and the Commission.

d. The University shall be entitled to release or make available reports, informatin or other data prepared or assembled by it pursuant to this Agreement in scientific journals and other publications and at scientific meetings, provided however, that a copy of the publication shall be submitted to the Commission for review and comment forth-five (45) days prior to such publication. Further, the University shall place the following disclaimer statement in a conspicuous place in all such reports or publications:

> The opinions expressed in this publication represent those of the University of California and not necessarily those of the State Lands Commission for whom the work was originally done.

Nothing in this provision shall be construed to limit the right of the Commission to release information obtained from the University or to publish reports, information or data in Commission publications.

9. **Equipment:**

a. Excepting Dantec instruments and attachments, title to all personal property, fixtures and real property improvements purchased with funds under this Agreement shall be in the Commission unless released to the University.

b. The University shall maintain and administer, in accordance with sound administrative and industrial practice, a program for the utilization, maintenance, repair, protection and preservation of Commission equipment so as to assure its full availability and usefulness for the performance of this Agreement or as long as this equipment remains in the control or possession of the University.

c. The University shall provide, with the final invoice, a final equipment inventory to the Commission. Possession and control of personal property shall be delivered to the Commission within thirty (30) days of termination of this Agreement.

10. **Designation of Representatives:** The Commission and the University each hereby name a representative who shall represent it during the term of this Agreement. The Commission or the University may change its representative by notifying the other as provided for in Paragraph 11.

The Commission's representative for technical matters shall be:

Mr. Steve Sekelsky
State Lands Commission
1807 13th Street
Sacramento, CA 95814

The Commission's representative for contractual matters shall be:

Mr. David Brown
State Lands Commission
1807 13th Street
Sacramento, CA 95814

The University's representative for technical matters shall be:

Mr. Bruce R. White
Mechanical, Aeronautical and
Materials Engineering Department
Univeristy of California
Davis, CA 95616

The University's representative for contract matters shall be:

Ms. Louise Ivey
Office of Research
410 Mrak Hall
University of California, Davis
Davis, CA 95616

11. **Notice:** Any notice, communication, amendments, additions, or deletions to this Agreement, including change of address of either party during the term of this Agreement, which the Commission or the University shall be required or may desire to make shall be in writing and may be personally served or sent by prepaid first class mail to the respective parties as follows:

Commission: Owens Lake Project Coordinator
State Lands Commission
1807 13th Street
Sacramento, CA 95814

University: Ms. Louise Ivey
Office of Research
410 Mrak Hall
University of California
Davis, CA 95616

12. **Disputes:** Except as otherwise provided in this Agreement, any dispute concerning a question of fact arising under or relating to the performance of this Agreement which is not disposed of by agreement shall be decided by the Commission's representative, who shall reduce his decision to writing and shall transmit a copy thereof to the University. The decision of the Commission's representative shall be deemed final and conclusive unless, within thirty (30) days from the date of receipt of such copy, the University transmits to the Commission a written appeal. Said appeal shall be supported with specificity. In connection with any appeal proceeding under this clause, the University shall be afforded an opportunity to be heard before the State Lands Commission and to offer evidence in support of its appeal. Pending the final resolution of any such dispute, the University shall proceed diligently with the performance of this Agreement and in accordance with the written decision of the Commission's representative which is the subject of the University's appeal.

IV. In the event of an inconsistency in this Agreementm, the inconsistency shall be resolved by giving precedence in the following order:

A: Interagency Agreement/Form 13.

B: Exhibit A.

C: Exhibit B.

JOINT POWERS AGREEMENT BETWEEN GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT AND STATE OF CALIFORNIA, STATE LANDS COMMISSION FOR THE PROVISION OF WIND-TUNNEL SIMULATION SERVICES

INTRODUCTION

WHEREAS, the Great Basin Unified Air Pollution Control District (hereinafter referred to as "District") has the need for the Research and Development services of the State of California State Lands Commission (hereinafter referred to as "State"), and in consideration of the mutual promises, covenants, terms, and conditions hereinafter contained, the parties hereby agree as follows:

TERMS AND CONDITIONS

1. **SCOPE OF WORK:**

The State shall furnish to the District, those services and work set forth in Attachment A, attached hereto and by reference incorporated herein.

Services and work provided by the State under this Agreement will be performed in a manner consistent with the requirements and standards established by applicable federal, state, and county laws, ordinances, regulations, and resolutions. Such laws, ordinances, regulations, and resolutions include, but are not limited to, those which are referred to in this Agreement.

2. **TERM:**

The term of this Agreement shall be from Feb. 2, 1995 to May 31, 1996 unless sooner terminated as provided below.

3. **CONSIDERATION:**

A. **Compensation** - District shall pay State in accordance with the Schedule of Fees (set forth as Attachment B) for the services and work described in Attachment A which are performed by State.

B. **Travel and per diem** - Costs of all travel and per diem which State incurs in providing services and work under this agreement are included in the compensation to be paid to State in the Schedule of Fees (Attachment B). State will not be entitled to any additional compensation for travel expenses or per diem incurred by State in performing this Agreement.

C. **No additional consideration** - Except as expressly provided in this Agreement, State shall not be entitled to, nor receive, from District, any additional

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consideration, compensation, salary, wages, or other type of remuneration for services rendered under this Agreement. Specifically, State shall not be entitled, by virtue of this Agreement, to consideration in the form of overtime, health insurance benefits, retirement benefits, disability retirement benefits, sick leave, vacation time, paid holidays, or other paid leaves of absence of any type or kind whatsoever.

D. **Limit upon amount payable under Agreement** - The total sum of all payments made by the District to State for services and work performed under this Agreement, shall not exceed 58,440 (hereinafter referred to as "contract limit"). District expressly reserves the right to deny any payment or reimbursement requested by State for services or work performed which is in excess of the contract limit.

E. **Billing and payment** - Billing and Payment will be in accordance with the Schedule of Fees (set forth as Attachment B).

F. **Federal and State taxes** -

(1) District will not withhold any federal or state income taxes or social security from any payments made by District to State under the terms and conditions of this Agreement.

(2) District has no obligation to withhold any taxes or payments from sums paid by District to State under this Agreement. Payment of all taxes and other assessments on such sums is the sole responsibility of State. District has no responsibility or liability for payment of State's taxes or assessments.

