BOX ELDER COUNTY
April 21, 1994

The Board of Planning Commissioners of Box Elder County, Utah, met in regular session in the Commission Chambers of the Box Elder County Courthouse, 01 South Main Street, in Brigham City, Utah, at 7:00 p.m. on April 21, 1994.

The meeting was called to order by Chairman Richard Kimber with the following members present, constituting a quorum:

Richard Kimber	Chairman
Allen Jensen	Commissioner, Member
Louis Douglas	Member
Deanne Halling	Member
Jon Thompson	Member
David Tea	Member
Denton Beecher	Ex-Officio Member/Surveyor
Marie Korth	Ex-Officio Member/Recorder Clerk

Others in Attendance: (Attachment No. 1)

APPROVAL OF MINUTES:
Chairman Kimber presented the Minutes of March 17, 1994, for approval. Mr. Tea made a motion to approve the Minutes of March 17, 1994, as prepared. Mr. Thompson seconded. The motion carried.

AGENDA: (Attachment No. 2)

CONDITIONAL USE PERMIT:
Keith Jones RV Park: (Attachment No. 3)
Mr. Keith Jones presented a request for a conditional use permit for a private recreation campground on the south end of Willard Bay and pointed out the location on a map.

Mr. Jones first discussed the General Plan, stating the proposed park is consistent with the Plan in several ways; all of the property is within the Multiple Use area around the bay. He stated one of the primary uses under the code is recreation. Mr. Jones stated the goals and objectives of the General Plan include developing recreational resources, encouraging tourism, providing access to a park, and developing the Willard Bay area. Mr. Jones emphasized he is applying for a conditional use permit for a **private recreation park**, not an RV park. He described the proposed park and its amenities. He stressed the fact that the park would be landscaped with grass and trees and would be very attractive. Power, water, and sewer would be available as well as fishermen's access and public restrooms.

Mr. Jones said he is asking for a zoning variance, changing from a 60 foot zone to a 20 foot zone. Mr. Jones said by his bringing electric power into the the area, the local residents would also benefit. In addition the county tax base would be increased, and summer jobs would be provided for young people.

Mr. Jones stated he has the support of many adjacent property owners and provided several letters of support along with 300 signatures on a petition in support of the campground.

Chairman Kimber asked Mr. Jones the difference between this proposal and a former one. Mr. Jones stated this is not a request for a zone change, but for a conditional use permit.

Mr. Thompson made a motion to table the concept and proposal for further study and investigation. Ms. Halling seconded. The question was asked if this is something the county attorney would look at or if it would be for review of the Planning Commission. Mr. Beecher said the Planning Commission should review and discuss the proposal and make recommendations. Chairman Kimber stated the Planning Commission may want to recommend another public hearing. Chairman Kimber called for the vote. It was unanimous in the affirmative. The motion carried.

Letter From Division of Wildlife Resources: (Attachment No. 4)

At the end of the meeting Mr. Beecher presented a letter from Mr. Jack A. Rensel, State Department of Natural Resources, Division of Wildlife Resources, in support of Mr. Jones' request.

OPPOSITION TO CONDITIONAL USE PERMIT:
Keith Jones RV Park:

Mr. Charles Brown, Manager of the LDS Church farm in South Willard, met with the Commissioners to voice his opposition to the proposed RV park. Mr. Brown stated he is opposing the park because of what developments of this nature can lead to. The Church has had to close down numerous operations throughout the United States as a result of encroachment.

Mr. Brown said the dairy and orchards are where they are because they can be out in an isolated area. All of the surrounding fields which support the dairy are vital to the operation. He said the millions of dollars that will be generated by their various projects would be in jeopardy in the future if these kinds of things move in to agricultural areas. Mr. Brown emphasized that the proposed thirty lot park is only a beginning; Mr. Jones would like to increase the size of the park which would lead to additional problems. He said the total dollars generated by all of the agriculture in the area would be much more beneficial to the county than a thirty lot RV park which is only a single operation.

Chairman Kimber asked Mr. Brown to put his remarks in the form of a letter to the Planning Commission.

Memorandum in Opposition to Conditional Use Permit: (Attachment No. 5)

Attorney Stephen Hadfield, representing John Larkin and Lowell Lemon, farmers in the South Willard area, presented a Memorandum in Opposition to Request for Conditional Use Permit on Land owned by Keith Jones. Mr. Hadfield said there are basically two reasons for the opposition: 1) The allowed conditional uses for this type of zoning do not include an RV park. The only things allowed are private parks or recreational grounds or private recreational camps or retreats such as private, non profit recreational campgrounds. 2) Even if the RV park were to be allowed, there are several reasons the request should be denied: a) A majority of the land owners in the adjacent area oppose the project; b) The use as an RV park would destroy the agricultural uses; c) There would be an impact on the spraying of the property; d) It would require additional access that may ruin other agricultural property along with various other problems such as a high water table, bugs, odors, etc.

PARSON GRAVEL PIT:

Opposition to gravel pit, Statement by Dawn Scothern: (Attachment No. 6)

Ms. Dawn Scothern, a resident of South Willard, met with the Commissioners to present documents in opposition to the Parson Gravel Pit in South Willard. Ms. Scothern first brought up health problems, citing silica dust which comes from crushing gravel. She said she had contacted the toxicologist and epidemiologist at the EPA in Denver who sent her a very lengthy report, "Inhalation Toxicology of Silica", (attached). Ms. Scothern had attached a sheet, "Health Problems Summary due to Silica Dust", which she read. She cited three ways the silica can get into the body: 1) breathing, 2) ingesting through food or drinks, 3) through the aquifers.

Ms. Scothern said she went to the US Geological Survey for information. They told her the water in this area is obtained from the east shore aquifer, the second largest aquifer in the state of Utah, which runs from Brigham City to Bountiful and eventually into the Great Salt Lake. Ms. Scothern stated there is a very great potential for contamination. Ms. Scothern pointed out Parson's gravel pit on a map stating it is in an alluvial fan which is a recharge of the system. It is felt 1/3 to 1/2 of the recharge area comes from a unique set of mountains that run between Willard and North Ogden; they are very steep and rugged and retain a lot of water. The aquifer supplies water to communities all along the Wasatch front. Ms. Scothern described the recharge area in detail. She said they know West Warren and Plain City and even South Willard have extreme amounts of silica dust in their wells. Most of the wells range in depth from 400 to 700 feet. She said Parsons are disturbing and contaminating the water in the aquifer.

Ms. Scothern stated there is also a big problem with the fault lines which run along the mountain. There is one that runs along

Highway 89 and a mini fault line running through the middle of the Parson pit. Ms. Scothern stated she brought that up because spring water comes from faults. She said the state feels water quality should be monitored in the area because if the water table drops, the saline water from the Great Salt Lake could encroach upon the fresh water aquifers. Ms. Scothern re-emphasized the dangers of polluting the aquifer and stated someone would have to take the responsibility for any contamination.

Statement from Gary Coleman: (Attachment No. 7)

Mr. Coleman presented a written statement outlining his complaints relative to the Parson pit. Mr. Coleman said he called the county in 1990 and was told Parsons were working in an existing pit and nothing could be done about it. He said in 1992 Parsons were hauling within 20 feet of the mobile homes and 25 feet of the gas meters with no provisions for run-a-way trucks. Mr. Coleman stated Parsons is reclaiming asphalt for which they have no permit. Mr. Coleman stressed the aquifer is being polluted.

Mr. Coleman stated Parsons was supposed to reseed five acres of slope. He said they do not have to reseed until they have five acres of slope; that is a very big hole.

Statement from Donna Ball: (Attachment No. 8)

Ms. Donna Ball stated the gravel pit had been in operation since 1986 without adequate water. She passed around some pictures showing the dusty conditions in the pit. Ms. Ball said at present she is in the process or working with epidemiologists in Salt Lake City. She is very concerned about the silica dust causing serious health problems.

Ms. Ball expressed her concerns about the manner in which conditional use permits are issued. She quoted from the Box Elder County Zoning Ordinance, Chapter 6, Conditional Uses: "That such use will not, under the circumstances of the particular case, be detrimental to the health, safety or general welfare of persons residing or working the the vicinity, or injurious to property or improvements in the vicinity." She stated evidently the Planning Commission felt the operation was not going to be detrimental to the health or well being of the neighboring property owners.

Ms. Ball next referred to the 1992 Land Use Management and Development manual for Box Elder County. She said the purpose for the Conditional Use Chapter was to promote the health, safety, convenience, and general welfare of present and future inhabitants of the county. She said this chapter also provides a framework of standards within which those governmental decisions must be made.

Ms. Ball then referred to Chapter 14, "Sensitive Area Overlay Zone", stating the purpose of the sensitive area overlay zone is to designate and describe those areas within Box Elder County that possess physical and/or environmental characteristics which require

special public consideration of applications for uses which might affect the structure of the land, the management of water, safety of future occupants, etc. Ms. Ball said South Willard is a sensitive overlay area.

Ms. Ball next discussed multiple use - MU160. She said Parsons have applied for a 16 inch well which will take 1,000,000 gallons a day out of the watershed. She stressed the ultimate best use of the land can be recommended by the Planning Commission to the County Commission. Ms. Ball stated the area is intended to be primarily residential and protected from encroachment by commercial and industrial uses. Ms. Ball referred to the July 1990 Planning Commission Minutes, page 6, Mr. Grover made a statement that the Jack Parson pit came before the Planning Commission as a subdivision.

Ms. Ball stated she spoke with Mr. Robert Fotheringham of the State Division of Water Rights who told her rejected material might cause an impoundment of water. She said Mr. Facer told her rejected material is 1) top soil, 2) trees or brush that had been removed, 3) piles of rocks.

Ms. Ball next referred to a letter from LarWest Engineering addressed to the Box Elder/Willard City Flood Control District. She expressed concern about three items in the letter: 1) There have been several plan revisions since review one year ago. The FCD has not received any updated set of plans. 2) Lack of detailed construction documents make it difficult to determine final disposition of flood control measures. 3) It was reported a $20,000.00 bond was required. This amount seems extremely low and without apparent basis.

BROCHURE: (Attachment No. 9)

At the end of the meeting Ms. Ball passed out a brochure, "Take Pride in Utah, Don't Spoil a Good Thing", published by the State department of Natural Resources

Commissioner Jensen stated it was never the intent of the Planning Commission to do anything that is going to violate the quality of life in South Willard. The Planning Commission did issue the permit in good faith. He said they met with the Willard Flood people who agreed with the project at the time.

Letter to Bob Linnell: (Attachment No. 10)

Commissioner Jensen referred to a letter he had written to Mr. Bob Linnell expressing his support and appreciation for his assistance. He said Mr. Linnell told him Air Quality and Water Quality and also Ted Stewart from the Division of Natural Resources had reviewed allegations made against the Parson Company gravel pit. Commissioner Jensen stated if Parsons is in violation, the Commission will act accordingly. Commissioner Jensen stated the County Attorney has advised, because of the legal implications, that the permit can be stopped even though it was issued by the Planning

Commission and not the County Commission. It has now progressed to the point it is in the area of estoppel.

PARSON & NIELSEN PIT FLOOD CONTROL:
Statement by Ron Nelson:

Ron Nelson, Chairman, Willard/Box Elder County Flood Control District, stated he had four major concerns: 1) Inadequacy of construction documents received by the Flood Control District. 2) The adequacy of flood bonding, 3) Transferring use permits in general, 4) Moving from phase one to phase two in the DN pit.

Mr. Nelson quoted from a letter from County Attorney Jon Bunderson dated Oct. 4, 1985, attached to the Box Elder County Planning Commission Minutes of May 21, 1992, "The person to whom the permit is issued should understand that he or she then becomes responsible to meet the conditions imposed." Mr. Nelson said he hoped that would also mean the person would be responsible for any litigation or violations that have been pointed out and imposed by the flood district.

Mr. Nelson then read from another letter from Jon Bunderson, dated May 8, 1992, "Phase one (concerning Nielson north pit above Willard City) as shown on the map must be completed before phase two can begin." Mr. Nelson said this must be completed.

Mr. Nelson said there is a very large stockpile directly in front of the detention basin which creates a threat to Willard City. In addition the slopes that have been taken out have moved east into the mountain and are very steep.

Mr. Nelson stated the concerns he has brought up in the meeting must be resolved. They pose a serious threat of flooding to the life and property of the people in Willard. The Flood Control District believes that these operations must be discontinued by DN Development and by Parsons until the issues are resolved. It is their opinion that if these problems are not resolved by all parties concerned, conditions will continue to get worse and legal action will be necessary.

Commissioner Jensen stated he had met with the Flood District and had given them a copy of the Sensitive Area Ordinance and explained how they could make it a sensitive area and probably would not have to have another gravel pit down in that end of the county.

SOUTH WILLARD WATER COMPANY:
Water Studies - Parson North Pit: (Attachment No. 11)

Mr. Kevin Cole and Mr. Terry Pritchard, representing Mr. Robert Williams of the South Willard Water Company, met to discuss their concerns. Mr. Cole presented a letter to the Box Elder County Planning Commission along with a summary of state water studies concerning the Parson Willard north pit area. He said two different engineers are working on studies at present.

Mr. Cole reported two state scientists are working with the South Willard Water Company. They are doing a delineation study at present in which they will study, foot by foot, pollutants, contaminants, etc. The other study is the aquifer study. From that the South Willard Water Company has come up with three suggestions: 1) Advise the County Commissioners that a hold be put on any recommendations relating to Parsons Willard north pit area until the state related studies now underway are completed. 2) Require a comprehensive environmental impact statement from Parsons concerning the Parsons North Willard pit site. 3) If a conditional use permit is re-issued prior to the completion of the state water related studies, a liability bond in the amount of one hundred million dollars be required of Parsons covering the health conditions that might arise from the water contamination traced to the Parson operation. Mr. Cole requested things be put on hold until the information is in.

PARSON GRAVEL PIT COMPLAINT:
Comments from Elmer Ward:

Mr. Elmer Ward, South Willard landowner, stated he was concerned because there was no public hearing concerning the Parson gravel pit. He said if there had been a public hearing, a permit would not have been issued. Mr. Ward said the people in South Willard do not feel they have been treated fairly. They are asking the Planning Commission to be responsible for what they are doing.

Mr. Ward said the people in the area have been trying to stabilize the McGuire Canyon for years; there has not been a flood in the area for several years. Mr. Ward said he was very concerned when he found a gravel pit was going to be allowed in the area with a depth of 100 feet. He stated he had asked Attorney Jon Bunderson about a public hearing. Mr. Bunderson told him he would recommend a public hearing.

Mr. Ward read from Planning Commission Minutes which stated any flood water must be contained on Parson property. From another set of Minutes, "If it isn't contained on Parson property, the neighbors must be contacted and get a flood channel established." He said he called the Flood District engineer, Mr. Larsen, and told him of his concerns. Mr. Ward asked Mr. Larsen if the water was to stay on Parson property or if it had to have a channel. Mr. Larsen said he did not know. He said no one on the Planning Commission knows either.

Mr. Ward said he had contacted Mr. Baird who was with the Forest Service Water Resources for 40 years and is now retired and showed him the area. Mr. Ward asked Mr. Baird for his opinion. He told Mr. Baird a permit had been issued to White's for a depth of 20 feet; it was transferred to Parsons for a depth of 100 feet. Mr. Baird was very surprised. Mr. Ward stated he would like the record to show: 1) There never was a public hearing on the gravel pit. 2) The permit was first issued for a depth of 20 feet while the permit asked

for 30 and for a subdivision. 3) When Mr. Rob White requested permission to move the gravel, he contacted all of the neighbors. In the Minutes Mr. Facer said the landowners on the south and the west had been contacted and there were no objections. He said Mr. White who sold the property for the gravel pit was the landowner on the south and west.

Comments by Gay Pettingill:

Mr. Gay Pettingill, a landowner in South Willard also appeared to discuss the Parson gravel pit. Mr. Pettingill commented on Mr. Nielsen's gravel pit permit #38, stating about 14 years ago a serious flood damaged several homes below the area. Many years ago a flood came down through McGuire Canyon and seriously damaged Mr. Pettingill's property. He said flooding is unpredictable. He said if anything happened right now, there would be a disaster. The water would come right out of the canyon, down the slopes and cause great destruction.

Mr. Pettingill stated a petition was signed with over 170 signatures in South Willard protesting the gravel pit. He said he had expected an answer. Chairman Kimber informed Mr. Pettingill it had been requested by the County Commission that the petition be a part of the Planning Commission Minutes.

Mr. Ward stated he would like the record to show, Minutes of May 6, 1993, "if there is any misuse of the permit, the permit will be revoked." Mr. Ward said the permit also indicates reseeding will be done before going on to the next level. Nothing has been done. He said he could not understand a permit being issued when there is not enough water to take care of the requirements.

Mr. Ward stated he would like the record to show that written comments have not been received from the Utah Geological Survey, the Utah Division of Wildlife, the US Conservation Service, the US Forest Service, local land owners, Utah Air and Water Quality. They were there for the 20 foot depth but not for the 100 foot.

Mr. Ward referred to the Planning Commission Minutes of March 17, 1994, stating Mr. Facer said he would like to clarify some issues concerning storm sewer runoff. Mr. Ward said Mr. Facer stated two different groups of engineers looked at the situation and agreed that there was no problem. Mr. Ward stated he would like to know who the engineers were and why they felt there was no problem.

Mr. Ward again read from the Minutes, "Mr. Facer presented some drawings illustrating the topography of the proposed excavation of the gravel explaining it is exactly the plans approved in 1986." Mr. Ward said we are not talking about plans in 1986, it is now 1994.

SERVICE STATION & JUNK YARDS - SOUTH WILLARD:

Mr. Pettingill said over a year ago a letter was written stating something was going to be done about a service station in

South Willard. There are things going on between 12:00 and 2:00 in the morning almost every night. The police have watched very closely; they are not repairing cars. Also just the last few days there have been big truck loads of materials being unloaded down at the Stevens and Crabtrees; the junk yards are getting bigger. They are eyesores and need to be stopped.

RESPONSE TO CONCERNS:

Parson Gravel Pit - Fay Facer: (Attachment No. 12)

Mr. Facer stated Parsons have operated the gravel pit since 1986. There were no real issues or complaints until about a year ago. He agreed the permit has changed as well as the mining. Mr. Facer stated when the permit was amended in 1993, the Planning Commission addressed it for about five months, and almost everything mentioned in this meeting was talked about on the Planning Commission level. The Planning Commission studied the issues; all agencies that were a part of the process were contacted. He said the Planning Commission did issue and approve the permit.

Mr. Facer said there are three issues that need to be addressed: 1) Air quality, 2) Flood control, 3) Quality of the well.

Air quality is monitored and controlled at random by the State Bureau of Air Quality. Parsons would be notified if there were a violation; there have been none. Mr. Facer presented a "Findings of Fact, Conclusions of Law, and Judgment of Acquittal" dealing with a court case between K D Sand & Gravel and Willard City. The issue deals with air quality.

Mr. Facer stated there has always been water at their operation, either from the Willard Canal or by water trucks. They have tried to acquire some property with water rights. Mr. Facer said the water is necessary for a washing operation; they also want to be able to sprinkle the pit with sprinkler systems. Mr. Facer stated they are doing everything they can to control dust and keep it within prescribed limits.

Mr. Facer stated it was alleged Parsons have been deficient, have changed the plants, etc. Mr. Facer stated there have been no material changes in the plans; only a few modifications. He said Mr. Ron Nelson was present at the Planning Commission meeting when those modifications were discussed.

Mr. Facer stated Parsons has hired Mr. Dee Hansen who was the State Water Engineer for a number of years. Six years ago he was appointed Director of Natural Resources. He is now a consultant. Mr. Hansen talked with the Flood District Engineer, Mr. Larsen. Mr. Facer stated he met with Mr. Hansen and Mr. Larsen at the site and a lot of issues were clarified.

Mr. Facer presented a letter written to Mr. Robert Williams of the South Willard Water Company from the Division of Drinking Water,

dated March 15, 1994. "Based on this preliminary assessment of the gravel pit located south and southeast of the new well, it does not appear to be a cause of contamination to the new well at the present time. However, as the gravel pit expands closer and uphill to the well, the potential impact to the well and surrounding ground water will increase." . . . . . "Although there does not seem to be an impact from the gravel pit on your new well at the present time, I recommend that the South Willard Water Company and the Jack B. Parson Company continue to work together to protect the ground water, sharing all wells."

Mr. Facer pointed out on a map an area they have mined. He commented that top soil is very scarce on the mountain. He said they would pile up what was available. Within the next 30 days they will probably have fifty or sixty cottonwood trees planted along the two perimeter areas. By fall the entire area will be reseeded.

Mr. Facer stated the issue of asphalt came up. There was a test made on the asphalt that was stockpiled. He said they never intended to bury it. They intended to recycle it. He presented a copy of a letter from the Bear River Health Department, "The results show that the contamination test for the well is below any regulatory level, no further action will be taken." . . . "I do not feel that the quantity of material that was stored at the Parson pit will have any adverse affect on your well (Parkin property)." Mr. Facer said they will continue to recycle asphalt at the site.

Mr. Facer quoted from a letter written by Gale Larsen of LarWest Engineering dated April, 1993, "In summary, this site is a rather large and long lasting operation. It appears to be suitable for gravel extraction without major adverse affects on storm water management. Methods of development and mitigation measures seem reasonable. Flood control measures are being taken into consideration." Mr. Facer stated Gale Larsen and Parson's engineer did the calculations on the runoff and agreed that Parson's plan would work for flood control. It will enhance the flood control.

Mr. Facer recommended no action be taken at this time and table the issue for 90 days; give the Flood Control people and others an opportunity to work on the problem and then meet together.

A brief discussion was held concerning dust on the leaves of fruit trees and the problems caused, including mites. Also there is the question of who is responsible for reimbursement of damages caused by dust. Mr. Facer stated they will probably not be mining gravel until July, so dust should not be a problem.

Commissioner Jensen made a motion that the Planning Commission wait until there is word from the State on the water quality issue and the air quality issue and on the report from the natural resources before any action is taken. Mr. Douglas seconded.

After a brief discussion, Commissioner Jensen amended the motion to include the Flood Control people. Chairman Kimber stated the second still stands.

Discussion: Mr. Thompson stated he felt Flood Control should be involved. He said he is concerned about the sensitive area around the South Willard drinking water well and asked if we could request there be no further encroachment on that sensitive area until after that has been tested by the people mentioned in the motion. Mr. Facer stated Parsons would go no closer to the well until Spring of 1995. He said he was concerned about leaving the time frame open ended; it could be a much longer time than anticipated. Commissioner Jensen stated he would like to withdraw his motion.

Mr. Thompson made a motion to table the discussion on all of the issues that have been presented for further study and analysis including professional people from the different divisions that have been mentioned including Flood Control, and the engineers, and that there be no further encroachment, that Parsons's operation would be restricted from encroaching upon the watershed sensitive area until after January 1, 1995. The sensitive area is 1,500 feet or the results of the state tests if they proceed. Mr. Tea seconded. The motion carried.

MINOR SUBDIVISIONS:

Gale Welling Minor Subdivision, Amended:

Mr. Beecher stated Mr. Welling would like to amend his minor subdivision. He presented the plat plan explaining the only change is making lot two larger. Mr. Tea made a motion to approve the Gale Welling Minor Subdivision as changed. Mr. Douglas seconded. The motion carried.

Stokes Minor Subdivision:

Mr. Beecher presented the Stokes Minor subdivision on 9600 North west of 6800 West for three lots. He said there are letters from Mt. Fuel, the water company, and Utah Power & Light for utilities. Mr. Beecher stated he felt it should be noted on the plat and agreed to by all concerned that the county takes no responsibility for any flooding that might occur because of irrigation and that the homes be built accordingly. Commissioner Jensen made a motion to approve the Stokes Minor Subdivision. Ms. Halling seconded. The motion carried.

FORMS: Attachment No. 13)

Mr. Beecher presented some recommended forms for proposed use by the county regarding zoning and conditional use permits. He said the forms should assist applicants in understanding requirements. Mr. Tea made a motion to recommend to the County Commission that these forms be accepted and that they do a study to determine a fee schedule. Mr. Douglas seconded. The motion carried.

Mr. Thompson made a motion to adjourn at 11:00 p.m. Ms. Halling seconded. The motion carried.

Passed and adopted in regular session this 30 day of June, 1994.

Richard D. Kimber, Chairman

ATTEST:

Marie G. Korth
Recorder/Clerk

Planning Commission
April 21, 1994

Name	Address / Title
Gary W. Coleman	8615 So. Hwy 89 Willard Coleman MBL Homes
Ron Rueson	P.O. Box 95 Willard / Chairman Willard Flood District
Darrell Southern	916 W. 7800 So Willard
Bergell Wetzel	775 W 7900 S Willard
Emery J. Ward	8490 So Hwy 89 Willard Utah
Stephen R. Hadfield	98 North Main, Brigham City / Attorney
Lowell Lymon	7400 So Hwy 89 Willard Ut 84307
John Taylor	9455 So. 2000 W. Willard, Ut 84340
David Southern	916 W. 7800 So Willard Ut 84340
Jack Hooper	7885 So Hy 89 Willard
Darrel J. Hooper	7885 So Hwy 89 Willard
Judd Larkin	8455 So 2000 W Willard Ut 84340
[illegible]	7045 So Hwy 89 Willard Ut
[illegible]	75[illegible] So 7[illegible] So Willard Ut
Ann Bakrell	7265 So Hy 89 Willard Ut.
Lenard Lymon	7400 S. Hwy 89, Willard
Lynda Larkin	8455 So 2000 W Willard, Ut
Susan Lunstrum	1016 W. 75[illegible] So. Willard
Tim Linsday	1016 W 7800 So Willard Ut
Charles F. Brown	8290 So Hwy 89 Willard Utah
Lorie Brown	8290 So. Hwy 89 Willard, Ut
Kay Wettingill	7769 So Hwy 89 Willard Ut.
[illegible] Fettingill	7769 So. Hwy 89 Willard, Ut 84340
Steven Fettingill	325 So 1200 W Perry, Utah 84302
Richard E Day	815 W 7800 S Willard Ut 84340
JoAnn Day	" " "

ATT 1

Sheryl Rex	9310 S. 2000 W	Willard
Donna Ball	18395 150W	Willard
BRADLEY Rex	9310 S. 2000 W.	WILLARD
Jay Jacu	Jack B Parson Companies	
Randy Anderson	" "	"
Keith Jones	990 E 800 N	Shelley, ID 83274

BOX ELDER COUNTY RECORDER/CLERK
Box Elder County Courthouse
01 South Main Street
Brigham City, Utah 84302
(801)734-2031 FAX (801)734-2038

NOTICE and AGENDA

Notice is hereby given that the Box Elder Planning Commissioners will hold a regular Planning Commission Meeting Thursday evening, April 21, 1994, at 7:00 p.m. in the Commission Chambers, Room 10, Box Elder County Courthouse, 01 South Main Street, Brigham City, Utah.

7:00 - 7:05	Welcome and approval of the minutes of March 17, 1994.
7:05 - 7:20	Request for Conditional Use Permit for RV Park Keith Jones, Developer
7:20 - 7:30	Opposition to Conditional Use Permit John Larkin and Lowell Lemon
7:30 - 7:45	Statement regarding Parson Gravel Pit Donna Ball, Gary Coleman, Dawn Scotheren
7:45 - 7:55	Parson and Nielsen pit flood control Ron Nelson
7:55 - 8:10	Parson Gravel Pit complaint Elmer Ward and others
8:10 - 8:25	Parson Gravel Pit complaint Robert Williams and others
8:25 - 8:35	Parson Gravel Pit Fay Facer
8:35 - 8:40	Welling Minor Subdivision revised
8:40 - 8:45	Stokes Minor Subdivision
8:45 - 8:50	Presentation of forms for consideration
8:50	Old Business

Mailed to the Box Elder News & Journal and Ogden Standard Newspaper this 19th day of April, 1994.

Marie G. Korth

Marie G. Korth
Box Elder County Recorder/Clerk

ATT 2

4/21/94

BAY CAMPGROUND

PRIVATE RECREATION PARK

WILLARD, UTAH

Prepared By:
Keith W Jones

for the

Box Elder County Planning Commission
April 21, 1994

ATT 3

APPLICATION

HEARING PRESENTATION

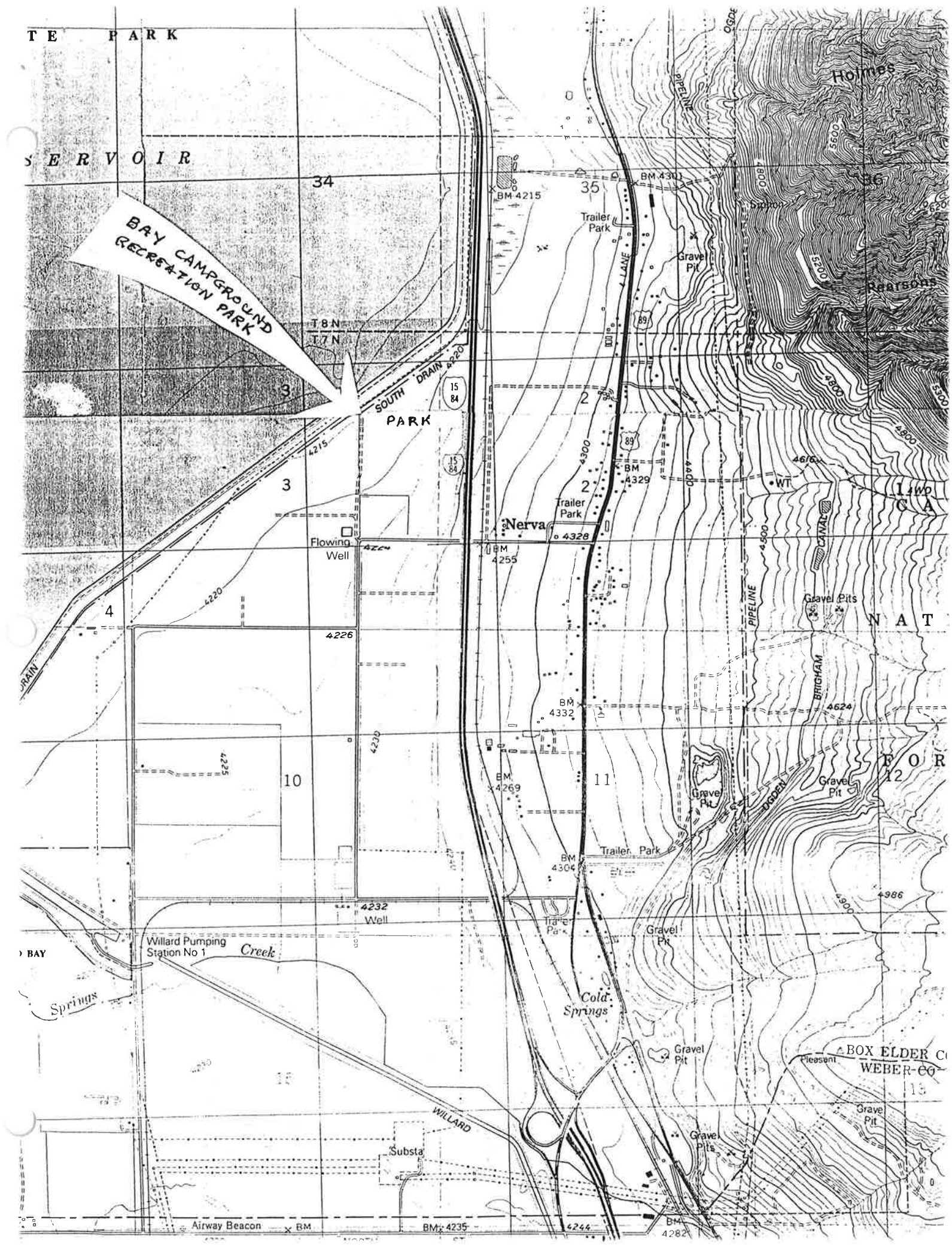
FOR A

CONDITIONAL USE PERMIT

FOR THE

* * * * BAY CAMPGROUND * * * *

* PRIVATE RECREATION PARK *


T E P A R K
S E R V O I R
BAY CAMPGROUND RECREATION PARK
SOUTH PARK
DRAIN
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BM 4301
BM 4329
BM 4255
BM 4332
BM 4269
BM 4304
BM 4282
BM 4235
4328
4226
4232
4244
4986
4624
4616
Trailer Park
Gravel Pit
Gravel Pits
Flowing Well
Nerva
Holmes
Rearsons
Willard Pumping Station No 1
Creek
Springs
Cold Springs
Substa
Airway Beacon
PIPELINE
CANAL
OGDEN
BRIGHAM
WILLARD
BOX ELDER C
WEBER CO
Pleasent
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15
84

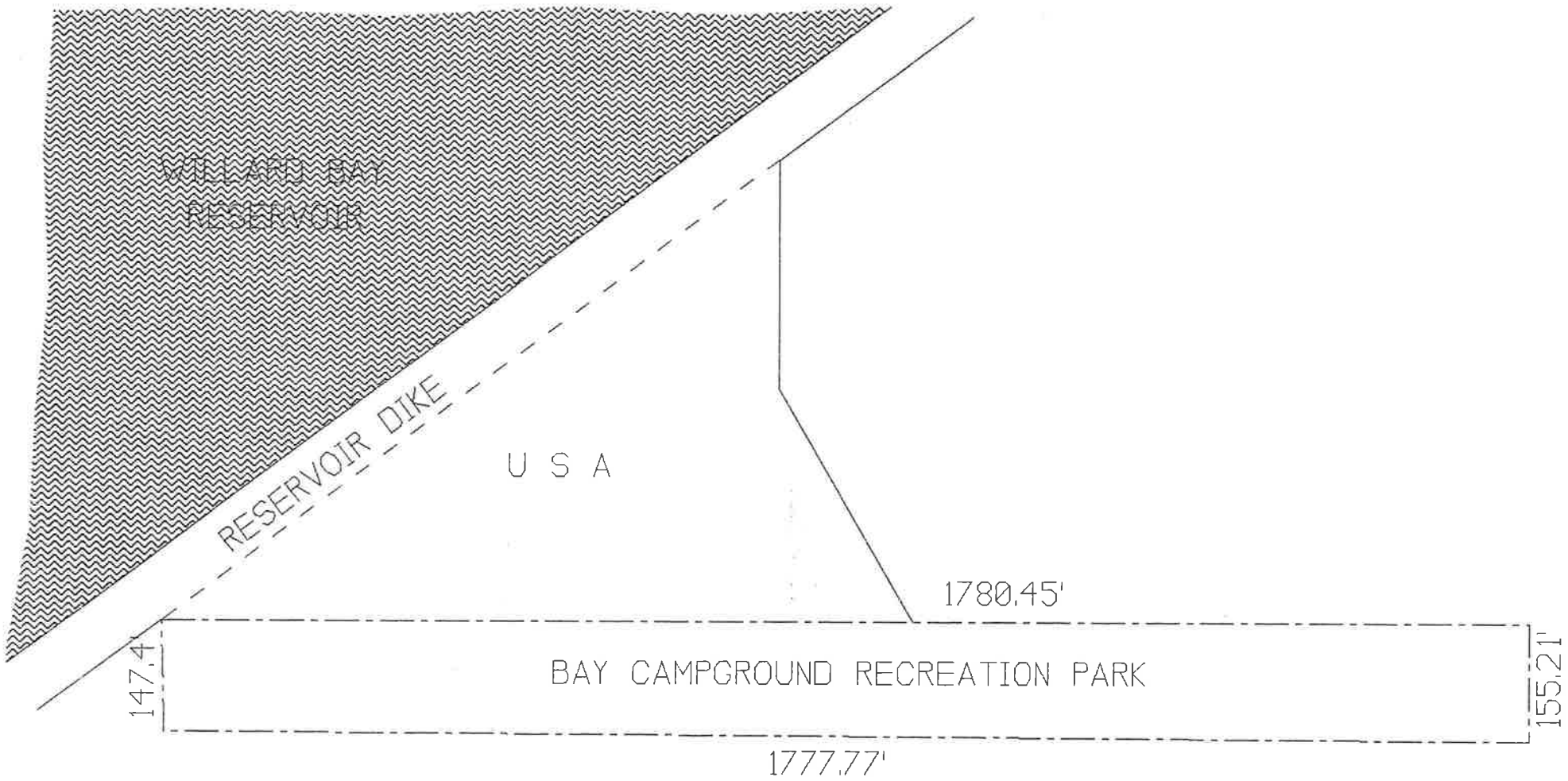

VILLARD BAY
RESERVOIR
RESERVOIR DIKE
U S A
1780.45'
147.4'
BAY CAMPGROUND RECREATION PARK
155.21'
1777.77'

FIGURE 3

GENERAL PLAN CONFORMANCE

- ☺ THE BAY CAMPGROUND PRIVATE RECEATION PARK *IS CONSISTENT* WITH THE APPROVED BOX ELDER COUNTY GENERAL PLAN

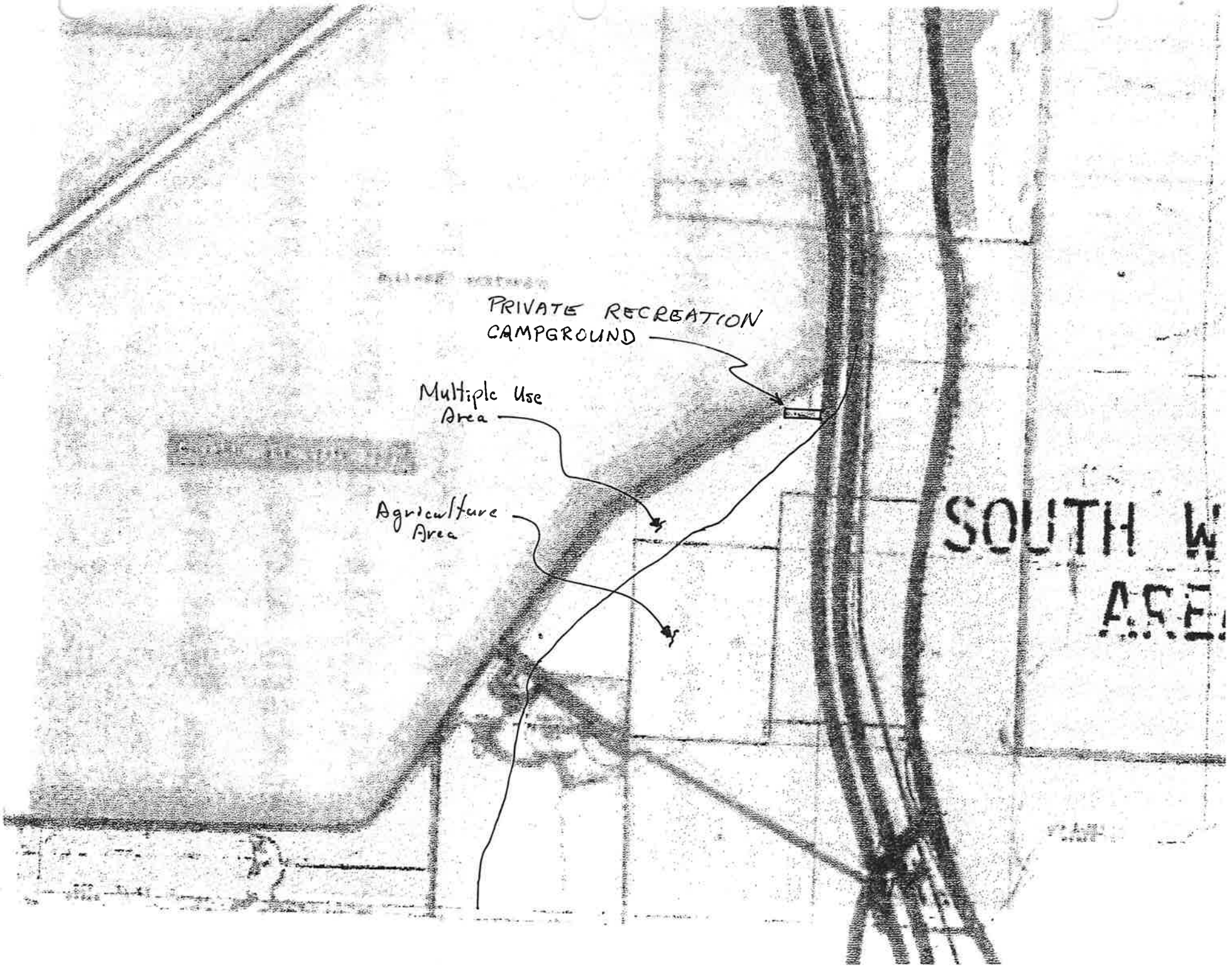
- ☺ PROPERTY WITHIN THE DESIGNATED "MULTIPLE USE AREA" AROUND THE WILLARD BAY RESERVOIR, ONE OF THE COUNTIES MOST VALUABLE RECREATION RESOURCE AREA.

- ☺ ONE OF THE *PRIMARY USE* IN THE "MULTIPLE USE AREA" IS *RECREATION*

- ☺ GENERAL PLAN GOALS AND OBJECTIVES INCLUDE:
  DEVELOP RECREATION RESOURCES
  ENCOURAGE TOURISTS TO VISIT COUNTY
  EVERYONE TO HAVE ACCESS TO A PARK
  (BAY CAMPGROUND FULFILLS THESE GOALS AND OBJECTIVES)

- ☺ STATE OF UTAH – PARKS AND RECREATION DEMONSTRATES RECREATION CAMPGROUND ARE COMPATIBILITY TO AREA LAND USES

- ☺ "WILLARD BAY AREA" IS DESIGNATED FOR PARKS AND RECREATION DEVELOPMENT


PRIVATE RECREATION CAMPGROUND
Multiple Use Area
Agriculture Area
SOUTH W
AREA

CONDITIONAL USE PERMIT

- CAMPGROUND PROPERTY IS LOCATED IN AN A-20 DISTRICT - AGRICULTURE DISTRICT

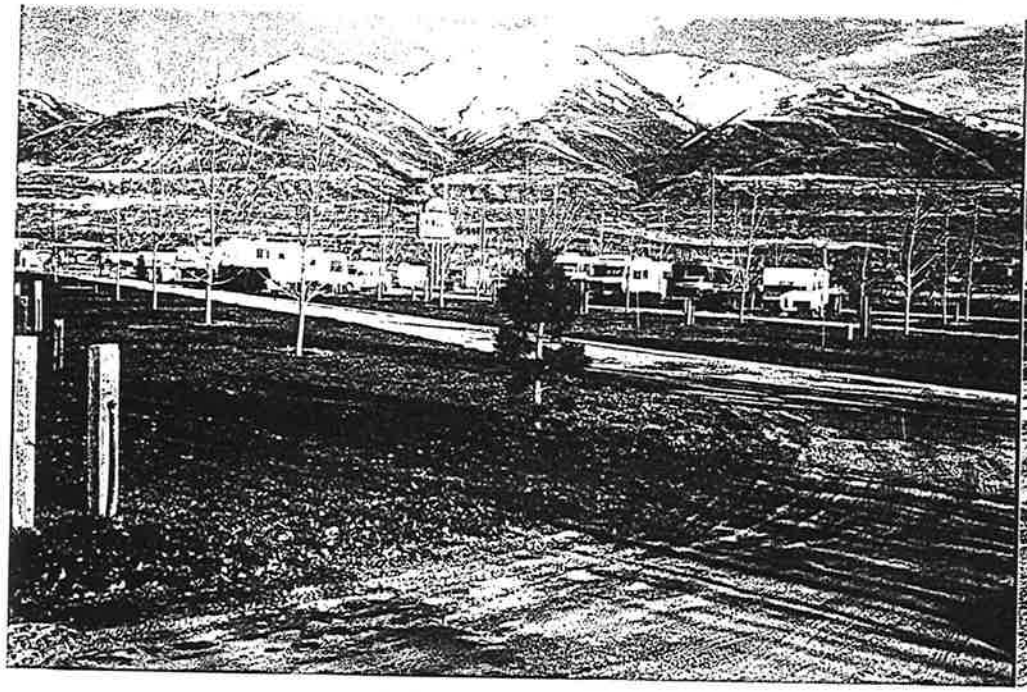
- PRIVATE PARK OR RECREATION GROUNDS OR PRIVATE RECREATION CAMP OR RESORT IS A CONDITIONAL USE PERMITTED USE IN A-20 DISTRICT PER CODE 10.1.13

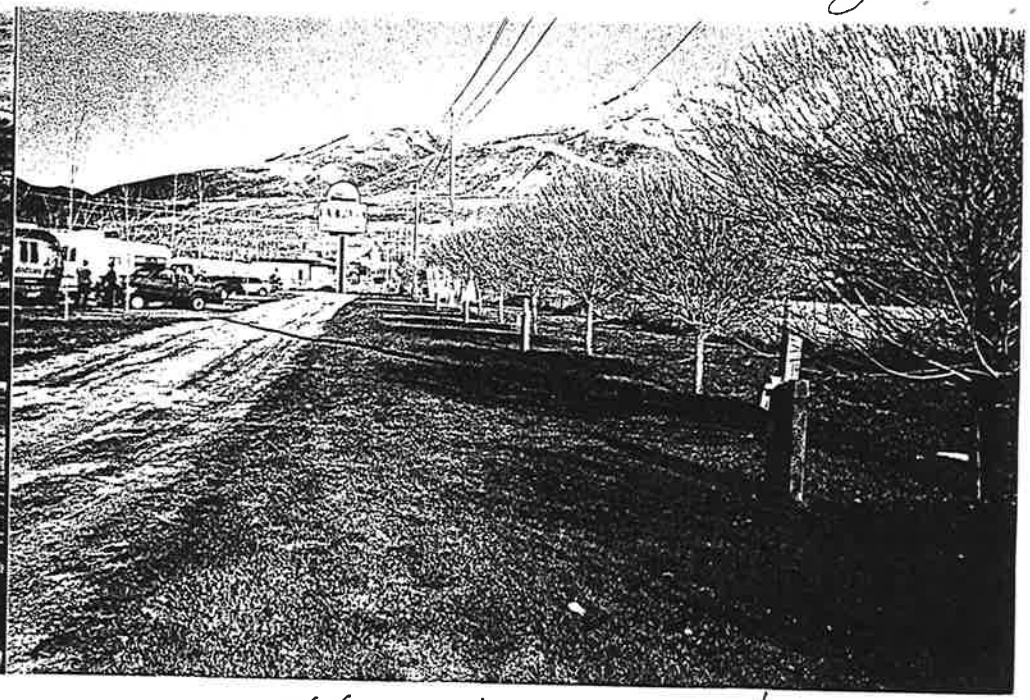
- CODE DEFINED AGRICULTURE USE
  Grazing and pasturing of animals, tilling of soil, raising of crops, horticulture, and gardening.
  NOT INCLUDING any AGRICULTURE INDUSTRY or AGRICULTURE BUSINESS

- CODE DEFINED AGRICULTURE INDUSTRY
  The processing of raw food products by packaging, treating, and/or intensive feeding.
  INCLUDES animal feed yards, raising furbearing animals, commercial poultry or egg production, commercial greenhouses, and similar uses.