4. **WORK SCHEDULE:**

State's obligation is to perform, in a timely manner, those services and work identified in Attachment A. State will coordinate with District to insure that all services and work will be performed within the time frame set forth by District.

5. **REQUIRED LICENSES, CERTIFICATES, AND PERMITS:**

State will be responsible for ensuring that any licenses, certificates, or permits required by the federal, state, county, or municipal governments for the services and work described in Attachment A, are procured and valid at the time State begins performance of this Agreement. Further, during the term of this Agreement, State must ensure that such licenses, certificates, and permits remain in full force and effect. Licenses, certificates, and permits may include, but are not limited to, driver's licenses, professional licenses or certificates, and business licenses. Such licenses, certificates, and permits will be procured and maintained in force at no expense to the District. State will provide District, upon beginning performance of this Agreement, with evidence of current and valid licenses, certificates and permits which are required to perform the services identified in

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Attachment A. Where there is a dispute between State and District as to what licenses, certificates, and permits are required to perform the services and work identified in Attachment A, District reserves the right to make such determinations for purposes of this Agreement.

6. **OFFICE SPACE, SUPPLIES, EQUIPMENT, ETC:**

State shall provide such office space, supplies, equipment, vehicles, reference materials, and telephone service as is necessary for State to provide the services identified in Attachment A to this Agreement. District is not obligated to reimburse or pay State, for any expense or cost incurred by State in procuring or maintaining such items. Responsibility for the costs and expenses incurred by State in providing and maintaining such items is the sole responsibility and obligation of State.

7. **DISTRICT PROPERTY:**

A. **Personal Property of District** - Any personal property such as, but not limited to, protective or safety devices, badges, identification cards, keys, etc. provided to State by District pursuant to this Agreement are, and at the termination of this Agreement remain, the sole and exclusive property of District. State will use reasonable care to protect, safeguard and maintain such items while they are in State's possession. State will be financially responsible for any loss or damage to such items, partial or total, which is the result of State's negligence.

B. **Products of State's Work and Services** - Any and all compositions, publications, plans, designs, specifications, blueprints, maps, formulas, processes, photographs, slides, video tapes, computer programs, computer disks, computer tapes, memory chips, soundtracks, audio recordings, films, audio-visual presentations, exhibits, reports, studies, works of art, inventions, patents, trademarks, copyrights, or intellectual properties of any kind which are created, produced, assembled, compiled by, or are the result, product, or manifestation of, State's services or work under this Agreement are, and at the termination of this Agreement remain, the sole and exclusive property of the State. However, State hereby grants to District an irrevocable non exclusive right to use any such products for any District purpose without payment of any further compensation or requirement of prior State approval.

8. **WORKERS' COMPENSATION:**

State shall provide worker's compensation coverage, in the legally required amount, for all State's employees utilized in providing work and services pursuant to this Agreement. By executing a copy of this Agreement, State acknowledges its obligations and responsibilities to its employees under the California Labor Code, and warrants that State has complied and will comply during the term of this Agreement with all provisions of the California Labor Code with regard to its employees. Further, State will ensure that any

contractor whom it engages to perform work or services under this Agreement will provide workers' compensation coverage for its employees.

9. **INSURANCE:**

A. **General Liability** - State shall procure, and maintain during the entire term of this Agreement, a policy of general liability insurance or a self insurance program which covers all the work and services to be performed by State under this Agreement. Such insurance policy or a self insurance program will have a per occurrence combined single limit coverage of not less than $6,000,000.00. Such policy or a self insurance program will not exclude or except from coverage any of the services and work required to be performed by State under this Agreement. Any policy of insurance will be issued by an insurer authorized to sell such insurance by the State of California, and having at least a "Best's" policyholder's rating of "A" or "A+." District will be named as "an additional named insured" on this policy. State will provide the District with evidence of a self insurance program or a copy of the policy and a certificate of insurance showing the District as "an additional named insured" and indicating that the policy will not be terminated, canceled, or modified without thirty (30) days written notice to the District.

B. **Business Auto** - If State utilizes a motor vehicle in performing any of the work or services identified in Attachment A (Scope of Work), State shall cover such vehicle operations by a self insurance program or procure and maintain in force throughout the duration of this Agreement, a business auto liability insurance policy with minimum coverage levels of $300,000.00 per occurrence, combined single limit for bodily injury liability and property damage liability. The coverage shall include all State owned vehicles and all hired and non-owned vehicles used in performing under this Agreement.

Evidence of a self insurance program or a certificate of insurance shall be provided to the District at least ten (10) days prior to the start of work under this Agreement. Any policy shall contain a provision prohibiting the cancellation or modification of said policy except upon thirty (30) days prior written notice to the District.

C. **Professional Liability** - If State or any of its employees is required to be professionally licensed or certified by any agency of the State of California in order to perform any of the work or services identified in Attachment A (Scope of Work), State shall cover such professional liability with a self insurance program or shall procure and maintain in force throughout the duration of this Agreement, a professional liability insurance policy with a minimum coverage level of $1,000,000.00. Evidence of the self insurance program or proof of such insurance shall be provided to District at least ten (10) days prior to the start of any work by State.

10. **STATUS OF STATE:**

All acts of State, its agents, officers, and employees, relating to the performance of this Agreement, shall be performed as independent contractors, and not as agents, officers, or employees of District. State, by virtue of this Agreement, has no authority to bind or incur any obligation on behalf of District. Except as expressly provided in Attachment A, State has no authority or responsibility to exercise any rights or power vested in the District. No agent, officer, or employee of the District is to be considered an employee of State. It is understood by both State and District that this Agreement shall not under any circumstances be construed or considered to create an employer-employee relationship. As an independent contractor:

A. State shall determine the method, details, and means of performing the work and services to be provided by State under this Agreement.

B. State shall be responsible to District only for the requirements and results specified in this Agreement, and except as expressly provided in this Agreement, shall not be subjected to District's control with respect to the physical action or activities of State in fulfillment of this Agreement.

C. State, its agents, officers, and employees are, and at all times during the term of this Agreement shall, represent and conduct themselves as independent contractors, and not as employees of District.

11. **DEFENSE AND INDEMNIFICATION:**

State shall defend, indemnify, and hold harmless District, its agents, officers, and employees from and against all claims, damages, losses, judgments, liabilities, expenses, and other costs, including litigation costs and attorney's fees, arising out of, resulting from, or in connection with, the performance of this Agreement by State, or State's agents, officers, or employees. State's obligation to defend, indemnify, and hold the District, its agents, officers, and employees harmless applies to any actual or alleged personal injury, death, or damage or destruction to tangible or intangible property, including the loss of use. State's obligation under this paragraph extends to any claim, damage, loss, liability, expense, or other costs which is caused in whole or in part by any act or omission of the State, its agents, employees, supplier, or any one directly or indirectly employed by any of them, or anyone for whose acts or omissions any of them may be liable.

State's obligation to defend, indemnify, and hold the District, its agents, officers, and employees harmless under the provisions of this paragraph is not limited to, or restricted by, any requirement in this Agreement for State to procure and maintain a self insurance program or a policy of insurance.

To the extent permitted by law, District shall defend, indemnify, and hold harmless State, its agents, officers, and employees from and against all claims, damages, losses,

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judgments, liabilities, expenses, and other costs, including litigation costs and attorney's fees, arising out of, or resulting from, the active negligence, or wrongful acts of District, its officers, or employees.

12. **RECORDS AND AUDIT:**

A. **Records** - State shall prepare and maintain all records required by the various provisions of this Agreement, federal, state, and municipal law, ordinances, regulations, and directions. State shall maintain these records for a minimum of four (4) years from the termination or completion of this Agreement. State may fulfill its obligation to maintain records as required by this paragraph by substitute photographs, microphotographs, or other authentic reproduction of such records.

B. **Inspections and Audits** - Any authorized representative of District shall have access to any books, documents, papers, records, including, but not limited to, financial records of State, which District determines to be pertinent to this Agreement, for the purposes of making audit, evaluation, examination, excerpts, and transcripts during the period such records are to be maintained by State. Further, District has the right, at all reasonable times, to audit, inspect, or otherwise evaluate the work performed or being performed under this Agreement.

13. **NONDISCRIMINATION:**

During the performance of this Agreement, State, its agents, officers, and employees shall not unlawfully discriminate in violation of any federal, state, or local law, against any employee, or applicant for employment, or person receiving services under this Agreement, because of race, religion, color, national origin, ancestry, physical handicap, medication condition, marital status, age, or sex. State and its agents, officers, and employees shall comply with the provisions of the Fair Employment and Housing Act (Government Code section 12900, et seq.), and the applicable regulations promulgated thereunder in the California Code of Regulations. State shall also abide by the Federal Civil Rights Act of 1964 (P.L. 88-352) and all amendments thereto, and all administrative rules and regulations issued pursuant to said act.

14. **CANCELLATION:**

This Agreement may be canceled by District without cause, and at will, for any reason by giving to State thirty (30) days written notice of such intent to cancel. State may cancel this Agreement without cause, and at will, for any reason whatsoever by giving thirty (30) days written notice of such intent to cancel to District.

15. **ASSIGNMENT:**

State may subcontract this Agreement, or any part of it, with the express written consent of District. State shall not assign any monies due or to become due under this Agreement without the prior written consent of District.

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16. **DEFAULT:**

If the State abandons the work, or fails to proceed with the work and services requested by District in a timely manner, or fails in any way as required to conduct the work and services as required by District, District may declare the State in default and terminate this Agreement upon five (5) days written notice to State. Upon such termination by default, District will pay to State all amounts owing to State for services and work satisfactorily performed to the date of termination.

17. **WAIVER OF DEFAULT:**

Waiver of any default by either party to this Agreement shall not be deemed to be waiver of any subsequent default. Waiver or breach of any provision of this Agreement shall not be deemed to be a waiver of any other or subsequent breach, and shall not be construed to be a modification of the terms of this Agreement unless this Agreement is modified as provided in paragraph twenty-four (24) below.

18. **CONFIDENTIALITY:**

State agrees to comply with the various provisions of the federal, state, and county laws, regulations, and ordinances providing that information and records kept, maintained, or accessible by State in the course of providing services and work under this Agreement, shall be privileged, restricted, or confidential. State agrees to keep confidential all such information and records. Disclosure of such confidential, privileged, or protected information shall be made by State only with the express written consent of the District.

19. **CONFLICTS:**

State agrees that it has no interest, and shall not acquire any interest, direct or indirect, which would conflict in any manner or degree with the performance of the work and services under this Agreement.

20. **SEVERABILITY:**

If any portion of this Agreement or application thereof to any person or circumstance shall be declared invalid by a court of competent jurisdiction, or if it is found in contravention of any federal, state, or county statute, ordinance, or regulation, the remaining provisions of this Agreement, or the application thereof, shall not be invalidated thereby, and shall remain in full force and effect to the extent that the provisions of this Agreement are severable.

21. **FUNDING LIMITATION:**

A. The ability of District to enter this Agreement is based upon available funding from various sources. In the event that such funding fails, is reduced, or is modified, from one or more sources, District has the option to cancel, reduce, or modify this Agreement, or any of its terms within ten (10) days of its notifying State of the cancellation, reduction, or modification of available funding. Any reduction or modification of this Agreement made

pursuant to this provision must comply with the requirements of paragraph 23 (Amendment).

B. This agreement shall not be effective until it has been approved by the Department of General Services.

22. **ATTORNEY'S FEES:**

If either of the parties hereto brings an action or proceeding against the other, including, but not limited to, an action to enforce or declare the cancellation, termination, or revision of the Agreement, the prevailing party in such action or proceeding shall be entitled to receive from the other party all reasonable attorney's fees and costs incurred in connection therewith.

23. **AMENDMENT:**

This Agreement may be modified, amended, changed, added to, or subtracted from, by the mutual consent of the parties hereto, if such amendment or change is in written form and executed with the same formalities as this Agreement, and attached to the original Agreement to maintain continuity.

24. **NOTICE:**

Any notice, communication, amendments, additions, or deletions to this Agreement, including change of address of either party during the terms of this Agreement, which State or District shall be required, or may desire, to make, shall be in writing and may be personally served, or sent by prepaid first class mail to, the respective parties as follows:

Great Basin Unified Air Pollution Control District
157 Short Street
Bishop, California 93514

State Lands Commission
1807 13th Street
Sacramento, California 95814

25. **DESIGNATION OF AGREEMENT REPRESENTATIVE:**

The Commission and District hereby name a representative who shall represent his or her agency regarding this Agreement. Each agency may change its representative by notifying the other agency as provided for in Paragraph 24.