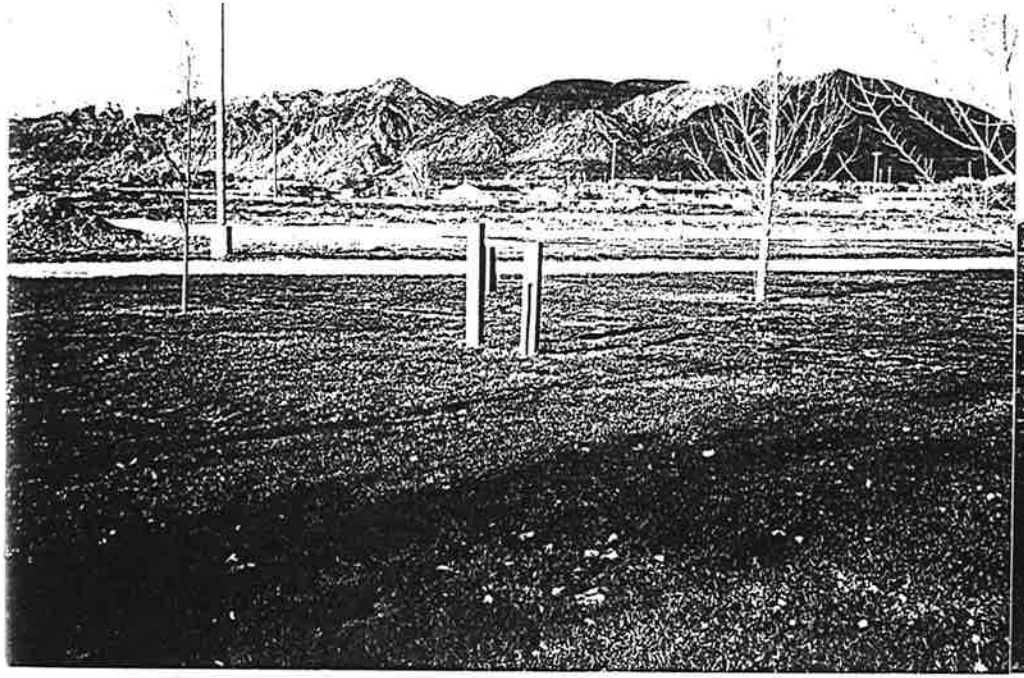
- MOST CAMPGROUNDS IN UTAH ARE LOCATED IN AGRICULTURE AREAS WITH CATTLE PASTURED IN ADJACENT FIELDS

Corner spot RV Park Brigham City





Cattle to North



Cattle to West

THE

BAY CAMPGROUND

PRIVATE RECREATION PARK

IS NOT A

RECREATION VEHICLE PARK

IT IS A

* * * * * CAMPGROUND * * * * *
FOR
CAMPING
A
PRIVATE PARK - RESORT

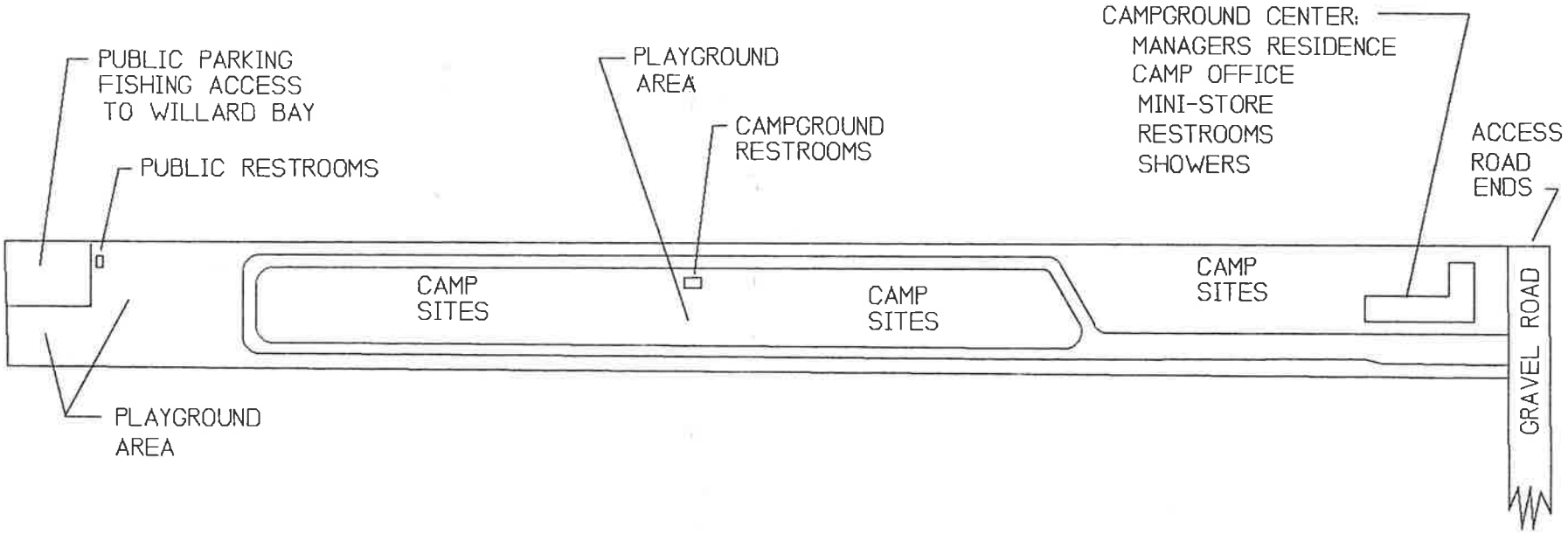
BAY CAMPGROUND

PRIVATE RECREATION PARK

* * * * * * * * * * * * * *

DESCRIPTION

- ☺ CAMP CENTER BUILDING
- ☺ 30 CAMPING LOCATIONS
- ☺ MID-PARK RESTROOMS
- ☺ CHILDREN PLAYGROUND AREA
- ☺ FISHERMAN'S ACCESS
  PUBLIC PARKING AND
  PUBLIC RESTROOMS



BAY CAMPGROUND

PRIVATE RECREATION PARK

PREPARED BY:
Keith W Jones
April 6, 1994
SCALE: 1" = 200'

BAY CAMPGROUND

PRIVATE RECREATION PARK

* * * * * * * * * * * * * * *

CAMP CENTER BUILDING

- CAMP OFFICES
- MANAGER'S RESIDENCE
- PARK EQUIPMENT STORAGE
- MINI-STORE
- RESTROOMS
- SHOWERS
- ZONING ORDINANCE VARIATION – REQUEST
  SIDE YARD FROM 60 FEET TO 20 FEET
  TYPICAL FOR AN RR-5 ZONE
  PROPERTY ONLY HAS 155 FOOT FRONTAGE

BAY CAMPGROUND

PRIVATE RECREATION PARK

* * * * * * * * * * * * * *

CAMPING SITES

- ☺ GRASS PARK (Greenbelt Area)
- ☺ WATER – HOSE CONNECTION
- ☺ ELECTRICAL – 20 AMP
- ☺ 1 – 2 FAST GROWING SHADE TREES – 5 YEARS

  MANY MORE TREES AND SCRUBS WILL BE PLANTED THROUGHOUT THE PARK AND ALONG THE ROADS

- ☺ CAMP TABLE
- ☺ SEWER FOR 5 SITES (Minimum)

BAY CAMPGROUND
PRIVATE RECREATION PARK

* * * * * * * * * * * * * *

ROADS

- ☺ 36' PARK ENTRANCE – GRAVEL
- ☺ 30' TWO WAY – GRAVEL
- ☺ 15' ONE WAY – GRAVEL
- ☺ PARK ACCESS ROAD

  EXISTING 50' GRAVEL COUNTY
  FROM NERVA LANE
  DEAD ENDS AT THE PROPERTY
  A-20 DISTRICT CODE – GRAVEL

BAY CAMPGROUND

PRIVATE RECREATION PARK

* * * * * * * * * * * * * *

UTILITIES

☺ ELECTRICAL – UP&L

UNDERGROUND WITHIN PARK

MINIMAL CAMPGROUND LIGHTING

RESTROOM AND SHOWER BUILDING
LIGHTS TO BE ON ALL NIGHT

☺ CULINARY WATER

NEW DEEP WELL – 14.5 gpm
WATER RIGHT WITH PROPERTY
OR
SOUTH WILLARD WATER DISTRICT

BAY CAMPGROUND

PRIVATE RECREATION PARK

* * * * * * * * * * * * * *

UTILITIES (CONTINUED)

- IRRIGATION WATER - PRESSURE

  WEBER BASIN
  OR
  SHALLOW WELL

- SEWER

  CAMP CENTER WITH THE CAMP RESTROOMS AND SHOWERS WILL HAVE A COUNTY HEALTH DEPARTMENT APPROVED SEPTIC TANK AND DRAIN FIELD SYSTEM (4500 gpd maximum)

  MID-PARK AND PUBLIC RESTROOMS WILL BE VAULTED AND PUMPED

PUBLIC FISHERMAN'S ACCESS TO WILLARD BAY RESERVOIR

- PUBLIC GRAVELED PARKING FOR 20 CARS
  (Provided by Campground)

- PUBLIC RESTROOMS
  (Provided and Maintained by the Campground for Public Use)

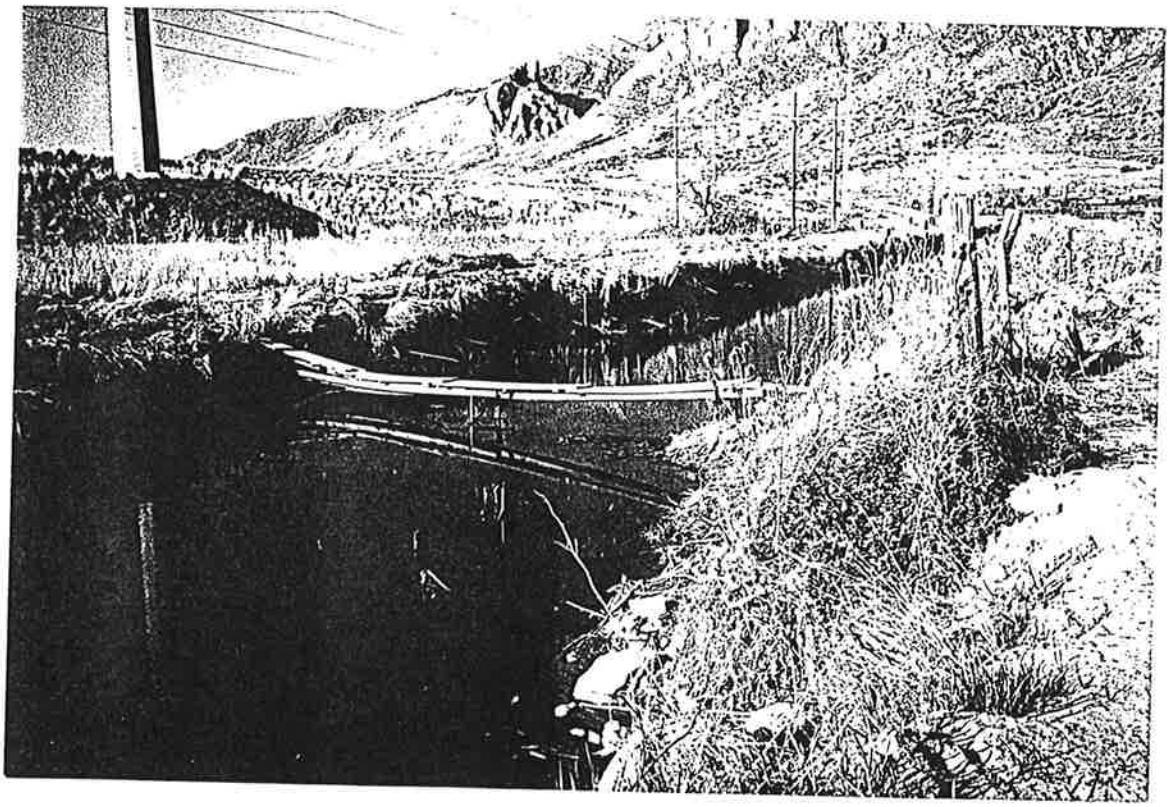
- NEW SOUTH DRAIN BRIDGE FOR WHEELCHAIR ACCESS
  Working with the BLM, Fish and Wildlife, and State of Utah State Parks and Recreation.

- DOCK: PARALLEL TO ROCKY DIKE
  Working with State Parks and Recreation

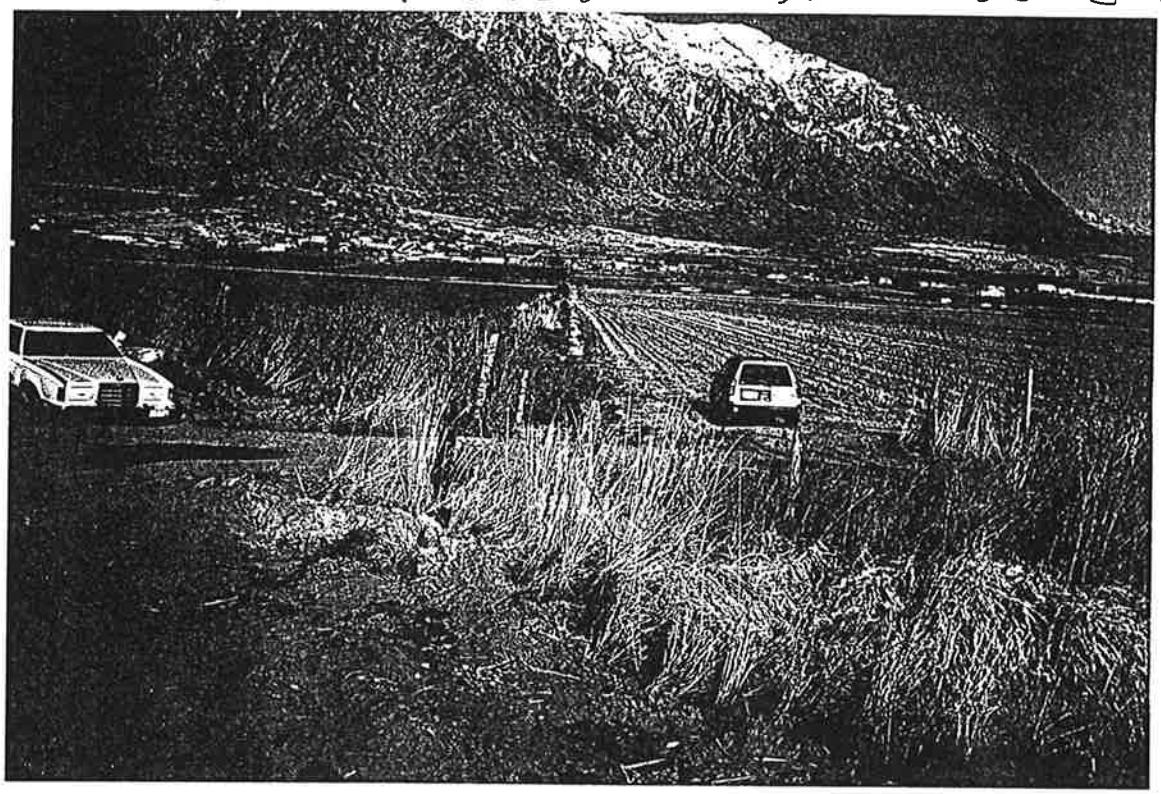
- GRASS PARK – WALKWAY ALONG SOUTH DRAIN WATERWAY
  Working with BLM

FISHERMAN'S ACCESS BRIDGE

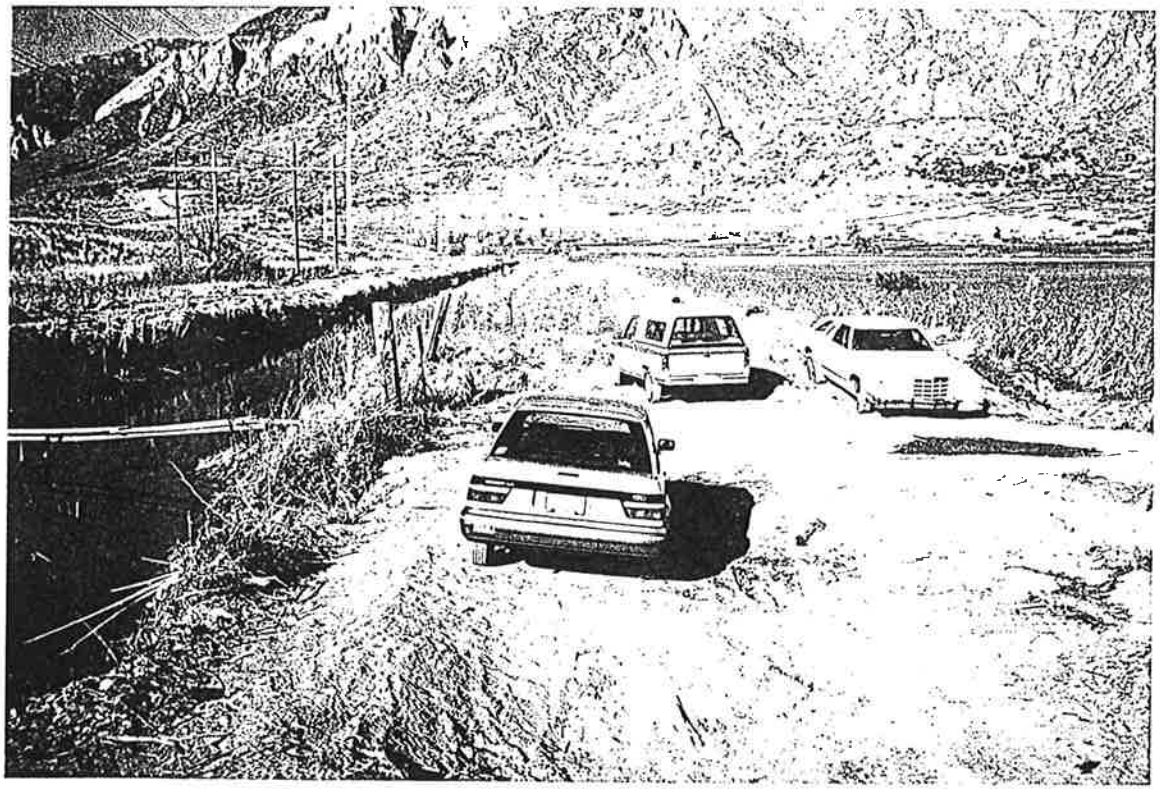
BRIDGE



PROPOSED BAY CAMPGROUND PROPERTY FROM FISHERMAN'S ACCESS



WATER WAY CLEANING 1992

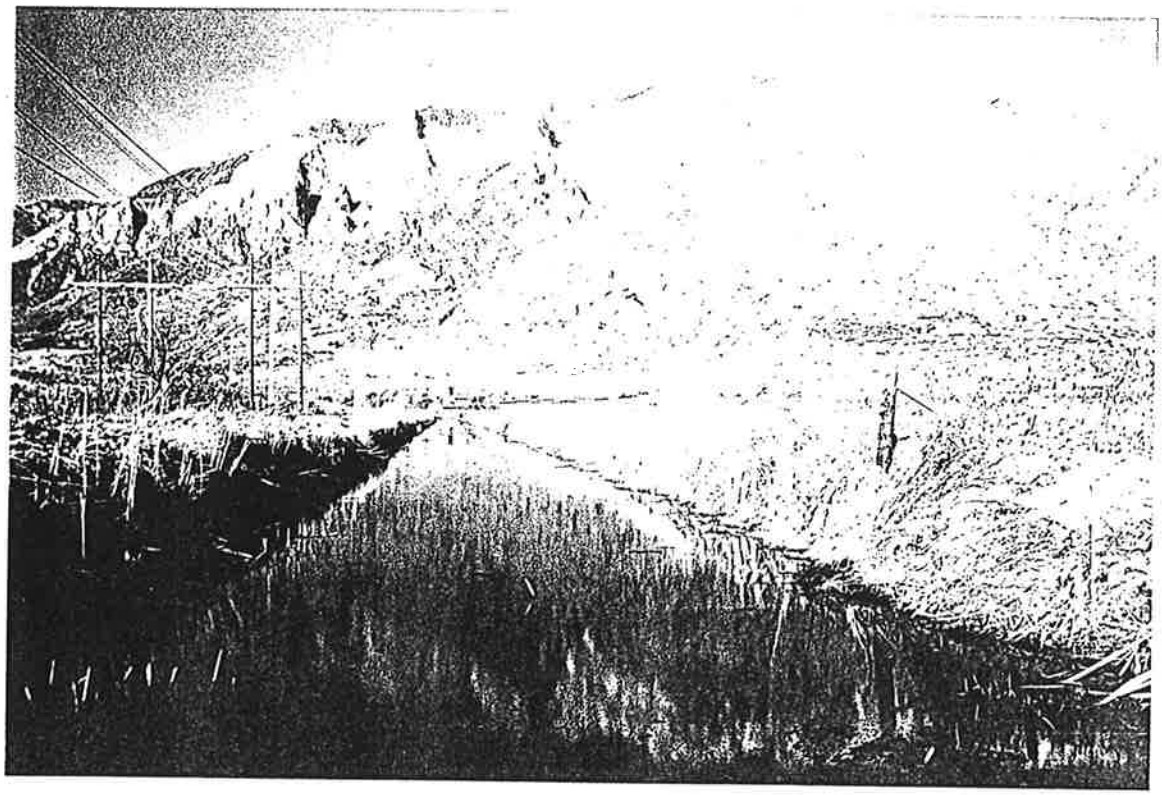


PRESENT PARKING

MOUNTAINS LOOKING NORTH/EAST UP WATER WAY

END OF BRIDGE

PRESENT PARKING



MOUNTAINS REFLECTION IN WATERWAY

ECONOMIC IMPACT

- ☺ INCREASED PROPERTY VALUE WHEN ELECTRICAL POWER COME WEST OF INTERSTATE I-15
- ☺ INCREASE TAX BASE WITHOUT BURDEN TO SCHOOLS OR COMMUNITY FACILITIES
- ☺ PROVIDES SUMMER JOBS
- ☺ PROVIDES 24-HOUR SECURITY TO AREA
- ☺ TOURIST BUY IN BOX ELDER COUNTY WILLARD/PERRY FRUITS, ETC
- ☺ PROVIDES PUBLIC PARK AND IMPROVED WILLARD BAY FISHING AND WALK ACCESS
- ☺ DEVELOPMENT OF A PUBLIC PARK WITHOUT ANY COST TO COUNTY

PROJECT SUPPORT

- ☺ PROPERTY OWNERS ADJACENT AND ALONG ACCESS ROAD TO CAMPGROUND
  Letter Submitted to County:

  1 Barbara Cook Chapman, trustee from Marion Cook Family

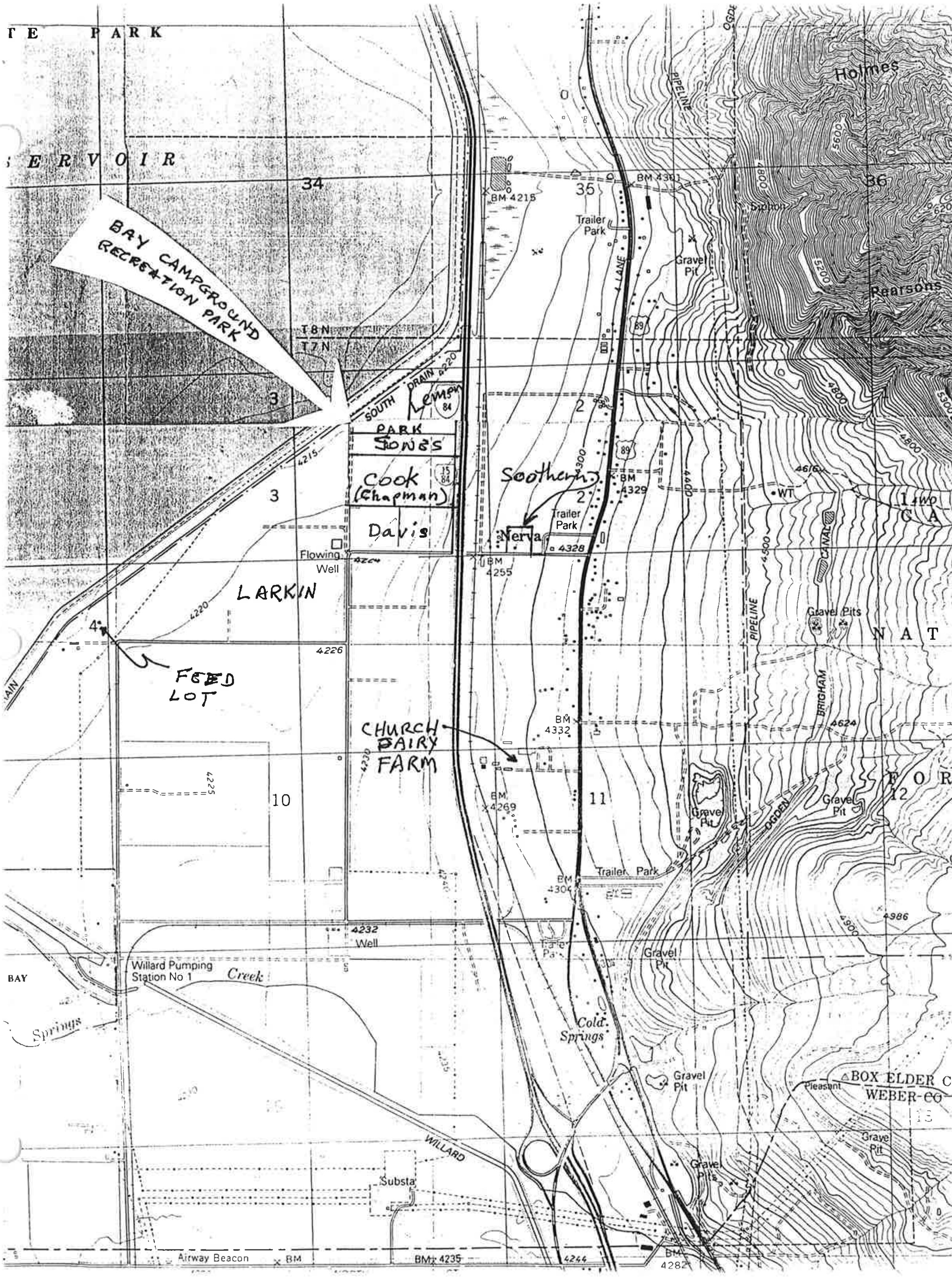
  2 Bob and Ronda Davis

  3 Dawn Scothern

- ☺ PETITIONS WITH OVER 300 SIGNATURE OF SOUTH WILLARD, WILLARD, AND PERRY RESIDENTS

- ☺ LETTERS AND CARDS MAILED TO THE COUNTY COMMISSION FROM OVER 30 RESIDENTS

- ☺ LETTER – BOX ELDER COUNTY ECONOMIC DEVELOPMENT EXECUTIVE DIRECTOR
  Timothy L. Solomon



T E P A R K
E R V O I R
BAY CAMPGROUND RECREATION PARK
Holmes
Rearsons
Siphon
34
35
36
BM 4301
BM 4215
Trailer Park
Gravel Pit
4 LANE
PIPELINE
T8N
T7N
SOUTH DRAIN
PARK
JONES
COOK (Chapman)
Davis
Southern
Nerva
Trailer Park
BM 4329
BM 4255
Flowing Well
LARKIN
FEED LOT
CANAL
Gravel Pits
N A T I
BRIGHAM
CHURCH DAIRY FARM
BM 4332
BM 4269
F O R
OGDEN
Trailer Park
BM 4304
Well
BAY
Willard Pumping Station No 1
Creek
Springs
Cold Springs
Gravel Pit
Pleasant
BOX ELDER CO
WEBER CO
WILLARD
Substa
Airway Beacon
BM 4235
BM 4282

5145 South 1000 East
Salt Lake City, Utah 84117
March 19, 1994

Box Elder County Commission
Brigham City, Utah

Dear Commissioners

I am writing to present the views of my family which are the owners of a piece of property in Box Elder County in the Willard area that is recorded as property belonging to the Marion N. Cook Family Trust.

This property is adjacent to property that is owned by Keith W. Jones who is requesting a zoning change. We are in support of the change sought by Mr. Jones.

We have been informed that Mr. Delond Cole, who rents the property from us, has indicated that he is expressing our views when he speaks about this proposed change. Mr. Cole is expressing his views and not ours. My brother, three sisters, and myself are in support of Mr. Jones' request for a zoning change.

Sincerely,

Barbara C. Chapman

Barbara Cook Chapman, Trustee
Marion N. Cook Family Trust

RECEIVED Feb 1, 94

Dear County Commissioners, FEB 2 2 1994

COUNTY COMMRS

I would like to express my support for Mr. Jones RV park project.

On January 18, 1994 I attended the meeting on the RV park proposal. I did address the meeting. I was not angery, I was concerned on various safety questions I had about this RV park using 7800 So. I live on this road so it would directly effect me. After the meting on the following week. January 25, 1994, alot of my questions and concerns were addressed and I found Mr. Jones answers to be greatly researched and I felt that they met my questions with answers I find suitable. After this meeting I had a long talk with Mr. Jones where I was able to ask even more questions on the things that concern me.

As of the problem with the smells of nature that come from the area If Mr. Jones signs papers that no one would come back on the farms for the smells of nature. I don't see how this can be a concern of the people in the area. With the problem of dust, I don't

See that there is any concern for this. The farming in the area creates more dust then that of the RV'ers. There is a lot of dust that comes from the gravel pit of Parson's much more then that of the amount of RV'ers. If Mr. Jones paves the ~~access~~ access Road, where will the dust come from?

There are a few concerns that I still have, but I feel that they can be worked out with working with Mr. Jones on a one to one bases. I have found Mr. Jones to be a pleasant person and willing to work with everyone. I feel we need to give him a chance to express his plans and give him ~~of~~ a fair chance and Ruling.

I dont appose his project for a RV park as long as safety standards are met.

Thank You

Dawn Brothers

916 W. 7800 S

Willard, Ut 84340

BOX ELDER COUNTY ECONOMIC DEVELOPMENT

March 4, 1994

Box Elder County Commissioners
County Courthouse
Brigham City, UT 84302

Dear Commissioners:

This letter is written in support of allowing a campground to be located near Willard Bay. This project is being proposed by Mr. Keith Jones. Mr. Jones attended the County Tourism Council on February 15, 1994 and briefly discussed this project. His idea appears to be beneficial to the county and would enhance the Willard Bay area.

Very truly yours,

Timothy L. Solomon
Executive Director

TLS/st

102 East Forest Street
Brigham City, Utah 84302

SANPETE COUNTY SHERIFF'S OFFICE

RECD MAR 11 1994

Wallace S. Buchanan
Sheriff

160 N. Main, Manti, Utah 84642
Phone (801) 835-2191
Fax (801) 835-2143

March 9, 1994

Box Elder County Commissioners
Lee Allen, Chairman
01 South Main Street
Brigham City, Utah 84302

Dear Commissioners:

This letter is being written at the request of Keith Jones, President of the Sportsman's Resort Dev. Corp. I received a letter from Mr. Jones on March 8, 1994. Mr. Jones had some questions regarding the problems, if any, our department has had with the Camper World R.V. Park located in Sanpete County.

In my opinion, Camper World has been an asset to Sanpete County, and in the 19 years that I have worked in the Sheriff's Office we have had very few problems. We have very few complaints from the citizens surrounding the area, regarding noise, vandalism, or animals killed etc.

I hope I have answered any questions you had regarding this. Please advise if there is anything further I can do to help.

Sincerely,

Wallace S. Buchanan
Sanpete County Sheriff

WSB/dlh

Dear Commissioners,

We support the proposed RV campground going in west of I-15 south of Willard Bay. We did not attend the Public Hearing on January 21 because we had no concerns that needed to be addressed. Now that there is opposition, I would like to make it known that I would like to see a private campground next to Willard Bay. It will be an asset to our community and county. Please vote to have this project.

Thank You,

Dear Commissioners,

We support the proposed RV campground going in west of interstate I-15 on the south side Willard Bay. We did not attend the Public Hearing on January 21 because we had no concerns that needed to be addressed. We can not see how anybody would not want this resort down by Willard Bay. The more we hear about this project the better it sounds. It should be an asset for our community and county. Now that there is opposition, I would like to make it known that I would like to see this RV-Resort campground go in next to Willard Bay. Please support this project.

Thank You,

Lorin Peterson

Dear Commissioners,

We support the proposed RV resort campground going in west of interstate I-15 south of Willard Bay. We were for this project and thought you were too. I would like to make it known that I would like to see this RV campgrounds next to Willard Bay. It will be an asset to our community and county. Please vote in favor of this project.

Thank You,

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Thank You,

Dear Commissioners,

We support the proposed RV campground going in west of interstate I-15 at the south side of Willard Bay. It will be an asset to our community and county. We can not see how anyone would oppose such a project. Now that it is known that there is opposition, I would like to make it known that I would like to see a private campground near Willard Bay. Please vote for this project. Keep up the good work.

Thank You,

PERRY, UT. 84302

Dear Commissioners,

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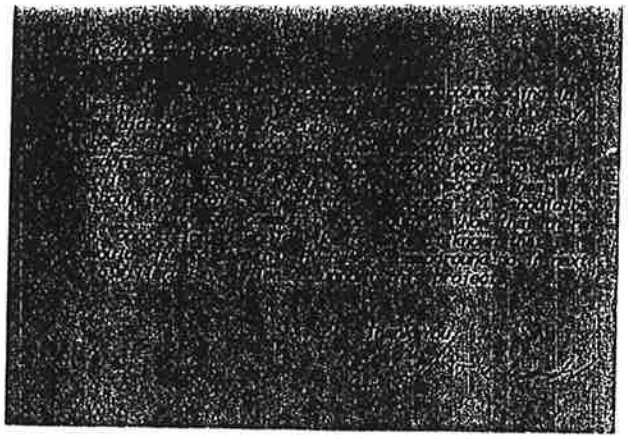
Thank You,

Wimpil Degraw



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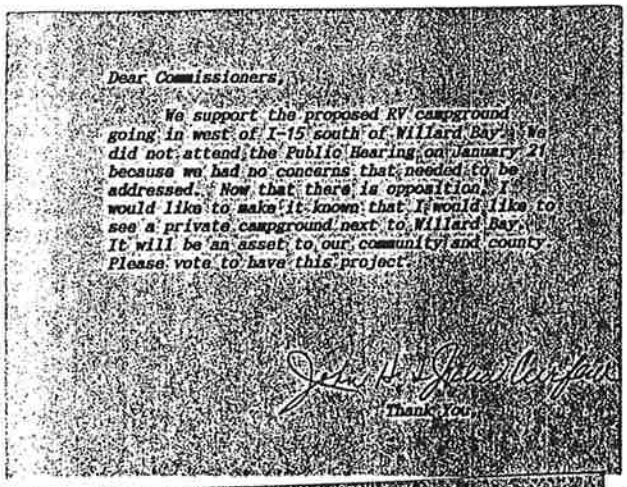

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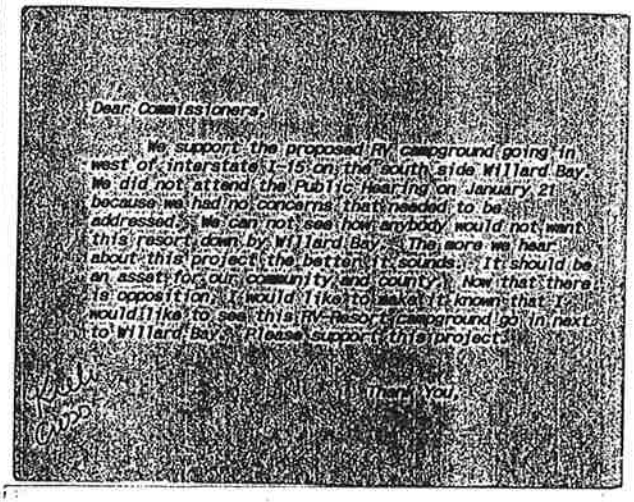

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Thank You,

Daniel J. Wilkins

12530 S 1450 W Perry

Dear Commissioners,

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Thank You,

Kathleen B. Esplin

Dear Commissioners,

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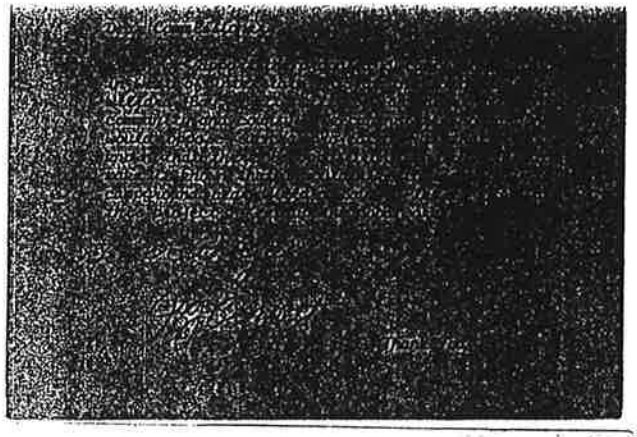
Thank You,



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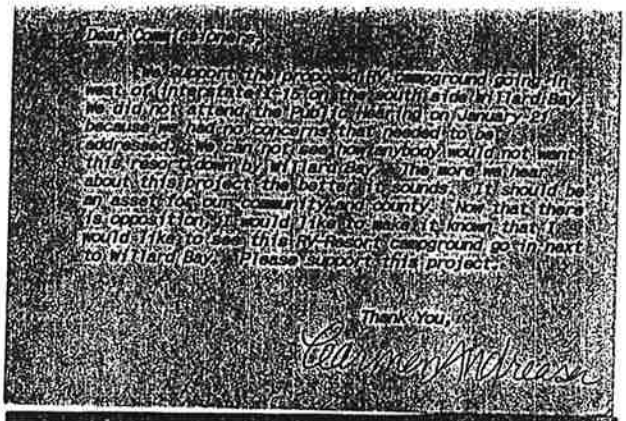
Thank You,

Tim Cordrick

P.S. I'm looking forward to seeing



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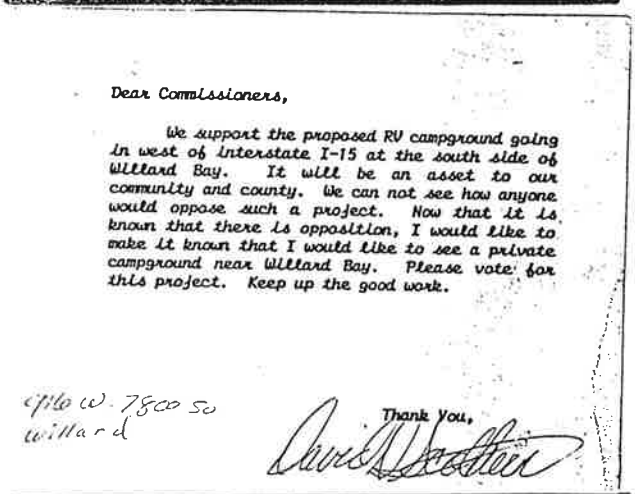
Thank You,

Connie Adams



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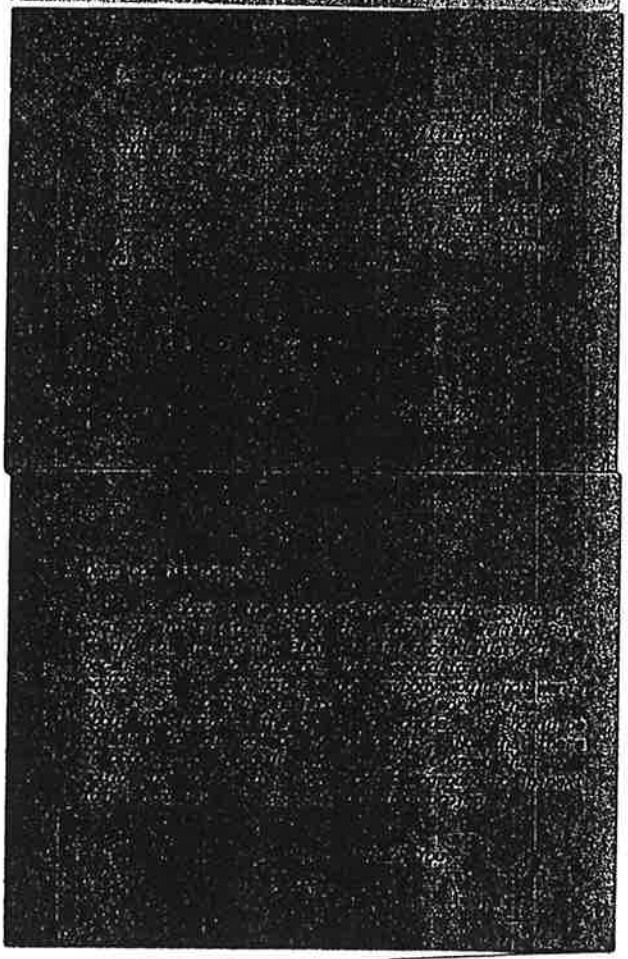
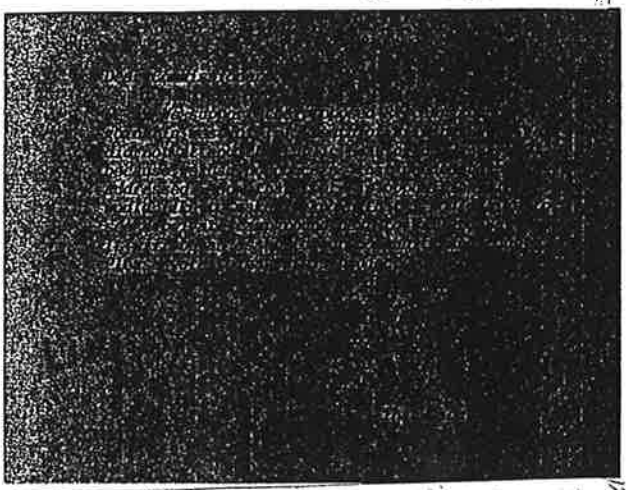
Thank You,