COMMISSION'S REPRESENTATIVE SHALL BE:
Steve Sekelsky

DISTRICT'S REPRESENTATIVE SHALL BE:
Theodore D. Schade

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26. ENTIRE AGREEMENT:

This Agreement contains the entire agreement of the parties, and no representations, inducements, promises, or agreements otherwise between the parties not embodied herein or incorporated herein by reference, shall be of any force or effect. Further, no term or provision hereof may be changed, waived, discharged, or terminated, unless the same be in writing executed by the parties hereto. /////

IN WITNESS THEREOF, THE PARTIES HERETO HAVE SET THEIR HANDS AND SEALS THIS 5th DAY OF April, 19 95.

DISTRICT	STATE
By: Ellen Hardebeck	By: _____
Dated: April 5, 1995	Dated: _____

APPROVED AS TO FORM AND LEGALITY:

_____
District Counsel

9503162

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ATTACHMENT A

JOINT POWERS AGREEMENT BETWEEN GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT AND STATE OF CALIFORNIA, STATE LANDS COMMISSION FOR THE PROVISION OF WIND-TUNNEL SIMULATION SERVICES

TERM: From: Feb. 2, -95 **To:** May 31, 1996

SCOPE OF WORK

The tasks to be performed and the deliverables to be provided by the State are described below. A protocol for the proposed work dated December 1994 entitled "Protocol for Numerical Simulation of Particle Saltation (1995)" has been prepared by Bruce R. White and Hyon-Mann Greg Cho of the University of California, Davis. Said protocol is attached and shall herein be made part of this agreement.

Tasks

1. June 1, 1995 - September 1 1995 - Using the Davis Atmospheric Boundary Layer Wind Tunnel (ABLWT), identify the significant parameters influencing wind flow characteristics in the wake of sand fences and arrays, and develop empirical equations for the velocity profiles and surface shear stress behind the fences as a function of those parameters. Develop a numerical model that will predict sand transport rates and the sand collection efficiency of fences and fence arrays as a function of those parameters (tentatively identified as porosity, ratio of fence height to roughness height, orientation to wind direction, array spacing, gaps under fencing and gaps in the array, ratio of fence length to fence height, and amount of sand build-up on the fence).

2. September 1, 1995 - November 1, 1995 - Construct a simulation of the Davis Owens Lake sand fence array and a number of other array spacings and use the Davis ABLWT to produce wind-field parameters in and around the array. Use these parameters in the numerical model to compare model outputs of sand flux and dune shape with those measured in the field in order to validate the model.

3. November 1, 1995 - February 1, 1996 - Run the validated model for particle sizes and wind velocities characteristic of Owens Lake. Predict where dunes will form downwind of fences depending on parameters of fence and array design.

4. February 1, 1996 - April 1, 1996 - Use the model to predict sand transport rates and saltation suppression effectiveness for various fence and array design parameters. Optimize these parameters to minimize saltation and predict what the optimum effectiveness would be.

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Deliverables

By May 1, 1996 deliver to the District a final report which contains a) the optimum design of a single fence to minimize sand transport, an estimate of the sand transport reduction effectiveness of the design and a description of how the effectiveness of the fence varies as a function of the parameters listed in Task 1, b) the optimum design of an array of fences, the saltation reduction efficiency of that array, and a description of how the effectiveness of the array varies as a function of the parameters listed in Task 1, and c) a copy of the numerical model and source code on disk with instructions for use.

PROGRESS REPORTS

The term of the contract is February 2, 1995 - May 31, 1996. The State shall submit project progress reports that describe project activity a minimum of one report every three months (quarterly). The District may require the State to provide in-person verbal project progress reports at public meetings.

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ATTACHMENT B

AGREEMENT BETWEEN
GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT
AND STATE OF CALIFORNIA, STATE LANDS COMMISSION
FOR THE PROVISION OF
WIND-TUNNEL SIMULATION SERVICES

TERM: From: Feb. 2, 95 To: May 31, 1996

SCHEDULE OF FEES

Payment for work to be performed shall be on a lump sum basis. State shall submit to the District invoices for payment according to the schedule below. Upon timely receipt of the statement by the fifth day of the month, District shall make payment to the State by the last day of the month. **In no case shall the total amount payable to the State for the work performed under this agreement exceed $40,000.**

Payment #	Amount	Payable
1	$10,000.00	Upon execution of this Agreement by both the State and the District.
2	$48,440.	Upon submittal of the final report described in Attachment A to the District and acceptance of said report in writing by the District.

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PROPOSAL

TO THE

GREAT BASIN UNIFIED AIR POLLUTION CONTROL DISTRICT

FIELD AND WIN D TUNNEL STUDIES TO DETERMINE THE VEGETATION COVER REQUIRED TO SUPPRESS SAND AND DUST TRANSPORT AT OWENS LAKE

Nicholas Lancaster,
Desert Research Institute,
UCCSN,
Reno, Nevada.

Bruce R. White and Greg H.M. Cho,
University of California, Davis

James D. Iversen
Iowa State University,
Ames, Iowa.

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GREAT BASIN
UNIFIED APCD

February 2, 1995

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BACKGROUND

The destruction of evaporite crusts by the impact of saltating sand has been identified as one of the major processes by which dust is emitted from the bed of Owens Lake. Numerous methods of dust emission control have been or are being studied, many of which involve the establishment of vegetation on surfaces subject to sand and dust transport.

In natural conditions, the presence of vegetation and surface moisture content are major controls of sand transport and wind erosion. Dust control measures should follow these natural principles. Unless sand and dust source areas are to be kept permanently wet, requiring large amounts of water (which may not be available) and expensive irrigation networks, revegetation of these areas may be an economic and appropriate control strategy, as many natural sand surfaces around Owens Lake are vegetated to some degree with salt grass as the dominant species.

OBJECTIVES

The objective of the proposed studies is to determine the amount of vegetation cover that is required to minimize sand transport by wind on surfaces on and around Owens Lake. The goal is to predict the optimum vegetation cover to achieve a high level of control of sand transport and dust emissions via a semi-empirical model of the relations between sediment flux and vegetation cover.

APPROACH

We will conduct intensive field and wind tunnel studies of sediment flux, winds, and vegetation cover to determine the amount of vegetation required to minimize sand transport by wind on surfaces on and around Owens Lake.