David Wadsworth

1716 W. 7800 So
Willard





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Thank You,

Scott Bushnell

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Box Elder County do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

South Willard Residents

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	Stanley K Parker	7985 So Hwy 89 Willard
2	Louise Parkin	same
3	Donnalee Ball	7895. 755W Willard, Ut
4	LeRoy C Ball	Same
5	Jana Peterson	7865 S. 750 W willard, UT.
6	Terry Peterson	755W 7900So. WILLARD UT
7	Janis Perry	765 W 7900 So Willard, UT
8	Heidi Sporna	40 W 200 S willard, UT
9	Patty Stone	519 W 100 S Brigham UT
10	Ethel Heiner	655 So Main Willard
11	Wynn S. Hillstead	655 No Main Willard
12	CRAIG WELK	90 HILLVIEW DR BRIGHAM CITY
13	Chris Baxter	155 s 300 E. Bx118 Willard City
14	Annette Hansen	57 N. 200 E Willard,
15	Craig Carlson	255 E 100 E willard
16	Julie Carlson	255 E 100 E willard
17	Patty Shabbey	275 E 100 N willard
18	Carol C. Colton	285 E. 100 N. WILLARD
19	[illegible]	325 E. 100 No willard Ut.
20	[illegible]	" " "

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV–CAMPGROUND PROPOSED FOR WEST OF I–15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the South Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	Chrissy Richardson	845 W. 8700S. #1 Willard
2	Brittiley Pike	845 W. 8700S #4 Willard
3	G. Lee Southoff	845 W 8700S #5 WILLARD
4	Chris C Pearson	845W 8700S #6 willard
5	Joy A Rinell	845 W 8700 S #9 Willard
6	Wendell Holmes	845W 8700 S #38 Willard
7	Evelyn Rinell	845 W 8700 S #7 Willard
8	Will Hicks	845 W 8700S #10 Willard
9	Nancy L Morris	845 W 8700 S #16 Willard
10	Buck S Shuster	845W 8700S #36 WILLARD
11	Laura L Ferguson	845 W 8700S #40 Willard
12	David L. D'Ana	845 W. 8700 S. #42 Willard
13	Irene Jones	845 W. 8700 S0
14	Heidi Gordon	845 W. 8700 S. #34 Willard
15	Shane Gordon	" "
16	Dana Miller	" #33
17	Jean Stengell	" " " " #32
18	Ruby Rogers	" " " " #32
19	Kathleen Hunter	" " " #31
20	Chris Cain	" " " #30

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the South Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	L. Dell Brock	845 W 8700 S, Willard, Ut 84340
2	James H Brock	845 W 8700 S, Willard, Ut 84340
3	Thomas Hess	845 W 8700 S Willard Ut, 84340
4	Leland Horner	845 W 8700 S. Willard, Ut. 84340
5	Lynette Bunker	845 W 8700 S Willard UT 84340
6	Mary B. Swartz	845 W. 8700 S. Willard, UT 84340
7	George F. Arnold	845 W 8700 S Willard UT 84340
8	Bonnie Hoskins	845 W 8700 S Willard Ut 84340
9	Kim C Hillis	845 W 8700 S Willard UT
10	Allen Murphy	7720 S. Hwy 89 #23 Willard Ut.
11	Pamela Murphy	7720 S. Hwy 89 #23 Willard UT
12	Barbara Warner	7720 So Hwy 89 #30 Willard Ut 84340
13	Keith Dai	6900 S. Hwy 89 Willard
14	Katina Munkel	1060 S. Main Willard
15	Ed Summers	1060 So Main Willard
16	Vick Sanderson	1030 So. Main Willard
17	Wallace Summers	86850 Main Willard
18	Audrey Lee	195 So main Willard.
19	Margareth Lee	845 S. Main Willard
20	Keven L Hardy	8135 main Willard

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Box Elder County do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

South Willard Residences

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	Gary W. Coleman	8615 So. Hwy. 89 #16 No.
2	Myrna L. Beede	8615 So Hwy 89 #15 - North
3	Pat Moore	8615 S Hwy 89 #16 N Willard
4	Ida Jo Mapp	8615 S Hy 89 #13 N
5	Julie Schlehuber	8615 S Hwy 89 #12
6	Stu Davis	8615 So. Hwy 89-9N
7	Dorothy Gooden	8615 So. Hwy 89-9-N.
8	Boyd Davis	8615 So. H. Hy 89-9N.
9	Eugene Busby	8615 So Hwy 89 9N
10	Jo Flegal	8615 So Hwy 89-N3
11	Lil Flegal	SAME
12	Shirley D Wilcox	8615 So. Hwy 89-2N
13	Betty Wall	8615 So Hwy 89-N1
14	Colleen Kay	8615 Hwy 89
15	David Hadley	8615 S. Hwy 89 #7 So.
16	Christine Hadley	"
17	Martha Bryant	8615 S Hwy 89 #85
18	Mary H. McGuire	8615 S Hwy 89 #95
19	Bob Masters	8118 So Hwy 89
20	Ruth Masters	8118 So Hwy 89

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Perry and Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	[illegible]	P.O. Box 217 Willard
2	[illegible]	P.O. Box 89 Willard
3	[illegible]	Box 321 Willard
4	[illegible]	194 S 1st W Willard
5	[illegible]	170 S 1st W Willard
6	[illegible]	175 S 100 W. Willard
7	[illegible]	150 100 W. Willard
8	[illegible]	130 W 100 So Willard
9	Duane Kunzler	130 W. 100 So. Willard
10	Linda L Haines	175 W 100 S. Willard
11	[illegible]	151 S 200 W Willard
12	[illegible]	195 S. 200 W. WILLARD
13	[illegible]	301 N 200 W Willard
14	[illegible]	305 N 200 W Willard
15	[illegible]	199 W. 200 N. Willard
16	[illegible]	171 N 1st W
17	[illegible]	128 N 1st W Willard Ut
18	Steve Zundel	1249 E 3100 N. No. Ogden, Ut.
19	[illegible]	P.O. Box 411 Willard
20	MARIO SIMMONS	155 W. 100 W Willard

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Perry and Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	[illegible]	127 No 100 W Willard
2	[illegible]	140 W. 100 N. Willard
3	[illegible]	55 S 1st East willard
4	[illegible]	55 So. 1st E Willard
5	[illegible]	170 E. Center Willard
6	[illegible]	10 S 2nd E willard
7	[illegible]	45 S 2nd E willard
8	[illegible]	75 S 2nd E. Willard
9	[illegible]	235 E. 200 S. Willard
10	Judy D. Stevens	250E 200S Willard
11	[illegible]	[illegible] Willard
12	[illegible]	275 E 200 S Willard
13	[illegible]	190 S 2nd E Willard
14	Chester & Grace Reyes	197 E 100 S Willard
15	Aaron & Cassie Plumsaker	190 E 100 South
16	[illegible]	160 E 100 [illegible]
17	[illegible]	155 E 100 S Willard
18	Richard Zundel	955. 200 E. Willard ut.
19	[illegible] Zundel	95 So 2E Willard UT
20	[illegible] Zundel	95 S 200 E WILLARD UT

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Perry and Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	[illegible]	Box 442 Willard, Ut
2	[illegible]	Box 257 Willard Ut
3	Eddie Brimberry	Box 222 Willard Ut.
4	Frances Brimberry	" " Ut
5	Donald & Gloria Eldridge	PO 302 Willard Ut
6	[illegible]	P.O. 358 Willard Ut.
7	Diana Baker	PO Box 267 Willard Ut.
8	Jaquie Jensen	P.O. Box 15 Willard, UT
9	[illegible]	PO Box 15 Willard Ut
10	Judy Larkin	PO Box 743 "
11	Dean Coburn	Box 28 Willard, Ut.
12	William E Snell	Box 453 Willard UT
13	Kathleen Esplin	Box 368 Willard, Ut.
14	Josh Snell	PO BOX 443, Willard, UT
15	[illegible]	PO BOX 407 WILLARD, UT
16	Laura Johnson	PO Box 84 " " "
17	[illegible]	P.O. Box 120 Willard Ut.
18	[illegible]	Willard UT
19	Larry A Christopherson	P.O. 437 WILLARD UT
20	Max C Smith	170 E 200 So.

Names

Names

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the South Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	[illegible]	[illegible]
2	[illegible]	7720 Hwy 89 #3 Willard UT.
3	[illegible]	7720 So Hwy 89 # 30
4	[illegible]	7720 So Hwy 89 # 10 Willard UT 84357
5	[illegible]	7720 So Hwy 89 # 45 Willard [illegible]
6	[illegible]	7720 S Hwy 89 #4 Willard 84357
7	[illegible]	7720 S Hwy 89 #1 Willard [illegible]
8	[illegible]	7720 S Hwy 89 Willard
9	[illegible]	7720 S. Hwy 89 #13 Willard
10	[illegible]	7720 S Hwy 89 #15 Willard
11	Diana Wright	7720 So Hwy 89 # 3 Willard
12	[illegible]	7720 S Hwy 89 # 17 Willard
13	[illegible]	7720 S. Hwy 89 #39
14	[illegible]	7720 S Hwy 89 #39 Willard
15	BILL MONEY	7720 S. HWY 89 #41 WILLARD
16	[illegible]	7676 So Hwy 89 Willard
17	[illegible]	7355 S. Hwy 89. Willard [illegible]
18	[illegible]	7780 So Hwy 89 Willard UT
19	[illegible]	7125 S. HWY 89 WILLARD 84340
20	[illegible]	195-50. -200 W. Willard at

[illegible] 7738

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the South Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	Sheila Strong	725 S main Willard
2	Josie Jackson	708 So main Willard
3	Cyndy L Christensen	438 So Main Willard
4	John H. Kotts	42 EAST CENTER ST. WILLARD
5	Shirley P. Kotts	42 E. Center St. Willard
6	Nona Jeddson	56 E Center St Willard
7	MIKE FLINT	95 E 100 S WILLARD
8	Dan Flint	26155 Hwy 89 PERRY
9	Rue Flint	95 E 100 S Willard
10	Blaine Bedingar	10. E " "
11	Julia Curfew	146 E 200 E Willard
12	John H Carfew	" " "
13	Frances Bowdle	434 E 1st So Willard
14	LeRoy H Bowdle	234 E 1st So Willard
15	Connie Hansen	1st So Willard
16	Rhonda Call	1st So Willard
17	Dave Esplin	125 So 300E Willard
18	David Wilson	305 E 100 S. Willard
19	Bryan A. Miller	1055. 300E Willard
20	Neal Wyatt	455. 300E Willard

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Box Elder County do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	Val Greer	816 So. Main Willard
2	Elden Hardy	Ogden
3	[illegible]	813 s main willard
4	[illegible]	767 S main willard
5	[illegible]	762 S Main Willard
6	[illegible] Nichols	76 E. 100 N. Willard
7	Judy Brueger	85 N. 1st East -
8	Douglas Pinkerton	95 E 1 North
9	Heather Hasenohrl	127 N. 100 E Willard
10	Sandra Baumann	126 E 100 N. Willard
11	Edward C Baumann	Box 97 Willard ut
12	Wendy Allred	Box 483 Willard UT
13	Sharon Zundel	Box 425 Willard ut 84340
14	Darrel Bennett	Box 726 Willard 84340
15	Sid Bodily	Box 21 Willard, ut. 84340
16	Scott Bodily	Box 21 Willard, Ut. 84340
17	[illegible]	Box 504 willard, ut 84340
18	[illegible]	4413 S. 150 E. Ogden
19	[illegible]	P.O. Box 9323 Ogden
20	[illegible]	105 N Main Willard

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	Stacey Rundell	95 So. 200 E. Willard
2	Sabrina Laub	169 S. 200 East Willard
3	Brandi Wells	520 W. 600 N. Bear River City
4	William Laub	169 S. 200 E. Willard
5	Isabelle McNeely	355 So Main, Willard
6	Pamela S. Coates	369 So. Main, Willard
7	Brett Eaton	315 So MAIN WILLARD
8	Robert G. Krumm	301 S. MAIN WILLARD
9	Kathy Olson	255 S MAIN WILLARD
10	Darrell Lifield	55 Fo 200 S. Willard
11	Dean Youngkeit	171 So Main Willard
12	KIMBALL K HENSLEY	325 N MAIN "
13	LaVee C Hensley	" "
14	Walton Summers	365 E 200 So. Willard
15	Carrie Beyer	325 E 200 So. Willard
16	Susan Deamons	295 S 200 E Willard
17	[illegible]	260 S 3rd E Willard
18	Manuel Salinas	71 E 100 N
19	Carrie Vega	2834 Liberty Ave
20	Dan Salinas	230-7th Ogden

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the ~~South~~ Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	James E. Wells	301 E. 125 N
2	Homer E McCall	177 E 100 N
3	Jamy Braegger	151 E 100 N
4	John T Edwards Jr	50 N 100 E
5	Janice Eskelson	46 N 100 E
6	Bill Cowley	46 No. 100 E.
7	Jimmy Wall	4 N 1ST 100 E
8	Ryan Jones	10 S 2ND E
9	Kayleen Jones	10 So 2nd East
10	Jerene Bustamante	7 So 2nd East
11	Robert Bandel	
12	Sue Anderson	57 So 100 W.
13	Rachel Braegger	7150 1ST WEST
14	Rhea Loveland	705 100 West
15	Kenneth N Barker Jr.	95 South 100 West
16	Rachel Barker	95 South 100 West
17	[illegible]	50 South Main
18	Lance Brumberry	9 South Main #3
19	John Cosgrove	9 South Main #4
20	Lynette Gallegos	9 South Main #5

WE ENCOURAGE YOUR SUPPORT FOR THE RV–CAMPGROUND PROPOSED FOR WEST OF I–15 ON SOUTH SIDE OF WILLARD BAY

The following Coast to Coast Campers do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they encourage your support of the rezoning of land next to Willard Bay to accommodate this RV-Park campground. We believe this proposed Coast to Coast campground next to Willard Bay will bring a lot of tourism to Willard from all over the State of Utah and the USA. It will be an asset to your County and the Willard Bay area. When we travel we bring our money and spend it in the campground community.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

Campers

Willard Residents

	Name:	Address:
1	William Giles	2125 W. 800 N. West Point
2	Michael J. Canty	1035 N. Harrisville Rd.
3	Blain H Johnson	736 N 825 W Clearfield Ut
4	Carole H Johnson	" " " "
5	Janet A. Tanner	49 W 200 S Willard
6	Raymond A. Hansen	65 W 200 S Willard
7	Marcia Mueller	125 W 200 S Willard
8	Dan N. Mueller	125 W 200 S Willard
9	Lorin Farley	176 So. 200 W Willard
10	Ronald F. Larsen	110 S. 200 W Willard
11	Helen B. Larsen	" " "
12	Konrad Hardy	190 E 200 S Willard
13	Shirleen Farley	181 E 200 S. Willard
14	[illegible]	181 E 200 S. Willard
15	Dawn Buckley	205 200 E Willard Ut
16	Jennifer Eskridge	205 S 200 E Willard Utt
17	Marilynn Eskridge	205 So 200 E Willard
18	Robert Eskridge	" " "
19	Scott L. Buckley	205 So. 200 E. Willard
20	Gordon W. Farley	156 So 200 E. Willard

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Perry and Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	Welda B Mund	100 N Main Willard Ut 84340
2	Stephanie Mund	135 N. Main Willard, Ut 84340
3	Sheila Hoppie	195 N. Main Willard, UT 84340
4	W. Bart Hoppie	195 N. Main Willard, Ut.
5	Boyd Hirschi	2362 So 425 West Perry, Utah
6	GARY BEADLES	504 W. ALLEN PERRY, UT. 84302
7	Jeff Nelson	505 W Allen Perry Ut
8	Mary Deiter	515 W. 2400 S. Perry Ut 84302
9	Kellen Fletcher	520 W 2400 S Perry Ut 84302
10	Bonny Fletcher	540 W. 2400 S. Perry Ut 84302
11	Karen Caldwell	2435 S. 550 W. Perry Ut 84302
12	Edward J. Dubiszewski	2455 S. 550 W. Perry UT 84302
13	Kristi Green	2460 S. 550 W. Perry UT 84302
14	Heath Green	2460 S. 550 W Perry Ut 84302
15	Jon McMullen	2465 So 550 W Perry Ut 84302
16	Lori Morris	2475 S. 550 W. Perry Ut. 84302
17	Wilma Taylor	2480 S. 550 W Perry Ut. 84302
18	Elgie Hale	2485 S. 550 W Perry UT. 84302
19	Ruben Lopez	9 S. Main Trailer #5
20	Larry Erickson	2560 S. 500 West Perry Ut 84302

WE SUPPORT THE PLANNING DISTRICT REZONE FOR THE RV-CAMPGROUND PROPOSED FOR WEST OF I-15 ON SOUTH SIDE OF WILLARD BAY

The following property owners and/or residents in the Perry and Willard Area do hereby state to Box Elder County Commission and Box Elder County Planning Commission that they support the rezoning of land next to Willard Bay to accommodate an RV-Park campground. We believe this private campground next to Willard Bay will bring a lot of outside tourism needed for our community and will be an asset to our Willard/Perry area.

WHEREFORE, we, the undersigned, do hereby SUPPORT the proposed rezoning:

	Name:	Address:
1	[illegible]	2420 So 400 W. Perry
2	[illegible]	2470 So. 400 W Perry
3	Nanette Earl	410 W 2300 So Perry
4	[illegible]	2475 S. 450 W Perry
5	[illegible]	2430 S 450 W Perry
6	Reva Anderson	2410 S 450 W Perry
7	Margaret H Bush	2505 S 450 W Perry
8	Shirley K Bowman	2555 S. 450 W. Perry
9	Kathleen Wright	[illegible]
10	[illegible]	2575 Peach Dr, Perry
11	David Drews	2590 So 450 West Perry
12	[illegible]	2580 So 450 West Perry
13	[illegible]	2560 S. 450. Perry
14	[illegible]	2520 S. 450 W, Perry
15	Robert R. Bingham	2565 S Cherry Dr, Perry Ut 84302
16	[illegible]	2580 S. 500 W. Perry 84302
17	[illegible]	2555 Cherry Perry
18	[illegible]	3564 So Hwy 89 Perry
19	[illegible]	2530 S. 550 W, Perry, Utah
20	[illegible]	2530 S 550 W Perry, Ut

ADDITIONAL SUPPORT FOR CAMPGROUND

- ☺ BOX ELDER COUNTY TOURISM COUNCIL
- ☺ GOLDEN SPIKE COUNCIL
- ☺ STATE OF UTAH TOURISM COUNCIL
- ☺ STATE OF UTAH
  NATURAL RESOURCES
  DEPARTMENT OF PARKS AND RECREATION,
  AND
  WILDLIFE RESOURCES AND FISHERIES
  MANAGEMENT
- ☺ U.S. BUREAU OF RECLAMATION
  WEBER BASIN PROJECTS

OPPOSITION

- ODOR FROM AREA

  AGRICULTURE INDUSTRIES

  AND

  AGRICULTURE BUSINESSES

- GNATS, MOSQUITOS, AND BUGS

  STATE OF UTAH PARKS AND RECREATION SPRAYS AND CONTROLS THIS PROBLEM AND CAMPERS CONTINUE TO RETURN TO THE WILLARD BAY STATE PARK
  INSECT SPRAYING IS PART OF OUR BUDGET

- OLD AND ILLEGAL FARMING PRACTICES:

  SPILLING MANURE ON ROADS

  UNCONTROLLED SPRAYING

  LEAVING EQUIPMENT IN ROAD

  ANIMAL WASTE IN DRAINAGE DITCHES

COMPATIBILITY

THE *BAY CAMPGROUND IS COMPATIBLE* PER THE CODE DEFINITION IN SECTION 1.43.3.9

Compatibility will be measured by:

- ☺ Whether or not the proposed development adversely impacts the quality of life in the area,

- ☺ Property values must be sustained or enhanced as opposed to diminishing values,

- ☺ Effects of ultimate traffic on streets will be considered rather than complaints that a new development will increase unwanted traffic,

- ☺ Improvements in infrastructure will be considered as to how and who pays for them, positive contributions to the financing of needed improvements will be weighed against the assessment on existing residents,

- ☺ Proximity of possible impacts will be evaluated and non-directly impacted citizens will be considered in the group of the general citizenry,

- ☺ Consideration will be relief from the monotonous somewhat uniform subdividing of the countryside will be considered a positive factor if it provides a aesthetic relief.

SUPPORT

SOMETHING

GOOD

IN

BOX ELDER

COUNTY

****

WE PETITION THE
BOX ELDER PLANNING COMMISSION
AND
THE BOX ELDER COMMISSION
TO GRANT APPROVAL
FOR A
CONDITIONAL USE PERMIT
FOR THE
CONSTRUCTION AND OPERATION
OF THE PROPOSED
BAY CAMPGROUND
PRIVATE RECREATION PARK

4/21/94

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt
Governor
Ted Stewart
Executive Director
Timothy H. Provan
Division Director

Northern Region
515 East 5300 South
Ogden, UT 84405-4599
801-479-5143
801-479-4010 (Fax)

April 18, 1994

Mr. Denton Beecher
Box Elder County
Planning and Zoning Commission
#1 South Main
Brigham City, UT 84302

Dear Mr. Beecher:

Last week Mr. Keith Jones came into our office to discuss his plans for the Bay Campground at Willard Bay Reservoir. He explained his plans for developing angler access and parking at the end of 1500 West. He would provide parking for 20 cars, public restrooms, a new bridge and wheel chair accessible paved trail up to the reservoir. This would all be done with private money and would improve angler access for shore fishing in the south eastern part of Willard Bay.

At the present time except in the marina's there is not any access for physically challenged people around Willard Bay. Many anglers use the access at the end of 1500 West and probably many more would if a better bridge was built across the ditch. If this development was done as an amenity to Mr. Jones campground and at no charge to the public then we feel like this access improvement is a good thing and should be developed.

If you have any questions please contact our office.

Sincerely,

Jack A. Rensel

Jack A. Rensel
Northern Region Supervisor

ATT 4

4/21/94

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BEFORE THE BOX ELDER COUNTY COMMISSIONERS

MEMORANDUM IN OPPOSITION TO REQUEST FOR CONDITIONAL USE PERMIT ON LAND OWNED BY KEITH JONES

This Memorandum of Points and Authorities is filed with the Box Elder Planning Commission as a summary of the evidence and the law, and is filed in opposition to the request for a conditional use permit on a 24.65 acre parcel located west of Interstate 15 in the unincorporated area of South Willard located within Box Elder County, State of Utah. The same reasons advanced by this Planning Commission in denying the request for re-zoning apply to the application for a conditional use permit.

CURRENT ZONING

Box Elder County recently enacted a "Land Use Management and Development Code" with an effective date of 17 February, 1993. (Hereinafter, this document will be referred to as the "Land Use Code".) The current zoning of land is "agriculture", A-20.

The recently enacted "Land Use Code" provides that this area west of the Interstate Freeway should be zoned for agriculture

uses.[1] The "Land Use Code" required that any change in zoning be consistent with the "general plan" adopted for the County. Since the general plan mandates that the area remain in agricultural uses, the County could not rezone this area without creating a conflict with its general plan.

The definition of AGRICULTURAL DISTRICTS, is as follows:

"The purposes of providing an agriculture district are to promote and preserve in appropriate areas conditions favorable to agriculture and to maintain greenbelt spaces. These districts are intended to include activities normally and necessarily related to the conduct of agriculture and to protect the district from the intrusion of uses inimical to the continuance of agricultural activity." See "Land Use Code" section 10.1.2 (p.10-2).

DENIAL OF REZONING BY PLANNING COMMISSION AND BOX ELDER COUNTY COMMISSION

The Box Elder Planning Commission and the Box Elder County Commission reviewed the application and recommended that Mr. Jones' request for rezoning be denied. (see B.E. Planning Commission minutes from meeting held February 24, 1994.)

THE PRESENT REQUEST FOR CONDITIONAL USE IS NOT WELL FOUNDED AND SHOULD BE DENIED AS A MATTER OF LAW

Page 10-4 (a complete copy of this page is attached as Exhibit A) only allows a "private park or recreational grounds or

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[1]While the master plan has a narrow strip of land on Willard Bay designated as potential recreational uses, it is believed the strip must be on state owned property.

private recreational camp or retreat", and is not meant to include a "recreational vehicle" park. Mr. Jones seeks to have a recreational vehicle park (travel trailer park) on his property. The clear wording of Page 10-4 Section 10.3.13 does not include the term "recreational vehicle park or travel trailer park". (see Page 1-47 Section 1.43.18.2). (A complete copy of that page is attached as Exhibit B).

The closest definition to a "private park or recreational grounds or private recreational camp or resort" is found in the definition of a private non-profit recreational grounds and facilities. That is defined as a "non-profit recreational ground and facilities operated by a non-profit corporation, association or group". It is submitted that that would be similar to the Girls Home in Mantua, or the Rulon White Recreation Retreat existing on the grounds east of Highway 89-91 in South Willard. (A complete copy of the page containing that definition is attached as Exhibit C).

The Land Use Code does recognize zones in which conditional use permits may be granted for "recreation coach" or "R.V." parks. Those are authorized as conditional uses in a CS, CH, and CG zone, as contained on Page 12-3. (A complete copy of that page is attached as Exhibit D). The term "recreation vehicle" or "recreation coach" is also a defined term which is defined on

Page 1-47 (see Exhibit B Section 1.43.18-1).

Clearly what Mr. Jones is proposing is an R.V. park where "vehicles with or without motive power designed and constructed to travel on public streets, and designed for use as a human habitation of a temporary and recreational nature could come to be parked and have temporary habitation". Since the Land Use Code only allows those uses in the zones stated above (CS,CH, and CG), it is clear that the "private park or recreational grounds or private recreational camp or resort" as provided on Page 10-4 which constitutes a conditional use in an A-20 zone is not what was contemplated by the ordinance.

If by some tortured interpretation of the code Mr. Jones were to "hoodwink" the County Planning Commission and convince them that the definition of a "private park or recreational grounds or private recreational camp or resort" included a recreational vehicle or recreational coach park, still under the criteria established for conditional uses under Chapter 7 of the Land Use Code, the request for conditional use should still be denied. Page 7-3 contains the grounds for the denial of a conditional use permit in Sections 7.1.5, 7.1.5.1, 7.1.5.2. (see Page 7-3 attached hereto as Exhibit E).

The same reasons for denying a zone change as found by this Planning Commission and by the Box Elder County Commission, apply

to the denial of the conditional use permits. Briefly, those reasons are listed as follows:

REASONS TO DENY THE CONDITIONAL USE PERMIT

1. THE LANDOWNERS DO NOT WANT THE REZONING.

While there have been petitions filed with the County seeking to support the rezoning, only the applicant (Keith Jones) and one land owner (Bob Davis) have favored rezoning in this area. There has been presented to the County a copy of the map showing the approximate 80 different ownerships of parcels of property west of the freeway, of which only two are in favor of rezoning. Not ever Mr. Davis has spoken in favor of the conditional use permit.

2. THE USE IS INIMICAL TO AGRICULTURAL USES.

The area west of the freeway clearly is designated by the County Comprehensive General Plan for agricultural uses. To allow the R.V. park would be inimical to the current agriculture uses, and to the general plan, adopted approximately one year earlier by the Count.

3. THE PROPOSED USE WOULD PROHIBIT OPTIMUM SPRAYING

Aerial spraying of the farm land could not be performed because of the possibility of claims of pesticide poisoning by the owners and occupants of the proposed R.V. park.

4. INADEQUATE PAVING TO ACCESS THE AREA

There is no adequate paved roads to get to the property. The frontage road is a dirt road, as would be any other roads except "Nerva Lane." Dust from these roads would impact crops.

5. INADEQUATE ACCESS TO THE AREA

The area sought to be rezoned is remote from regular highway areas including freeway on and off ramps and sits in the middle of an exclusive agricultural area.

6. HIGH WATER TABLE

The water table in the area is high, which would make land uses requiring septic tanks impossible to design without substantial problems. There is NO sewer system available to service an R.V. park. A formerly "existing" mobile home park located east of the proposed area adjacent to Highway 89-91 and owned by Attorney William Marsh was forced by the Health Department to be "shut down" and all mobile homes had to be removed because of the constant high-water problems which caused raw sewage to surface. This location of the Marsh property is far more suitable to septic tanks and drain fields than is Mr. Jones' location. The County and Health Departments spent enormous time and money to eradicate the "Marsh" problem and to close that "park". Mr. Jones' location would create more problems than the "Marsh" location.

7. COMPLAINTS FROM USERS WOULD BE A CONSTANT PROBLEM.

There are three dairy farms, one hog farm, one large feedlot, and other farming operations which would create odors in the area, and the land owners would be facing constant complaints and possible lawsuits from owners and/or from renters in the R.V. park, which would be constant source of problems and troubles to the agricultural ownership interests in the area. John Larkin and Sons, Lowell Lemon, the LDS Church and the Lunday dairy own over 85% of the land west of the freeway and all are adamantly opposed to this conditional use.

8. LOSS OF AGRICULTURAL INCOME WOULD OUT-WEIGH R.V. INCOME

The agricultural interests have a sizeable economic impact in the economy of Box Elder County, which impact is far greater than any possible economic benefit from the proposed RV park. The major landowners west of the freeway purchase several million dollars annually worth of feed, supplies, and livestock from Box Elder County farmers and businesses.

9. THE COUNTY HAS NOT FILLED ITS CURRENT R.V. OCCUPANCY

Other RV park developments have never had full occupancy, and to grant this use may, in fact, further decrease RV rentals from other RV parks in the area. (See letter of Gary Bywater attached hereto.) The State of Utah has indicated a willingness to negotiate its use of property for an R.V. park near its South

Marina.

10. CONGESTION ON EXISTING STREETS

The main road for access to this parcel goes past a cherry processing plant. Since the main use of the RV park would be during the month of July, increased traffic would conflict with the pie cherry harvest season, and would pose constant problems and crowding on Nerva Lane.

11. INCREASED TRAFFIC WOULD POSE SAFETY CONCERNS

Nerva Lane is an area where there are numerous children living along or by the road, and the increased traffic would cause increased safety concerns for residents in the area.

12. GNATS, MOSQUITOS, AND BUGS

The citizens of the County would be expected to furnish constant spraying for the elimination of gnats, mosquitos, flies and bugs, which thrive in this area.

13. HIGH VOLTAGE ELECTRIC TRANSMISSION LINES

A high voltage electric transmission line borders the west boundary of Jones' property. There is not a direct road to Willard Bay, which would necessitate foot traffic crossing the UP&L easement.

14. DRAINAGE CANAL

A large drainage canal must be crossed by foot traffic to gain access to Willard Bay. The canal will pose a safety concern

to children who come to the park.

15. INCREASED LAW ENFORCEMENT

An increase in the concentration of people in an R.V. park will bring a corresponding increase in vandalism, traffic congestion, crime, and littering. This would require an increase in law enforcement in a county with limited financial resources.

16. LOWLAND SUBJECT TO FLOODING

The parcel of property proposed for development is the "lowest" elevation in the entire area. Thus it would be subject to flooding in the event of dike failure from Willard Bay and also is subject to all run-off water from the South Willard area. This parcel does not lend itself to development for a R.V. park and is far more suitable for continued agricultural uses.

For these reasons, it is requested that the Planning Commission deny this request for a conditional use permit.

DATED this 21st day of April, 1994.

Stephen R. Hadfield

Stephen R. Hadfield
Jeff R Thorne
MANN, HADFIELD & THORNE
Attorneys for Protestants

pj/2:larkin.me2

BAY CAMPGROUND

PRIVATE RECREATION PARK

Proposed
Conditional Use Application

Prepared By:
Keith W Jones
April 7, 1994

We request a "Conditional Use Permit" to develop the Bay Campground Private Recreation Park in an A-20 District per the Box Elder County Land Use Management and Development Code, Adopted 24 November 1992, Effective Date 17 February, 1993, Section 10.3.13. The Bay Campground Private Recreation Park Plan is attached for your review and approval.

The Bay Campground Private Recreation Park is to be located on property described as follows:

01-041-006
Part of Section 2 and 3, Township 7 North, Range 2 West, Salt Lake Base and Meridian. Beginning at a point 1551.4 feet South from the Northwest corner of Section 2; thence South 88°56' East 727.5 feet, more or less, to the Railroad Right of Way; thence South 0°30' West 156.5 feet; thence North 88°40' West 2028 feet to Road; Thence North 0°48' West 147.4 feet; thence South 88°56' East 1303.5 feet, more or less, to point of beginning. Less tract conveyed to Utah State Road commission. Containing 6.29 Acres.

This property, as described, was previously owned by Elaine B Call since March 1974, and the size and shape of the property pre-dates all Box Elder County planning and zoning codes. Because the size and shape of the property does not meet the code, we apply for an exception to Section 10.9.1 - Side Yard Regulation, from A-20 to RR-5, or 20 feet. (See Code 1.18) The property was purchased in November 1993 by Keith W Jones and Sharon Jones, Husband and Wife, for the specific purpose of developing a recreation facility on private property adjacent to Willard Bay Reservoir State Park. Over 900 feet of this specific property boundary borders the USA Property, owned by the U. S. Bureau of Reclamation, and managed by the State of Utah Department of Natural

Resources Division of Parks and Recreation. The Utah Department of Fish and Game manages and provides fisherman's access to the Willard Bay Reservoir at the end of 1500 West Street, the northwest corner of the proposed park property.

This property is within the "Multiple Use Area" around Willard Bay Reservoir as defined in the Box Elder County General Plan, 1992 - 2005, adopted 24 November 1992. Some of the Goals of the General Plan are to develop recreational resources of Great Salt Lake and associated areas, to encourage tourists and travelers to visit the county, and to provide the services and facilities that are adequate to meet these needs. The Willard Bay State Park, which is filled to capacity many week ends during the summer season, only provides water to the campers. Every camper nowadays wants both water and electrical power to their camp site, and most desire sewer at their camp site. The state park facilities **do not** adequately meet the need of these tourists. Private recreational camp facilities are greatly needed around the Willard Bay Reservoir, one of Box Elder County most valuable recreational resources. This proposed Bay Campground Private Recreation Park fulfills these objectives of the General Plan, and is in the multiple use area around the reservoir set out for future recreation development.

The State of Utah Department of Parks and Recreation operates two state campgrounds adjacent to the Willard Bay Reservoir, which demonstrates the need for camping in the area, and demonstrates campground compatibility with existing area land uses. They have also demonstrated that insects around the reservoir can be controlled; many people continue to come back and camp at the state parks. Most campgrounds in the State of Utah are located in farming areas, with pastured cattle across the fence lines, proving compatibility with agriculture uses.

The proposed recreation park owners are working with the Bureau of Reclamation and the State of Utah Parks and Recreation to improve the existing fisherman's access to Willard Bay Reservoir. Public parking for about 20 vehicles and a public restroom will be provided in the northwest corner of the campground property. A new bridge over the south drain and a wide path to the

top of the dike will be constructed to provide wheel chair access to the reservoir for handicap fishing from the dike. A dock parallel to the rocky reservoir dike may also be installed to further encourage day fishing off the South Bay bank. The south bank of the reservoir dike will be planted in grass and mowed by the park. Within several years, this property along the south bank of Willard Bay Reservoir could become one of Box Elder County's choice public parks, developed completely with private money.

The campground recreation park will bring electrical power and community culinary water to the west side of the interstate, which will greatly increase the property value to the area, and directly increase the tax base without any additional burden to the schools or community facilities. The park will provide community recreation facilities at no cost to the county. With electrical power, the farms to the south and adjacent to the park could use sprinkling irrigation, which will greatly increases crop yields, while conserving water.

Attached are petitions with over 300 signature of South Willard, Willard, and Perry residents showing their support for a private campground adjacent to Willard Bay Reservoir. These residents see the need for such development adjacent to Willard Bay Reservoir which is consistent with the approved Box Elder County General Plan. Most signatures represent one household's opinion, not just one individual.

Timothy Solomon, Box Elder County Economic Development Director, has written a letter to the County Commissioners in support of this project. The Box Elder County Tourism Council, Golden Spike Council, the State of Utah Tourism Council, and the State of Utah Department of Parks and Recreation are in support of a private recreation campground adjacent to Willard Bay.

We, therefore, petition the Planning Commission and the County Commission to grant approval and a Conditional Use Permit for the construction and operation of the Bay Campground Private Recreation Park.

BAY CAMPGROUND

PRIVATE RECREATION PARK

PLAN

WILLARD, UTAH

Prepared By:
Keith W Jones

April 7, 1994

BAY CAMPGROUND
PRIVATE RECREATION PARK
PLAN

WILLARD, UTAH

Prepared By:
Keith W Jones
April 7, 1994

In pursuant to a Conditional Use Permit application, this Bay Campground Private Recreational Park Plan is provided for the Box Elder County Planning Commission and Box Elder Commission review and approval as required by The Box Elder County Land Use Development and Management Act, per the Box Elder County Land Use Management and Development Code, Adopted 24 Nov. 1992, Effective Date 17 Feb. 1993. This proposed Bay Campground Private Recreation Park fulfills several objectives of the General Plan, and is located in the "Multiple Use Area" around the Willard Bay Reservoir proposed for future recreation development.

PROJECT LOCATION:

The Bay Campground Private Recreation Park is to be located on the south side of Willard Bay Reservoir adjacent to Interstate. See following figures:

Figure 1 Section of the aerial map showing the project location,

Figure 2 Section of a USGS map of the area showing the project location,

Figure 3 Drawing showing the surveyed property boundary, and adjacent State of Utah Willard Bay Park property lines.

PROPERTY DESCRIPTION:

Part of Section 2 and 3, Township 7 North, Range 2 West, Salt Lake Base and Meridian. Beginning at a point 1551.4 feet South from the Northwest corner of Section 2; thence South 88°56' East 727.5 feet, more or less, to the Railroad Right of Way; thence South 0°30' West 156.5 feet; thence North 88°40' West 2028 feet to Road; Thence North 0°48' West 147.4 feet; thence South 88°56' East 1303.5 feet, more or less, to point of beginning. Less tract conveyed to Utah State Road commission. Containing 6.2 Acres.

PROPERTY OWNERSHIP:

The property is owned by Keith W Jones and Sharon Jones, husband and wife.

PARK DESCRIPTION:

The Bay Campground Private Recreation Park will be a simple campground located adjacent to southeast corner of Willard Bay Reservoir. The park will have a camp center building, 30 camp sites, mid-park campground restrooms, two playground areas, and a public parking area with public restrooms. The park will be in grass except for the buildings and road way. See Figure 4 - Bay Campground facility layout.

The **camp center** will house the manager's residence, camp office, mini-store, restrooms, and showers. A mobil home will be used as a temporary manager's residence and camp office for the first two seasons of operation.

The **30 camping sites** will have access to both water and electrical facilities; some sites will also have sewer connections. Fast growing trees will be planted for each camping site to provide shade. Tables will also be provided to each sites.

The **road** within the recreation park will be gravel. The park entrance will be 36 feet wide, the two way road 30 feet wide, and one way road 15 feet wide.

A graveled **public parking area** for improving existing fisherman's access to Willard Bay Reservoir and **public restrooms** will be located off the end of 1500 West Street in the northwest corner of the property.

Recreation equipment rentals will also be available through the camp office.

TREES AND SHRUBS:

Many trees and shrubs will be planted all around and through the park as the park is developed. It is planned that every camping site will eventually have a large shade tree. Evergreen shrubs will be planted in the parkway in front

of the camp center building and around the camp center and restroom buildings. Evergreen/pine trees will be planted throughout the resort to provide area privacy without blocking the beautiful view of the mountains.

WATER SOURCES:

Culinary Water will come from the South Willard Water District, or a deep water well drilled into the artesian aquifer located off the subject property.

Irrigation water for watering the grass will be purchased and pumped from Willard Bay or it will be from a new shallow irrigation well to be located in the northwest corner of the property. The irrigation water system will only be pressurized when the grounds keeper is watering the grass and shrubs within the park. There will be no hose connection in the irrigation system, to insure and prevent accidental usage.

SEWER SYSTEM:

The **sewer system**, less than 4500 gallons per day, will be septic tanks and drain fields. The system will be designed and installed as required by the Box Elder County Department of Health. The mid-park restrooms and the public restrooms by the fisherman's access will have holding tanks that will be pumped as required.

ELECTRICAL POWER:

Utah Power and Light will supply the **Electric Power** to the park. All electric power within the property boundaries will be underground. There will be minimal outside lighting around the park, enough to make it safe, but dark enough for the campers to sleep. Bright lights will remain on all night at the park entrance and inside the restrooms and shower facilities.

SECURITY:

Security will be provided twenty four hours a day during the summer when park is operating. The park is expected to be closed at about 10:00 PM and open at 7:00 AM each day. A one-way exit will always be available. The fences around the property will be maintained for the security of the park guests. Within two year of the startup of the park, the existing barb wire fences will be replaced with a six foot chain link fence.

SUMMARY

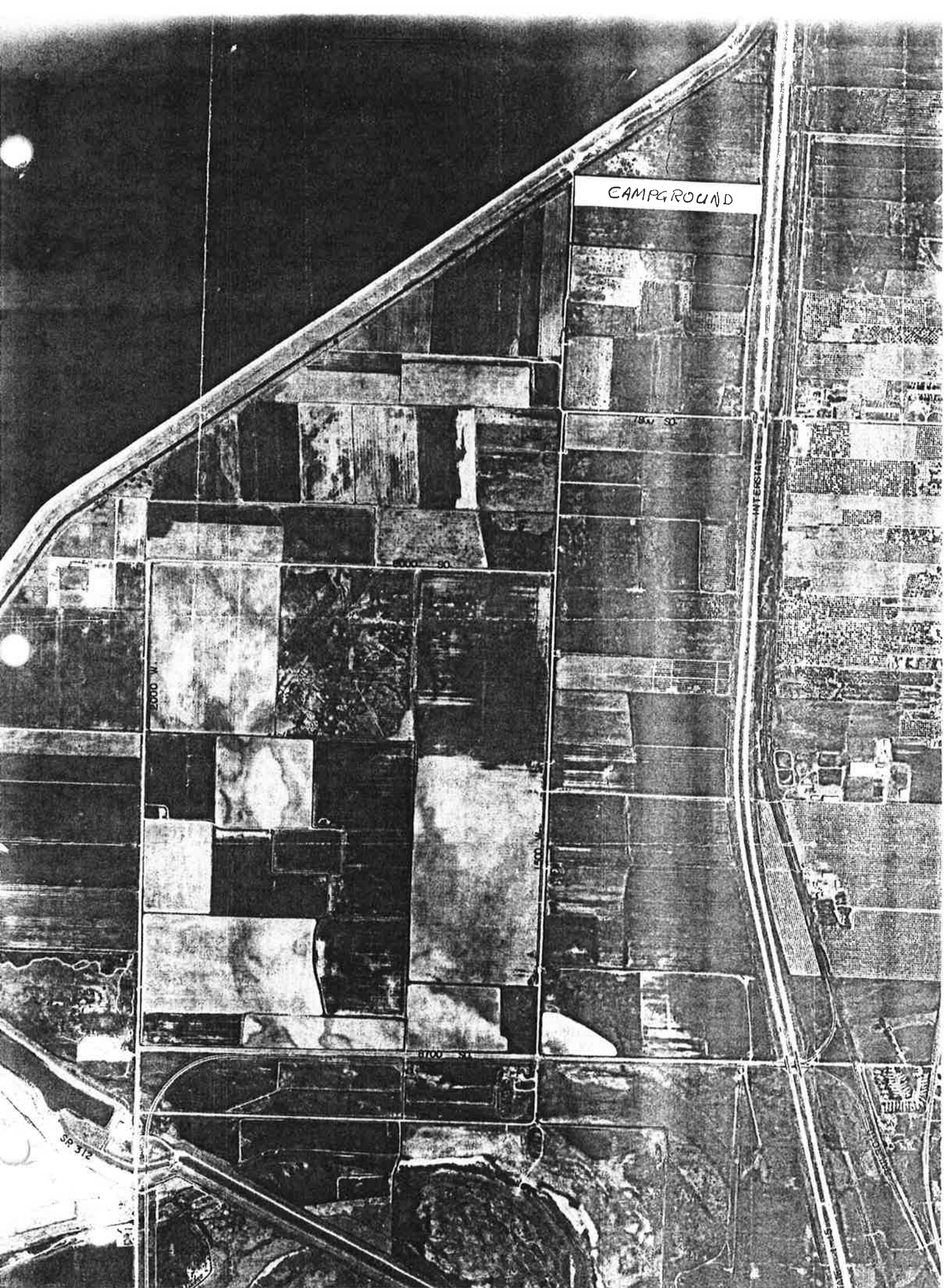
The proposed Bay Campground Private Recreation Park will support 30 camp sites with water and electrical power. The camp center will contain a managers residence, camp office, restrooms, and shower. The park will also have two other restroom buildings and a public parking area for the fisherman's access.

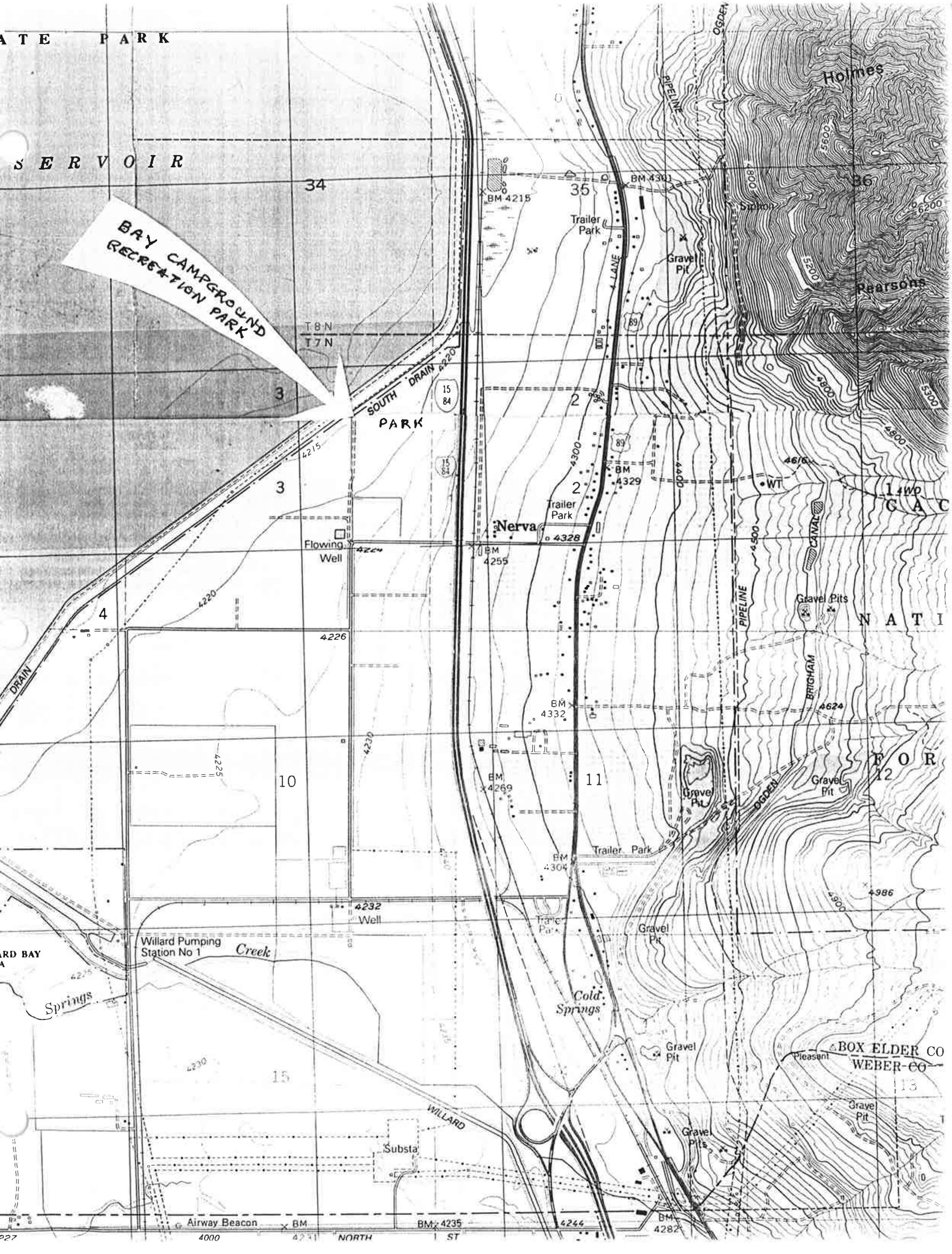
The Bay Campground Private Recreation Park will comply with all local, state, and federal regulations and ordinances. The park will be a good neighbor and an **asset** to the community. The park will double the property value west of Interstate I-15. The high property value will increase the local tax base without any burden to the schools or community facilities. It is expected that the park will increase the area employment base by 3 people during the summer months. The visiting tourists will bring money into the local economy.

This proposed Bay Campground Private Recreation Park fulfills several objectives of the General Plan, and is in the multiple use area around the Willard Bay Reservoir planned for future recreation development.

The State of Utah Department of Parks and Recreation operates two state campgrounds adjacent to the Willard Bay Reservoir, which demonstrates the need for camping in the area, and demonstrates campground compatibility with existing area land uses. They have also demonstrated that insects around the reservoir can be controlled. Most campground in the State of Utah are located in farming areas with pastured cattle across the fence lines, demonstrating compatibility with agriculture uses.

The proposed Bay Campground Private Recreation Park **is consistent** with the Box Elder County General Plan, and **is compatible** with the agricultural uses. (See Code 1.43.1.3 and 1.43.3.9)


CAMPGROUND
INTERSTATE
SR 312



ATE PARK
SERVOIR
BAY CAMPGROUND RECREATION PARK
PARK
T8N
T7N
SOUTH DRAIN
34
35
36
3
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4
10
11
12
15
Holmes
Pearsons
Trailer Park
Gravel Pit
Gravel Pits
PIPELINE
OGDEN
BRIGHAM
CANAL
4 LANE
BM 4215
BM 4301
BM 4329
BM 4255
BM 4332
BM 4269
BM 4304
BM 4235
BM 4282
Nerva
4328
Flowing Well
Well
4224
4226
4232
4220
4215
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4225
4624
4986
WT
Willard Pumping Station No 1
Creek
Springs
Cold Springs
WILLARD
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NORTH
ST
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BOX ELDER CO
WEBER CO
Pleasant
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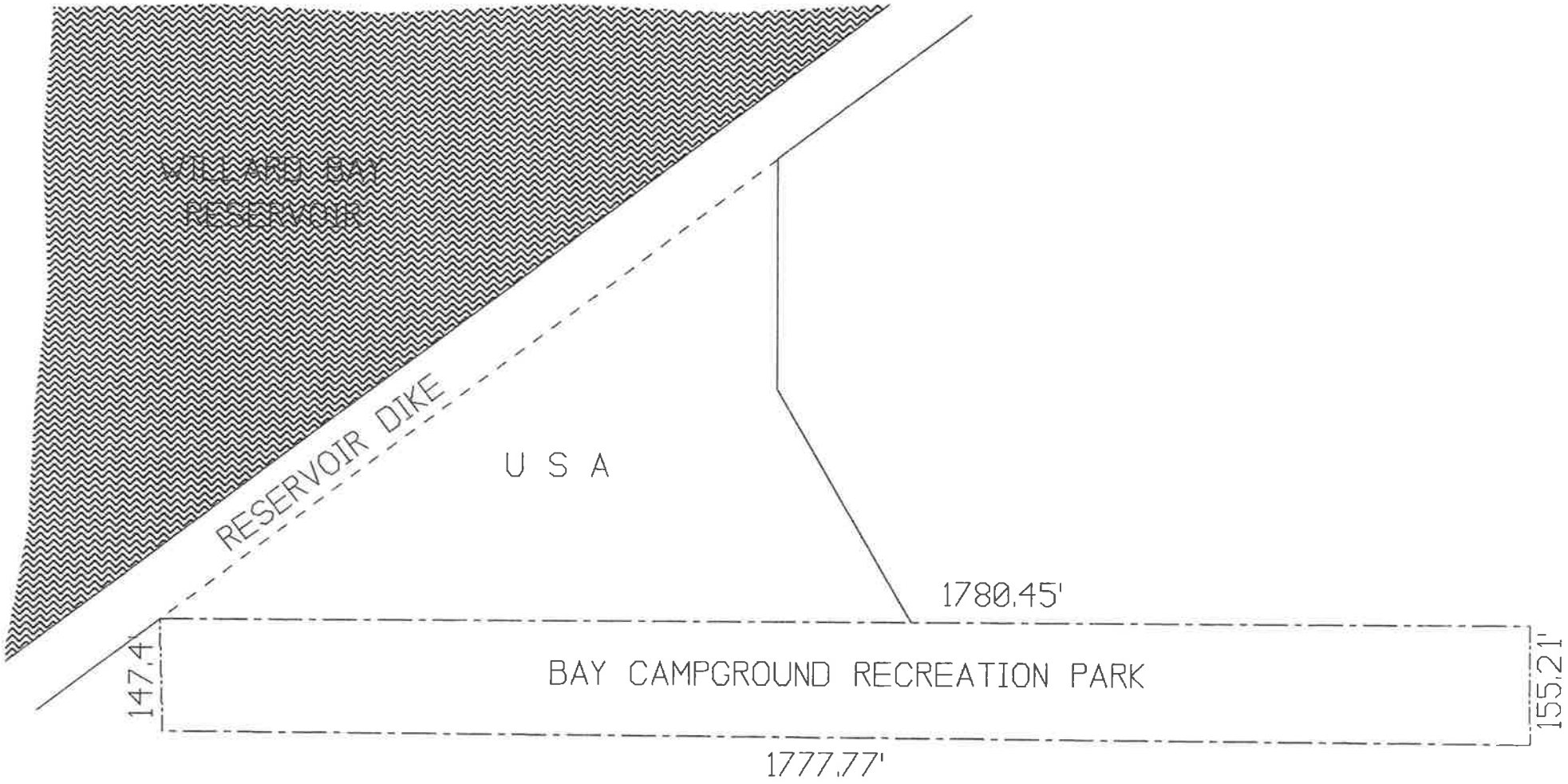
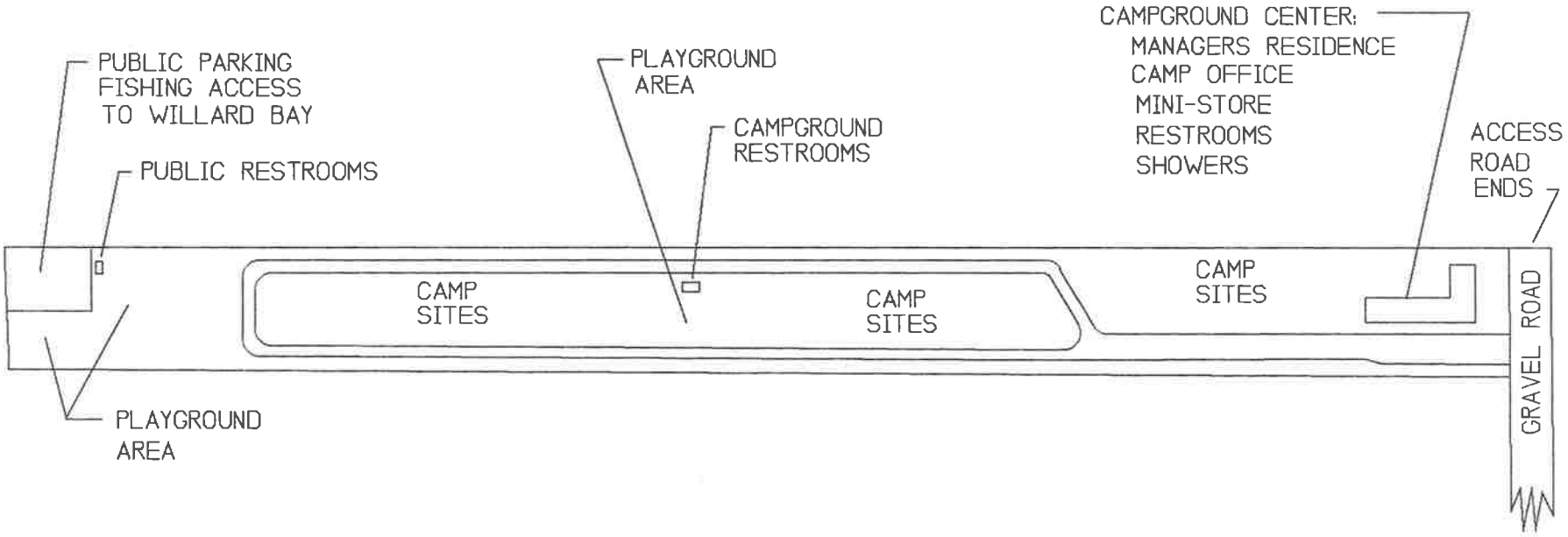

WILLARD BAY
RESERVOIR
RESERVOIR DIKE
U S A
1780.45'
147.4'
BAY CAMPGROUND RECREATION PARK
155.21'
1777.77'

FIGURE 3



BAY CAMPGROUND

PRIVATE RECREATION PARK

PREPARED BY:
Keith W Jones
April 6, 1994
SCALE: 1" = 200'

FIGURE 4

PLANNING DISTRICT

CONCEPT PLAN

FOR

BAY VIEW SPORTSMAN'S RESORT

WILLARD, UTAH

Prepared By:
Keith W Jones, President
Sportsman's Resort Development Corporation

ATT 3

PLANNING DISTRICT
CONCEPT PLAN

FOR

BAY VIEW SPORTSMAN'S RESORT
WILLARD, UTAH

Prepared By:
Keith W Jones, President
Sportsman's Resort Development Corporation

1055 29th St.
Ogden, Utah 84403
(801) 394-9063

990 E 800 N
Shelley, Idaho 83274
(208) 346-6673

INTRODUCTION:

In pursuant to a P-District rezoning application, the Sportsman's Resort Development Corporation submits this proposed **BAY VIEW SPORTSMAN'S RESORT Concept Plan.** This concept plan is provided for the Box Elder County Planning Commission review and approval as required by The Box Elder County Land Use Development and Management Act, per the Box Elder County Land Use Management and Development Code, Adopted 24 Nov. 1992, Effective Date 17 Feb. 1993.

PROJECT LOCATION:

The Bay View Sportsman's Resort is to be located on the south side of Willard Bay adjacent to Interstate 15 in part of the Northwest Quarter of Section 2 and part of the Northeast Quarter of Section 3, Township 7 North, Range 2 West of the Salt Lake Base and Meridian, containing 24.653 acres.

See Figure 1 - Aerial map showing the project boundries, Figure 2 - U.S. Geological Survey Map, and Figure 3 - Property Boundry for Bay View Sportsman's Resort (based on the Hansen and Associates, Inc. survey dated 10/26/93 providing the detail property description and Box Elder County plat maps Book 1 pages 40 and 41.)

PROPERTY OWNERSHIP:

The property is owned by Keith W Jones and Sharon Jones, husband and wife, the owners of Sportsman's Resort Development Corporation, an S-Corporation incorporated in the State of Utah. Keith Jones is also president of the corporation with Todd Jones vice president and Sharon Jones secretary.

GENERAL DESCRIPTION:

The Bay View Sportsman's Resort will be a luxury **private membership** Recreational Vehicle (RV) Resort located adjacent to south-east corner of Willard Bay. When the resort is complete, the resort will have between 125 to 200 RV sites; resort center which contains a caretaker's residence, resort sale offices, rental rooms, sports equipment sales/rentals office, mini-store, recreation rooms, teen game room, and restrooms and showers; swimming pool with a children's wading pool, and adult only hot pool; another restroom and shower building; and in the middle of the property will be a very large grass play area for softball, volleyball, and children's play ground.

The project will included a culinary water facility building which will contain the deep water well, a 50,000 gallon water storage tank, and a 2000 gallon pressure tank; an owner/manager's residence; three public storage buildings; and one public RV and boat storage compound. A mobil home will be used as a temporary sales office for the first two year of operation.

ACTIVITIES TO BE PERMITTED:

The activities to be permitted at the resort are:

1) Recreation vehicle park,

2) Timeshare/Membership condos (Eight motel type rooms located in resort center building),

3) Private Swimming Pool - members/guests only,

4) Play ground,

5) Real Estate Agency/Brokers - Sales of resort memberships,

6) Mini-Store - Groceries, Ice cream, Pop, Souvenirs, Resort specialty clothing, Fishing equipment, and video rentals,

7) Merchandise vending machines,

8) Sports equipment rentals - bicycles, paddle boats, wind surfers, and sail boats,

9) Public storage garages,

10) RV and boat storage compound,

11) Culinary water facility,

DETAILED RESORT FACILITY DESCRIPTION:

A more detail description of the proposed resort is:

1) **Bay View Sportsman's Resort** will be a **Luxury Private Membership RV-Resort** with a maximum of two hundred (200) RV hookups. Over half the sites will have full service hookups with electric, water, sewer, and TV cable; and the remaining sites will only have electric and water hookups. The two entrances and the road and parking in front of the resort center will be asphalt; all other roads within the resort will be gravel. The parking sites will be grass with at least one fast growing tree for each camp site to provide shade. Tables will also be provided for 70% of the camp sites.

   The resort will be represented by both Coast to Coast and Resorts Properties International, who both provide inter-resort exchange privileges for our members to go to over 450 other resorts throughout USA, Mexico, and Canada. It is expected that the RV parking area of the resort will be operated about 70 to 75% capacity during the peak summer months, and only 10 sites during the week ends of the winter months. See Figures 4, 5, and 6 - showing the proposed resort layout plan with buildings, roads, and grass areas along with potential RV parking for maximum 200 units. (Size could be limited by the water and sewer limitations.)

2) The **Resort Center** has a large party room with deck over looking the Willard Bay, a party room kitchen facilities, TV area and game area for the RV users; resort membership sales and management offices; resort caretaker dwelling; a mini-store for perishable grocery items, gift shop, and resort sports ware; two unit laundry area; and restrooms and showers.

The resort center area includes a member's only **swimming pool** just off the south side of the resort center, a children wading pool, and an adult only **hot pool**. The swimming pool area will only be open during the summer months.

On the second floor of the resort center are eight single family rental units. Members may use these units instead of pulling their own RV to the resort. These units are considered as timeshare/daily rental units for members only as part of the Coast to Coast and/or Resort Properties International programs. These are NOT for rent to the general public.

The proposed resort center building will be a two story building 120 foot long and 40 foot wide with a 15 foot wide deck on the north and west sides. The swimming pool will be located on the south side between the resort center building and the culinary water facility building. See Figure 7 - Bay View Sportsman's Resort Center and Pool Area floor plans.

3) In the middle of the resort, is a **Restroom and Shower building** for the RV-park users only. This building will be closed during the winter months; only the restrooms and showers in the resort center will be available during the winter months. See Figure 8 - Mid-Resort Restroom and Shower Building floor plan.

4) In the middle section of the resort is a **Large Grass Park/Playground** for RV-park users. There will be areas set up for soft ball, volley ball, and a small children play ground. An area by the resort center will be setup for basket ball.

5) Three secured **Garage Storage Buildings**, to be located along the south property line, will be available for rent to the public. Access will be provided from all sides of the buildings. Each building will have 36 garages 14 feet wide and 24 feet deep, and 20 storage closets 4 1/2 feet wide and 14 feet deep. These units will be rented individually to the public and are not part of the Bay View Sportsman's Resort facilities for resort members only. See Figure 9 - Garage Storage Building.

6) A **RV and Boat Storage Compound** area is provided on the west end of the south property line. This RV and boat storage area available to the Bay View Sportsman's Resort members and is also open to rent space for the general public. In the future, part of this area may be roofed to add extra protection for the stored RVs and boats.

7) **Temporary Office** - An office trailer/mobil home will be places on the site at the southeast entrance for a temporary resort membership sales office and temporary caretakers dwelling. It is presently planned to be located in the managers residence location on the site plan. The trailer will be on the property less than two years; to be removed no later than the fall of 1996.

8) **Public Facility Future Option** - If the USA government will allow, Bay View Sportsman's Resort will build and maintain a **Public Restroom** facility at the end of 1500 West Street for present Willard Bay public fisherman's access.

ROADS:

The public road on the east side of the property in front of the resort will be constructed with asphalt in accordance with the county road specifications, if required by the county. Because the properties on both sides are farm land, we would prefer to have the counnty road remain a gravel road. Most of the RV campgrounds of the type proposed within Utah have county access roads that are gravel. Gravel roads give the resort a camping

atmosphere which is desired by the resort membership. The roads within the resort will all be gravel. The resort entrances, the road in front of the resort center, and the parking in front of the resort center and swimming pool will be asphalted. There will be no curbs or gutters along any of the roads within the resort.

WATER SOURCES:

Culinary/Potable water will come from a **deep water well** drilled into the artesian aquifer. The deep water well, a 50,000 gallon below ground concrete storage tank, and a 2000 gallon pressure storage tank will be located within the Culinary Water Facility building. The Culinary Water Facility system design, construction, and operation will be authorized from the State of Utah, Department of Health.

Irrigation water for watering the grass will be purchased and pumped from Willard Bay or it will be from a new shallow irrigation well to be located in the northwest corner of the property. The irrigation water system will only be pressurized when the grounds keeper is watering the grass and shrubs within the resort. There will be no hose connection in the irrigation system to insure and prevent accidental usage by a RV camper.

No water will be supplied to the storage buildings or to the RV and boat compound.

Note: Detail plans for both the culinary and irrigation under ground water piping systems and for the Culinary Water Facility will be provided in the Step 2: Preliminary Design Plan.

SEWER SYSTEM:

The **sewer system** for the resort will be septic tanks and drain fields to be located in the middle and west half of the property. The system will be designed and installed as required by the Box Elder County Department of Health, and/or the State of Utah, Department of Environmental Quality, Division of Water Quality, permit. The resort will not be used until a permitted sewer system has been installed and certified. Each RV site sewer hookup will be located and installed in accordance with the Uniform Plumbing Code.

No sewer facilities will be supplied to the storage buildings or to the RV and boat compound.

Note: Detail plans for the sewer piping systems will be provided in the Step 2: Preliminary Design Plan.

ELECTRICAL POWER:

Utah Power and Light will supply the **Electric Power** to the resort. All power will come through the Culinary Water Facility Building. All power to the RV parking sites will be able to be turned-off inside the Culinary Water Facility Building. All electric power within the property boundaries will be underground. Power outlets to the RVs will vary throughout the resort from 25 amps to 50 amps at each pedistal.

There will be minimal outside lighting around the RV resort; enough to make it safe, but dark enough for the campers to sleep. Bright lights will remain on all night at the entrance and inside the restroom and shower facilities.

Note: Detail plans for the underground electrical systems will be provided in the Step 2: Preliminary Design Plan.

NATURAL GAS:

All RV resort building and hot water will be heated by natural gas.

Note: Detail plans for the natural gas piping systems will be provided in the Step 2: Preliminary Design Plan.

FIRE PROTECTION:

All buildings in the resort will have automatic **fire protection systems**. There will be no fire hydrants within the resort. This is not expected to be a problem because each RV will be connected to water.

SECURITY:

Security will be provided twenty four hours a day during the summer when operating the RV parking area. The resort complex is expected to be closed at about 10:00 PM and

open at 6:00 AM each day. A one-way exit will always be available. The front wall and fences around the property will be maintained for the security of the resort members and guests.

FENCES:

A 4 to 5 foot decorative wall will be build along the east property boundary with two entrances for the RV resort and one entrance directly into the resort center double car garage. Both resort entrances will have electrically operated security gates. Within two year of the startup of the resort, the existing barb wire fences on the other three sides will be replaced with a six foot chain link fence.

TREES AND SHRUBS:

Many trees and shrubs will be planted all around and through the resort as the resort is developed. It is planned that every RV site will eventually have a large shade tree. Evergreen shrubs will be planted in the parkway in front of the wall along the road on the east side of the property and around the resort center and culinary water facility buildings. Evergreen/pine trees will be planted throughout the resort to provide area privacy without blocking the beautiful view of the mountains.

Note: Detail proposed plans for the trees and shrubs will be provided in the Step 2: Preliminary Design Plan.

SUMMARY

This project will comply with all local, state, and federal regulations and ordinances. The **Bay View Sportsman's Resort** will be a good neighbor and an asset to the community. This property will increase the local tax base without any burden to the schools or community facilities. It is expected that the resort will increase the area employment base by 15 people during the summer months and 4 people all year. The $1M plus construction costs will also be a boost the local community.

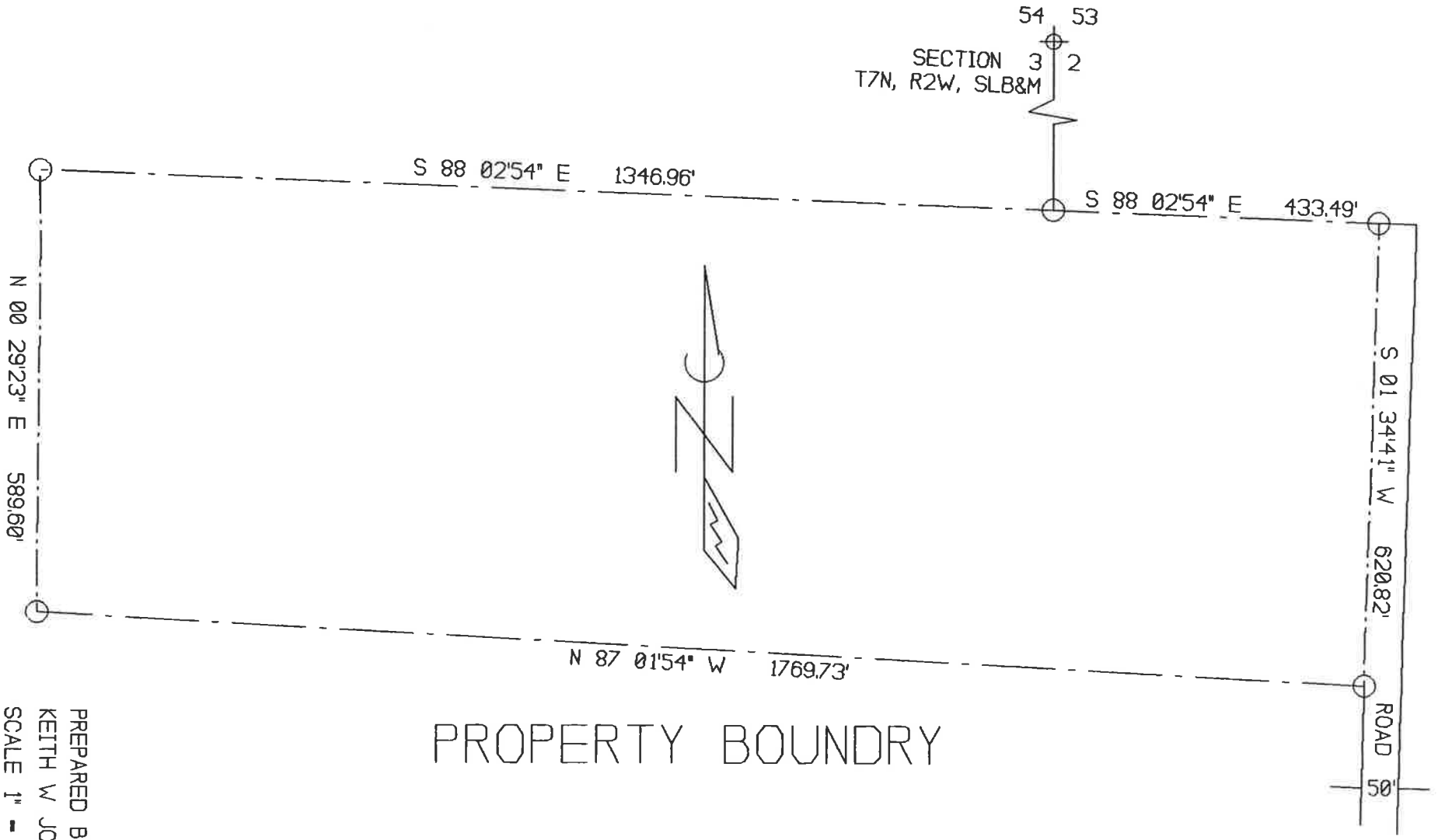
The **Bay View Sportsman's Resort members** and the Coast to Coast and Resorts Properties International out-of-state visiting exchange members will bring money into the local economy.

FIGURE 1


BAY VIEW
SPORTSMAN'S
RESORT
ELEVATION 4223
BM 4215
Trailer Park
T8N
T7N
SOUTH DRAIN
Artesian Well
Nerva
BM 4255
BM 4218
4226
UNION
4334
BM 4269
PACIFIC
4305
Reservoirs
4232
BM 4226
Creek
Cold Springs
Cold Sprs
Grave Pit
BM 4272
Swimming Pool
Utah Hot Sprin
(BM 4282)
Airway Beacon
BM 4234
WILLARD CANAL
34
35
3
2
9
10
11
16
15
14

FIGURE 2

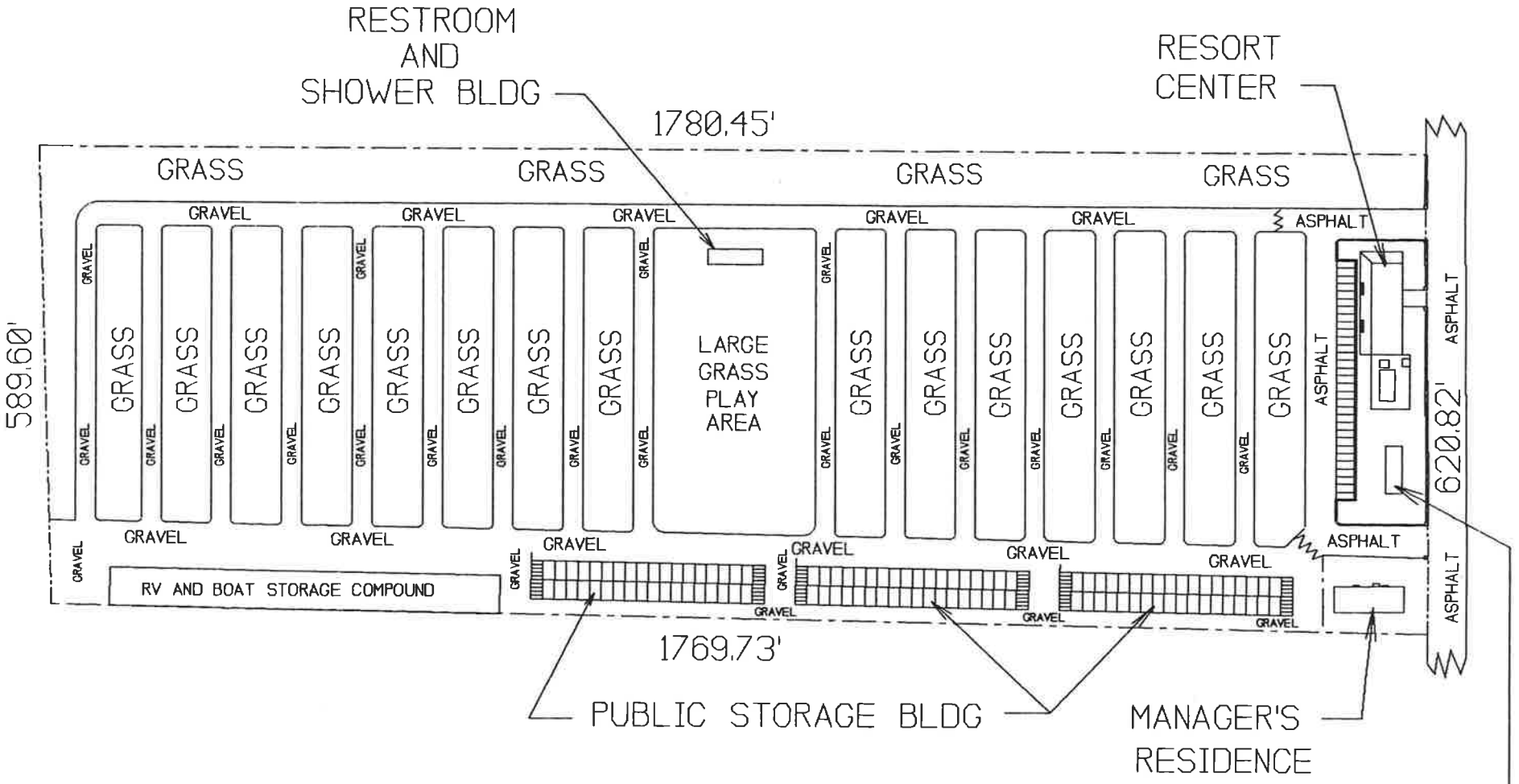
BAY VIEW SPORTSMAN'S RESORT
WILLARD, UTAH



PROPERTY BOUNDRY

PREPARED BY:
KEITH W JONES
SCALE 1" = 200'

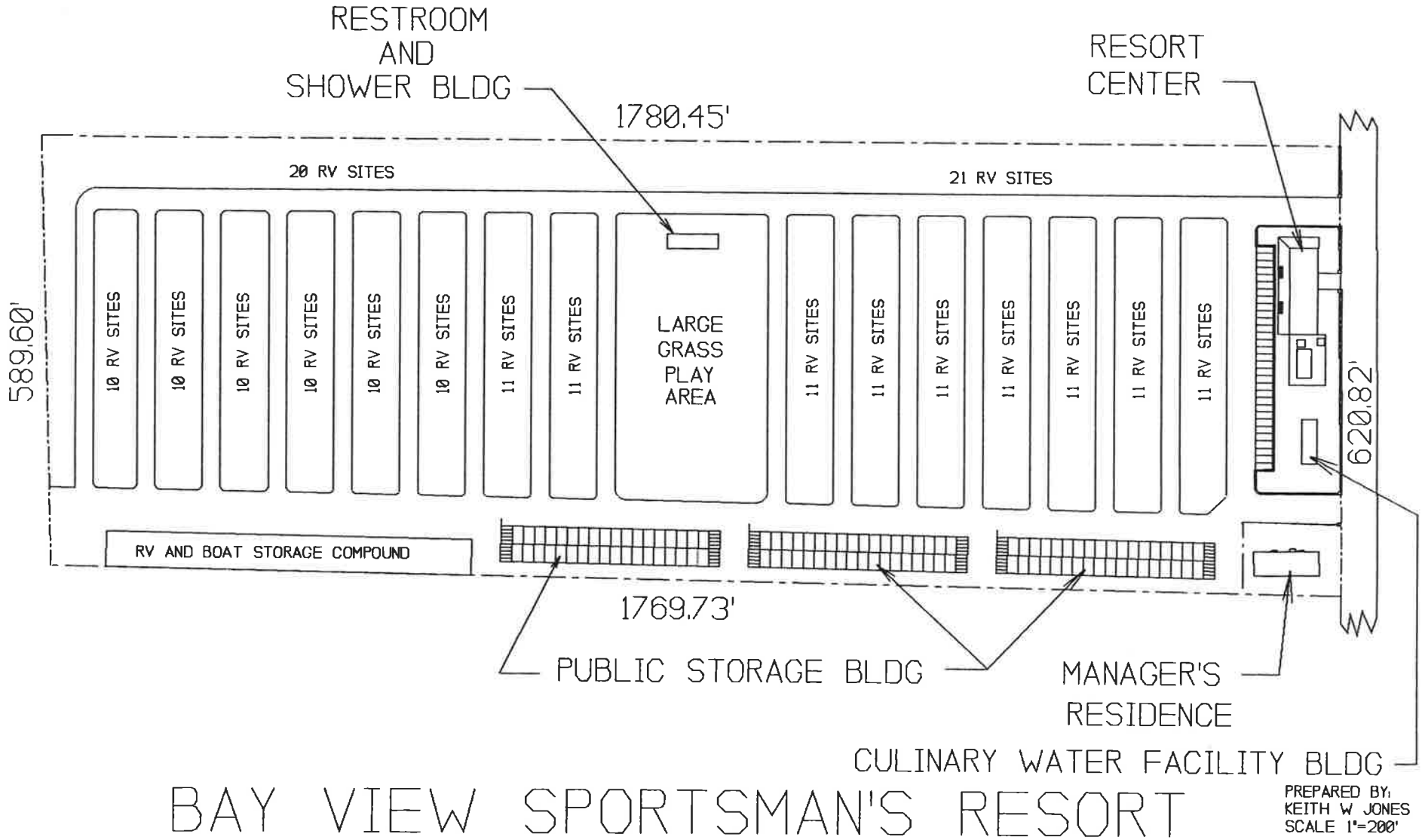
FIGURE 3



BAY VIEW SPORTSMAN'S RESORT

PREPARED BY:
KEITH W JONES
SCALE 1"=200'

FIGURE 4



BAY VIEW SPORTSMAN'S RESORT

PREPARED BY:
KEITH W JONES
SCALE 1"=200'

FIGURE 5

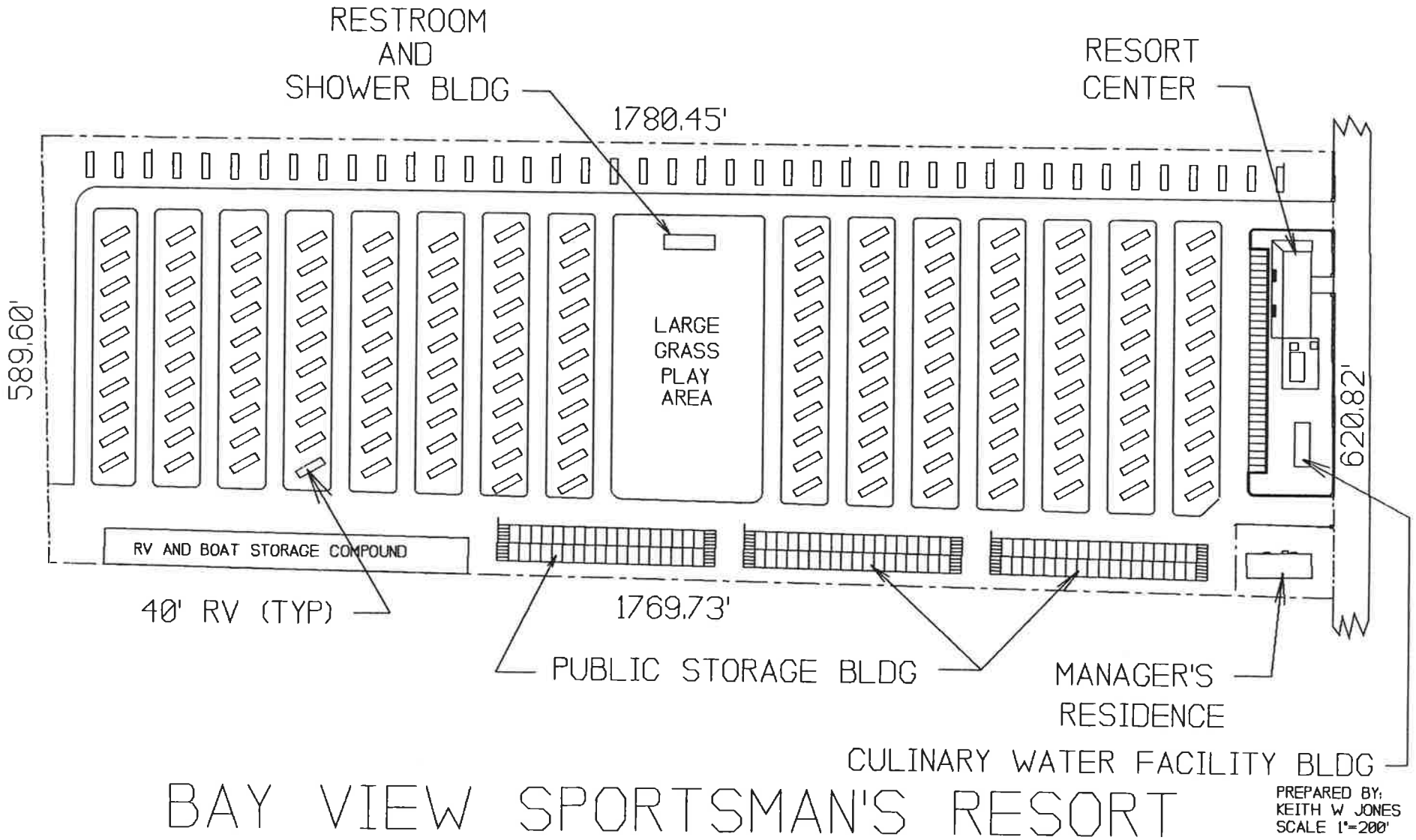
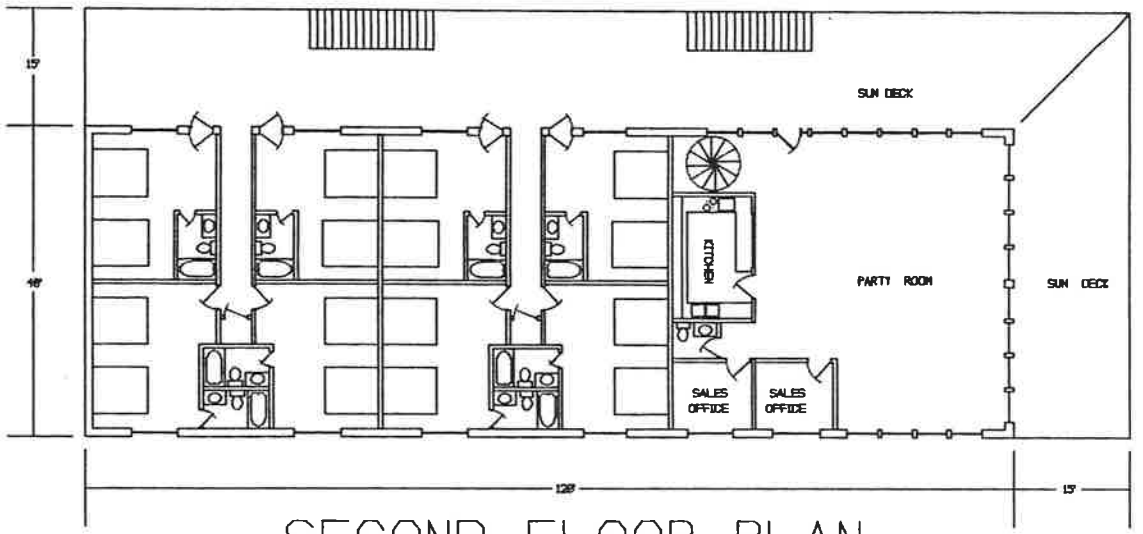
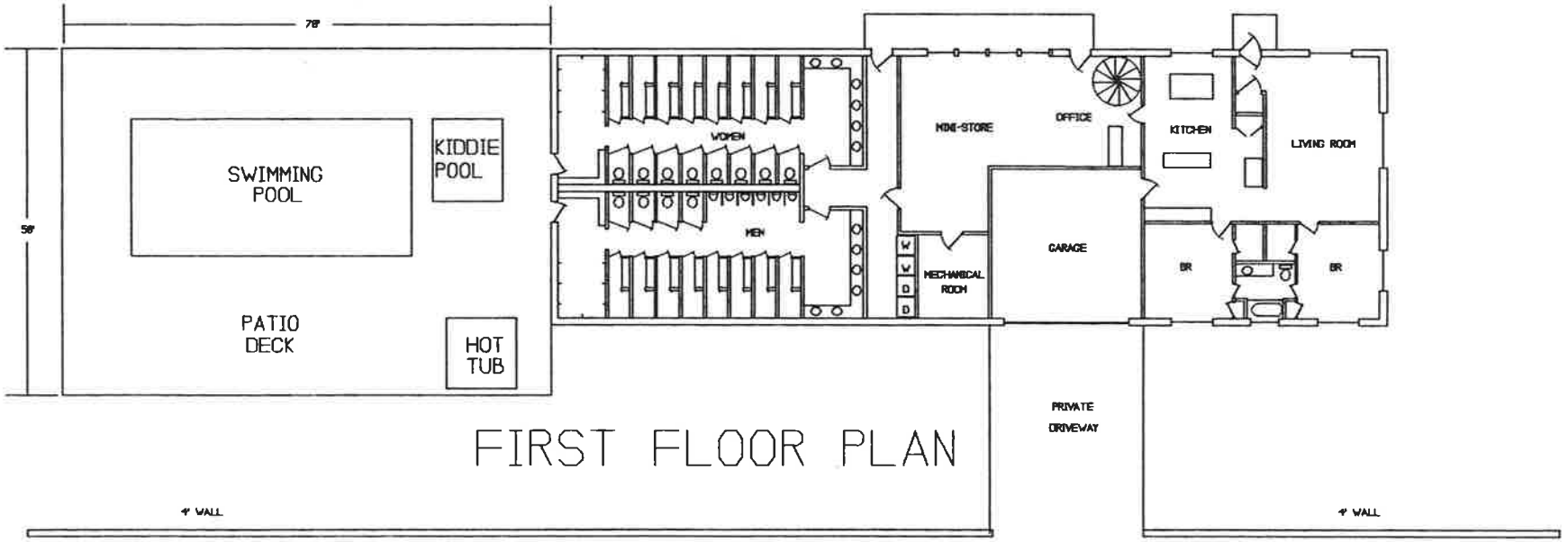