Field studies will focus on: (1) natural sand sheet surfaces adjacent to Owens Lake that are vegetated (mostly with salt grass) to varying degrees; and (2) areas of a pilot 8 hectare salt grass revegetation area on the bed of Owens Lake with different vegetation densities. These studies will provide information on: (1) the natural controls of sand transport in the area and (2) the effects of variations in vegetation cover on sediment flux on the lake bed.

Wind tunnel studies will concentrate on controlled experiments of the effects of different plant density and planting schemes on wind erosion and transport thresholds. These studies will complement the field studies by examining a greater range of plant cover and spacing than will be possible to achieve in the field, as well as a greater control on wind and sediment characteristics to determine, for example, drag coefficients of plants in different growth stages and seasons. Wind tunnel studies will also address (in controlled conditions) aspects of array geometry including the effects of gaps and variability in plant cover due to failure of plants to become established, as well as potential fetch effects.

It is our goal to develop an semi-empirical model based on these field and wind tunnel studies that adequately describes the processes observed in the field and in the wind tunnel. We will seek to establish relations between the threshold wind shear velocity for sand transport, the flux of sand and dust, and vegetation cover. This model can then be used to guide vegetation establishment and management practices.

SCIENTIFIC BACKGROUND

The presence of vegetation is important to both the entrainment and transport of sand by the wind. Vegetation protects the surface via direct cover of the surface, trapping of particles, and most importantly by extracting momentum from the air flow. When the wind blows over a smooth unobstructed surface, the shear stress is imparted more or less uniformly across the entire surface, but when non erodible roughness elements are present a proportion of the shear stress is absorbed by the roughness elements protecting the underlying erodible surface. The degree of protection is a function of their size, geometry, and spacing (Lyles et al., 1974; Marshall, 1971; Musick and Gillette, 1990; Stockton and Gillette, 1990). Low densities of roughness elements tend to reduce the threshold velocity of the surface and cause increased erosion around the elements because of the development and shedding of eddies (Logie, 1982). By contrast, higher densities of roughness elements tend to increase the threshold velocity of the surface.

Although many sand surfaces are vegetated to some degree, the effects of vegetation on sand transport rates are however poorly known. Empirical studies of the effects of vegetation on sand transport by Ash and Wasson (1983) and Wasson and Nanninga (1986) indicate that sand transport can take place even when vegetation cover is as much as 45%. Vegetation cover affects sand flux via increasing the aerodynamic roughness (z_0) of the surface. This in turn will affect the threshold wind shear velocity for transport (u_{*t}) and the flux of saltating sand.

The effect of vegetation on the wind and sediment transport can be assessed by estimating or measuring the plant drag coefficient (C_d), silhouette area (the vertical cross-section of the plant that the wind "sees", A_s) and density to produce a measure of roughness density λ (Raupach et al., 1993), or in the case of vegetation, the lateral cover (L_c) (Musick and Gillette, 1990). Both parameters are defined as the ratio between silhouette area (the cross-section of the plant that the wind "sees") and total surface area:

$$L_c = DA_s \tag{1}$$

where D is canopy population density (number of individuals per unit area) and A_s is mean frontal-silhouette area (height x diameter) per canopy, and:

$$\lambda = A_s / S \tag{2}$$

where S is the surface area per plant.

For sparse arrays, the aerodyanamic roughness can be approximated by

$$z_0 = \lambda H \tag{3}$$

where H is the mean height of the roughness elements (Raupach et al., 1993).

The effect of vegetation on threshold wind shear velocity can be estimated as the ratio between the threshold wind shear velocity with and without roughness elements.

$$u_{*t}/u_{*tr} = 1 + 1.8\,(1 - e^{-10[C_d\lambda]})/\,1 - 3\,(C_d\lambda) \tag{4}$$

For example, given a 1 m high plant with a drag coefficient of 0.7 and a silhouette area of 0.5 m^2 for each 10 m^2 of surface area, this analysis predicts a 71% increase in threshold wind shear velocity for particle movement, compared to an identical but unvegetated surface.

For typical value of z_0 for Owens Lake of 0.005m, and a u_{*t} of 0.2 $m.sec^{-1}$, the wind speed would be:

$$\ln [u*/fz_0] = 2 + (0.1225\,[\,U_g/u*]2 - 25)^{0.5} \tag{5}$$

where f is the Coriolis parameter ($8.65.10^{-5}$ sec^{-1}) for the Owens Valley and U_g is the geostrophic wind speed

Assuming a value of 10 m.sec^{-1} for U_g, then the wind shear velocity would be 0.28 m.sec-1, or significantly above the threshold value of 0.2 m.sec^{-1}. However, for the same surface with the 1 m-high plants described above, z_0 = 0.05 m and $u*_t$ = 0.34 m.sec^{-1}. Given the same wind speed of 10m.sec^{-1}, the wind shear velocity increases to 0.33 m.sec^{-1} because the surface is rougher, but this value is less than the predicted threshold wind shear velocity of 0.34 m.sec^{-1} and the surface is protected.

These approaches provide the theoretical basis for the proposed studies. We propose to investigate the relations between lateral cover/roughness density of vegetation, threshold wind shear velocity, and sediment flux in both wind tunnel and field situations. We will estimate critical values of vegetation cover and size for Owens Lake surfaces via these equations and use them to select field sites and determine the wind tunnel experimental plant density. We will also compare the field and wind tunnel data with these predictions and use these data to provide a semi-empirical predictive equation that can be used to guide vegetation establishment practices.

FIELD STUDIES

The proposed field studies will be divided into 2 parts, each concerned with a different type of sandy surface: (1) studies of natural flat sandy surfaces that are vegetated to varying degrees to gain a basic understanding of the wind, sediment flux, and vegetation parameters involved, and (2) intensive studies of the effects of changes in vegetation cover on sediment flux as the 8 hectare salt grass vegetation plot develops. On the basis of these investigations, we will develop hypotheses to be tested in subsequent project phases. We envisage that future studies will involve monitoring of the vegetation plot as plant cover density increases , field studies of different planting geometries that wind tunnel studies suggest are effective, as well as studies of natural dune areas to assess strategies for stabilizing dunes created with sand fences.