RESTROOM
AND
SHOWER BLDG
1780.45'
RESORT
CENTER
589.60'
LARGE
GRASS
PLAY
AREA
620.82'
RV AND BOAT STORAGE COMPOUND
40' RV (TYP)
1769.73'
PUBLIC STORAGE BLDG
MANAGER'S
RESIDENCE
CULINARY WATER FACILITY BLDG
BAY VIEW SPORTSMAN'S RESORT
PREPARED BY:
KEITH W JONES
SCALE 1"=200'

FIGURE 6

BAY VIEW SPORTSMAN'S RESORT CENTER AND POOL AREA



SECOND FLOOR PLAN



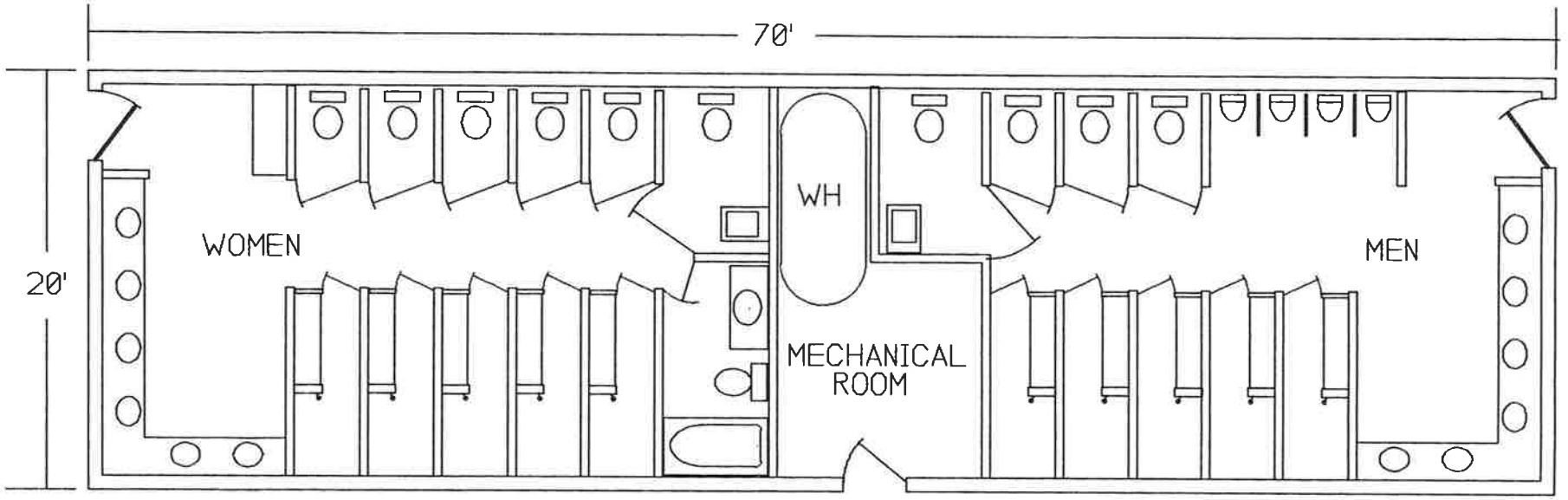
FIRST FLOOR PLAN

FRONTAGE ROAD - 50' WIDE

℄

PREPARED BY:
KEITH W JONES
SCALE 1"=25'

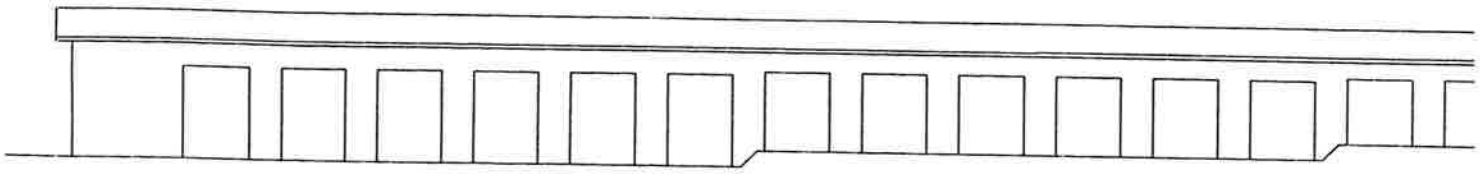
FIGURE 7



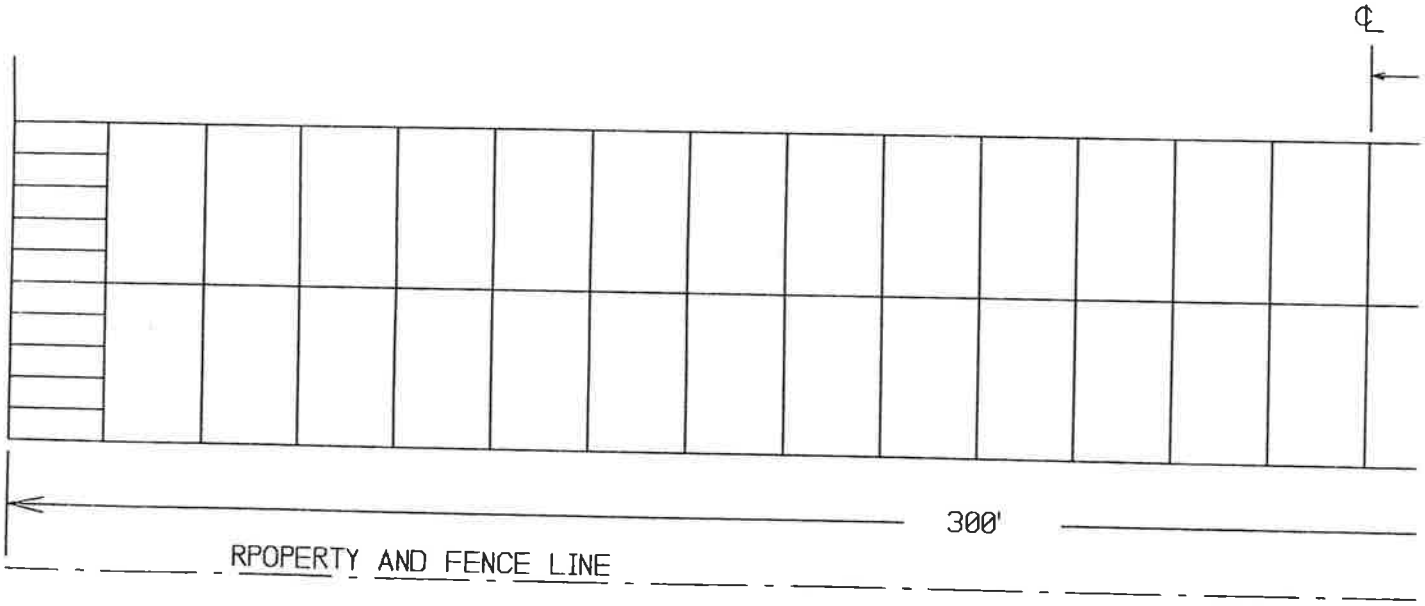
MID-RESORT RESTROOM AND SHOWER BUILDING

PREPARED BY:
KEITH W JONES
SCALE 1"=8'

FIGURE 8



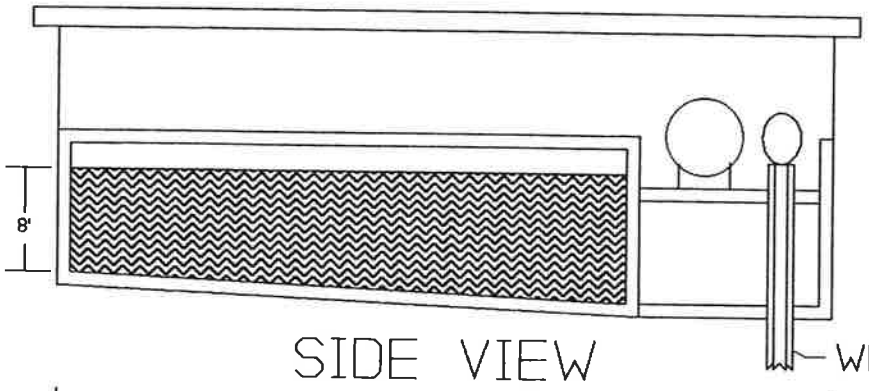
SIDE VIEW



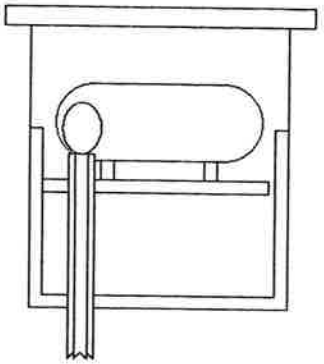
FLOOR PLAN VIEW

GARAGE STORAC

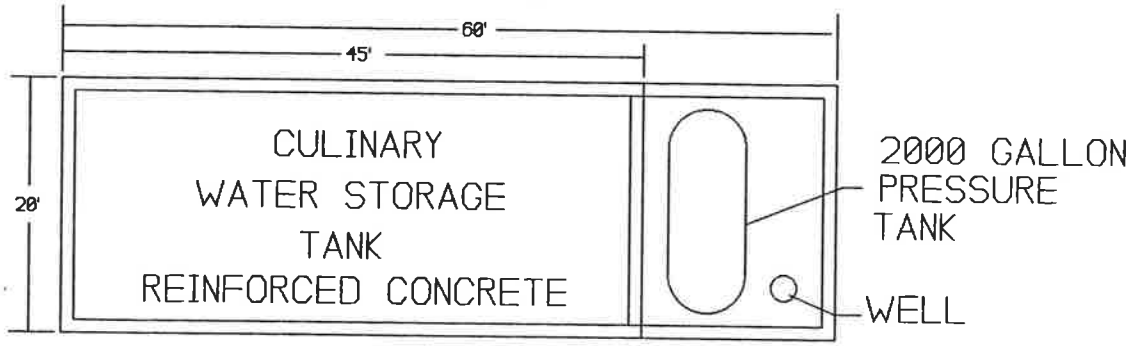
FIGURE 9



SIDE VIEW



END VIEW



PLAN VIEW

CULINARY WATER FACILITY

PREPARED BY:
KEITH W JONES
SCALE 1"=15'

FIGURE 10

CONCEPT PLAN

ENVIRONMENTAL IMPACT ASSESSMENT

FOR

BAY VIEW SPORTSMAN'S RESORT

WILLARD, UTAH

Prepared By:
Keith W Jones, President
Sportsman's Resort Development Corporation

CONCEPT PLAN
ENVIRONMENTAL IMPACT ASSESSMENT

FOR

BAY VIEW SPORTSMAN'S RESORT
WILLARD, UTAH

Prepared By:
Keith W Jones, President
Sportsman's Resort Development Corporation

1055 29th St.
Ogden, Utah 84403
(801) 394-9063

990 E 800 N
Shelley, Idaho 83274
(208) 346-6673

INTRODUCTION:

The Sportsman's Resort Development Corporation plans to develop and operate Recreational Vehicle (RV) resort, **"BAY VIEW SPORTSMAN'S RESORT"**, on the south side of Willard Bay adjacent to Interstate 15 in part of the Northwest Quarter of Section 2 and part of the Northeast Quarter of Section 3, Township 7 North, Range 2 West of the Salt Lake Base and Meridian. The property contains 24.7 acres which presently is farmland. See Figures 1, 2, and 3 in the Concept Plan.

PROJECT DESCRIPTION:

The **Bay View Sportsman's Resort** will be a luxury **private membership** RV-Resort. The resort will have a maximum of 200 RV sites. Over half the sites will have full service hookups with electric, water, sewer, and TV cable; and the remaining sites will only have electric and water hookups. The two entrances and the road and parking in front of the resort center will be asphalt; all other roads within the resort will be gravel.

MULTIPLE USE, AGRICULTURE AND RURAL RESIDENTIAL DISTRICTS

		MU-160	MU-80	MU-40	A-20	RR-10	RR-5	RR-1
10.3.4.3	Farms devoted to raising and marketing chickens, turkeys, or other fowl or poultry, fish or frogs, mink, rabbits, including wholesale and retail sale	P	P	P	P	P	C	–
10.3.4.4	Apiary and Aviary	P	P	P	P	C	C	–
10.3.4.5	Forestry except forest industry	P	P	P	P	P	P	–
10.3.4.6	Forest Industry, such as a saw mill, wood products plant, etc.	C	C	C	–	-	–	–
10.3.4.7	Family food production	P	P	P	P	P	P	P
10.3.5	Kennel	C	C	C	C	C	C	C
10.3.6	Dude ranch, family vacation ranch	C	C	C	C	C	–	–
10.3.7	**DWELLINGS**							
10.3.7.1	Single-family dwelling	C	C	C	P	P	P	P
10.8.7.2	Two-family dwelling	C	C	C	P	P	P	–
10.3.7.3	Three-family dwelling	C	C	C	C	–	–	–
10.3.7.4	Four-family dwelling	–	–	–	–	–	–	–
10.3.7.5	Residential facilities for handicapped or elderly	C	C	C	C	C	C	C
10.3.8	Home occupation	C	C	C	C	C	C	C
10.3.9	Child day care and nursery	–	–	–	–	C	C	C
10.3.10	Household pets	P	P	P	P	P	P	P
10.3.11	Mine, quarry, gravel pit, rock crusher, concrete batching plant, or asphalt plat, oil and gas wells, steam wells, test boring for exploration, etc.	C	C	C	C	C	–	–
10.3.12	Power generation	C	C	C	C	–	–	–
10.3.13	Private park or recreational grounds or private recreational camp or resort, including accessory or supporting dwellings or dwelling complexes and commercial service uses which are owned or managed by the recreational facility to which it is accessory	C	C	C	C	C	C	–
10.3.14	Public stable, riding academy or riding ring, horse show barn or other equestrian facilities under single management	C	C	C	C	C	C	–

areas. The primary purpose for the construction of such a dwelling is to provide shelter during those limited periods of time when recreation is sought in the adjacent areas.

1.43.18.1 RECREATIONAL VEHICLE. (RECREATIONAL COACH) A vehicle, with or without motive power, designed and constructed to travel on public streets, and designed for use as a human habitation of a temporary and recreational nature.

1.43.18.2 RECREATIONAL VEHICLE PARK (TRAVEL TRAILER PARK). Any area or tract of land or a separately designated section within a mobile home park where lots are rented or held out for rent to one or more owners or users of recreational vehicles for a temporary time not to exceed 30 consecutive days.

1.43.18.3 RECREATIONAL VEHICLE SPACE. A plot of ground within a recreational vehicle park designated and intended for the accommodation of 1 recreational vehicle.

1.43.18.4 RENEWABLE ENERGY. That form of energy whose supply is natural, inexhaustible and not dependent upon fossil fuel supplies. Examples include residential solar heat, wind power, geothermal power and many other supply sources.

***1.43.18.5** RESIDENTIAL FACILITY FOR ELDERLY PERSONS means a single-family or multiple-family dwelling unit that meets the requirements of Chapter 8 of this "Code" and any ordinance adopted under authority of "Chapter 8".

1.43.18.6.1 Residential Facility for Elderly Persons does not include a health care facility.

***1.43.18.6** RESIDENTIAL FACILITY FOR HANDICAPPED PERSONS means a single-family or multiple-family dwelling unit that meets the requirements of Chapter 8 of this code and any ordinance adopted under authority of that chapter.

use on the lot; any use which establishes the primary activity on a lot.

1.43.16.11 PRIVATE NON-PROFIT RECREATIONAL GROUNDS AND FACILITIES. Non-profit recreational grounds and facilities operated by a non-profit corporation, association, or group.

1.43.16.12 PROFESSIONAL TEAM, QUALIFIED. An individual or group of individuals qualified by virtue of training, experience, state licensing where appropriate and membership in professional associations which pass upon qualifications prior to admittance to membership. A determination of whether or not a team is qualified, in the sense explained above, shall be made solely by the Planning Commission.

1.43.16.13 PROTECTION STRIP. A strip of land between the boundary of a land development and a street within the land development, for the purpose of controlling the access to the street by property owners abutting the land development.

1.43.16.14 PUBLIC FACILITIES AND PUBLIC SERVICE FACILITIES. For the public convenience, certain infrastructure including streets, water lines, sewer lines, public utilities, and drainage facilities may be allowed to serve various areas of the community, as public facilities. Possible additional facilities such as a sub-station for fire and/or police, post office and/or hospital may be determined to be in the public interest as well, as public service facilities by Box Elder County.

1.43.17 QUASI-PUBLIC. A seemingly public institution, entity or organization that is not actually public. (Because of an independent or private control over it)

1.43.18 RECREATION DWELLING (CABIN, RECREATION CABIN). A dwelling designed for limited rather than primary occupancy and generally located adjacent to or with easy access to recreational

12.3 USE REGULATIONS

No building, structure or land shall be used and no building or structure shall be hereafter erected, structurally altered, enlarged or maintained in the commercial and industrial districts except as provided in this Code. Accessory uses and buildings customarily incidental to uses authorized by conditional use permit in any district are also authorized by issuance of a conditional use permit in any such district. Temporary uses as defined in this Code are authorized in any district upon issuance of a conditional use permit for the same.

		C-N	C-S	C-H	C-G	M-D	M-G
12.3.1	**AGRICULTURAL**						
12.3.1.1	Agricultural Industries	–	–	–	–	C	C
12.3.1.2	The Tilling of the Soil, the Raising of Crops, Horticulture and Gardening	P	P	P	P	P	P
12.3.2	**COMMERCIAL**						
12.3.2.1	RESIDENTIAL Hotels, Tourist Courts and Motels Recreation Coach Parks Rooming and Boarding Houses	 – – –	 C C C	 C C –	 C C C	 – – –	 – – –
12.3.2.2	INDUSTRIAL Commercial Contract Printing	 –	 –	 –	 P	 P	 P
12.3.2.3	TRANSPORTATION Bus Terminals, Stations, etc. Hard Surface Parking, commercial Private Garage Structure Parking	 C – C –	 C C C C	 P C C C	 P C C C	 P C C C	 P C C C
12.3.2.4	COMMUNICATION Radio and Television Communication Facilities	 –	 C	 C	 P	 –	 –
12.3.2.5	RETAIL TRADE Antiques and Used Merchandise Bakeries Books and Stationery Candy,nuts and Confectionery Children's and Infant Wear Custom Tailoring Dairy Products	 – – – – – – P	 P P P P P P P	 – – – – – – P	 P P P P P P P	 – – – – – – –	 – – – – – – –

7.1.3.2.3 The Planning Commission may hold a preliminary hearing to consider its recommendations to the County Commission for revocation or suspension of permits which have been temporarily suspended at the next regularly scheduled meeting of the Planning Commission.

7.1.4 **EXPIRATION OF PERMIT.** Every conditional use permit shall expire by limitation and become null and void if the work authorized by such permit has not been commenced within 1 year, or is not completed within 2 years from date of issue; except that the Planning Commission may, if the permit holder presents satisfactory evidence that unusual difficulties have prevented work being started or completed within the specified time limits, grant a reasonable extension of time, up to 1 year, if written application is made before the expiration of the permit.

7.1.5 **GROUNDS FOR DENIAL OF A CONDITIONAL USE PERMIT APPLICATION.** The following shall constitute grounds for denial of a conditional use permit application:

7.1.5.1 Under circumstances of the particular case, the proposed use will be detrimental to the health, safety or general welfare of persons residing or working in the vicinity, or injurious to property or improvements in the vicinity and there is no practical means available to the applicant to effectively mitigate said detrimental effects.

7.1.5.2 The applicant cannot or does not give the Planning Commission reasonable assurance that conditions imposed incident to issuance of a conditional use permit will be complied with.

7.1.6 **ISSUANCE OF CONDITIONAL USE PERMIT TO BE DEPENDENT ON AFFIRMATIVE FINDINGS.** Conditional uses may be approved by the County Commission upon recommendation of the Planning Commission, in locations permitting such

905 West 1075 South
Brigham City, Ut 84302
(801)723-8858

FEB 9 1994

February 8, 1994

Jeff Thorne,Esq.
Mann, Hadfield & Thorne
98 N. Main
Brigham City, UT 84302

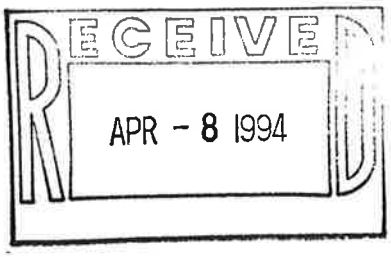
Dear Mr. Thorne,

We have run the Golden Spike R.V. Park for the last two years. As of yet, we have not averaged 50 percent occupancy.

Sincerely,

Gary Bywater

4/21/94



Keith W Jones
990 East 800 North
Shelley, Idaho 83274

April 7, 1994

Denton H. Beecher, Ex-officio Member
Box Elder County Planning Commission
01 South Main Street
Brigham City, Utah 84302

SUBJECT: APPLICATION OF A CONDITIONAL USE PERMIT

Dear Mr. Beecher:

Please schedule a hearing with the Box Elder County Planning Commission for me to present an Application for a Conditional Use Permit under the A-20 District, Sections 7.1.2.2, 7.1.6, and 10.3.13 of the Box Elder County Land Use Development and Management Act. Attached are eight copies of the Conditional Use Application with the proposed Bay Campground Private Recreation Park Plan for the Planning Commissioner's review and comments.

Please send me a timely notice of the hearing date and time; a self addressed stamped envelope is enclosed for you convenience. If there are any problems with the Application or you require additional information, please call me on 208-346-6673 or 800-236-4068.

Sincerely,

Keith W Jones

Keith W Jones

APPLICATION FOR CONDITIONAL USE PERMIT

BAY CAMPGROUND PRIVATE RECREATION PARK

Applicant's Name Keith W Jones
Address 990 East 900 North Shelley, Idaho 83274
Telephone (208) 346-6673

Application No. _____
Date Received by Building Inspector _____
Date of Hearing _____

Application is hereby made to the Planning Commission requesting that Campground, Private Recreation Park be permitted as a "conditional use" on 6.2 Acres (Sq. Ft. or Acres) located at I-15 Access Road from Nerva Lane (Street Address) in a A-20 zone (see attached location map).

Please complete the following:

I. State in detail what is intended to be done on or with the property. Include Site Plan as required in the Conditional Use Chapter of the Zoning Ordinance.

See attached Proposed Condition Use Permit Application with Bay Campground Private Recreation Park Plan (PLAN).

II. Explain fully how your application will satisfy each of the following conditions:

(a) The proposed use at the particular location is necessary or desirable to provide a service or facility which will contribute to the general well-being of the neighborhood or community.

The Recreation Park / Campground to be located adjacent to Willard Bay Reservoir is a need Recreation Facility for Tourism to the County. Property is within the Multi-Use Area around the Reservoir shown on the Box Elder County General Plan. Recreation Facilities are Need Here (See Attached Plan)

(b) The proposed use will not, under the circumstances of the particular case, be detrimental to the health, safety or general welfare of persons nor injurious to property or improvements in the vicinity.

By bringing in Electrical service west of I-15, property values will increase, Sprinkling Irrigation will be possible increasing crop need and conserving water. (See Attached Plan)

(c) The proposed use will be compatible with and complimentary to the existing surrounding uses, buildings, and structures when considering traffic generation, parking, building design and location, landscaping, noise, or other pollution.

Campgrounds are compatable with "Agricutuve" Uses as defined in the Code. Most campgrounds in Utah have pastured cattle across the fence line. Crop farming is also conducted around most campground in the State. (See Attached Plan)

(d) The proposed use conforms to the goals, policies, governing principles and emerging land use patterns of the Master Plan. Please list specific goals and policies as adopted in the Master Plan which would be pertinent.

The proposed use is consistant with the Master or General Plan approved by the county in 1993. The proposed use also satisfies several objectives of the General Plan and is in the Mult. Use Area around the Willard Bay Area designated as Recreation. (See Attached Plan)

III. Attach a copy of market analysis and economic study which justifies the proposed use, and any assurance of financial ability or program to complete and conduct the use (if required by Planning Commission)

Will be supplied IF REQUESTED by Planning Commission in writing.

IV. If proposed use is providing a public service, rather than a private personal use, explain how it will benefit the public or render a service to the community.

The campground supplies sleeping Area for Traveling Tourist and people that want to use Willard Bay Reservoir Recreation Park (See Attached Plan)

V. List the names and addresses of all property owners within 300' of the subject property. (Use additional sheet if necessary)

John Larkin
Lowd Lemon
Kent & Sharon Jones

VI. Fee paid _____.

Signed: Kent L. Jones (Applicant) April 8, 1994

9905800 N (Address) Shelley ID 83274

(208) 346-6673 (Phone)

Zoning Administrators Action:

Date Approved: _____

Date Disapproved: _____

Date Referred to Planning Commission for Action _____

Planning Commission Action:

Date Approved: _____

Date Disapproved: _____

Governing Body Action if Appealed From Decision of Planning Commission:

Date Approved: _____

Date Disapproved: _____

Public Hearing Date if Deemed Necessary _____

Conditions of Approval ☐ , or Reasons for Disapproval ☐

List:

Signature: _____
Chairman, Planning Commission or, Zoning Administrator

The Building Inspector shall place the Conditional Use Application No. as well as any conditions of approval on the Building Permit.

Appealed to the Planning Commission from Decision or Zoning Administrator_____

Appealed to the Governing Body from Decision of Planning Commission _____

BAY CAMPGROUND

PRIVATE RECREATION PARK

Proposed
Conditional Use Application

Prepared By:
Keith W Jones
April 7, 1994

We request a "Conditional Use Permit" to develop the Bay Campground Private Recreation Park in an A-20 District per the Box Elder County Land Use Management and Development Code, Adopted 24 November 1992, Effective Date 17 February, 1993, Section 10.3.13. The Bay Campground Private Recreation Park Plan is attached for your review and approval.

The Bay Campground Private Recreation Park is to be located on property described as follows:

01-041-006
Part of Section 2 and 3, Township 7 North, Range 2 West, Salt Lake Base and Meridian. Beginning at a point 1551.4 feet South from the Northwest corner of Section 2; thence South 88°56' East 727.5 feet, more or less, to the Railroad Right of Way; thence South 0°30' West 156.5 feet; thence North 88°40' West 2028 feet to Road; Thence North 0°48' West 147.4 feet; thence South 88°56' East 1303.5 feet, more or less, to point of beginning. Less tract conveyed to Utah State Road commission. Containing 6.29 Acres.

This property, as described, was previously owned by Elaine B Call since March 1974, and the size and shape of the property pre-dates all Box Elder County planning and zoning codes. Because the size and shape of the property does not meet the code, we apply for an exception to Section 10.9.1 - Side Yard Regulation, from A-20 to RR-5, or 20 feet. (See Code 1.18) The property was purchased in November 1993 by Keith W Jones and Sharon Jones, Husband and Wife, for the specific purpose of developing a recreation facility on private property adjacent to Willard Bay Reservoir State Park. Over 900 feet of this specific property boundary borders the USA Property, owned by the U. S. Bureau of Reclamation, and managed by the State of Utah Department of Natural

Resources Division of Parks and Recreation. The Utah Department of Fish and Game manages and provides fisherman's access to the Willard Bay Reservoir at the end of 1500 West Street, the northwest corner of the proposed park property.

This property is within the "Multiple Use Area" around Willard Bay Reservoir as defined in the Box Elder County General Plan, 1992 - 2005, adopted 24 November 1992. Some of the Goals of the General Plan are to develop recreational resources of Great Salt Lake and associated areas, to encourage tourists and travelers to visit the county, and to provide the services and facilities that are adequate to meet these needs. The Willard Bay State Park, which is filled to capacity many week ends during the summer season, only provides water to the campers. Every camper nowadays wants both water and electrical power to their camp site, and most desire sewer at their camp site. The state park facilities do not adequately meet the need of these tourists. Private recreational camp facilities are greatly needed around the Willard Bay Reservoir, one of Box Elder County most valuable recreational resources. This proposed Bay Campground Private Recreation Park fulfills these objectives of the General Plan, and is in the multiple use area around the reservoir set out for future recreation development.

The State of Utah Department of Parks and Recreation operates two state campgrounds adjacent to the Willard Bay Reservoir, which demonstrates the need for camping in the area, and demonstrates campground compatibility with existing area land uses. They have also demonstrated that insects around the reservoir can be controlled; many people continue to come back and camp at the state parks. Most campgrounds in the State of Utah are located in farming areas, with pastured cattle across the fence lines, proving compatibility with agriculture uses.

The proposed recreation park owners are working with the Bureau of Reclamation and the State of Utah Parks and Recreation to improve the existing fisherman's access to Willard Bay Reservoir. Public parking for about 20 vehicles and a public restroom will be provided in the northwest corner of the campground property. A new bridge over the south drain and a wide path to the

top of the dike will be constructed to provide wheel chair access to the reservoir for handicap fishing from the dike. A dock parallel to the rocky reservoir dike may also be installed to further encourage day fishing off the South Bay bank. The south bank of the reservoir dike will be planted in grass and mowed by the park. Within several years, this property along the south bank of Willard Bay Reservoir could become one of Box Elder County's choice public parks, developed completely with private money.

The campground recreation park will bring electrical power and community culinary water to the west side of the interstate, which will greatly increase the property value to the area, and directly increase the tax base without any additional burden to the schools or community facilities. The park will provide community recreation facilities at no cost to the county. With electrical power, the farms to the south and adjacent to the park could use sprinkling irrigation, which will greatly increases crop yields, while conserving water.

Attached are petitions with over 300 signature of South Willard, Willard, and Perry residents showing their support for a private campground adjacent to Willard Bay Reservoir. These residents see the need for such development adjacent to Willard Bay Reservoir which is consistent with the approved Box Elder County General Plan. Most signatures represent one household's opinion, not just one individual.

Timothy Solomon, Box Elder County Economic Development Director, has written a letter to the County Commissioners in support of this project. The Box Elder County Tourism Council, Golden Spike Council, the State of Utah Tourism Council, and the State of Utah Department of Parks and Recreation are in support of a private recreation campground adjacent to Willard Bay.

We, therefore, petition the Planning Commission and the County Commission to grant approval and a Conditional Use Permit for the construction and operation of the Bay Campground Private Recreation Park.

BAY CAMPGROUND

PRIVATE RECREATION PARK

PLAN

WILLARD, UTAH

Prepared By:
Keith W Jones

April 7, 1994

BAY CAMPGROUND
PRIVATE RECREATION PARK
PLAN

WILLARD, UTAH

Prepared By:
Keith W Jones
April 7, 1994

In pursuant to a Conditional Use Permit application, this Bay Campground Private Recreational Park Plan is provided for the Box Elder County Planning Commission and Box Elder Commission review and approval as required by The Box Elder County Land Use Development and Management Act, per the Box Elder County Land Use Management and Development Code, Adopted 24 Nov. 1992, Effective Date 17 Feb. 1993. This proposed Bay Campground Private Recreation Park fulfills several objectives of the General Plan, and is located in the "Multiple Use Area" around the Willard Bay Reservoir proposed for future recreation development.

PROJECT LOCATION:

The Bay Campground Private Recreation Park is to be located on the south side of Willard Bay Reservoir adjacent to Interstate. See following figures:

Figure 1 Section of the aerial map showing the project location,

Figure 2 Section of a USGS map of the area showing the project location,

Figure 3 Drawing showing the surveyed property boundary, and adjacent State of Utah Willard Bay Park property lines.

PROPERTY DESCRIPTION:

Part of Section 2 and 3, Township 7 North, Range 2 West, Salt Lake Base and Meridian. Beginning at a point 1551.4 feet South from the Northwest corner of Section 2; thence South 88°56' East 727.5 feet, more or less, to the Railroad Right of Way; thence South 0°30' West 156.5 feet; thence North 88°40' West 2028 feet to Road; Thence North 0°48' West 147.4 feet; thence South 88°56' East 1303.5 feet, more or less, to point of beginning. Less tract conveyed to Utah State Road commission. Containing 6.2 Acres.

PROPERTY OWNERSHIP:

The property is owned by Keith W Jones and Sharon Jones, husband and wife.

PARK DESCRIPTION:

The Bay Campground Private Recreation Park will be a simple campground located adjacent to southeast corner of Willard Bay Reservoir. The park will have a camp center building, 30 camp sites, mid-park campground restrooms, two playground areas, and a public parking area with public restrooms. The park will be in grass except for the buildings and road way. See Figure 4 - Bay Campground facility layout.

The **camp center** will house the manager's residence, camp office, mini-store, restrooms, and showers. A mobil home will be used as a temporary manager's residence and camp office for the first two seasons of operation.

The **30 camping sites** will have access to both water and electrical facilities; some sites will also have sewer connections. Fast growing trees will be planted for each camping site to provide shade. Tables will also be provided to each sites.

The **road** within the recreation park will be gravel. The park entrance will be 36 feet wide, the two way road 30 feet wide, and one way road 15 feet wide.

A graveled **public parking area** for improving existing fisherman's access to Willard Bay Reservoir and **public restrooms** will be located off the end of 1500 West Street in the northwest corner of the property.

Recreation equipment rentals will also be available through the camp office.

TREES AND SHRUBS:

Many trees and shrubs will be planted all around and through the park as the park is developed. It is planned that every camping site will eventually have a large shade tree. Evergreen shrubs will be planted in the parkway in front

of the camp center building and around the camp center and restroom buildings. Evergreen/pine trees will be planted throughout the resort to provide area privacy without blocking the beautiful view of the mountains.

WATER SOURCES:

Culinary Water will come from the South Willard Water District, or a deep water well drilled into the artesian aquifer located off the subject property.

Irrigation water for watering the grass will be purchased and pumped from Willard Bay or it will be from a new shallow irrigation well to be located in the northwest corner of the property. The irrigation water system will only be pressurized when the grounds keeper is watering the grass and shrubs within the park. There will be no hose connection in the irrigation system, to insure and prevent accidental usage.

SEWER SYSTEM:

The **sewer system**, less than 4500 gallons per day, will be septic tanks and drain fields. The system will be designed and installed as required by the Box Elder County Department of Health. The mid-park restrooms and the public restrooms by the fisherman's access will have holding tanks that will be pumped as required.

ELECTRICAL POWER:

Utah Power and Light will supply the **Electric Power** to the park. All electric power within the property boundaries will be underground. There will be minimal outside lighting around the park, enough to make it safe, but dark enough for the campers to sleep. Bright lights will remain on all night at the park entrance and inside the restrooms and shower facilities.

SECURITY:

Security will be provided twenty four hours a day during the summer when park is operating. The park is expected to be closed at about 10:00 PM and open at 7:00 AM each day. A one-way exit will always be available. The fences around the property will be maintained for the security of the park guests. Within two year of the startup of the park, the existing barb wire fences will be replaced with a six foot chain link fence.

SUMMARY

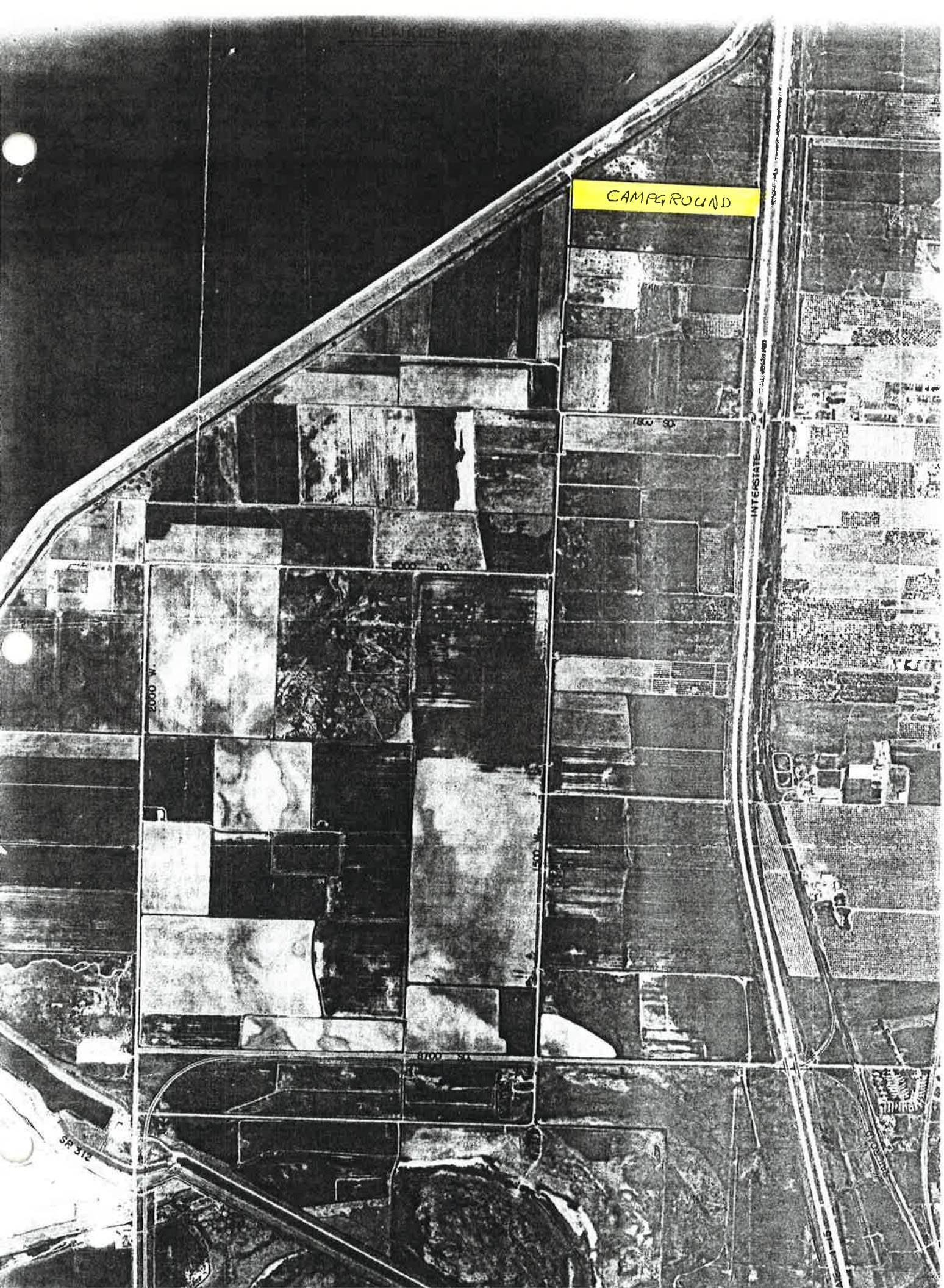
The proposed Bay Campground Private Recreation Park will support 30 camp sites with water and electrical power. The camp center will contain a managers residence, camp office, restrooms, and shower. The park will also have two other restroom buildings and a public parking area for the fisherman's access.

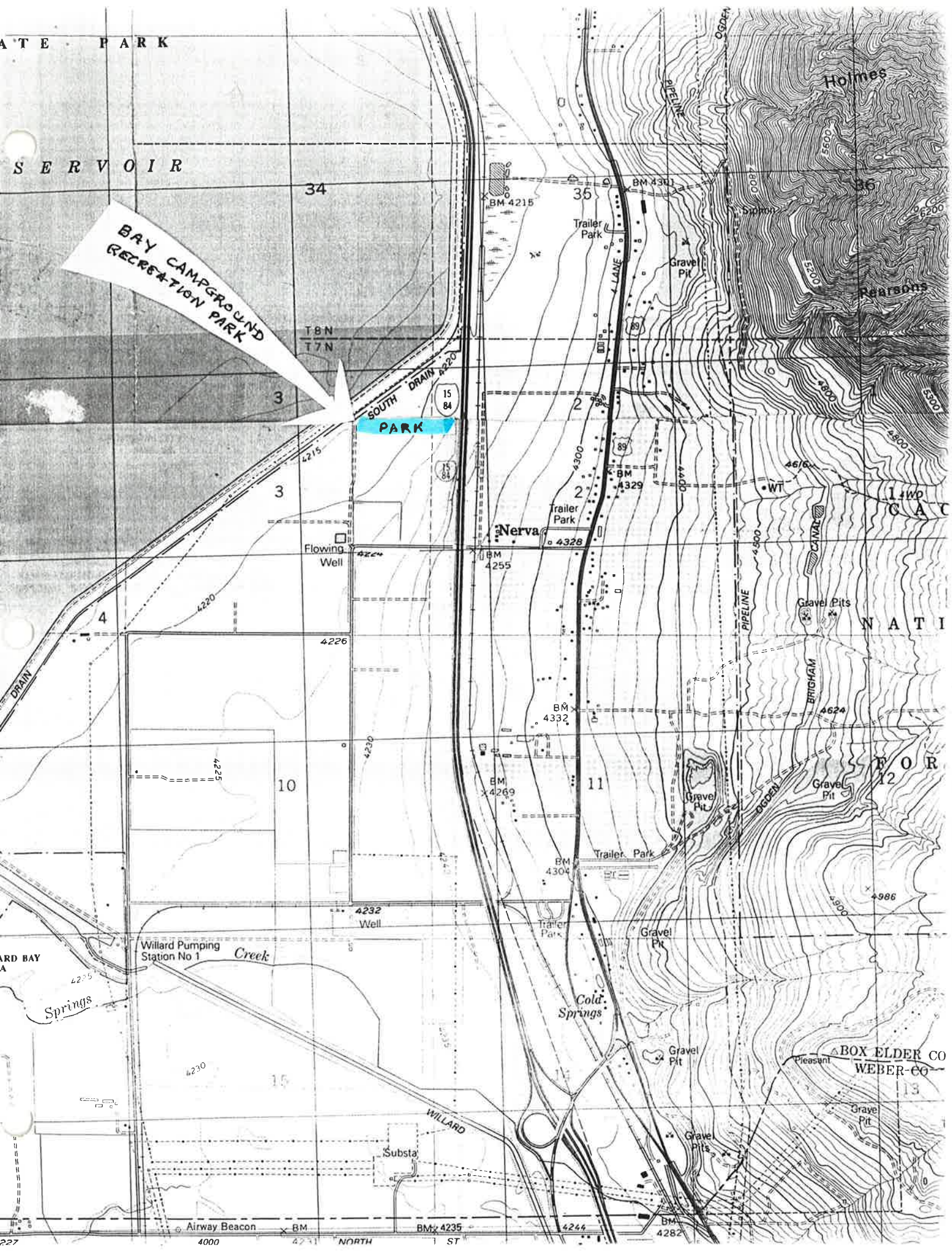
The Bay Campground Private Recreation Park will comply with all local, state, and federal regulations and ordinances. The park will be a good neighbor and an asset to the community. The park will double the property value west of Interstate I-15. The high property value will increase the local tax base without any burden to the schools or community facilities. It is expected that the park will increase the area employment base by 3 people during the summer months. The visiting tourists will bring money into the local economy.