Experimental design

The goal of the field experiments is to characterize vegetation cover, winds, and sediment flux across a variety of sandy surfaces. In each area to be investigated, we will instrument a series of plots on sand surfaces with varying natural and planted vegetation cover, as well as a plot in an area that has no vegetation. Each plot will be at least 20 m long in the direction of prevailing sand transporting winds to ensure that sand transport is fully developed at all places it is measured. Natural sites will be selected in consultation with GBUAPCD personnel for minimal relief, similar sand grain size, and a homogenous salt grass vegetation cover to minimize the range of variables that may affect sediment flux and to ensure that the flux measured is representative of that vegetation cover type. The primary sites will be located north of Keeler. We will instrument plots on the salt grass revegetation area in each of the areas of different initial planting densities (1 plug/square foot, 1 plug/ 2 square feet, and 1 plug/ 3 square feet). As the these areas develop in subsequent years, we will continue to monitor vegetation densities and sand flux to provide a range of data on relations between sand flux and vegetation cover.

We will utilize adjacent plots to minimize the amount of instrumentation necessary and the effort required to maintain sand traps and instruments. Plot orientations will parallel those currently used by the GBUAPCD on their study sites (e.g. the FIP) so that data can be compared between experiments. Existing data from

instruments sited at the 8 hectare salt grass plot site will be analyzed to gain data on the winds and sediment fluxes without vegetation for comparison with subsequent data sets. Additional instrumentation will be located before vegetation planting takes place in the summer of 1995 if these studies suggest that it is necessary.

Wind and Sediment Flux

We propose two intensive experiments to measure vegetation cover, winds, sand flux, and erosion and deposition patterns on the natural sites. The first will be conducted in November 1995 and will act as a pilot project for the full scale experiment to be conducted in March and April 1996. The goal of these experiments is to determine the sediment budget for each area in relation to its vegetation cover and to provide detailed wind and sediment flux data for comparison with the wind tunnel studies described below. We are particularly interested in understanding how vegetation may trap incoming sand, and the relations between vegetation cover, wind profile characteristics, and sand flux.

At both the natural and 8 hectare plot sites, we will erect a 4 m-high anemometer mast with 4 logarithmically-spaced anemometers to measure the local wind profile and understand its relations to vegetation cover characteristics for each area of different vegetation density (Fig. 1). Each plot will be instrumented with grid of sand traps on a 5 m spacing and co-located Sensit devices at 10 m intervals to measure transport thresholds and sand flux. Sand traps and Sensits will also be located at the upwind and downwind of each plot to measure the net sediment budget for each area. Erosion pins to determine changes in surface elevation will be located at 5 m intervals along the transect. Sediment fluxes will be determined for each major sand and dust transport event (storm). Thresholds for entrainment will be determined using the Sensit devices. We propose to use a modified form of our existing Nickling, McKenna-Neuman, and Lancaster design which has been calibrated in a wind tunnel and has proved excellent for short-term field studies of sand flux (Nickling and McKenna Neuman, 1994).

Prior to the start of fieldwork, we will develop a detailed experiment plan and measurement protocol in conjunction with GBUAPCD staff. This will be tested during the pilot field experiments in November 1995 and modified if necessary before the intensive field experiments in the spring of 1996.

Vegetation Cover

We will characterize the vegetation cover on the natural and planted sand sheet surfaces using the approach developed by Musick and Gillette (1990) and modified by ourselves on the Nevada Test Site. At intervals of 5 m along the transects, we will measure salt grass height, width, and density within three randomly located 1 m-square quadrats. These values will be averaged to generate a lateral cover (*Lc*) value for each part of the transect. We will collaborate with GBUAPCD personnel to develop measurement techniques and to determine relations between lateral cover and projected cover. Recent studies have shown that the porosity of vegetation is also an important variable affecting near surface winds and sediment flux (Wolfe and Nickling, 1993). We will devise methods to determine the porosity of individuals and clumps of salt grass and incorporate these measurements in our assessments of vegetation cover.

The vegetation measurements will be repeated twice during the year to study the possible effects of seasonal variations in vegetation cover characteristics on sediment flux. The first measurement will be made in late October at the end of the growing season and will be repeated at the beginning of the growth period in April .

Other measurements
We will also characterize other site parameters that may affect transport threshold and sediment flux. These include surface particle size, salt content, degree of crusting, and moisture content.

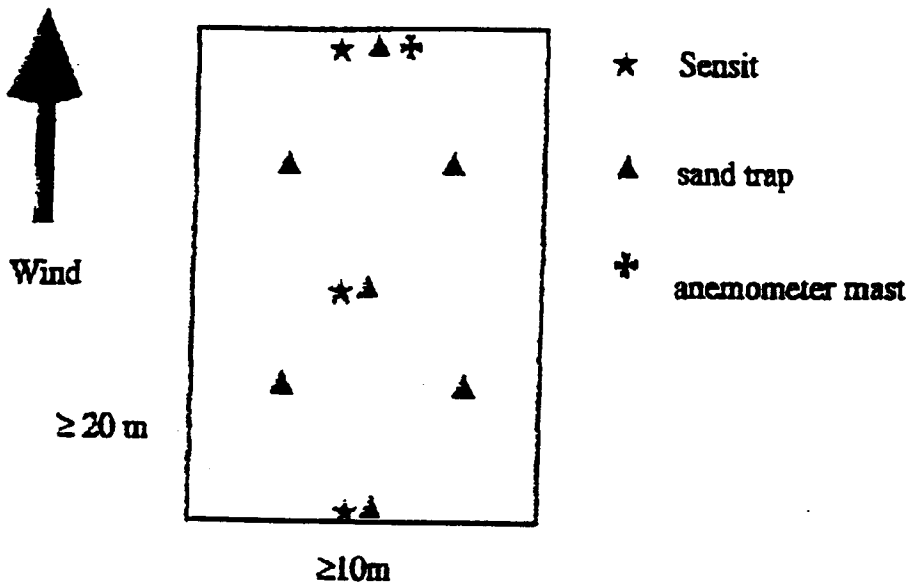

Figure 1: Schematic of vegetation and sand transport plot

Data analysis and model development
As our goal is to develop a fundamental understanding of the physical processes involved in sediment transport on vegetated surfaces, field data will be analyzed immediately following sediment transport events to provide the basis for an empirical model of the relations between threshold wind shear stress and vegetation lateral cover, as well as between lateral vegetation cover, aerodynamic roughness, sediment flux, and wind shear velocity. Based on these relations, we will provide a semi-empirical model that can be used to determine the optimum vegetation cover necessary for control of sediment transport and dust emissions.