This proposed Bay Campground Private Recreation Park fulfills several objectives of the General Plan, and is in the multiple use area around the Willard Bay Reservoir planned for future recreation development.

The State of Utah Department of Parks and Recreation operates two state campgrounds adjacent to the Willard Bay Reservoir, which demonstrates the need for camping in the area, and demonstrates campground compatibility with existing area land uses. They have also demonstrated that insects around the reservoir can be controlled. Most campground in the State of Utah are located in farming areas with pastured cattle across the fence lines, demonstrating compatibility with agriculture uses.

The proposed Bay Campground Private Recreation Park is consistent with the Box Elder County General Plan, and is compatible with the agricultural uses. (See Code 1.43.1.3 and 1.43.3.9)


CAMPGROUND
INTERSTATE
1800 SO
6000 SO
2000 W
1500 W
8100 SO
SR 312


BAY CAMPGROUND RECREATION PARK
PARK
Holmes
Pearsons
Nerva
Trailer Park
Gravel Pit
Gravel Pits
Flowing Well
Willard Pumping Station No 1
Creek
Springs
Cold Springs
Substa
WILLARD
Airway Beacon
BM 4215
BM 4300
BM 4329
BM 4255
BM 4328
BM 4332
BM 4269
BM 4304
BM 4282
BM 4235
Siphon
PIPELINE
OGDEN
CANAL
BRIGHAM
SOUTH DRAIN
DRAIN
LANE
Well
WT
4WD
BOX ELDER CO
WEBER CO
NORTH
ST

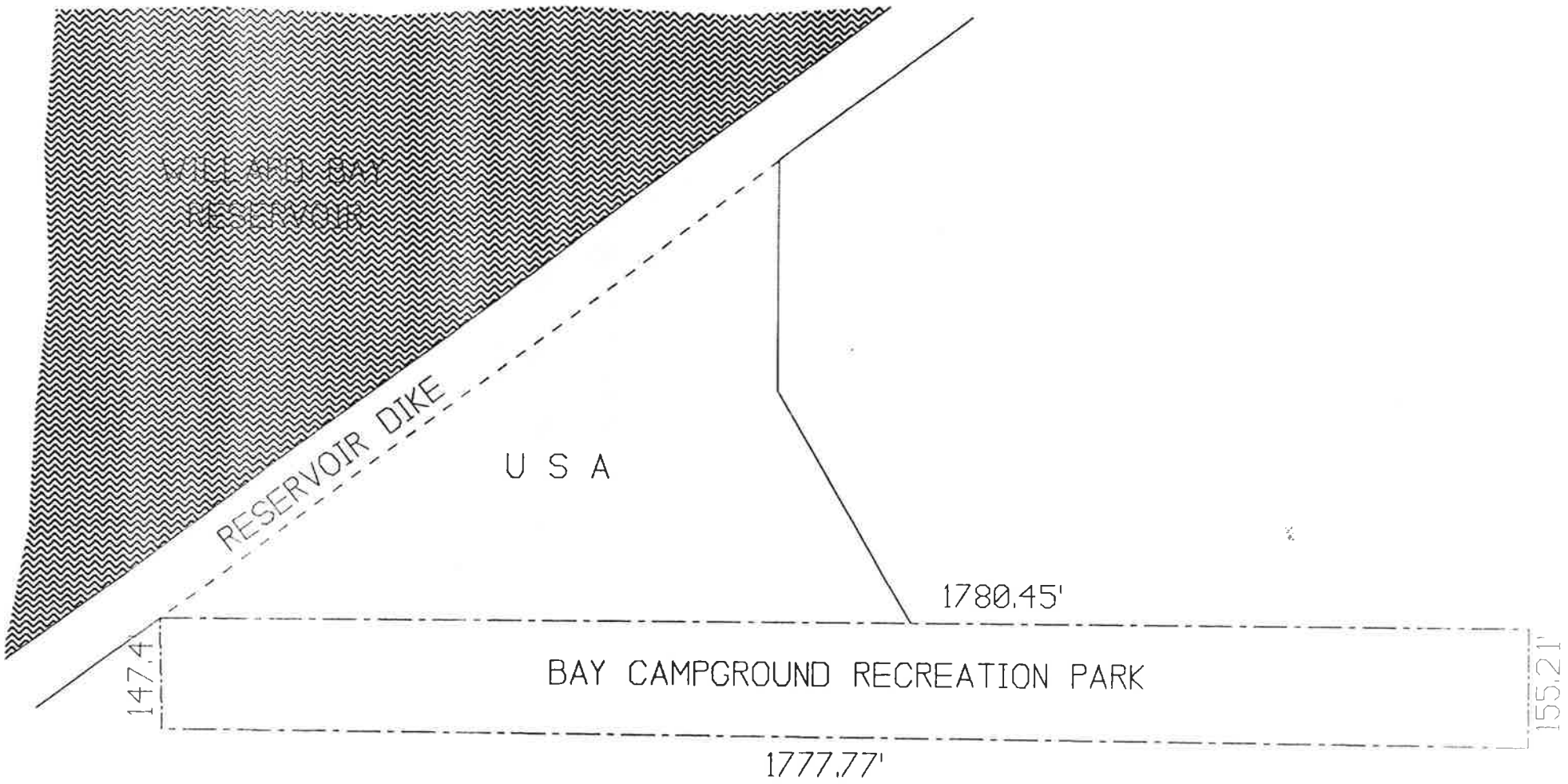
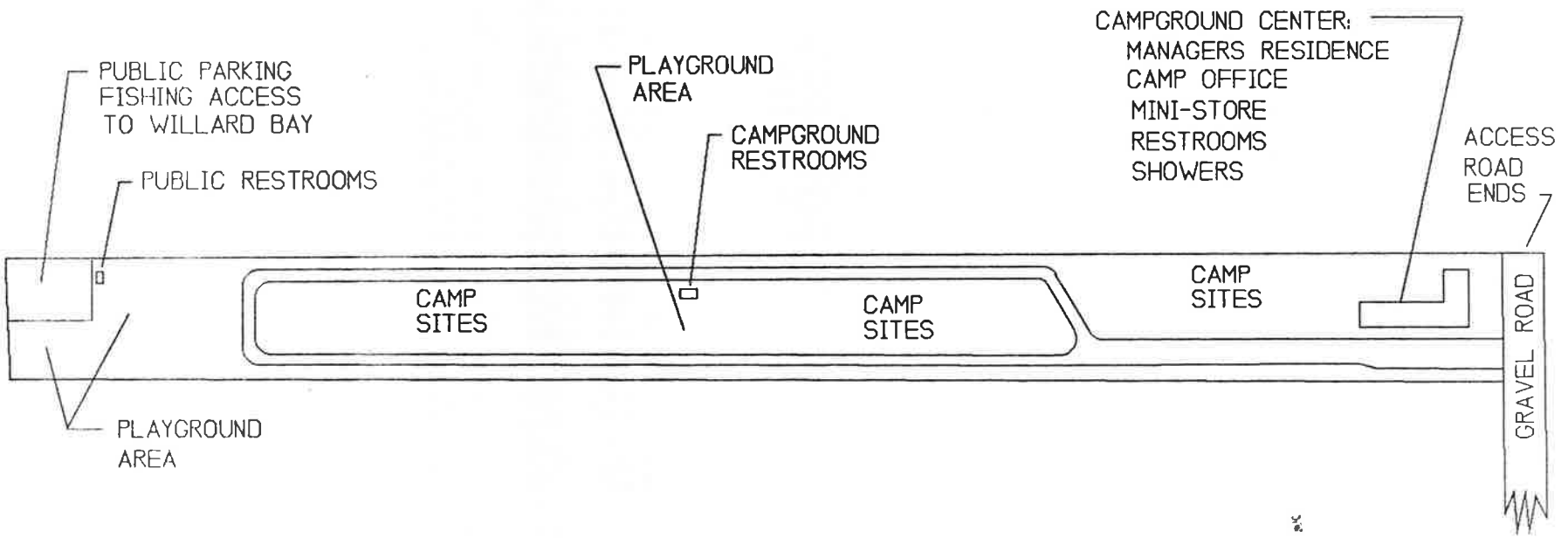

RESERVOIR DIKE
U S A
1780.45'
147.4
BAY CAMPGROUND RECREATION PARK
155.21'
1777.77'

FIGURE 3



BAY CAMPGROUND

PRIVATE RECREATION PARK

PREPARED BY:
Keith W Jones
April 6, 1994
SCALE: 1" = 200'

FIGURE 4

4/21/94

County Planning Commission April 21, 1994

Violations of Parsons Co. of the Conditional Use Permit.

In March 21, 1990 Parson was to East of our Mobile Home Court removing rocks with a cat, I called Denton Beecher at this time. He said no permit was issued because this was an existing pit.

In summers 1991 and 1992 Parson Co. came again to the East of our Mobile Home Court and removed Top Soil and Sub Soil and hauled this off to Payless Drug warehouse.

7.6.6.10 Topsoil is to be Stockpiled during rough grading and used on cut and fill slopes. The top soil was removed and never returned.

(land Use Management and Development Code)

5.8 A Pre-Existing Non-Conforming Use. States the land that is Non-Conforming prior to this code may remain so unless the use ceased for a continuous period in excess of 365 days.
No such Non-Conforming use of land may in anyway be expanded or extended, either in the same or on adjoining property.

This ground had not been touched prier 1982 I have a aerial photo verifies to this.

At this same time they were running their large trucks on the road directly to the North of us. Within 20 feet of our mobile homes and 25 feet of our gas lines and meters.
I know you people think that the residents of mobile homes are a sub-grade species but on the side where they ran their trucks.

I have a Box-Elder Police Officer, and at one time had three officers living in this Court.

I have a girl with two small boys age 4 and 5 her Uncle Is the Judge in Willard. I have a Master Sergeant in the Air Force at Hill,

I have man from Wyoming finishing out his Government career at Thiokol Corp. He still has a residence in Wyoming, this State is putting on a good face for him.
I have Bishop Lemmon's granddaughter and her husband. The balance of the rest on that side are mostly retired people.

Parsons Co and their trucks endangered the lives and property of all people living on the North side, at no time were any provisions set to protect us from runaways as required by the permit in the North area.

(Might I add this has not been installed yet. People residing there that would like to live out the rest of without having a truck going thru there house. Mr. and Mrs. Vicor are one such family.

ATT 7

The last time I was here March 17, I told you Parsons Co. brought up to gravel pit sight, asphalt and was putting dirt on it when they got caught by Stan Parken.

He took pictures of this (when you put dirt on something that is burying is it not?)

Then at this meeting Mr. Kimber you allowed Fay Faiser to come behind me and call me a liar.
Though he was not on the docket to speak just before you made a big deal about my name not being on the docket with Mrs. Ball. She told this board other people from Willard would speak as well as her.
That is more than hypocritical that is phoney.

Mr. Faser said, they were reclaiming this asphalt and they put in their crusher then put in a pile. Where in their permit does it say they can bring up asphalt, or a foreign substance and reclaim it? There is no such mention of this.

This still has an oil base to it and this on top of our aquifer, they are not allowed to crush without putting water on it, so where will the oil go? This violates code 7.6.6.5.1 pertaining to Fill Material.

This is not legal no matter what spin you put on it.

Well that shouldn't make any difference they sprayed diesel fuel on the ground and never reported that also. this is a direct violation of the Environmental Code 19-5-114

I would like to remind you again this is part of a recharge area for one of the largest aquifers in Northern Utah that extends on into Weber County all the way to Bountiful.
From State of Utah Department of Natural Resources.
The chemical quality of the ground water in the East Shore area is directly related to the quality of its recharge water.

I shouldn't think it be necessary to talk about what Law Suite this County could possibly create for themselves from other towns to the South if this aquifer is contaminated.

A piece of trivia from the National Rural Water Association, Once ground water is polluted it may remain that way for several thousand years.

Neither one of the permits issued in 1986 and 1993 have been issued legally this is according to the Land Use Management and Development Codes For Box-Elder County. 3.3.1.3 and 3.3.1.3.1

This permit of 1986 was asked for under the false pretense of turning this in to a subdivision as you yourself have alluded to in your own meeting minutes dated July 19, 1990.

Top soil was removed from both sights, and Parsons as of last week was in the process of hauling top soil back on the North Pit area.
This is a foreign soil to this area and may cause more weed problems than we have now, like we have with Dyer's Wode.
No top soil has been brought back to the area East of our Mobile Home Court to this date.

I would like someone to explain to me their definition of what 5 acres of slope is, because this is what must be uncovered before Parson is required to begun reseeding. I think someone pulled a fast dance.

The full length of our Mobile Home Court roadway is just about 5 acres that is a big hole, and as that letter stands today they will never need to replant anything if that is contract you agree to.

I could go on and on about the violations another has been Crushing gravel at night they have been doing this.
It is in violation of Code 7.6.6.2.1 about times of operations 7:00 a.m. to 5:30 p.m.

Parsons Company have committed at least 4 violations of Law and 4 of Conditional Use Permits as set forth in Land Use and Management Code. When do think enough is enough?

I am growing tired of running back and forth trying to get you people to do your job. If something is not done soon I will try and get a Grand Jury to look into the bias and prejudice actions that has taken place in this County.

Laws Violated
19-5-114 Spills or discharges of oil other substance.Notification to the executive secretary of the spill.
19-5-107 Discharges pollutants.

73-1-14 Interfering with waterworks. (destroys or removes any dam, head gate, weir, casing, valve, cap or other regulation of water.

History of operation of a gravel pits with out permits (1975 in Perry 1977 gravel pit between Perry & Willard) East of Coleman Mobile Home Court 1990,1991 & 1992.

Gary W. Coleman
Coleman Mobile Home Court
8615 So. Hwy. 89 # 16-No.
Willard, Utah 84340-9319
phone 782-5468

COUNTY COMMISSIONERS
R. Lee Allen
Allen L. Jensen
James J. White

BOX ELDER COUNTY
STATE OF UTAH

OFFICERS
Carlla J. Secrist, county auditor-treasurer
Marie G. Korth, county recorder-clerk
Robert E. Limb, county sheriff
Jon J. Bunderson, county attorney
Monte R. Munns, county assessor
Denton Beecher, county surveyor

April 4, 1994

Mr. Bob Linnell, Deputy
Intergovernmental Affairs
210 State Capitol
Salt Lake City, Utah 84110

Dear Bob:

Regarding our telephone conversation on March 31, 1994, concerning the Parson Company gravel pit in South Willard, Utah.

I support, and consider it appropriate, that the Department of Environmental Quality, specifically the Divisions of Water and Air Quality and the Department of Natural Resources, review allegations made by those individuals who met with you, to determine if there is substance to those assertions.

I appreciate your concern and efforts to assist Box Elder County officials in this issue. We will certainly use the recommendations of those departments in determining our course of action.

Again, thanks for your concern and your assistance.

Sincerely,

Allen L. Jensen, Commissioner
Box Elder County

ALJ:lr

ATT 10

801-734-2031 01 South Main Brigham City, Utah 84302

4/21/94

Keith W Jones
990 East 800 North
Shelley, Idaho 83274

April 7, 1994

Denton H. Beecher, Ex-officio Member
Box Elder County Planning Commission
01 South Main Street
Brigham City, Utah 84302

SUBJECT: APPLICATION OF A CONDITIONAL USE PERMIT

Dear Mr. Beecher:

Please schedule a hearing with the Box Elder County Planning Commission for me to present an Application for a Conditional Use Permit under the A-20 District, Sections 7.1.2.2, 7.1.6, and 10.3.13 of the Box Elder County Land Use Development and Management Act. Attached are eight copies of the Conditional Use Application with the proposed Bay Campground Private Recreation Park Plan for the Planning Commissioner's review and comments.

Please send me a timely notice of the hearing date and time; a self addressed stamped envelope is enclosed for you convenience. If there are any problems with the Application or you require additional information, please call me on 208-346-6673 or 800-236-4068.

Sincerely,

Keith W Jones

Keith W Jones

APPLICATION FOR CONDITIONAL USE PERMIT

BAY CAMPGROUND PRIVATE RECREATION PARK

Applicant's Name Keith W Jones
Address 890 East 900 North Shelley, Idaho 83274
Telephone (208) 346-6673

Application No. _____
Date Received by Building Inspector _____
Date of Hearing _____

Application is hereby made to the Planning Commission requesting that Campground, Private Recreation Park be permitted as a "conditional use" on 6.2 Acres (Sq. Ft. or Acres) located at I-15 Access Road from Nerva Lane (Street Address) in a A-20 zone (see attached location map).

Please complete the following:

I. State in detail what is intended to be done on or with the property. Include Site Plan as required in the Conditional Use Chapter of the Zoning Ordinance.

See attached Proposed Condition Use Permit Application with Bay Campground Private Recreation Park Plan (PLAN).

II. Explain fully how your application will satisfy each of the following conditions:

(a) The proposed use at the particular location is necessary or desirable to provide a service or facility which will contribute to the general well-being of the neighborhood or community.

The Recreation Park / Campground to be located adjacent to Willard Bay Reservoir is a need Recreation Facility for Tourism to the County. Property is within the Multi-Use Area around the Reservoir shown on the Box Elder County General Plan. Recreation Facilities are Need Here (See Attached Plan)

(b) The proposed use will not, under the circumstances of the particular case, be detrimental to the health, safety or general welfare of persons nor injurious to property or improvements in the vicinity.

By bringing in Electrical service west of I-15, property values will increase, Springline Irrigation will be possible increasing crop need and conserving water. (See Attached Plan)

(c) The proposed use will be compatible with and complimentary to the existing surrounding uses, buildings, and structures when considering traffic generation, parking, building design and location, landscaping, noise, or other pollution.

Campgrounds are compatable with "Agricuture" Uses as defined in the Code. Most campgrounds in Utah have pastured cattle across the fence line. Crop farming is also conducted around most campground in the State. (See Attached Plan)

(d) The proposed use conforms to the goals, policies, governing principles and emerging land use patterns of the Master Plan. Please list specific goals and policies as adopted in the Master Plan which would be pertinent.

The proposed use is consistant with the Master or General Plan approved by the county in 1993. The proposed use also satisfies several objectives of the General Plan and is in the Mult. Use Area around the Willard Bay Area designated as Recreation. (See Attached Plan)

III. Attach a copy of market analysis and economic study which justifies the proposed use, and any assurance of financial ability or program to complete and conduct the use (if required by Planning Commission)

Will be supplied IF REQUESTED by Planning Commission in writing.

IV. If proposed use is providing a public service, rather than a private personal use, explain how it will benefit the public or render a service to the community.

The campground supplies sleeping Area for Traveling Tourist and people that want to use Willard Bay Reservoir Recreation Park (See Attached Plan)

V. List the names and addresses of all property owners within 300' of the subject property. (Use additional sheet if necessary)

John Larkin
Lowel Lemon
Keith & Sharon Jones

VI. Fee paid _____.

Signed: Keith W Jones (Applicant) April 8, 1994

990 E 800 N (Address) Shelley ID 83274

(208) 346-6673 (Phone)

Zoning Administrators Action:

Date Approved: _____

Date Disapproved: _____

Date Referred to Planning Commission for Action _____

Planning Commission Action:

Date Approved: _____

Date Disapproved: _____

Governing Body Action if Appealed From Decision of Planning Commission:

Date Approved: _____

Date Disapproved: _____

Public Hearing Date if Deemed Necessary _____

Conditions of Approval ☐ , or Reasons for Disapproval ☐

List:

Signature: _____
Chairman, Planning Commission or, Zoning Administrator

The Building Inspector shall place the Conditional Use Application No. as well as any conditions of approval on the Building Permit.

Appealed to the Planning Commission from Decision or Zoning Administrator_____

Appealed to the Governing Body from Decision of Planning Commission _____

The RV parking sites will be all grass with at least one fast growing tree for each camp site to provide shade. See Figures 4, 5 and 6 of the Concept Plan for the resort internal roads and building layout.

The resort will have a resort center building which will contain a caretaker's residence, resort sale offices, rental rooms, sports equipment sales/rentals office, mini-store, recreation rooms, teen game room, and restrooms and showers. The swimming pool, with a children's wading pool and adult only hot pool, will be located adjacent to the resort center. There will be a very large grass play area for softball, volleyball, and children's play ground in the middle of the resort, along with another restroom and shower building. There will be three garage storage buildings and one RV and boat storage compound for use by the general public.

PRESENT PROPERTY CONDITIONS:

The property has been farmed for many years. This last year, 1993, it was in field corn, which was harvested as sileage. The property is covered with 4 to 6 feet of sandy/loam top soil, and then sandy-gravel/gravel to about 50 feet.

The property slopes to the northwest about 9 inches per 100 feet. (See Attached - Contour Map, Hansen and Associates, Inc. survey dated 10/26/93)

There are no water courses within the property boundaries. The "South Drain" runs parallel to the Willard Bay Reservoir dike, which comes close to the northeast corner of the project property.

The upper ground water table is believed to be about 10 feet; it is being studied at this time. The artesian ground water starts at about 270 feet and has about 7 pound pressure at the surface.

There are no known flood or geologic hazards within the property boundary.

The property has been cultivated/farmed for many years. At this time there is only corn stubble and a weeds along the fence lines.

There is no wildlife living on the property at this time. There are wildlife refuges in the low swamp areas around Willard Bay Reservoir. Ducks and other foul fly over the area.

There is presently no culinary water, sewer, electrical power, natural gas, or telephone services to the property. High power electric lines run along the west property boundary. The electrical power, natural gas, and telephone services are available 1/4 mile away on Nerva Road (7800 South).

PROPOSED IMPACT:

At most, two families will live at the resort. All other resort employees will live in the surrounding communities. The resort will have about 15 to 20 summer (part-time) employees, and 4 year round (full time) employees. No individual RV will be allow to remain at the resort more the 30 consecutive days. Except for one row (eleven sites), the RV resort will be closed from mid-October to mid-April. After the resort is fully developed and all available memberships are sold (5 to 7 years), it is expected that the resort will operate at about 70% to 75% capacity all summer except for three summer holiday week ends.

The property density will be:

6% Buildings and swimming pool area,

4% Asphalt/concrete for road entrances and resort center parking,

20% Gravel for internal roads and RV/boat compound,

69% Grass/shrubs of which 10% of the grass could have an RV parked.

Storm water will continue to drain into the "South Drain" but with greatly reduced sediments from erosion of the topsoil because the resort vegetation is permanent instead of being cultivated each year.

The resort's graveled roads will be sprinkled regularly to insure that there is not a dust problem for the campers. The speed limit for all roads within the resort will be 15 mph for camper safety and dust control.

The resort center and the restroom and shower buildings will have an automatic sprinkler fire protection system. The garage storage buildings will be all metal construction and divided in a manner to prevent fire from going between compartments.

Solid waste will be collected in covered garbage containers, collected by a garbage

collection company, who will haul it to the county landfill.
The project will drill a deep water well for culinary water.
The project will provide its own sewer collection and sewer treatment system.

UNAVOIDABLE ADVERSE IMPACTS:

The only adverse impact which cannot be avoided is the increase of solid waste that will be generated by the members and guests, which will have to be taken to the county landfill.

ECONOMIC IMPACT:

The Bay View Sportsman's Resort property will increase the local tax base without any burden to the schools or general community facilities. A maximum of two families will live on the property. The owner/manager has no school age children.
The present road access to the property is adequate, equal to that provided other similar private membership resorts in other Utah counties.
The resort will provide its own activities for the members. If allowed by the government, the resort will develop better public access to Willard Bay for fishing along with building and maintaining a public restroom building for these lake sportsman.
During the summer operating period, the resort will provide its own 24-hour security for the protection of its members and surrounding property.
It is expected that the resort will directly increase the area employment base by 15 to 20 people during the summer months and 4 people all year. The $1M plus construction costs will also be a boost the local economy.
It is expected that most of the **Bay View Sportsman's Resort members** will have their home outside of Box Elder County. These Bay View Sportsman's Resort members, along with the Coast to Coast and Resorts Properties International out-of-state visiting exchange members, will bring money into the local economy every year.
The **Bay View Sportsman's Resort** will be a good neighbor and an asset to the Willard area community.

4/21/94

Health problems summary due to silica dust.

Cohaestive Heart failure	Pulmonary Heart dease
high blood pressure	lung cancer
liver damage	allergic conditions
inflammation of major brochioles	
problems with larynx	silicois
various kidney problems to the extrem of renal failure	
lymphnode tissues inflammed	thyroide conditions
pneumocosises	emphysema
birthdefects	blood disorders
3-5% of lupis cases	spleen failure
migraines	asthema
kidney failure	sinisitius
allergic conditions	leisens on varios organs

greater chance of infections and viriuses
even a greater chance of getting the E-Coli
much greater chance of getting cancer in any or all of the organs encluding leukemia

The great risks of exposer can and does take place in as short of time as 8 days with exposer at 6 hours a day at 1 year after the 8 day exposer to the silica there remained 20% of the silicate in the lungs.

You lose 10% of your lung capazity after 14 months of exposer at a 5 day week at 6 hours a day this is not reversable.
The lining in all the airway passages decrease in size.

DRAFT

Crystalline silica

cristobalite 14464-46-1
tridymite 15468-32-3
Tripoli (mixture)
quartz 14808-60-7

4/21

DRAFT

INHALATION TOXICOLOGY OF SILICA (7631-86-9) IN SUPPORT OF DERIVATION OF A REFERENCE CONCENTRATION

SILICON DIOXIDE

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ATT 6

1.0 INTRODUCTION

The term silica refers to silicon dioxide (SiO_2; CAS No. 7631-86-9) which occurs naturally in a variety of crystalline and amorphous forms. The principal naturally occurring crystalline SiO_2 exists as quartz; three other forms of crystalline SiO_2 are cristobalite, tridymite, and tripoli. Although identical chemically, they differ from quartz in their crystal parameters. Quartz, cristobalite, and tridymite are interrelated and may change their form under different conditions of temperature and pressure (IARC, 1987). The basic structural units of the silica minerals are silicon tetrahedra (SiO_4), arranged in such a manner so that each oxygen atom is common to two tetrahedra. However, there are considerable differences in the arrangements of the silicon tetrahedra among the various crystalline forms of silica (Coyle, 1982). Naturally occurring amorphous forms of silica include diatomite or diatomaceous earth, a hydrated form such as opal, and an unhydrated form, flint (Stokinger, 1981). Diatomaceous earth is a loosely coherent, chalk-like sediment from unicellular algae which contains up to 94% SiO_2 (IARC, 1987). Silica is also a component of many naturally occurring silicate minerals in which various cations and anions are substituted into a crystalline silica matrix. Examples of such silicates are kaolin, talc, vermiculite, micas, bentonite, feldspar, and Fuller's earth (NIOSH, 1988). Commonly encountered synthetic amorphous silicas, according to their method of preparation, are SiO_2 gel (silica G), precipitated SiO_2 (silica P), and fumed SiO_2 (silica F). The most outstanding characteristics of synthetic amorphous silicas are their small ultimate particle size and high specific surface area which determines their numerous applications (Stokinger, 1981; Willey, 1982). The physical and chemical properties of selected crystalline and amorphous forms of silica are presented in Tables 1-1 and 1-2.

TABLE 1-1. PHYSICAL AND CHEMICAL PROPERIES OF SELECTED FORMS OF CRYSTALLINE SILICA

Property	Quartz CAS No. 14808-60-7	Cristobalite CAS No. 14464-46-1	Tridymite CAS No. 15468-32-3
Molecular weight	60.09	60.09	60.09
Physical state	colorless, white, black, purple, or green solid	colorless, white, or yellowish solid	colorless or white solid
Crystalline form	hexagonal; also in anhedral massive form	octahedral, rarely cubical; also in massive form	tabular, pseudohexagonal; also in massive form
Density	2.65	2.33	2.26
Hardness (Moh's scale)	7	6.5	7
Solubility			
Water	practically insoluble; 6-11 ppm at 25°C	practically insoluble	practically insoluble
Acids	soluble in hydrofluoric acid, but insoluble in most other acids	soluble in hydrofluoric acid, but insoluble in most other acids	soluble in hydrofluoric acid, but insoluble in most other acids
Organic solvents	insoluble	insoluble	insoluble

Silica is widely used in industry and has long been recognized as a major occupational hazard, causing disability and deaths among workers in several industries. Occupations and processes most commonly associated with silica exposure include mining, quarrying and tunneling, stonecutting, abrasives blasting, glass manufacture, potteries, foundries, boiler scaling, and vitreous enameling (Ziskind, 1976). Silica is one of the most common substances to which workers are exposed and the causal relationship between inhalation of dust containing crystalline silica and silicosis, a chronic inflammatory and fibrotic lung disease, is well established. Synthetic amorphous silicas, thus far, have not been shown to present as severe a hazard as quartz. Although there is experimental evidence that quartz also causes lung cancer, a clear correlation between pulmonary fibrosis and neoplasia has not been established. This report is intended to serve as a background document for the development of an inhalation Reference Concentration (RfC) of inhaled silica based on available data for health effects other than cancer and genotoxicity.

2.0 WEIGHT OF EVIDENCE

2.1 Human Studies

Human data consist of epidemiologic studies and case reports from occupationally exposed populations. However, in several of the available studies, useful data to assess the relationship between measured exposures to respirable silica dust and effects on nonmalignant respiratory disease are lacking.

The primary target organ of silica toxicity following inhalation exposure is the lung. Silicosis develops slowly in most cases, with decades between initial exposure and appearance of clinical symptoms. Three forms of the disease have been described: (1) a simple or chronic form of silicosis in which exposure extends for a period of 20-40 years before silicotic changes appear in chest X-rays; (2) an accelerated form after shorter exposures (5-15 years) to respirable silica at higher concentrations; and (3) an acute silicosis or silicoproteinosis that develops after 1-3 years of exposure and progresses faster than accelerated silicosis (NIOSH, 1981; 1988).

Dry cough may be an early manifestation of silicosis; as the disease progresses, the cough may become more prolonged and be associated with sputum production (Peters, 1986). Shortness of breath may occur during heavy exertion. In simple silicosis, general health is not usually impaired. The effects on pulmonary function are minimal to moderate, unless the disease is fairly advanced. Pneumothorax is common in advanced stages, and respiratory failure may occur as a result of progressive massive fibrosis. In the late stages of silicosis, cor pulmonale and congestive heart failure are likely to occur. Diagnosis of silicosis still rests mainly on chest X-ray evidence combined with a history of exposure. Small discrete opacities (silicotic nodules) approximately 1-3

mm in diameter are seen in the upper half of the lung fields, increasing in size and number as the disease progresses (Peters, 1986). The opacities appear in lymphatics around blood vessels, beneath the pleura in the lungs, and sometimes in mediastinal lymph nodes. The nodules may fuse, resulting in progressive massive fibrosis (Menzel and Amdur, 1986).

Significant factors that influence the severity and time to onset of silicosis are the concentration of silica dust in the atmosphere, duration of exposure, crystalline structure, percentage of free silica in the dust, particle size, individual susceptibility, and complicating disease such as tuberculosis (NIOSH, 1981; Heppleston, 1984; Davis, 1986). Free silica is a term used to describe the crystalline silica content of a dust or aerosol and is usually expressed as a percentage of the total when mixed dusts are involved. The development of silicosis depends on the inhalation of respirable free silica particles with a mass median aerodynamic diameter (MMAD) of < 10 µm. Although the respirable size may include any particle less than 15 µm, the smaller particle sizes are more pathogenic because they can deposit in the more distal portions of the respiratory tract. Particles with MMADs of 5-10 µm deposit primarily in the peripheral bronchi and bronchioles, while those 0.5-5 µm in size reach the lower respiratory tract and are deposited more in the small airways and alveoli. Respirable silica (quartz) particles in the occupational setting range widely in size, but particles with MMADs < 1 µm are believed to be most pathogenic (Uber and McReynolds, 1982; Davis 1986; NIOSH, 1988). In addition to particle size, the surface chemistry of crystalline silica may play a role in the toxicity exhibited toward individual cells such as the alveolar macrophage (Shi et al., 1989).

Free silica particles that reach the alveoli are readily phagocytized by alveolar macrophages. They exert a pronounced toxic effect on macrophages by damaging the structural

integrity of the cell membranes, resulting ultimately in lysis of the macrophage and release of the cell contents, including silica. Silica-induced macrophage lysis initiates a series of biological events that lead to the formation of characteristic silicotic nodules. A continuous accumulation and destruction of macrophages eventually results in the formation of collagenous fibers and the deposition of hyalin in these fibers (WHO, 1986; Worth and Stahlmann, 1983; Ziskind, 1976).

The incidence of silicosis in Vermont granite shed workers has been analyzed by a number of investigators. In the earliest report, Russell et al. (1929) studied 972 granite shed workers and divided them into four exposure groups according to the average "dustiness" in the work environment: 3-9 million particles per cubic foot (mppcf) (108 workers); 20 mppcf (146 workers); 27-44 mppcf (104 workers); and 37-59 mppcf (614 workers). Dust samples contained an average of 35% free silica and a number of silicate minerals. The years of employment ranged from < 5 to ≥ 35 years, with 75% of all workers employed for 10 years or more. Grouped by increasing order of dust exposure, 36, 31, 59, and 55% of workers were employed for 20 years or more. Diagnosis of silicosis was based on exposure history and physical examinations, corroborated by chest X-rays in a number of cases. The most frequently observed symptoms were unproductive cough, dyspnea, pains in chest, and changes in breath sounds and fremitus.* In the group with highest silica dust exposure (37-59 mppcf), the first case of silicosis appeared after 2 years of employment. All 614 workers in this group developed at least an early stage of silicosis after 4 years of employment. The first case of more advanced silicosis appeared after 5 years and after 9 years, approximately 90% of workers had advanced to this stage. In the groups exposed to 20 or 27-44 mppcf, the development of silicosis was reportedly proportional to silica dust exposure (number of cases not discernible from data presented). In the lowest exposure group (3-9 mppcf), two cases

* a dull roaring sound due to:
- vibration of chest wall
- or obstruction of trachea
- or pleural friction

of early silicosis appeared after 10 years and one case of moderately severe silicosis after 6 years of exposure.

Institution of dust control measures resulted in a reduction of silicosis documented in later Vermont studies (WHO, 1986). In 1969, the Harvard School of Public Health and the Industrial Hygiene Division of Vermont conducted a comprehensive study of the relationship between exposure to granite dust, percent quartz content of the dust, and lung disease among granite shed workers exposed for many years to low levels of granite dust. The results of the study were reported in three articles by Theriault et al. (1974a,b,c). A cross-sectional survey was carried out on a group of 883 workers between the ages of 25 and 65 who were currently working in the granite sheds. Chest X-rays and their relationship to lifetime dust exposure, ventilatory function, and smoking habits were examined. Cumulative dust exposures were calculated for each worker as the number of years of exposure at an average granite dust concentration of 523 $\mu g/m^3$ and an average quartz (respirable silica) concentration of 50 $\mu g/m^3$ and expressed as dust years. The fractional silica concentration of the respirable dust was about 9% in more recent years and 13-17% in the early years (Theriault et al., 1974a).

Chest X-rays were obtained from 784 workers and classified according to International Union Against Cancer (UICC)/Cincinnati classification for pneumoconiosis; 551 (70%) of the radiographs were considered normal and 233 (30%) showed various types of lung opacities that were divided into subgroups according to shape (rounded/irregular), size, and profusion (number of opacities/unit area). Workers with abnormal radiographs were exposed on the average to 2.3 times more dust that those with negative ones (43 dust-years vs. 19 dust-years). The irregular opacities correlated to age and cigarette smoking, but not to cumulative dust exposure. The size

and protrusion of the rounded opacities correlated to increasing dust exposure and were considered to be indicative of silicosis in 45 (19%) of workers with lung opacities. Based on a plot of workers with abnormal radiographs against dust-years (at a dust level of about 50 $\mu g/m^3$ as free silica), about 30% of workers showed silica-related lung opacities at exposures of 0-35 dust-years. [Only one radiologist read the chest X-rays; this could account for a potential false-positive diagnosis at 0 dust years]. After that, the curve increased dramatically: at 55 dust-years, 60% of granite shed workers had opacities. It was estimated that it would take 46-dust years of exposure to produce lung opacities in 50% of the workers (the specific distribution of the number of silica-related cases by dust year was not reported) (Theriault et al., 1974c). Workers with abnormal radiographs exhibited decreased forced vital capacity, forced expiratory volume in one second, and total lung capacity, but not residual volume. Residual volume increased with smoking but not with dust exposure, indicating an obstructive lung disease condition. Comparison of a plot of the effects of granite dust on ventilatory function with that seen for lung opacities indicated that the effects on ventilatory capacity occurred 13.5 years before opacities appeared in the chest X-rays (Theriault et al., 1974b,c).

NIOSH conducted a study at two silica flour mills (producing finely powdered crystalline silica) to determine the incidence of silicosis in workers and to survey airborne silica dust concentrations (Banks et al., 1981; NIOSH, 1981). The medical evaluation consisted of a chest radiograph, spirometry, and a questionnaire emphasizing medical history and respiratory symptoms. Based on the International Labor Organization (ILO U/C 1971) classification of chest radiographs for pneumoconiosis, the study found that of 61 current and former workers with 1-14 years of exposure to silica dust, 16 (26%) had chest radiographs indicating simple silicosis and 7 (11%) had progressive massive fibrosis (NIOSH, 1981). The average duration of exposure to

simple 7.7 yrs
massive 7.1 yrs

silica dust for the 16 workers with simple silicosis was 7.7 years; the 7 workers with progressive massive fibrosis of the lungs had an average exposure duration of 7.1 years. One worker (age 24) had progressive massive fibrosis after only 2.5 years of silica exposure, another after 4 years, and two others after 6 years. The silica content of the dust from both mills was 99% free silica; the mean diameters of the dust particles from air samples at various mill operations were within the respirable range (2.3-5.2 μm). Of 91 dust samples taken, 77 were above NIOSH's recommended standard of 0.05 mg/m^3 for respirable crystalline silica. The actual silica levels measured were not reported.

Ng et al. (1985) described five independent case reports of silicosis among jade workers in Hong Kong exposed to silica flour in the polishing process. The disease had an early onset and was rapidly progressive in three patients after an occupational exposure of 5-10 years; one patient showed evidence of tubercular infection in addition to silicosis. In another patient, nephritis and renal failure were seen together with progressive massive fibrosis. Measurement of the airborne dust concentrations were conducted in the work place of one patient who had worked with jade for 22 years and exhibited mild impairment of pulmonary function and silicotic lesions in the lungs (confirmed by chest radiographs). A bulk sample of the silica flour used contained 97% crystalline free silica; the silica content of the collected respirable dust was 89%. Gravimetric analysis of air samples showed a TWA concentration of 1.01 mg/m^3 when an exhaust fan was running and 5.62 mg/m^3 when the fan was off. The respirable dust concentrations were 0.34 and 0.72 mg/m^3 under the same circumstances, thereby exceeding OSHA's permissible exposure limit of 0.1 mg/m^3 for respirable free silica.

Saiyed et al. (1985) conducted a medical and environmental survey in the slate-pencil industry in central India. The slate pencil workers included 405 cutters who were directly exposed to silica dust, and 117 male and 71 female workers who were exposed to silica in the general work environment (noncutters). The mean duration of employment was 7.29, 7.62, and 14.69 years for cutters, male noncutters, and female noncutters, respectively. The medical survey consisted of medical and occupational histories and full chest X-rays for each worker. Results of chest radiographs showed a high incidence (54.5%) of silicosis among the 593 workers examined (cutters, 60%; male non-cutters, 41%; female noncutters, 46.5%). Progressive massive fibrosis was seen in 17.7% of all workers, with detectable lung lesions appearing after relatively short exposure times (<5 years for cutters, 6-10 years for male and female noncutters). The mean dust levels in the respiratory zone of the cutters were 46.47 mg/m^3 (total dust) and 10.41 mg/m^3 (respirable dust) with a 56.5% free silica content. The levels in the general work environment were 24.70 mg/m^3 (total dust) and 5.53 mg/m^3 (respirable dust).

An exposure-response relationship was seen in a case-control study with North Carolina "dusty trade" workers exposed to silica in a wide range of industries, such as mineral mining and milling, quarrying of granite and crushed stone, hard rock mining, and foundry work (Rice et al., 1986). Both cases and controls were ascertained from a program of environmental and medical surveillance of industries with silica-exposed workers maintained by the State of North Carolina since 1935. Working lifetime exposures to quartz were estimated for 216 male workers with silicosis and 672 disease-free workers. Impinger data (particulate counts from samples collected by impingement) were combined according to commodity-specific TWA formulae; mass data (from samples collected with a mass-respirable cyclone) were converted to count estimates by dividing by 0.09 [0.09 mg total respirable mass/m^3 = 1 mppcf]. The cumulative quartz exposure was

expressed as million particle years (mpy). The worker exposures were categorized in four groups: exposure at less than 20 mpy was considered the reference group; the range of exposures in the other categories were 20-59.9, 69-179.9, and ≥ 180 mpy, respectively. Using several independent methods of analysis, the investigators calculated that a statistically significant (p value not provided) risk of silicosis was present at an average cumulative exposure of 98 mpy, but not at 37 mpy. They also estimated that over a 40-year working period, the values would correspond to approximately 250 or 100 $\mu g/m^3$ (2.5 or 1 mppcf), respectively, with the lower value equivalent to the current OSHA standard for dust containing 100% quartz. Smoking history did not appear to substantially affect the results.

Goldsmith (1986) presented a preliminary examination of the comparative epidemiology of silica-containing particulate matter (silica, asbestos, and man-made mineral fibers), with emphasis on studies with exposure-response information and sufficient follow-up time to observe development of lung cancer. Studies of workers exposed primarily to silica were limited to Vermont granite workers and South African gold miners. For each study, uniform exposure concentration estimates based on average number of particles/ml of air were derived. The estimated exposure concentrations ranged from 1.58 to 3.68 particles/ml of air for 943 Vermont granite workers and from 240 to 480 particles/ml of air for South African gold miners (number of workers not reported). No smoking histories were available, and some dusts may have contained amphibolite dusts such as hornblende and actinolite. The lowest concentration related to either a statistically significant disease excess or the median concentration which caused death or characteristic radiological changes in the lungs was tabulated. The evidence suggested an exposure-response relationship for silicosis, but not for cancer. Radiological changes in the lungs indicative of silicosis showed an exposure-response relationship for silica exposure at a calculated

median concentration of 2.3 particles/ml of air. For other chronic pulmonary disease, the same median concentration was associated with increased mortality from tuberculosis, independent of silicosis.

Thomas and Stewart (1987) evaluated the risk of nonmalignant respiratory disease and lung cancer among pottery workers exposed to silica (quartz) and nonfibrous talc. The study population consisted of 2055 white males at three plants of a single U.S. company who had been employed for at least 1 year between 1939 and 1966. No measurements of airborne silica or talc dust were available; however, the investigators ranked various job categories according to their potential exposure (none, low, high). Follow-up through Jan. 1, 1981, indicated a substantial excess of nonmalignant respiratory diseases (pneumonia, pneumoconiosis, emphysema, and other respiratory diseases) among workers with high levels of exposure to silica dust [54 observed deaths, 23.4 expected; standardized mortality ratio (SMR) = 2.26]. The risk of respiratory disease increased with the number of years exposed, was not enhanced by talc exposure, and decreased in more recent time periods independent of duration of exposure, suggesting better dust control. For lung cancer, the SMR was 1.37 (18 observed deaths, 13.2 expected) for workers exposed to high levels of silica dust; however, those exposed to silica had a SMR of 2.54 (21 deaths observed; 8.3 expected). In the group exposed to silica and talc, the SMR rose with increasing years of talc exposure to 3.64 (8 deaths observed, 2.2 expected) among those employed for 15 years or more. There was no information on smoking history.

To establish an exposure-response relationship between exposure to respirable silica dust and silicosis, Pang et al. (1992) conducted a retrospective epidemiology study of selected workers from an underground tungsten mine in China. Historical surveillance and monitoring data were

collected for 1151 workers exposed to silica dust from 1958 to 1987. Those who were previously exposed to other dusts were excluded. According to employment practices in the People's Republic of China, the age of first exposure was assumed to be 18 years and the duration of exposure, 30 years. The total and respirable silica dust concentrations for major job categories were estimated from historical surveillance data, but were not reported in the article. The ratio of respirable silica dust concentration to total silica dust concentration was 0.529 and the estimated free silica content in respirable silica dust averaged 24.7%. Results of multiple regression analysis showed that the probability of developing silicosis was positively correlated with cumulative exposure to silica dust (diagnostic criteria for silicosis were not provided). At an exposure concentration of 0.24 mg/m^3, the probability of developing silicosis was estimated to be 0.8% over a 30-year exposure period in the absence of tuberculosis. The authors considered 0.24 mg/m^3 as a safe exposure limit under the given conditions. For purposes of an RfC derivation, this concentration could represent either a NOAEL or a LOAEL.

The only study regarding exposure to amorphous silica examined medical records of 165 workers in two industrial facilities producing HI-SIL and SILENE in order to assess the clinical effects of exposure to fine particle precipitated amorphous silica (Wilson et al., 1981). The monthly exposure for each worker was graded on a scale of 1 to 4 and a cumulative exposure index (CEI) was calculated for each worker by summing monthly dust exposure measured by personal airspace monitoring. A mean exposure index was calculated by dividing the CEI by total months exposed. Linear regression analysis of the yearly change of pulmonary function parameters [forced vital capacity (FVC); forced respiratory volume in one second (FEV_1); FEV_1/FVC; and maximum mid-expiratory flow (FEF 25-75)] showed no correlation with either the concentration (CEI) or total years of exposure. Among 44 workers with a mean exposure of 18

years (range 10-35 years), the yearly decline of FVC and FEV_1 were similar to the overall group. Chest X-rays of 143 workers taken prior to exposure to amorphous silica were compared with the most recent radiographs. Eleven of these workers (all with a previous history of working in a limestone mine or in a soda ash plant using limestone) had radiographic changes consisting of small rounded or irregular opacities. No worker with a history of exposure to only amorphous silica exhibited any radiographic evidence of lung lesions. Reported respiratory symptoms (cough and dyspnea) of the overall group correlated with smoking but not with exposure to amorphous silica.

In addition to the well-documented pulmonary toxicity resulting from inhalation of silica dust, there are indications that silica may also cause renal damage in association with or in the absence of pulmonary disease. In a review of diseases associated with silica exposure, NIOSH (1988) reported that mild focal, segmental, proliferative glomerulonephritis and tubular lesions have been found in a small number of patients with accelerated silicosis and in others with a history of dust exposure, but no pulmonary disease. Of 20 seriously ill silicotic patients examined by Saita and Zavaglia (1951), 20% exhibited albumiuria, 40% azotemia, and 45% impaired urine concentration. Osorio et al. (1987) presented a case report of a foundry worker with extensive silica exposure, who developed glomerulonephritis and progressive renal failure in the absence of pulmonary effects. Renal biopsy detected silica within the renal tissues. Giles et al. (1978) described massive proteinuria and renal failure in a sandblaster with acute silicoproteinosis. Another case report described nephropathy in a worker who had been exposed to high levels of silica dust while refurbishing furnaces and boilers (Saldanha et al., 1975). The clinical symptoms were albuminuria and hypertension in the absence of pulmonary disease. The authors speculated that the pathological alterations seen in the glomerulus and proximal tubule may be due to the

direct toxic action of silica, because greatly increased concentrations of silica were found in renal biopsy material. Although none of the studies indicated how silica was transported to the kidneys, the chemical may have been swallowed and entered systemic circulation.

2.2 Animal Studies

Numerous investigators have demonstrated the pulmonary fibrogenic potential of silica in a variety of animal species when exposed by inhalation or intratracheal instillation. However, the fibrotic effects of silica may vary depending on species as well as physical form of silica employed. For example, hamsters exhibit a weaker fibrogenic response than other rodents, dogs, or humans (Uber and McReynolds, 1982), and mice intratracheally injected with silica had a milder fibrogenic response than rats (Hatch et al., 1984). The degree of fibrosis in rats intratracheally injected with different forms of silica was least with amorphous (fused) silica, increased with quartz and crystobalite, and was highest with tridymite despite similar silica content, size distribution, and solubilities for all forms (King et al., 1953).

Although renal effects resulting from silica exposure have been observed in humans (see Section 2.1), no data were located documenting similar effects in experimental animals by the inhalation or intratracheal routes of exposure. Osorio et al. (1987) noted that silica gel (SiO_2 suspension in physiological fluid) administered by intraperitoneal injection or abdominal incision had been reported to induce a variety of renal lesions in rats and rabbits.

Commonly used parameters to follow the pulmonary effects of silica exposure of experimental animals are lung weight, development of fibrous tissue and collagen content, cytotoxicity,

biochemical indices, and immunologic responses. In most of the available studies, endpoints other than pulmonary toxicity were not examined routinely. Few studies provided concentration-response data from which no-observed-adverse-effect levels (NOAELs) or lowest-observed-adverse-effect levels (LOAELs) could be derived, thus necessitating comparisons among studies in which experimental conditions may vary considerably.

The following studies, all by inhalation, are arranged by increasing duration of exposure (subchronic or chronic) and physical form of silica (crystalline or amorphous); within each section, the studies are arranged by increasing exposure concentration.

2.1.1 Subchronic Exposure

2.1.1.1 Crystalline Silica

Burns et al. (1980) related early immunological changes with eventual cytological changes in the lungs by exposing female Balb/c mice, maintained in exposure chambers, to crystalline silica (Min-U-Sil; MMAD = 2.0 μm; σ_g not given) at a concentration of 4932.4 ± 235.4 μg/m^3 for 3, 9, 15, 27, 33, or 39 weeks. Control mice were kept in identical chambers, breathing only filtered air. Groups of six mice were removed at week 3, 9, 15, 21, and 27 and were challenged with *E. coli* antigen given as an aerosol. Silica exposure greatly reduced the ability of splenic lymphocytes to respond to the antigen in the spleen at all times tested; in the mediastinal lymph nodes, there was an initial increase in the number of anti-*E. coli* plaque forming cells at 9 weeks, followed by a decrease of this response at all subsequent time periods. At week 15, 21, and 27, the spleen/body weight ratio of exposed animals was significantly higher than those of controls. Lung tissue of animals exposed to silica from week 3 to 21 exhibited varying degrees of lymphoid infiltration in

the absence of other significant changes. Beginning at week 24 and subsequent exposure intervals, aggregates of silica-filled macrophages were observed. Macrophages were not detected in most control animals. By week 39, fibrotic nodules composed of collagen, fibroblasts, lymphocytes, and silica-filled macrophages were found. The nodules were located at the periphery of the lung near the pleural surfaces. why this location ?

Fischer 344 rats (24/sex), approximately 10 weeks old and weighing 190-260 g, were exposed 6 hours/day, 5 days/week to crystalline silica (Min-U-Sil) at an average dust concentration of 10 mg/m^3 for periods of 2, 4, 6, or 12 months (Vuorio et al., 1989). The silica employed was Min-U-Sil with a mean particle size of 1.87 ± 1.26 μm. Control animals were exposed to air in identical chambers. Development of fibrosis was followed by measurement of lung weight (as wet weight), histological examination, and determination of lung collagen content (as hydroxyproline). During the 12-month experimental period, there was a steady increase in lung weights to a level approximately 2-2.5 times higher than those of controls. However, the animal body weights remained constant during the same time period. Histological examination revealed a progressive pulmonary inflammation and fibrosis in the silica-exposed group. There was an increase in pulmonary collagen (as hydroxyproline) content together with changes in cellularity and the metabolic activity of the lungs as determined by pulmonary procollagen m-RNA content. Silica-exposed animals showed a time-dependent increase in procollagen m-RNA that was significantly * ($p < 0.05$) greater at each time point when compared with controls. The highest levels of procollagen m-RNA was seen in young animals, suggesting that during pulmonary development, collagen metabolism in lungs is even greater than during development of fibrosis.

* indicates collagen metabolism

Groups of male PVG rats (age 15 weeks) were exposed to pure quartz dust (Sikron F600) for 7 hours/day, 5 days/week in exposure chambers at target concentrations of 10 or 50 mg/m^3 of respirable dust (MMAD not reported) (Donaldson et al., 1990). The animals were removed at time points between 2 and 75 days of exposure for bronchoalveolar lavage to assess leukocyte response. Quartz exposure produced a time-dependent increase in the number of leukocytes, much earlier in onset and greater in magnitude at 50 mg/m^3 than at 10 mg/m^3. There were also significantly increased of levels of leukocyte lactate dehydrogenase (LDH) and N-acetyl-ß-D-glucosaminidase (NAG) activities at both 10 mg/m^3 and 50 mg/m^3 over the 75-day exposure period. In a second experiment, groups of rats were similarly exposed to airborne quartz dusts for 32 or 75 days, removed from exposure chambers, and allowed to recover for a further 64 days. There was a marked increase in pulmonary inflammation that continued after cessation of exposure to quartz.

Benson et al. (1986) exposed Fischer 344 rats (72/sex) in whole body chambers to 38 mg/m^3 α-quartz (Min-U-Sil), 7 hours/day for 4 weeks. The quartz MMAD was 2.2 µm, with a geometric standard deviation (σ_g) of 1.8. A corresponding group of control animals (72/sex) was exposed to filtered air. Animals were sacrificed at 2, 4, and 6 weeks after initiation of exposure and functional, biochemical, and cytological tests were performed. There were no changes in respiratory function after 4 weeks of exposure. An inflammatory response in the lungs, as indicated by an influx of neutrophils in the bronchoalveolar regions, was seen after 2 and 4 weeks. Only minimal biochemical changes in the lungs were observed after 2 weeks, but after 4 weeks of quartz exposure, there was a 5-fold increase in airway LDH activity (indicating cell damage), a 5-fold increase in airway protein content (indicating increased permeability of the alveolar/capillary barrier), and a 7-fold increase in airway β-glucuronidase activity (indicating release of

lysosomal enzymes in the lung). The number of lymphoid cells in the pulmonary lymph nodes were significantly (p value not reported) increased in quartz-exposed animals and remained elevated for at least 2 weeks after cessation of exposure.

Using a similar exposure protocol, Bice et al. (1987) evaluated the pulmonary immunotoxicity of inhaled quartz. F344 rats were exposed to 38 mg/m^3 α-quartz (Min-U-Sil, MMAD = 2.2 μm; σ_g = 1.8), 7 hours/day for 4 weeks. A corresponding group of control animals were exposed to filtered air. Groups (5/sex) of exposed and control rats were immunized by intratracheal instillation of sheep red blood cells (10^8 cells) at week 4, 6, 40, or 52 from the initiation of the exposures. Cellularity of lung-associated lymph nodes and antibody-mediated immunity were evaluated 7 days after immunization. Lung and lymph node tissues were examined histologically. The lung burden at the end of the 20-day exposure was 3.7 ± 2.8 mg quartz/g lung. Inhalation of quartz significantly ($p < 0.05$) increased the number of lymphoid cells at each of the sacrifice times, caused suppression of antibody responses at 52 weeks after start of exposure, and produced significant ($p < 0.05$) cellular changes in lungs and lung-associated lymph nodes.

In a protocol designed by Bennett et al. (1988) to provide a rapid assessment of the fibrogenic potential of inhaled materials, groups of young Alpk:AP rats were exposed nose-only to a respirable aerosol of α-quartz (Min-U-Sil), 6 hours/day, 7 days/week for 28 days. The study used rats of both sexes and two different ages (8 and 13 weeks) at first exposure. The cumulative exposure concentrations, calculated by multiplying the daily mean concentrations by the duration of exposure, were given as 8486 and 6314 mg/m^{-3}·hour (units as reported by investigators) for the younger and older rats, respectively. The aerodynamic size distribution of the aerosols indicated that at least 73% of the particles were respirable (mean particle size 5 μm). Control animals

were exposed to air. After exposure, the rats were kept for up to 1 year, followed by histopathological examination of the lungs. Interim sacrifices (4 animals/sex after 4, 17, and 34 weeks of exposure) were conducted to estimate the rate and severity of fibrogenic lesions. Lung weights of silica-exposed rats were slightly (20%) increased immediately after exposure and continued to increase at each time point until at the end of the 1 year-holding period, when the lungs were up to six times as heavy as controls. Multiple foci of foamy alveolar macrophages, associated with polymorph infiltration, were seen at the end of the 28-day exposure period. The fibrotic lesions were characterized by granulomatous inflammation in the major bronchioles, progressing to perivascular and pleural granulomata and multifocal alveolar lipoproteinosis during the holding period. A progressive granulomatous inflammation accompanied by various degrees of fibrosis was the principal effect seen in the tracheobronchial and mediastinal lymph nodes. The type of lesions observed in rats from both age and sex groups were similar throughout the study, although the lesions were more severe in the older (at first exposure) rats than the younger ones, especially at later time points.

2.1.1.2 Amorphous Silica

CD rats were exposed by inhalation nose-only to Ludox (a colloidal suspension of amorphous silica) at concentrations of 0, 10, 50, or 150 mg/m^3, 6 hr/day, 5 days/week (Warheit et al., 1991). The MMADs for the three Ludox exposures were 3.7, 3.3, and 2.9 μm, respectively (σ_g not reported). Groups of six rats from each of the exposure concentrations were evaluated after 2 and 4 weeks of exposure and at 3 months after a 4-week exposure to Ludox. Lung fluids and cells were lavaged and measured for cellular and biochemical parameters. Exposure to 150 mg/m^3 for 2 or 4 weeks or to 50 mg/m^3 for 4 weeks produced pulmonary inflammation as

evidenced by increased numbers of neutrophils, along with increases ($p < 0.05$) in bronchoalveolar lavage (BAL) protein, LDH, and alkaline phosphatase (AP) activities, and decreased macrophage phagocytosis. Most biochemical parameters returned to normal after a 3-month recovery period. Autoradiographic studies showed that the labeling index of terminal bronchiolar and lung parenchymal cells was increased in the mid- and high-concentration groups after 2 and 4 weeks of exposure and returned to normal following recovery. No changes in biochemical or cellular kinetic indices were noted at 10 mg/m^3, a concentration that can be considered a NOAEL.

In another study with Ludox reported by Kelly and Lee (1990), rats (25/group, strain not given) were exposed nose-only to Ludox at concentrations of 0, 10, 50, or 150 mg/m^3, 6 hours day, 5 days/week for 4 weeks (particle size or distribution not given). Five rats were sacrificed at the end of the exposure period, and 10 each at day 10 and 3 months post-exposure. No pulmonary effects were seen at the lowest concentration. At 50 and 150 mg/m^3, there was a concentration-related pulmonary response in the alveolar duct region characterized by silica dust-laden alveolar macrophages, neutrophilic infiltration, and Type II pneumocyte hyperplasia. Tracheal and mediastinal lymph nodes were enlarged due to the silica dust-laden alveolar macrophages and tissue hyperplasia. The pulmonary lesions decreased progressively during the 3-month observation period. The NOAEL for this study was also 10 mg/m^3.

2.1.1.3. Co[redacted]e Studies: Amorphous vs. Crystalline Silica

Reuzel et al. (1991) compared the pulmonary toxicity of three amorphous silicas (Aerosil 200, Aerosil R 974, and Sipernat 22S) with that of quartz dust in a subchronic inhalation study

with SPF-bred Wistar rats. Groups of 70 male and 70 female rats (age 6 weeks) were exposed to 0, 1, 6, or 30 mg/m^3 Aerosil 200, 30 mg/m^3 Aerosil R 974, 30 mg/m^3 Sipernat 22S, or 60 mg/m^3 quartz, 6 hours/day, 5 days/week for 13 weeks. The animals were serially sacrificed at the end of the exposure period and 13, 26, 39, and 52 weeks post-exposure. Because the very small particles of the amorphous silicas formed agglomerates and aggregates, the MMADs could not be determined; the range of the geometric particle size distribution was 1-120 μm. Quartz particle sizes varied between 0.1 and 25 μm. Aerosil 200, a hydrophilic silica, was selected as the primary test material because it is a widely used grade with a propensity to generate airborne particles. Aerosil R 974 was chosen because it is produced by chemical treatment of Aerosil 200, transforming it into a hydrophobic form; and Sipernat 22S, a hydrophilic material, was chosen because it has the same specific surface area as Aerosil 200.

Although body weight gains of quartz-exposed rats were not affected during the treatment period, a progressive reduction in weight gain was seen throughout the post-exposure period. A slight (5-10%) decrease in body weight gain occurred in males exposed to 30 mg/m^3 Aerosil 200 or Sipernat 22S at the end of exposure, but body weights returned to normal 52 weeks following cessation of exposure. Neutrophilic leukocyte counts were increased in most exposure groups but returned to normal within 13 weeks of termination of exposure; in quartz-exposed animals, the neutrophilic leukocyte counts remained high during the entire post-exposure period.

All four chemicals induced increases in lung weight at all concentrations tested, and pulmonary lesions such as accumulation of alveolar macrophages, inflammation, alveolar bronchiolization, and fibrosis. Most of the rats exposed to the amorphous silicas or quartz had swollen and spotted lungs with a spongy consistency and large lung-associated lymph nodes at the

end of exposure. These gross changes disappeared at week 26 after exposure in all rats treated with the amorphous silicas, but persisted during the whole observation period in rats treated with quartz. Histopathological examination of the lungs revealed mild pulmonary effects (accumulation of alveolar macrophages, intra-alveolar polymorphonuclear leukocytic infiltration, and increased septal cellularity) in rats treated with 1 mg/m^3 Aerosil 200, the lowest concentration tested. Alveolar bronchiolization was mainly observed in males exposed to 6 or 30 mg/m^3 Aerosil 200 or to Aerosil R 974. Focal interstitial fibrosis was first seen in some animals 13 weeks after exposure to 30 mg/m^3 of quartz and each of the amorphous silicas. This lesion disappeared during the subsequent observation period in rats exposed to Aerosil R 974 or Sipernat 22S, but became more severe in rats exposed to Aerosil 200 or quartz. In addition, rats exposed to 30 mg/m^3 Aerosil 200, Aerosil R 974, or quartz developed granulomatous lesions. Silicosis (defined by the authors as formation of collagen fibers and hyalinization of the granulomatous lesions) was only seen in quartz-exposed rats. The effects on the respiratory tract induced by the amorphous silicas were most pronounced at the end of the exposure period, but generally disappeared within one year post-exposure. Of the amorphous silicas examined, Aerosil 200 induced the most severe changes in the lungs, with only partial recovery, and Sipernat 22S induced the least severe, completely reversible changes. The quartz-induced pulmonary changes were comparable to those induced by Aerosil 200 at the end of the exposure period, but progressed thereafter, reaching a plateau at about 6 months post-exposure. The animals did not recover during the subsequent 6 months. Additional treatment-related effects, focal necrosis of the nose and rhinitis, occurred mainly in animals exposed to the amorphous silicas and only at the end of the exposure period; a slight degeneration of the nasal epithelium was seen in all treated groups. The nasal effects were reversible and were considered non-specific irritating effects of the amorphous silicas.

Rosenbruch et al. (1990) compared the fibrogenic effects of quartz (DQ-12) and amorphous silica (quartz glass VP 203-006) by exposing two groups of 35 male Wistar rats to 10 mg/m^3 of each chemical, 7 hours/day, 5 days/week for 12 months. Thirty rats served as untreated controls. The particle size of 99% of the quartz dust was < 4 μm, with 50% of particles having a particle size of 0.40 μm. A similar particle size distribution was reported for amorphous silica. The animals were serially sacrificed (5 rats/group after 4 and 8 months of exposure; 15 rats/group and 10 controls after 12 months) and the remaining rats were observed for another 12 months. Exposure to silica did not affect body weight gain. The relative lung weights of rats exposed to amorphous silica were comparable to those of controls, but lung weights of quartz-exposed rats were markedly increased, particularly at 12 and 24 months. Also seen at the end of the same time points were increased mediastinal lymph node weights in both quartz- and amorphous silica-exposed rats. Compared with controls, quartz-exposed rats had increased levels of serum lysozyme (an indicator of macrophage alterations) from month 8 on and increased levels of the liver enzyme, glutamate oxaloacetic transaminase, were seen at 12 and 24 months (microscopic examination of the liver showed no morphological changes). There were no significant alterations in serum chemistry in rats exposed to amorphous silica. Histologic examination of lungs showed qualitatively similar changes for both exposure groups; however, quartz-exposed rats exhibited more severe alterations. At 4 months, there were slight cellular alterations (macrophage infiltration and appearance of neutrophilic granulocytes); at 8 and 12 months, a few collageneous fibers and diffuse structural changes, including interstitial fibrosis, were noted. At the end of the 12-month observation period, pronounced fibrosis and granulomatous inflammatory reactions were seen in quartz-exposed rats. Histomorphologic changes, characterized as diffuse foci containing macrophages, epithelial cells, fibroblasts, and collagen fibers, were also observed in the mediastinal

lymph nodes of both exposure groups. Again, these effects were more severe in the group exposed to quartz. No morphological lung changes occurred in controls.

2.1.2 Chronic Exposure

2.1.2.1. Crystalline Silica

Rats, dogs, and guinea pigs were exposed by inhalation to 0.2, 0.5, or 5 mg/m^3 (2, 5, or 50 mppcf) of flux-calcined diatomaceous earth containing 61% cristobalite, 6 hours/day, 5 days/week for up to 2.5 years (Wagner et al., 1968). The MMAD was 0.7 μm (σ_g = 2.1). Few histopathological changes were found in the lungs of any of the three species tested; no changes were seen in 10 additional tissues examined histologically. There was, however, and increase of macrophagic infiltration of perivascular and peribronchial areas of the lungs in all three species, with rats and guinea pigs exhibiting similar responses. The responses at 0.2 and 0.5 mg/m^3 showed a good correlation with exposure concentration and duration. Although frank pulmonary fibrosis did not develop in rats, dogs, or guinea pigs, cellular infiltration in the lung and hyalinized fibrotic nodules in the lymph nodes developed in dogs at 0.5 mg/m^3, with scattered nodules seen at 0.2 mg/m^3.

Muhle et al. (1989) exposed Fischer 344 rats (50/sex) to 1 mg/m^3 quartz (DQ-12) in whole-body chambers, 6 hours/day, 5 days/week, for 24 months using a dry aerosol technique. The quartz MMAD was 1.3 μm (σ_g = 1.8) with a respirable fraction of 74%. Parallel groups were exposed to filtered air only. No treatment-related effect on life span or causes of death were observed; the median life span was 750 days from initiation of exposure. The principal non-neoplastic finding in the silica-exposed animals was extensive subpleural and peribronchiolar fibrosis described as unlike the nodular fibrosis seen in human silicosis. The lung collagen content

more than doubled in the silica-exposed group. Also seen was focal lipoproteinosis, cholesterol clefts, enlargement of lymph nodes, and a granulomatous response in walls of some of the larger bronchi. Lung tumors were first observed after 21 months of exposure. Eighteen of the quartz-exposed rats developed lung neoplasms, of which 12 were reported as malignant. The overall tumor incidence was higher in females than in males. The investigators suggested that the small particle size with corresponding large surface area of the DQ-12 silica employed may have been a factor responsible for the increased tumor incidence.

Immunologic responses were determined in groups of female Balb/c mice following inhalation of crystalline silica (Min-U-sil), 8 hours/ day, 5 days/week for 150, 300, or 570 days (Scheuchenzuber et al., 1985). The dust concentrations in inhalation chambers were adjusted to approximately 2 mg/m^3 of respirable silica dust, with particle sizes of 2.1 μm or smaller. Mice exposed to dusts for all time periods were immunized with *Escherichia coli* antigen for determination of specific humoral responses, while other groups of mice exposed for 570 days were used for additional immunoassays. Silica inhalation suppressed the number of specific plaque-forming cells in the spleen in response to *E. coli* and, when tested after 570 days of exposure, reduced the ability of alveolar macrophages to phagocytize *Staphylococcus aureus in vitro*. After 185 days of exposure, T-lymphocyte-mediated cytolysis of allogeneic tumor cells was severely reduced. However, no changes were found in antibody-dependent cytotoxic function or in proliferative responses to non-specific mitogens (concanavalin A, phytohemagglutinin-p, lipopolysaccharide). Proliferation of splenic lymphocytes after stimulation with allogeneic lymphocytes from C57BL mice was also unaltered; but the ability of these cells to kill tumor cells from the same strain of mice was severely reduced. The authors indicated that the effects of prolonged exposure were

confounded by age-related immunologic changes. Most of the immunologic responses occurred after relatively short exposures, increased to some extent with exposure, and were persistent.

Holland et al. (1986) exposed 62 female Fischer 344 rats, nose-only, to quartz (Min-U-Sil) dust at a concentration of 12 mg/m^3, 6 hours/day, 4 days/week for 83 weeks. The MMAD of quartz particles was 2.24 ± 0.2 μm (σ_g = 1.75). Control groups consisted of 62 rats exposed to the same inhalation protocol using filtered air only (sham controls) and 15 rats housed in the same location but not manipulated. Most exposed animals (54/60) surviving beyond 400 days exhibited pronounced pulmonary fibrosis characterized by granulomas and deposition of collagenous connective tissue. Silicotic nodules and pleural plaques were seen in most quartz-exposed animals. Emphysema often accompanied the fibrotic changes, with alveolar proteinosis in animals with advanced fibrosis. In controls, fibrosis was seen in only one animal. The mean lifespan of the quartz-treated group was within 10% of that of the sham control group. There was a 30% incidence of lung tumors (benign and malignant combined) in quartz-exposed rats with the earliest observed tumor seen after about 17 months of exposure.

Dagle et al. (1986) exposed Fischer 344 rats (144/sex) to 50 mg/m^3 quartz (Min-U-Sil 5), 6 hours/day, 5 days/week for up to 24 months. Respirable dust concentrations (TWA) were 51.6 mg/m^3 with a range of MMADs of 1.7-2.5 μm (σ_g = 1.9-2.1). Controls were exposed to air only. Subgroups of 5 rats were killed at 4-month intervals to study the development of lung lesions. The mean survival time of rats exposed to quartz for 24 months was 539 days compared with 688 days for the control group. The survival curves of the serially withdrawn rats suggested a cumulative concentration-response relationship. The mean survival times following initial exposure were 653, 585, 556, or 554 days for the subgroups withdrawn from quartz exposure at 4,

8, 12, or 18 months. Quartz-exposed rats had lower body weights (consistently observed only after 12 or more months of exposure), increased lung weights (as wet weight), and lung volumes. Pathologic changes at 4 months included grossly enlarged lungs with diffuse mottling, brown-to-purple discoloration, and grey-to-white subpleural foci. These changes generally became more severe with time. Histopathologically, increased number of alveolar macrophages, alveolar proteinosis, alveolar epithelial metaplasia, pulmonary adenomatosis, interstitial lesions, and lymphoreticular hyperplasia were observed. Occasional nodules of fibrosis were seen in rats surviving longer than 12 months. Epidermoid lung carcinomas were seen in 10/53 female and in 1/47 quartz-exposed male rats surviving 494 days.

Data by Pratt (1983) present evidence that the pathogenicity of crystalline and amorphous forms of silica differs. Guinea pigs were exposed by inhalation to cristobalite (45% crystallized) or amorphous silica (diatomaceous earth) at average dust concentrations of 150 mg/m^3 or 100 mg/m^3, respectively, 7-8 hours/day, 5.5 days/week, for up to two years. The crystalline silica was described as somewhat coarser than the amorphous form; approximately 50% of the crystalline and 70% of the amorphous material were less than 4 μm in diameter. In the experiment with crystobalite, pulmonary fibrosis was first observed in guinea pigs after 15 months; this condition became more severe after 21 months. In the experiment with diatomaceous earth, fibrosis was first noted after 24 months and was never as severe as with crystobalite.

2.1.2.2. Amorphous Silica

Groth et al. (1981) compared the pulmonary toxicity of inhaled synthetic amorphous silica F, silica P, and silica G in rats, guinea pigs, and monkeys. Eighty male Sprague-Dawley rats (300-

380 g), 20 male Hartley guinea pigs (400-800 g), and 10 adult male Cynomolgus monkeys (2300-5400 g) were exposed to silica dusts at a concentration of 15 mg/m^3 (7-10 mg/m^3 respirable dust), 5.5-6 hours/day, 5 days/week, for up to 18 months. An equal number of animals served as controls. The particle sizes (geometric mean) were 0.17, 0.27, and 0.38 μm for silica F, G, and P, respectively. Rats were serially sacrificed after 3, 6, and 12 months of exposure, and guinea pigs and monkeys after 10-18 months of exposure. All the animals were sacrificed at the end of the respective exposure periods. The most significant effect of exposure to all three amorphous silicas was seen in monkeys and was confined to the lungs and lymph nodes which contained large numbers of macrophages and mononuclear cell aggregates, sometimes significantly reducing the size of the bronchiolar lumen. Although reticulin fibers were found in aggregates in all three silica groups, collagen and early nodular fibrosis was present only in monkeys exposed to silica F. Few silica-containing macrophages were seen in the lungs and lymph nodes of rats and guinea pigs exposed to any of the silicas.

Eleven tests of pulmonary function were conducted to assess the degree of respiratory impairment in monkeys exposed to silica F, P, or G for 14 months (Groth et al., 1981). Functions that were significantly ($p < 0.05$) decreased at the end of the study period compared with controls included the lung volume measurements of forced vital capacity, inspiratory capacity, and total lung capacity following exposure to silica F and P. Resistance, compliance, forced expiratory flow at the last 10% ($FEF_{10\%}$), and closing volume, all measurements of lung ventilatory mechanisms, were significantly ($p < 0.05$) decreased in monkeys exposed to silica F and G when compared to controls. The greatest differences from controls were seen in compliance, $FEF_{10\%}$, and in residual volume/total lung capacity. The authors noted that, overall, respiratory impairment appeared to be most pronounced in silica F-exposed monkeys. Except for increased AP activity in silica F-

exposed monkeys, there were no statistically significant differences between silica-exposed and control groups with regard to clinical chemistry and hematology parameters. The effect on AP did not correlate with any observed pathology and was not attributed to silica exposure. Under the conditions of this experiment, silica F appeared to cause more adverse pulmonary effects than silica P or G. Possible contributing factors listed were smaller silica F particle size and greater aluminum and iron content of silica P and G. Aluminum and iron compounds have been reported to reduce the fibrogenic potency of silica, providing variable protection (Heppleston, 1984).

Schepers (1981) exposed albino Wistar or Sprague-Dawley rats to a precipitated amorphous silica (HI-SIL 233) at an average dust concentration of 3.57 mg/ft^3 (126 mg/m^3), 8 hours each day of the week for 15 months; rabbits and guinea pigs were exposed to the same concentration for 12 months and 24 months, respectively. Altogether 496 animals were used in the study, of which 270 were exposed to silica and 226 served as controls. The silica particles with a median size of 2-5 μm (with approximately 80% less than 5 μm in size), exhibited significant clustering. There was no significant difference in mortality between exposed and control animals. Lung weights (as dry weight) increased with silica exposure but returned to normal after cessation of exposure. The primary effects in the three species were limited to macrophage accumulation in alveoli, bronchioles, and lymphoid tissues, and mild proliferation of reticulin fibers in interstitial tissues. Macrophage accumulation was considered mild in rats, but was more evident in rabbits and guinea pigs. Guinea pigs exhibited greater macrophage infiltration of lymphoid tissue compared with that seen in the alveoli. In rabbits, the macrophage accumulation tended to be perivascular and in guinea pigs peribronchial. Almost complete reversal of all responses occurred on cessation of exposure. Bronchial and tracheal epithelia remained intact, and no pleural changes or neoplastic effects were noted.

2.3 Toxicokinetics

2.3.1 Humans

After inhalation, respirable size particles of silica accumulate in the alveolar regions of the lung and distribute throughout the lung and associated lymph tissue. Inhaled airborne dust particles in general are transported in the trachea, bronchi, bronchioli, and alveolar bronchioli to the larynx by ciliary movement of the epithelial cells lining the airways. Particles deposited in the alveoli can be engulfed by macrophages and then transported to the bronchioli or to the interstitial tissue of the lung and the lymphatic vessels. Elimination of particles from the lungs generally occurs in two phases. The rapid phase is usually completed within 24 hours with clearance of the recently deposited particles in the ciliated airways, either by transportation in the mucociliary stream or by solution and absorption. The slow phase occurs over several months (Wright, 1978).

A review by Ziskind (1976) showed that patients with silicosis usually had a least twice as much free silica in their lungs as normal individuals. The upper limit of free silica in the normal human lung is 0.2 g, whereas in silicotic lung disease it may increase to 15-20 g. Also noted in silicotic patients were increased kidney weights (Saldanha et al., 1975). For example, the silica content of renal biopsy material in a patient with acute silicoproteinosis was 200 ppm (dry weight) in contrast to reported normal values of approximately 14 ppm or 24 ppm in patients with chronic renal failure.

2.3.2 Animals

2.3.2.1 Deposition and Clearance

Heppleston (1963) exposed rats by inhalation to 4.0 mg/m^3 silica (particle size 0.5-5 μm) in the form of Belgian glass sand for time periods ranging from 0.5 to 40 hours. The initial deposition of silica was highest in the tracheobronchial ciliated air passages; it was also seen throughout the acini where the extent of deposition decreased as the respiratory airways proceeded distally. The distribution of particles was not uniform between the different acini and 2-3 months following cessation of exposure aggregates were formed, primarily in the proximal alveolar ducts but also in the distal portion of the acini.

Inhalation studies with rats reviewed by IARC (1987) indicate that the long-term clearance of quartz after inhalation is slow and biphasic, whereas amorphous silica dusts are cleared more rapidly. The absolute amount of silica dust eliminated increased with lung burden, but the efficiency of the elimination was either constant or decreased with time. One year after inhalation exposure of rats to quartz resulted in a marked reduction in alveolar retention attributed to the pulmonary lesions induced by quartz (Le Bouffant, 1971). Rats, exposed to an aerosol of respirable α-quartz particles for 6 hours/day on 8 consecutive days and studied at intervals up to 1 year after exposure, cleared most but not all silica from the lungs (Davis, 1986). There was an exponential clearance of silica over the first 3 or 4 months. However, approximately 20% of the initial silica was still present 6 and 12 months after exposure. The lung clearance (half-life) of rats exposed by inhalation to an amorphous silica suspension (Ludox) at concentrations up to 150 mg/m^3 for 4 weeks was about 50 days (Kelly and Lee, 1990).

A study by Pratt (1983), however, showed that the total silica content in the lungs of guinea pigs exposed by inhalation for up to 2 years to cristobalite (45% crystallized) or amorphous silica (diatomaceous earth) at average dust concentrations of 150 mg/m^3 or 100 mg/m^3, respectively, increased linearly for at least 21 months, without evidence that lung retention decreased with time. The maximum lung content of crystobalite was only 68 mg/lung, while that of amorphous silica was 120 mg/lung. The total amount of silica accumulated varied inversely with the degree of pulmonary damage, suggesting that silica dust that produces cell damage is more efficiently cleared from the lung than is the more innocuous amorphous form.

In a long-term inhalation study with guinea pigs, Schepers (1981) compared the amount of silica retained as a result of exposure to amorphous silica (HI-SIL 233) with that retained during inhalation of quartz dust for comparable time periods (12 months). Guinea pigs that inhaled quartz dust at a concentration of 106 mg/m^3 retained between 500 and 600 mg of silica. By contrast, less than 10 mg of silica was retained in the same time span by guinea pigs that had inhaled 126 mg/m^3 of amorphous silica. After 12 months of exposure, the relative lung silica content decreased in guinea pigs that had inhaled quartz dust, but continued to increase slowly in the animals exposed to the amorphous silica. This difference was explained by an increasing nonsiliceous mineral content in the lungs of the quartz-exposed animals associated with the progressive deposition of fibrous tissue in their lungs. Six months after cessation of exposure, the silica content of the lungs of HI-SIL 233-exposed animals was similar to that of untreated controls. By comparison, the elimination of silica from the quartz-exposed guinea pigs was negligible. At the same time, the silicotic lesions progressed further during this elimination phase.

A study by Brody et al. (1982) showed that alveolar macrophages play a major role in the clearance of silica. In rats exposed by inhalation to 109 mg α-quartz/m^3 for 3 hours, particles were distributed on alveolar duct surfaces, primarily in those closest to terminal bronchioles. The percentage of silica-containing macrophages on alveolar surfaces increased from 36% immediately after exposure to 66% during the 24 hours following exposure; this high level was maintained for 24 days, and then decreased to 25% 42 days after exposure. The percentages of silica-containing macrophages recovered by lavage were similar to those seen *in situ*. Three days after exposure, some silica particles had been translocated to the alveolar interstitium.

Differences in deposition and clearance between quartz and three amorphous silicas (Aerosil 200, Aerosil R 94, Sipernat 22S) and between the three amorphous silicas were noted in a recent subchronic inhalation study with rats (Reuzel et al., 1991) (see Section 2.1.1.3. for additional experimental details). High concentrations of silica were detected in the lungs and lung-associated lymph nodes of rats exposed to quartz both at the end of the 13-week exposure period and at all stages of the post-exposure period (1 year). Much lower silica concentrations were detected in the lungs of animals treated with the amorphous silicas. Of the groups exposed to the amorphous silicas, the highest silica concentrations were seen in the lungs and lymph nodes of rats exposed to Aerosil R 974 at the end of exposure, with smaller amounts still present at weeks 13 and 26 post-exposure. Silica was detected in the lungs of all rats exposed to Sipernat 22S, and in the lymph nodes of about 50% of rats at the end of exposure; during the post-exposure period, the silica content of the lungs declined rapidly, but more slowly from the lung-associated lymph nodes. Aerosil 200 was very quickly cleared from the lungs and lymph nodes. In most animals, all three amorphous silicas were completely cleared from the lungs by week 39 of the post-exposure period.

Accumulations of macrophages laden with fine granular material and the presence of all silicas tested in the regional lymph nodes indicated an active role of the macrophages in lung clearance in the Reuzel et al. (1991) study. Aerosol 200 and quartz induced the most pronounced responses to alveolar macrophages, both at the end of exposure and during the post-exposure period, despite the fact that Aerosil 200 was cleared the fastest of all the silicas tested. Sipernat 22S induced only slight response to alveolar macrophages even though some of the material was still present 26 weeks after the end of exposure. The authors indicated that differences in physical/chemical properties of the surface of the particles might have accounted for the difference in macrophage response and clearance rate of the amorphous silicas. The very small primary particles of the amorphous silicas had relative surface areas about 10-1000 fold greater than that of quartz. On the basis of this difference in relative surface area, the amorphous silicas can be expected to exhibit greater solubility than the quartz particles. In addition, mucociliary clearance of the test materials may have been different, thus affecting clearance (Reuzel et al., 1991).

2.3.3.3 Excretion

Data regarding the excretion of silica in animals are limited to two reports in the older literature. According to King et al. (1933a), quartz is "slightly" soluble in body fluids and is readily excreted in the urine as silicic acid either after clearance from the lungs or after ingestion. The level of silicic acid in urine is influenced by diet. For example, omnivorous animals (rats and dogs) had a much lower urinary excretion of silicic acid than herbivorous animals (rabbits) that ingested high concentrations of silica present in whole grains, straw, and hay. Intragastric administration of finely powdered quartz resulted in marked increases in urinary excretion of silica

in rabbits and dogs. When 1 g of quartz suspended in 50 ml of water was administered to a dog by gavage, the urinary excretion of silica increased from 1 mg (considered a normal value) to 3.9 mg/100 ml at 1 hour, remained high for several hours (4.7 mg/100 ml at 8 hours), and returned the next day to its original level (King et al., 1933b).

3.0 REGULATIONS, STANDARDS, AND ADVISORIES

Because of its potential to cause adverse health effects in exposed populations, a number of regulations and guidelines have been established for silica by various agencies. A summary of

TABLE 1-1. PHYSICAL AND CHEMICAL PROPERIES OF SELECTED FORMS OF CRYSTALLINE SILICA

Property	Quartz CAS No. 14808-60-7	Cristobalite CAS No. 14464-46-1	Tridymite CAS No. 15468-32-3
Molecular weight	60.09	60.09	60.09
Physical state	colorless, white, black, purple, or green solid	colorless, white, or yellowish solid	colorless or white solid
Crystalline form	hexagonal; also in anhedral massive form	octahedral, rarely cubical; also in massive form	tabular, pseudohexagonal; also in massive form
Density	2.65	2.33	2.26
Hardness (Moh's scale)	7	6.5	7
Solubility			
Water	practically insoluble; 6-11 ppm at 25°C	practically insoluble	practically insoluble
Acids	soluble in hydrofluoric acid, but insoluble in most other acids	soluble in hydrofluoric acid, but insoluble in most other acids	soluble in hydrofluoric acid, but insoluble in most other acids
Organic solvents	insoluble	insoluble	insoluble

Sources: Coyle, 1982; ACGIH, 1986; IARC, 1987

TABLE 3 0. REGULATIONS AND GUIDELINES APPLICABLE TO SILICA

Chemical	Agency	Description	Value	Reference
Crystalline silica				
Quartz	OSHA	PEL (8-hour TWA)	0.1 mg/m^3 [a]	OSHA, 1989
	ACGIH	TLV (8-hour TWA)	0.1 mg/m^3 [a]	ACGIH, 1991
	NIOSH	recommended exposure limit for occupational exposure as a TWA for up to 10 hour workshift	0.05 mg/m^3 [a]	NIOSH, 1989
	MSHA	recommended exposure limit in coal mines	0.1 mg/m^3 [a]	Villnave et al., 1991
	IARC	carcinogenicity classification	2A[b]	IARC, 1987
Crystobalite; tridymite	OSHA	PEL (8-hour TWA)	0.5 mg/m^3 [a]	OSHA, 1989
	ACGIH	TLV (8-hour TWA)	0.05 mg/m^3 [a]	ACGIH, 1991
	NIOSH	recommended exposure limit for occupational exposure as a TWA for up to 10 hour workshift	0.05 mg/m^3 [a]	NIOSH, 1989
Silica, fused	OSHA	PEL (8-hour TWA)	0.1 mg/m^3 [a]	OSHA, 1989
	ACGIH	TLV (8-hour TWA)	0.1 mg/m^3 [a]	ACGIH, 1991
Amorphous silica				
Precipitated and gel	OSHA	PEL (8-hour TWA)	6 mg/m^3	OSHA, 1989
	ACGIH	TLV (8-hour TWA)	10 mg/m^3 [c]	ACGIH, 1991
Diatomaceous earth (containing <1% crystalline silica)	OSHA	PEL (8-hour TWA)	6 mg/m^3	OSHA, 1989
Diatomaceous earth (uncalcined)	ACGIH	TLV (8-hour TWA)	10 mg/m^3 [c]	ACGIH, 1991
Amorphous silica	IARC	carcinogenicity classification	3[d]	IARC, 1987
Particulate matter	EPA	national primary and secondary ambient air quality standard	150 μg/m^3 (24-hour average); 50 μg/m^3 (annual arithmetic mean)	U.S. EPA, 1991

[a]As respirable free silica
[b]Based on sufficient evidence of carcinogenicity in animals and limited evidence in humans
[c]As total dust containing <1% crystalline silica
[d]Based on inadequate evidence of carcinogenicity in animals and humans
[e]Particulate matter in ambient air as PA_{10} (particles with an aerodynamic diameter $\leq$ 10 μm)

ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International [illegible]
NIOSH = National Institute [illegible]

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directly involved. Unfortunately the grave risks of asbestos were realized only after it became widely used.