Relations between vegetation cover and thresholds for sand transport will be determined by comparing data on the onset of sand movement provided by the Sensits and the wind profile parameters from co-located anemometer masts at each area of different vegetation density. These analyses will provide a relation between vegetation cover and the threshold wind shear velocity for sand transport. By using data on the aerodynamic roughness of each area, we will be able to determine the wind speed at a standard height (e.g. 10 m) that corresponds to each threshold wind shear velocity.

Relations between sediment flux and vegetation cover will be developed using principles of sediment mass conservation. For each area of a sand surface, a decrease in local sand transport rates with distance means that the influx of sediment to the area will

exceed the outflux, leading to sediment storage and therefore an increase in the local bed elevation by deposition of sediment. Conversely, increased sediment transport rates with distance result in sediment outflux exceeding influx, leading to removal of material and lowering of the local bed elevation by erosion of sediment. These relations can be expressed in terms of the sediment continuity equation in 2 dimensions is:

$$dh/dt = -dq_s/dx \qquad (6)$$

where h is the local bed elevation, q_s is the local volumetric sediment transport rate in the direction x and t is time.

Assuming that: (1) the sediment flux changes in space because changes in vegetation cover affect the near surface wind profile and thus the ability of the wind to transport sediment, and (2) the sediment flux adjusts rapidly to changes in vegetation cover (probably within 2 to 5 m, following Bagnold (1941)), measurements of the flux of sediment into, within, and out of each area of different vegetation cover will provide data on the spatial increase or decrease in flux associated with the changes in vegetation cover. These data can be used to assess the effect of vegetation cover changes on sand flux as well as to derive a mean flux for each vegetation cover type. A hypothetical representation of the type of relation to be expected is shown below in Figure 2. The effect of vegetation on sand flux will also be assessed by comparing the bare surface flux with that in each vegetated area. Changes in sediment flux will also be compared with erosion pin data – decreases in flux will result in deposition, whereas an increase will result in erosion. For each vegetation cover type, we will acquire data on wind shear velocity and spatially averaged sediment flux. The relations between these parameters for both natural and planted areas of salt grass will be used to develop a family of curves similar to those shown below that can be used to assess the appropriate vegetation cover necessary to protect a surface from erosion (Fig. 2).

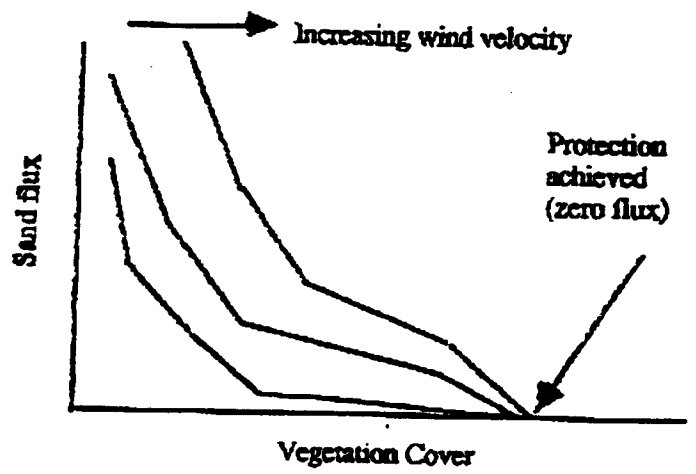

Figure 2: Schematic view of relations between sediment flux and vegetation to be expected from field data. Each curve represents a flux vegetation relation at a different overall wind velocity.

WIND-TUNNEL STUDIES AND FLUX MODEL DEVELOPMENT

Wind-tunnel studies will be carried out in two of UC Davis facilities. For studying wind flow over vegetation without saltation present, the Atmospheric Boundary-Layer Wind Tunnel (ABLWT) will be used. For studies involving saltating material such as determination of surface material transport rates, etc., the Saltation Wind Tunnel (SWT) will be utilized. Both facilities are located at UC Davis, Davis, California. The acquired wind-tunnel data and field data will be used in the empirical development of a site-specific transport model which will be developed exclusively for the Owens (Dry) Lake bed playa.

Experimental design

Three specific tasks are identified for wind-tunnel testing:

(1) The value of the local friction speed, $u*$, will be experimentally determined in the ABLWT for several different full-scale salt grass planting configurations. For example, the proposed downwind alternate planting array of five feet of vegetation followed by five feet of "bare"(or existing ground cover) followed by five feet of vegetation with this alternating cycle of vegetated-"bare" continuing on downwind would be testing in full-scale in the ABLWT. The configuration is referred to as the 5-5-5 one with the first number indicating the leading edge (upwind)length in feet of vegetation cover followed by the second number which indicates the length in feet of the "bare" surface followed by the third number which again represents the length in feet of the repeated vegetation cover. Additional ABLWT tests would include varying both the vegetated and "bare" lengths, e.g. a 5-2.5-5 and 4-6-4 each could be tested, as well as many other combinations.

These tests would be conducted for three different vegetation densities. Assuming the lateral cover is exactly twice the vertical projected cover for salt grass, then the maximum vertical projected cover would be 50%. (This fixed relationship between the lateral and vertical coverage is due the plant's structure angle being 60 angle). Therefore, it is proposed to test vertical coverages of 15%, 30%, and 45% to determine the effect from minimum to maximum vertical projected cover. The values of friction speeds will be determined from mean velocity profiles made as a function of downwind position over the salt grass bed identified in the above paragraphs. These measurements will be taken without saltation occurring. For selected cases, the threshold friction speed ($u*_t$) will be determined in the SWT using surface material taken from representative areas of the Owens Lake playa. These series of tests will identify the functional relationship of the threshold friction speed, $u*_t$, as a function of: mean wind speed at a reference height; effect of surface roughness, i.e., various X-Y-Z spacing configurations; and vertical projected cover.

(2) Correlated vertical and horizontal photographs will be taken of the vegetated salt grass coverage as a function of mean wind speed at a reference height and relative salt grass density, i.e., 15%, 30%, and 45% vertical projected cover. These tests will be used to visually illustrate the differences between "static"(no wind) geometry of salt grasses to "dynamic"(wind alternated) geometries of salt grasses. The purpose of these tests is to identify the effective change, if any, in the relationship of lateral to vertical coverage of salt grass under dynamic conditions. The results of these tests may introduce a new parameter, referred to as plant flexibility. This new parameter will be incorporated into both the empirical threshold friction speed formulation as well as the

development of the surface material transport model. These experiments will be carried out in both the ABLWT and SWT facilities without and with saltation occurring, respectively.

(3) For selected optimum geometry configurations described in item (1) above, surface material transport rates will be measured by UC Davis material collectors (see White and Mounla 1991 for details), by two Sensits Instruments (on loan to UC Davis from GBUAPCD) and by GBUAPCD "collection buckets" that are currently employed in the field. Transport flux rates , q, will be determined as a function of mean wind speed at a reference height; the threshold friction wind speed, u_{*t}; the surface roughness (both "X-Y-Z" spacing as well as salt grass density and plant flexibility). These data will be used in the empirical development of the flux rates equation. Additionally, these tests will provide a calibration between the various flux collectors being used in the wind tunnel and in the field.

Flux model development

A site-specific flux equation will be developed that will apply to the Owens Lake (Dry) playa. Based upon the wind-tunnel threshold friction speed results and wind-tunnel flux measurements, an empirical model (or equation) will be determined that relates the flux rate (surface material transport rate) as a function of mean wind speed at a reference height, surface roughness ("X-Y-Z" spacing and vegetation density), and plant flexibility.

PERSONNEL AND EQUIPMENT

Dr. Nicholas Lancaster (DRI) and Dr. Bruce White (UCD) will act as the co-Principal Investigators and will collaborate in experimental design, data analysis, model development and preparation of all reports. Dr. Lancaster will be responsible for the design and execution of the field studies. Dr. White and Dr. Greg Cho (UCD) will be responsible for the wind tunnel experiments. Dr. Jim Iversen (University of Iowa) will assist in the design of wind tunnel and field experiments and collaborate intensively in the data analysis and model development phases of the project. Regular meetings of the project personnel will be held at DRI and UC Davis to ensure that our efforts are coordinated.

We will collaborate with Ms Carla Scheidlinger and Dr. Jim Paulus (GBUAPCD), to develop a methodology for the vegetation measurements that will be conducted by DRI personnel. Maintenance of the instrumentation and sand traps, and collection of necessary field samples of surface sediments for moisture and salt content will be undertaken by DRI and GBUAPCD personnel under the direction of Mr. Bill Cox. Samples will be collected for each major sand transport event during the periods of intensive study.

Equipment for the field experiments, to include one anemometer mast with four anemometers and temperature sensors, 3 Sensits, and erosion pins for each plot will be provided via the GBUAPCD with additional anemometer masts, dataloggers, and sand traps provided by DRI.

To successfully carried the above wind-tunnel tasks it is expected that the GBUAPCD staff provides the salt grasses to be tested in the wind tunnels. This includes the desired plant density as foreseen by GBUAPCD staff); sufficient material taken from a representative area of the lake bed; at least two Sensit instruments in good operating

condition with calibration curves and sufficient operation instructions; and, lastly, all full-scale mean wind velocity profiles acquired over the field study area acquired during the coarse of the field study. Each profile should have at least two different temperature readings taken at different heights such that atmospheric stability correction factors may be applied the mean wind velocity profiles. The surface Sensit instruments should be made available by August 1,1995 and the salt grasses made available by September 1, 1995 or when appropriate growth as occurred in the GBUAPCD laboratories. The mean velocity profiles with temperature information should be made available to UC Davis as they are acquired.

PROJECT TIMELINE

Assuming a project start date of July 1995, our schedule for project tasks is as follows.

Field studies

Spring 1995: Interact with GBUAPCD on instrumentation for 8 hectare revegetation plots to be established in summer 1995. Preliminary sand flux measurements to test sand trap modifications.

August - October 1995: Develop detailed experimental design and select field sites for natural sand sheet surfaces.

October 1995: Set up plots and instrumentation. First vegetation measurements.

November 1995: Pilot flux measurements.

January - February 1996: Analysis of pilot project data. Possible changes to protocol.

March - April 1996: Intensive wind and sediment transport experiments.

May - June 1996: Analysis of first season's data. Initial model development and reporting.

Wind tunnel studies

July 1995.: Assemble existing instrumentation and calibrate ABLWT and SWT.

August - October 1995: Measure velocity profiles over the various salt grass configurations to be tested. Assumes salt grass and Owens Lake surface materials is provided to UC Davis from GBUAPCD by August 1st, 1995.

September -November 1995: Reduce wind tunnel data to determine friction speeds and threshold friction speeds.

December 1995 to February 1996. Conduct surface flux measurements in the SWT and reduce flux data.

March 1996: Photography of salt grass in wind tunnel under dynamic conditions.

April-May 1996: Develop semi-empirical transport equations utilizing wind-tunnel data

All investigators

June 1996: Integration and comparison of field and wind tunnel data. Write Final Report of project.

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PROJECT BUDGETS

DESERT RESEARCH INSTITUTE

		Rate	Units	Total
PERSONNEL				
Nicholas Lancaster	Per hour	42	336	14112
Graduate Student	Per hour	11	1440	15840
Technical support	Per hour	25	100	2500
Secretarial support	Per hour	25	40	1000
SUB TOTAL PERSONNEL				33452
TRAVEL				
Mileage	Per mile	0.5	5000	2500
Per diem (meals + lodging)	Per day	80	50	4000
SUBTOTAL TRAVEL				6500
OTHER DIRECT COSTS				
Field supplies				2540
Sample analyses	Per sample	50	25	1250
Copying and communications				500
Equipment rental (*)	Per day	50	20	1000
Equipment (sand traps)	Each	50	20	1000
SUBTOTAL OTHER DIRECT COSTS				6290
TOTAL DIRECT COSTS				46242
INDIRECT COSTS		0.73		33757
TOTAL COSTS				$79,999

* For DRI equipment only.
Assumes that GBUAPCD will provide equipment for data collection as discussed in proposal

UC DAVIS

		Rate	Units	Total
PERSONNEL				
Principal Investigator	Per month	7989	1.5	11984
Research Assistant	Per month	2134	12	25608
Benefits				
Principal Investigator		9.10%		1090
Research Assistant		10.29%		2635
SUB TOTAL PERSONNEL				41317
Student Fee Remission				9696
Wind Tunnel Expendable Supplies				2114
TOTAL DIRECT COSTS				53127
INDIRECT COSTS		10%		5313
TOTAL COSTS				$58,440