Asbestos causes a variety of lung problems. The first to be recognized was restrictive lung disease caused by widespread lung scarring, the result of heavy exposure for many years. The first symptoms are shortness of breath and "clubbing" of the fingers. A chest X ray shows thick shadows concentrated in the lower lung regions. Later it was recognized that such persons are at heightened risk for lung cancer, a risk that is greatly increased if they also are cigarette smokers.

Pleural disease also strikes asbestos workers. This takes the form of calcified scars known as plaques and occasionally as fluid accumulation in the pleural cavity. Calcification is plainly seen on X ray. The most dreaded of the asbestos-related lung diseases is a malignant pleural growth known as mesothelioma. The treatment of this form of cancer has been unsuccessful. Equally frightening, mesotheliomas have occurred in persons exposed only briefly to asbestos, such as the wives of asbestos workers who have handled their husbands' work clothes.

The definitive answer to the asbestos problem is not yet available. In view of the potential dangers of even brief exposure, it is difficult to set safe limits. It is clear, however, that those regularly exposed to asbestos must stop smoking. It is possible that many of the functions of asbestos in industry will be fulfilled by other materials.

Silicosis. Silicon is one of the most common elements in the earth's crust. It usually is found in the form of silicon dioxide, also known as silica. Quartz, sand and sandstones, flint, granite, and other hard stones have high silica content. Silicosis results from repeated exposure to free crystals of silica deposited in the lungs. Persons at high risk for silicosis include sandblasters, hardrock tunnelers, quarry workers, stone cutters, foundry workers, and makers of refractory materials.

The mechanism of lung scarring by silica is better understood than the scarring by asbestos. Silica is a potent killer of lung macrophages. As repeated generations of macrophages ingest silica particles and are killed by these particles, they release inflammatory chemicals that eventually provoke a scar tissue response.

There are no clear signs of early silicosis. The first indication is usually an abnormal chest X ray, with scattered pinpoint punctures throughout the lung. This stage of disease, causing neither symptoms nor functional disability, is called simple silicosis. Fortunately, most patients never proceed beyond this stage. In a few, however, a complication known as conglomeration occurs. The small nodules enlarge and blend into large areas of destruction. Patients become breathless and may approach respiratory failure. It is unclear why some patients progress to this stage while others do not. In rare instances the coexistence of tuberculosis may incite the conglomerate phase. It is also possible that silicosis predisposes to the development of tuberculosis.

There is no specific therapy for silicosis. Standards for limiting silica particle concentration in the workplace are well established.

Coal miner's lung ("black lung") shares many of the features of silicosis. It is caused by the inhalation of coal dust, which collects in the lung in local formations known as coal macules. This state of disease is simply a chest X ray finding without symptoms or disability. As in silicosis, there is a progressive form known as progressive massive fibrosis which leads to disability, sometimes death.

Great progress has been made in establishing safe working levels of coal dust. As in all occupational diseases, prevention is much easier than treatment.

Chemical irritants. A large number of gases used in industrial processes irritate the respiratory system. They include ammonia, hydrogen chloride, chlorine, sulfur dioxide, nitrogen dioxide, and phosgene. The soluble gases, such as chlorine and ammonia, cause upper respiratory irritation marked by chest pain and cough. The nonsoluble gases, such as nitrogen dioxide and phosgene, reach the alveoli and small airways where they cause an outpouring of fluid into the lungs, known as pulmonary edema. Great amounts of alveolar fluid interfere with breathing.

It may be necessary to treat these exposures with supplemental oxygen. Occasionally, steroids are used to treat cases of massive pulmonary edema.

Hypersensitivity lung diseases are caused by an immune reaction directed against certain organic substances inhaled into the lung. In farmer's lung particles of fungus growing in moldy hay are shaken into the air when the hay is stirred up, then are inhaled deeply into the lung where they are attacked by the body's immune defenses. Fever, chills, and breathlessness follow several hours later. Similar diseases are incited by other fungi, or organic substances such as animal danders or feathers. Only a small percentage of those exposed develop the disease.

Annual recharge to the East Shore aquifer system averaged about 153,000 acre-feet during 1969-84. The primary sources of recharge are seepage from natural channels and irrigation canals, about 60,000 acre-feet, and subsurface inflow from consolidated rock, about 75,000 acre-feet. Total recharge may vary considerably from one year to the next with changes in annual surface-water inflow and precipitation. Total annual surface-water inflow to the study area was estimated to average about 860,000 acre-feet for 1969-84, but averaged almost 1,500,000 acre-feet for 1983-84 when precipitation was much greater than normal.

Estimates of the hydraulic properties of the aquifers were made from aquifer tests, lithologic and specific-capacity data, and with the use of a numerical model. Values of transmissivity determined using these methods range from less than 1,000 feet squared per day in consolidated rock and in basin fill near Great Salt Lake to greater than 100,000 feet squared per day in basin fill near the mouth of Weber Canyon.

Ground water generally moves from recharge areas near the mountain front, where there is a downward vertical gradient, to discharge areas near Great Salt Lake, where artesian pressures create an upward gradient. Locally, the hydraulic gradient may be reversed seasonally or over the long term by large-scale withdrawals of water from wells.

Long-term trends of water levels indicate a steady decline at most observation wells since the early 1950's. The declines generally follow the trend of less-than-normal precipitation until the late 1960's, when water levels continued to decline, despite normal or greater than normal precipitation. The continuing declines are due to large-scale increases in ground-water withdrawals. Water levels have declined as much as 50 feet in the principal pumping center (centered near Hill Air Force Base) and as much as 35 feet in areas farther from the pumping center. The increase in withdrawals and the subsequent water-level declines have caused approximately 700 wells within about 30 square miles to cease flowing since 1954.

The average annual discharge from the East Shore aquifer system during 1969-84 was estimated to be 182,000 acre-feet, including 54,000 acre-feet by wells, 70,000 acre-feet to drainageways and springs, and 50,000 acre-feet as diffuse seepage to Great Salt Lake. The annual withdrawal of ground water for municipal and industrial use increased from about 10,000 acre-feet in 1960 to more than 30,000 acre-feet in 1980 to supply the 66 percent increase in population, which grew from 175,000 people in 1960 to 290,000 in 1980.

Water in the East Shore aquifer system is generally potable and suitable for most uses; however, local areas may contain water with chloride concentrations in excess of 250 milligrams per liter. In addition, local areas contain warm water, with temperatures of 20 to 40 degrees Celsius, associated with a series of fault zones. Little or no evidence exists of changes in the chemical quality of water from most wells sampled prior to 1970 and again after 1980. The changes that have occurred are assumed to be a result of local conditions, such as different proportions of water of different chemical characteristics entering a well, related to vertical variations of water quality and effects of local withdrawals, and not a widespread change in water quality.

A three-dimensional finite-difference numerical model was used in the study of the East Shore aquifer system. The model was used to refine concepts of the aquifer system in the Weber Delta area and to project effects of increases in ground-water withdrawals. It was constructed as a three-layer system, with two layers representing the aquifer system including its confined and unconfined parts, and the uppermost layer used mostly to simulate discharge to the shallow water-table zone from the underlying aquifer system. The area simulated was the part of the East Shore aquifer system extending from north of Willard southward to about one mile north of Centerville, and was defined as the Weber Delta aquifer system. The model was calibrated to steady-state conditions using data for the period 1953-55, and to transient-state conditions using data for the period 1955-85.

Various hydrologic properties and processes were evaluated as part of the calibration process, including (1) construction of transmissivity maps; (2) developing ranges of vertical hydraulic-conductivity values; and (3) determining subsurface recharge from consolidated rock, variation of total recharge with time, and changes in discharge to drains, flowing wells, and Great Salt Lake with changes in ground-water withdrawals and recharge. Changes in recharge during transient-state calibration were estimated using annual changes in streamflow in the Weber River. Large rises in the level of Great Salt Lake in 1983-84 were simulated, with the results indicating only small rises in water levels near the lake and decreased discharge by diffuse seepage to the lake.

A principal test of the simulations and the method of model calibration was to reproduce a measured 50-foot water-level decline during 1955-85, which was primarily a result of increased ground-water withdrawals for municipal and industrial use. The calibrated model was used to project the effects of increased withdrawals in the future. Predictive simulations were made based on doubling withdrawals for municipal and industrial use over a 20-year period while using (1) the average recharge rate of 107,000 acre-feet per year, and (2) a less-than-average rate of 100,000 acre-feet per year. The results were additional water-level declines of 35 to 50 feet in the principal pumping center, and simulated decreases in ground-water storage of 80,000 to 115,000 acre-feet after 20 years. Increased ground-water withdrawals and water-level declines of this magnitude would likely cause flowing wells in a large area to cease flowing, and would decrease the amount of natural discharge as seepage to drains, evapotranspiration, and diffuse seepage to Great Salt Lake.

The predictive simulations are based on a calibrated model. They are assumed to be a reasonable representation of possible changes to the East Shore aquifer system in the Weber Delta area given assumed increases in withdrawals and possible changes in recharge; however, the model results are general and should not be used to evaluate site-specific problems.

Recharge

The East Shore aquifer system is simulated by the model only in the Weber Delta area (p. 3), whereas recharge was calculated in the preceding parts of the report for the entire East Shore area. Recharge values specified in the simulations for individual parts of the Weber Delta area, therefore, do not necessarily correspond to values for the entire study area. However, values used as initial estimates for recharge were virtually the same as those calculated in preceding sections, when adjusted to represent the part of the aquifer system simulated by the model. The annual recharge at the end of steady-state calibration was simulated at about 109,000 acre-feet, or about 44,000 acre-feet less than estimated for the entire study area.

Recharge from the land surface was specified in the model using constant-flux recharge nodes as close as possible to the actual locations. The constant-flux recharge includes: seepage from the Weber and Ogden Rivers, the Davis and Weber Canal, ungaged perennial, ephemeral, and intermittent streams, irrigated areas, and infiltration directly from precipitation within the recharge area. The constant-flux recharge nodes were located in the uppermost active model layer.

Recharge by subsurface inflow from consolidated rock of the Wasatch Range to the basin-fill deposits of the aquifer system was simulated during steady-state calibration by constant-head nodes, primarily in layer 3. All calculated and estimated rates of recharge from other sources were independently measured or estimated for the model; therefore, the flow calculated by the model from the constant-head nodes was assumed to be from subsurface inflow. Initially, constant-head nodes were placed in most cells along the eastern boundary. However, when the independently-calculated recharge rates were added, the initial flow from many of these boundary cells became negligible, and the constant-head boundary at such cells was eliminated. Further discussion on how recharge was estimated is in the ground-water recharge section on pages 26-32.

Subdivision of the Weber Delta part of the East Shore Aquifer System

The aquifer system consists of complex, interconnected multiple aquifers in the basin-fill deposits. The system includes confined parts previously called the Sunset and Delta aquifers (Feth and others, 1966) and their lateral extensions, including the area along the mountain front where the system is unconfined. Further discussion of the aquifer system is in the previous section on "Geology and hydraulic properties of the East Shore aquifer system". The confined parts of the system vary in thickness, continuity, and lithology and in places it is not possible to delineate separate aquifers.

The model consists of three layers that represent the shallow water-table zone and two separate confined or unconfined intervals of the East Shore aquifer system in the Weber Delta area. The layers have different lateral extents as shown in figure 45. Layer 1, which is used to simulate discharge to the shallow water-table zone from the underlying aquifer system, is simulated only where the potentiometric surface is near or above land surface, roughly corresponding to the area of evapotranspiration in figure 45. Layer 1 is simulated only as it relates to the underlying layers, thus there is no recharge to, or discharge from layer 1 except the water that has moved upward from layer 2. Layer 2 represents the upper confined interval of the aquifer system where it is less than 400 feet deep, including the Sunset aquifer where it has been delineated. Layer 2 was not simulated in the area near Hill Air Force Base because the potentiometric surface there is greater than 400 feet deep. Layer 3 represents the confined parts of the aquifer system where it is deeper than 400 feet, including the Delta aquifer where it has been delineated. Layer 3 also represents the unconfined parts of the aquifer system near the mountain front. Layer 3 is simulated over the entire area of active cells shown in figure 45.

The confining layers between the aquifers were not simulated as separate layers, primarily because of a lack of data. It was assumed that the change in storage and horizontal flow in the confining layers was insignificant. Therefore, it was not essential to simulate the confining layers separately; however, vertical flow through the confining layers was simulated.

GROUND-WATER CONDITIONS IN THE EAST SHORE AREA, BOX ELDER, DAVIS, AND WEBER COUNTIES, UTAH 1960-69

Technical Publication No. 35
State of Utah
DEPARTMENT OF NATURAL RESOURCES
1972

Constituent	Concentration
Sulfate	250
Chloride	250
Fluoride	1.2[1]
Nitrate	45
Iron	.30
Dissolved solids	500

[1]Optimum concentration recommended for water used in public supplies at average annual maximum daily air temperatures prevailing in the East Shore area; presence of fluoride in average concentrations greater than two times the optimum value constitute grounds for rejection of the supply. (U.S. Public Health Service, 1962, p. 8.)

Most of the ground water in the East Shore area that contains less than 500 mg/l of dissolved solids (pl. 3 and table 2) also meets the maximum limits for the other constituents listed above.

CONCLUSIONS

The decline of water levels throughout most of the project area during 1960-69 continued a trend started in the previous decade; however, the rate of decline diminished in the latter part of the study period. A part of the decline was due to continuing withdrawals from wells and a part is due to residual effects of drought. Although part of the water-level decline can be attributed to increased pumping at large-diameter wells, about one-third of the total volume of ground water withdrawn during 1969 was discharged by small-diameter wells. The use of imported surface water in urban areas that are on the ground-water recharge zone has resulted in an increase of recharge in those areas.

Monitoring of water levels and withdrawals of water from wells should be continued in order to provide an assessment of the effect of continued ground-water development in the area.

No significant chemical-quality changes have occurred over a large area. The water quality has varied locally, but it has generally been a year-to-year fluctuation rather than a long-term trend. Significant seasonal variation of chemical quality was not observed during 1968 or 1969. Although increased development of the ground-water resources has caused water levels to decline considerably in some areas, significant water-quality changes over a large area have not been associated with the decline. In a small area near Woods Cross, however, water-quality changes observed in some wells may be due to water-level decline.

Water-quality monitoring should be continued in the East Shore area and near Antelope Island, especially at new well fields. Because of the proximity of Great Salt Lake to the new wells near Antelope Island and Little Mountain, it is conceivable that saline or brackish water could encroach into the fresh-water aquifers.

	1950	1960	1970
City of Bountiful	6,000	17,000	28,000
Davis County (total)	31,000	65,000	99,000
City of Ogden	57,000	70,000	69,000
Weber County (total)	83,000	111,000	126,000

About 2,000 persons reside in that part of Box Elder County covered by this report. In 1960 about 80 percent of the population was in urban areas.

Previous studies and acknowledgments

Previous investigations in the East Shore area include detailed studies in the Bountiful district by Thomas and Nelson (1948) and in the Weber Delta district by Feth and others (1966). A study of water-level and quality-of-water data collected during 1953-61 in the southern and central parts of the East Shore area was made by Smith and Gates (1963). The East Shore area has also been included in a series of annual reports on ground-water conditions in Utah. The latest in the series is by Sumsion and others (1970) and includes references to previous reports in the series. Other investigations have been summarized in the report by Feth and others (1966).

The cooperation of the many landowners in the East Shore area who gave permission for data acquisition from their property is gratefully acknowledged. The cooperation of the various officials of State and municipal governments in supplying information is also appreciated. Special thanks are extended to officials and personnel of the Great Salt Lake Minerals and Chemicals Corp., the Weber Basin Water Conservancy District, the U.S. Bureau of Reclamation, and the Utah State Parks and Recreation Division for their cooperation and assistance.

GROUND WATER

Summary of general conditions

The ground-water reservoir in the East Shore area consists of unconsolidated and semiconsolidated deposits, which range in grain size from clay to boulders. At the base of the Wasatch Range the deposits consist chiefly of coarse-grained delta, alluvial-fan, and slope-wash deposits; they grade westward into fine-grained but well-sorted lacustrine deposits. The principal aquifers consist of gravel or gravel and sand in the east half of the area and of sand in the west half.

The major sources of recharge to the ground-water reservoir in the East Shore area are subsurface flow from the Wasatch Range, direct infiltration from precipitation, and seepage from the Weber and Ogden Rivers, mountain front streams, and irrigated areas. Subsurface flow from

the Wasatch Range accounts for nearly half of the natural recharge to the reservoir. Feth and others (1966, p. 39) estimated annual natural recharge in the Weber Delta district to be 70,000 acre-feet and attributed 30,000 acre-feet to subsurface flow from the mountain front.

The conclusion that considerable quantities of water enter the area in the subsurface from the mountain front is supported to some extent by local conditions at well (A-2-1)20ddb-1, east of Bountiful. This well is in the vicinity of a major fault zone in an area where the ground water was believed to be under water-table conditions. When this well was completed, however, it was reported to have an artesian head of 51 feet above land surface and to flow about 1,000 gpm (gallons per minute). From examination of the drill cuttings, it is inferred that the well taps coarse unconsolidated deposits or perhaps underlying brecciated bedrock. Water probably enters the aquifer from the nearby mountain block and is confined beneath poorly sorted, poorly permeable mud-rock flow deposits. The flow of the well must be derived solely from recharge from the mountain block because the confining mud-rock flow would prevent any local recharge. Similar conditions may exist locally elsewhere along the mountain front.

Ground water in the East Shore area occurs chiefly under artesian conditions in a multiaquifer reservoir. Water-table and perched conditions occur locally in the stream deltas and along the mountain front. Some wells are finished in water-table aquifers; however, the majority of wells in the area are finished in artesian aquifers and this report deals mainly with the artesian aquifers.

In the Bountiful district, Thomas and Nelson (1948) defined three separate artesian aquifers—the shallow, intermediate, and deep aquifers. Local differences in lithology occur within the district, and frequently it is not possible to distinguish among the aquifers. Depths to the tops of the aquifers below land surface range from 60 to 250 feet, from 250 to 500 feet, and more than 500 feet for the shallow, intermediate, and deep aquifers, respectively. Each aquifer varies considerably in thickness.

For most of the Weber Delta district, Feth and others (1966, p. 36-37) have delineated two major artesian aquifers. The more productive and areally extensive is the Delta aquifer, the top of which is from 500 to 700 feet below land surface and which generally is from 50 to 150 feet thick. The Sunset aquifer is shallower, but it is not as productive nor as extensive as the Delta aquifer. The top of the Sunset aquifer in most places is from 250 to 400 feet below land surface, and the aquifer is from 50 to 250 feet thick. Artesian aquifers exist above the Sunset aquifer in many parts of the area, but they are generally less productive and are limited in areal extent. The Delta and Sunset aquifers do not extend to the area south of Kaysville because of a bedrock high near Kaysville. (See Feth and others, 1966, p. 36.) In the area of Ogden-Plain City-North Ogden the two aquifers are not recognizable as separate units.

Ground water moves generally westward from the areas of recharge toward Great Salt Lake. Feth and others (1966, p. 54-56) estimated that 40,000 acre-feet of water flows annually through a section of ground-water reservoir about 13 miles long and 1,300 feet thick in the Weber Delta district. Some water is intercepted and discharged by wells; some moves upward through the confining beds and is discharged by springs, seeps, and evapotranspiration in the lowlands near Great Salt Lake; and some continues through the aquifers westward under the lake.

The movement of water in aquifers beneath Great Salt Lake has been traced almost as far as Antelope Island. In 1968 a test well—(B-4-3)19acc-1—was drilled on the causeway from Syracuse to Antelope Island about three-quarters of a mile northeast of the northern tip of the

Ground water is discharged from the area by wells and springs, by seepage into drains, lakes, and swamps, by subsurface flow, and by evapotranspiration. In 1939 the Utah State Engineer, in cooperation with the Works Progress Administration (Utah State Engineer, 1940, p. 33-41), estimated that 26,000 acre-feet of water was discharged by wells in the project area for this report. In 1946 Thomas and Nelson (1948, p. 195) estimated 14,000 acre-feet as the total annual draft upon the ground-water reservoir in the Bountiful district by wells, springs, and drains. In 1954 Feth and others (1966, p. 50) estimated that about 25,000 acre-feet was discharged annually by wells in the Weber Delta district. In 1959 Smith and Gates (1963) estimated that about 53,000 acre-feet was discharged annually by wells in the East Shore area. Springs account for a very small part of the total discharge of ground water. Feth and others (1966, p. 57) estimated that 20,000-70,000 acre-feet of water leaves the Weber Delta district as subsurface flow to Great Salt Lake.

Development of ground water

Well construction

The total number of wells constructed in the East Shore area during 1960-69 is shown in figure 2, and the wells constructed from 1960 through August 1969 are shown on plate 1 and tabulated in table 1. More than 75 percent of all the wells constructed are domestic and stock wells that are less than 6 inches in diameter, and most of these are flowing wells.

Most wells in the Bountiful district and in the southern part of the Weber Delta district near the mountain front are finished at depths of less than 400 feet, either because sufficient water was obtained above that depth or because consolidated rock was encountered. In the southwestern part of the Weber Delta district, the predominance of wells drilled to depths greater than 400 feet indicates that the best aquifer in this area is more than 400 feet deep. In the west-central part of the Weber Delta district, it appears that adequate supplies are being obtained from nearly all depths, but most wells in the area west and north of Roy are less than 400 feet deep. Wells in the east-central part of the Weber Delta district are mainly large-diameter public-supply wells more than 400 feet deep. In the northwest part of the Weber Delta district, most new water supplies are obtained from wells more than 400 feet in depth. In other parts of the project area the number of deep (more than 400 feet) wells constructed during 1960-69 is about the same as the number of shallow (less than 400 feet) wells constructed during the same period.

The number of wells constructed annually declined from 1964 to 1969, and the number of wells drilled for replacement of inoperative wells was less than 2 percent of the total number of new wells completed. This decrease in well construction coincides with the increased distribution of water through the facilities of water conservancy districts.

The total number of wells abandoned or unused in the project area is not known. However, the number of small-diameter wells abandoned or unused was estimated on the basis of a detailed inventory made in September 1969 in five land sections that were believed to be representative of the entire area (sec. 26, T. 2 N., R. 1 W.; sec. 14, T. 3 N., R. 1 W.; sec. 16, T. 4 N., R. 2 W.; sec. 19, T. 5 N., R. 2 W.; and sec. 16, T. 6 N., R. 2 W.). The inventory showed that 119 small-diameter wells were in use in the five sections. According to records of the Utah State Engineer, however, 173 small-diameter wells had been constructed in these five sections as of September 1969. Thus, about 30 percent of the total small-diameter wells on record were either abandoned or unused. Applying this percentage to the approximate number of 4,500 small-diameter wells in the project area (based on fig. 2 and Arnow and others, 1964, p. 16 and 20) indicates that about 1,400 small-diameter wells have either been abandoned or are unused, and about 3,100 such wells were in use in 1969.

ground-water districts in the project area. Ogden Pioneer powerhouse is near the mouth of Ogden Canyon, and it was selected because fluctuations of precipitation at this station were assumed to be representative of regional fluctuations of precipitation. Note that the withdrawals by small-diameter wells and by large-diameter wells for multiple-use purposes were not combined on a year-to-year basis in figure 3 with annual pumpage for municipal and industrial supply. However, withdrawals from these wells for 1960 and 1969 are given in the above table; and in the following discussion, water-level fluctuations are related to total withdrawals from wells.

In the Bountiful district, water levels in 1969 showed a general recovery from the low levels reached in 1961 (see hydrographs of wells (A-2-1)19dbc-1, (B-2-1)13aab-1, (B-2-1)26aad-1, and (A-2-1)18abd-12). Water levels declined nearly 40 feet from the early 1950's to 1961 in parts of the district, but they have recovered about 30 feet since that low period. Large fluctuations in water levels are characteristic of the areas in the Bountiful district where withdrawals from wells are greatest. The rapid rate of recovery in the first half of the decade was due to decreased pumping, which in turn was due to the importation of water by aqueduct from the Weber River. The rate of recovery was slower during the latter part of the decade, because the pumping again increased to about the same level as that prior to 1960. The water level in well (B-2-1)26aad-1 probably best reflects this increased pumping.

Note that the low water levels in 1961 occurred after a long period of below average precipitation as well as after a period of heavy withdrawal from 1957 to 1959. In 1969, after 3 years of withdrawal about equal in amount to that for 1957-59, and the curve for cumulative departure from average annual precipitation showing only a slight upward trend, water levels remained considerably above the 1961 levels. This is due in part to urbanization in the recharge zone of the aquifers in the eastern part of the Bountiful district. Urbanization has resulted in a large amount of lawn watering, predominantly with surface water brought in from outside the area. This has resulted in a significant increase in the amount of recharge from the surface because the area previously was not irrigated, and the only source of surface recharge was from precipitation directly on the area. Elsewhere in the district, water-level fluctuations coincide more closely with changes in precipitation as is indicated by the hydrograph of well (B-3-1)25dab-1.

During 1950-63, water was diverted from Centerville Creek into a nearby spreading basin east of Centerville along the mountain front. The diversions generally were from April through August, during the period of maximum runoff when excess water was available for diversion. The average annual diversion was 230 acre-feet, and the largest annual diversion was 548 acre-feet in 1957. The amount of water diverted was small when compared to recharge by natural processes. The hydrograph of well (A-2-1)18abd-12, which is a shallow well (90 ft deep) about 1 mile west of the spreading basin, shows similar fluctuations of water levels both before and during the period of diversion. Therefore, it is inferred that water spreading has not appreciably affected water levels in the shallow zone in this area.

Throughout the Weber Delta district, with the exceptions of the bench areas near North Ogden and the extreme northern and southern parts of the district, water levels declined from 1960 through 1969. The declines ranged from 0 to 20 feet in the district. Hydrographs of wells (B-4-1)30bba-1, (B-4-2)20ada-1, (B-5-1)30ada-1, and (B-5-3)36ada-1 (fig. 3) show water-level fluctuations that are, in general, characteristic of most of the district.

in great part by white-collar workers, and the financial arrangements involve purchasing the dwelling with the assistance of the employer. Apart from such special examples, the company town planned from the start by the employer for his workers is becoming an incident in the past growth of industry.

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INDUSTRIAL HYGIENE. The application of the combined techniques of engineering, chemistry, physics, and medicine to the control of the environment of the industrial worker, in order to protect his health, is the major concept of industrial hygiene. Employment of medical and nursing principles to improve the health of a group of employees, entirely apart from any occupational hazards, is a secondary concept.

Infectious diseases, with a few exceptions, are not typically occupational in origin and are not a major concern of the industrial hygienist. Occupational diseases, prevention of which is the chief purpose of industrial hygiene, are most commonly caused by dusts, fumes, vapors, gases, irritating chemicals, and abnormal physical factors in the environment of the worker.

Dust Diseases.—*Silicosis,* a disease of the lungs caused by inhalation of dust containing free silica, is perhaps the most important occupational disease. The American Public Health Association defines silicosis as a "disease due to breathing air containing silica (SiO_2), characterized anatomically by generalized fibrotic changes and the development of miliary nodulation in both lungs, and clinically by shortness of breath, decreased chest expansion, lessened capacity for work, absence of fever, increased susceptibility to tuberculosis. . . ."

Ordinarily silicosis is developed only after several years of work in a dusty environment; but when dust concentrations are unusually high, it may follow exposure of only a year or two. Combined silica (silicate) does not cause silicosis. The form of free silica most commonly encountered in nature and responsible for most cases of this disease is quartz. Occupations in which silicosis may present a hazard include mining, tunneling, stonecutting, pottery manufacturing, sandblasting, and other foundry operations.

Asbestosis is a lung disease caused by inhalation of asbestos fibers. The changes produced are unlike those of silicosis. The fibrosis is diffuse and not nodular, and there is less susceptibility to tuberculosis. However, there is evidence that asbestosis may be associated with lung cancer.

Byssinosis is a lung disease contracted by cotton mill workers, especially in England.

Siderosis is a nondisabling condition characterized by a deposit of iron oxide in the lungs, frequently observed among welders and miners of iron ore.

Berylliosis results from the inhalation of beryllium oxide and certain other beryllium compounds. While its chief symptoms refer to the respiratory tract, it is considered by some authorities to be a systemic disease. The greatest concentration of cases has been in the fluorescent lamp industry, where the phosphors (fluorescent powders) used to coat the inside of the lamps formerly contained beryllium. Short exposure to high concentrations of beryllium compounds, particularly soluble compounds such as the fluoride, may result in pneumonitis. Both forms of the disease are frequently fatal.

Heavy Metal Poisoning.—*Lead poisoning* ranks next to silicosis among occupational diseases. Formerly it was associated chiefly with the painting trade; now it is rarely encountered among house painters, but is found frequently in such diverse industries as storage-battery manufacturing, nonferrous foundries, lead smelters and refineries, plastics manufacturers, and automobile assembly plants. The commonest symptoms are colic, weakness of the wrists, and anemia.

Mercury intoxication, as observed in industry, usually results from inhalation of the vapor. It was formerly common among felt hat makers, who knew it by the descriptive term, "hatter's shakes." Many countries and various states of the United States ban the use of mercury-treated fur for hat manufacturing; but there are many other industrial uses of mercury.

Manganese poisoning from the inhalation of high concentrations of the dust of manganese compounds may result in damage to the nervous system and partial paralysis. Typical symptoms are a stumbling gait and mask-like facial expression. The disease is most prevalent in smelting and mining operations.

Cadmium poisoning most frequently results from inhalation of fumes of heated cadmium, and takes the form of a severe chemical pneumonitis. Chronic cadmium poisoning among workers engaged in the manufacture of cadmium-nickel storage batteries has been reported in Sweden and France.

Zinc fume fever is a transient illness resulting from inhalation of freshly formed fumes of zinc oxide. It occurs chiefly among brass founders and welders of galvanized metal.

Other heavy metals, such as arsenic, vanadium, thallium, and uranium, are toxic and produce occasional occupational intoxications.

Organic Solvents.—*Benzene,* or benzol, is one of the most dangerous of the common solvents. Absorption of the vapor not infrequently results in blood changes which may progress to aplastic anemia, a fatal disease. Because of its toxicity, the use of benzene in rubber cements and lacquer formulations has been virtually abandoned in the United States; but it is still employed in paint removers and as a raw material in the chemical industry.

Carbon tetrachloride, widely used as a cleaner because it is volatile and will not burn, is a dangerous kidney and liver poison. At present it is probably the number-one toxic solvent problem in the United States.

Carbon disulphide was formerly used in the rubber industry, but is now found chiefly as a raw material in viscose rayon manufacture. It produces mental symptoms, leading in extreme cases to insanity. Major episodes of carbon disulphide poisoning have been reported in Poland and Italy.

Other solvents which have produced serious occupational intoxications include tetrachlorethane, ethylene chlorohydrin, and dioxane.

Pesticides.—The use of toxic chemicals to control insect, fungus, and rodent pests has created some serious occupational hazards. Methyl bromide, a gas used as a fumigant, also to some extent as a fire extinguisher, damages the central nervous system and also is a lung irritant. Parathion,

sizing machinery mentioned, there must be other equipment in the mill for transporting and storing the ore in process, for removing excess water, or even drying it, and for taking samples at critical points in the process. The coarse and fine waste products must be removed from the plant and stored, usually permanently; fine waste frequently is a source of stream pollution and may thus cause expensive litigation. Where possible this material is used for mine fill, but often the milling processes do not remove all of the valuable mineral from the ore, and the waste, or tailing, is placed in temporary storage for a few years or several decades until discovery of a more efficient concentration process makes it possible to extract more of the valuable mineral at a profit.

MINING ADMINISTRATION

Organization.—A mine may be owned or operated, or both owned and operated, by an individual, a partnership, or a corporation. Many manufacturing companies own and operate the mines which supply their raw materials; these are called captive mines. A mining industry faces a peculiar set of financial problems due to the fact that its assets, in the form of mineral deposits, are constantly diminishing, even though the known deposits, or reserves, may be enlarged by new discoveries on the property. Furthermore, many deposits of large extent and apparent value cannot be mined economically because of unfavorable geologic conditions, or because no system of mineral preparation has been developed to separate the constituents of the ore without excessive cost.

A mining company usually operates one property under a manager who directs the operations of the mine and preparation plant. A maintenance department keeps the equipment in operating condition, the elaborateness of the shop facilities increasing with the size of the operation and the remoteness from sources of supply. Headed by an electrical and a mechanical engineer, this department should include a timber and carpenter shop, a blacksmith shop, machine shop, electrical shop, vehicle maintenance shop, and steam, water, and power plants. The accountant often has charge of purchasing and the warehouse. Usually the company has its own doctors, nurses, and hospital. A town and stores may be constructed and owned by the company, but the trend is to dispose of all such holdings. An engineering department including mining engineers, geologists, surveyors, samplers, assayers, and mineral preparation engineers provides technical guidance for the manager and the operating departments. This department may design all structures and many machines for the special conditions prevailing at the property. See also MINING ENGINEERING.

Because mining depletes the natural resources of the country, special laws are enacted to control it. See also MINING LAWS. The special hazards of mining have caused the passage of laws in most states to provide for minimum safety standards, and mines are subject in addition to laws governing industry in general. The accounting system, besides offering ready information to be used in cost analysis to improve operating efficiency, must supply all data required for compliance with these laws.

Mine Safety.—This important factor in mining has received increasing attention since early in the 20th century, and substantial progress has been made in reducing fatal and lost-time accidents. While the public eye is quickly focused on spectacular mine disasters such as coal mine explosions and mine fires in which occasionally one hundred or more men are killed at one time, the total number killed in small accidents in any year is far greater and warrants proportionally more attention to the means of reducing the frequency, both in number of accidents or fatalities per man-day worked, and in the number per unit of production.

Progress in mine safety is attained by continuous attention to accident preventatives, such as the proper selection, training, and discipline of workers; the provision of a plant with proper arrangement, safety devices and warning signs; the wise use of incentives to work safely, such as competitions and bonuses; and, above all, a true "safety-mindedness" on the part of management, reflected in ardent support of the program. A safety engineer of mature judgment, respected by his colleagues, and with authority to enforce his decisions can do much to plan and execute an effective safety program.

Closely allied to safety is the health of the miner. Hazards peculiar to the industry or of greater-than-average severity when encountered in mining are numerous. Because of the dark and sometimes damp working places and the abrupt changes of temperature when entering or leaving the mine, pneumonia, rheumatism, and tuberculosis are more common than in many other industries. The extended workings foster laxness in sanitary precautions, and thus hookworm disease and typhoid fever may be spread.

Where free silica is encountered in the rock, silicosis, a laceration of the lung tissue, is caused by inhaling very fine particles of quartz. The illness can be fatal unless detected in time and its advancement checked by change of occupation; [illegible] caused more fatalities than all types of mining accidents. The hazard is reduced by use of wet drilling methods and by wearing respirators, and medical research is developing improved methods of treatment. In lead mines where the carbonate occurs, lead poisoning may result from inhalation or swallowing. Mercury poisoning is a great hazard where cinnabar is mined, and ores containing arsenic are also dangerous.

Gases occurring in mines present a dual hazard of poisoning and explosions. Carbon monoxide, dangerous in concentrations of 3/100 of 1 per cent or more, depending on the period of exposure, is formed by blasting, mine fires, and explosions. It is difficult to detect, and canaries or mice were long carried into mines for this purpose, since, being more easily affected than humans by the gas, their distress or collapse gave warning of danger. Nitrogen trioxide and tetraoxide, which are formed when dynamite burns instead of detonating, are poisonous gases which have caused a number of deaths. Hydrogen sulphide, more deadly than carbon monoxide, is fortunately seldom encountered in mines.

In coal mines and some metal mines methane (firedamp) is encountered; this gas forms explosive mixtures in air when it makes up from 5.0 per cent to 13.9 per cent of the mixture. Explosion of a small pocket of methane can stir up fine coal dust and ignite it, causing the explosion to extend through a large part or all of the mine with loss of many lives and much

Many coal deposits and a few ore deposits lie nearly horizontal in the earth. If the overlying ground is not too strong, they can be mined by **longwall stoping.** An excavation (or stope) is dug into the ore vein. The miners drill and blast the ore off the face of one wall of the stope. As the ore is dug out, the rock and ore above will cave in. The stope's walls must be held up by timber or steel supports. When all the ore is taken from one wall of the stope, the supports are removed and that wall caves in. Then the miners start digging ore from the wall on the other side.

Caving is another method that can be used to remove ore. Openings are cut under large blocks of ore. Small pillars are left to hold the ore in place. When everyone is safely out of the openings, the pillars are blasted. The weight of the ore and rock above it causes the ore to cave in. The broken pieces of ore are scooped up, usually by automatic loading machines, and carried away.

Ore is transported to the main shaft by underground railway trains. At the shaft it is loaded onto elevators called **skips** and hoisted to the surface.

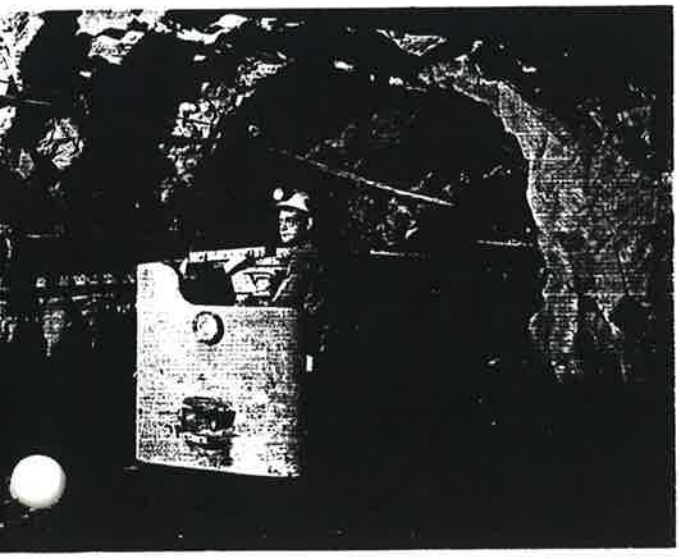
Safety in Underground Mines

Huge fans circulate fresh air through the mine tunnels. A fresh air supply is important for several reasons. Drilling and blasting in the passageways and stopes stir up dust. Miners could not work long if they had to breathe this dust-filled air all the time. The dust from quartz, a form of silica, is especially harmful. Inhaling this dust for long periods of time can cause a lung disease called **silicosis.** Gases from explosives are also released into the air when blasting is going on. These gases are harmful to breathe. Besides fouling the air, the dust and gases may cause fires or explosions. Thus, good ventilation of a mine is a necessary safety precaution. Some mines also are very hot from the earth's heat. They must be air-conditioned so that the miners are comfortable while they work.

Another problem is groundwater, which constantly seeps into mines. The water must be pumped out all the time, even when the miners are not working. If pumping stopped even for a few weeks or months, the drifts and stopes might be flooded.

Miners have to be careful of such dangers as falling rock, cave-ins, large digging and loading machinery, and the explosives used for blasting. In spite of all these hazards, the number of mine accidents and deaths has steadily decreased. Mining companies, miners' unions, and the government are continually looking for ways to make mining safer. Miners must take special training courses and safety-education programs.

Ore cars, which run on train tracks, are used to carry mineral-laden rock from an underground mine.



▶SURFACE MINING

Surface mines extract ore that lies near the surface of the earth. The work is faster and easier than underground mining. No shafts, drifts, or stopes have to be dug. All the heavy digging and loading can be done by large power equipment, which cannot be taken into most underground mines.

Surface mines are of two types—open-pit bench mines and strip mines. An open-pit bench mine looks like a bowl lined with a series of benches or terraces. Strip mines are used to mine coal. They follow the coal bed across the countryside.

The ease and speed of surface mining make it less expensive than underground mining. Even very low-grade ores can sometimes be mined with profit in open-pit mines. Huge quantities of ore are taken from open-pit mines. More minerals are obtained from these mines than are obtained from underground mines.

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with the Polish insurgents and Great Britain leaning to the German side. The warring factions were at last persuaded to suspend hostilities and the question was referred to the Allied Supreme Council. It met in Paris Aug. 8-12, 1921 and, failing to agree, referred the question to the Council of the League of Nations. A commission was appointed, and its decision, made public on Oct. 20, 1921, divided the plebiscite area in nearly equal parts between Poland and Germany.

The greater part of Czechoslovak Silesia was ceded to Germany as a consequence of the Munich settlement of Sept. 29, 1938. A month later, on November 1, Czechoslovakia signed an agreement yielding to Poland an area of 419 square miles with a population of 241,698. Then, in 1939, when Germany conquered Poland and seized Czechoslovakia, all Silesia came under Reich domination. The Allied victory in World War II brought about restoration in 1945 of Germany's Silesian conquests; but determination of new boundaries for Prussian Silesia had to await the peace treaty.

SILHOUETTE, sĭl-oo-ĕt', is the representation in solid black of the outlines of an object, occasionally with a few assisting lines drawn in white. The name comes from Etienne de Silhouette, French Minister of Finance in 1759. He strove by severe economy to remedy the evils of a war which had just terminated, leaving the country in great exhaustion. At the end of nine months he was obliged to leave his place. During this period all the fashions in Paris took the character of parsimony. Coats without folds were worn; snuff-boxes were made of plain wood; and, instead of painted portraits, outlines only were drawn in profile. All these fashions were called *à la Silhouette;* but the name remained only in case of the profiles.

SILICATES, a great group of minerals, compounds of various elements with silica. The group includes a few important ores but is chiefly significant as the great group of rock-forming minerals. A discussion of the important minerals of this group will be found in the introduction to the article on rocks. See also FELDSPAR; AMPHIBOLE, etc.

SILICIFIED WOOD, a variety of the minerals quartz or opal in which the mineral has replaced the wood. Opalized wood is wood changed into opal; petrified wood includes either of the above as well as wood changed into coal (see PALÆOBOTANY). According to J. D. Dana the trees now silicified in Arizona seem originally to have flourished on the shores of an inland lake, into which they fell and became water-logged; then they were buried beath volcanic material of a highly silicious racter which underwent alteration through action of water setting free more silica n the water could hold in solution. As the od decayed this silica was deposited in its s until finally the woody fibre completely appeared and what was once wood became rtz. As this change took place only particle particle, the minutest cells of the wood are served and may be seen under the micrope. In the great petrified forests of Arizona, w a government park, there are trunks of es three or four feet in diameter and over) feet in length, completely changed to quartz. Over the whole section are scattered petrified trunks and fragments from the size of a hickory-nut to several feet in diameter. At one place in the park a petrified tree has fallen across a ravine about 50 feet wide, forming a natural bridge. This Arizona petrified wood has been extensively exhibited and sold under the trade names of "jasperized wood," "agatized wood" and "woodstone," having been manufactured into tiles, paper-weights, cane and umbrella handles and many novelties, while complete transverse sections have been mounted as table-tops. The material is partly jasper, richly colored red and yellow by the oxides of iron and partly translucent chalcedony, with occasional spots of clear quartz and amethyst. Silicified wood abounds in the Rocky Mountains, while a similar forest exists in the Yellowstone Park. Opalized wood is also common, especially in California and Oregon. Consult Merrill, 'Fossil Forests of Arizona' (1911). See FOSSILS.

SILICIOUS SINTER. See GEYSERITE.

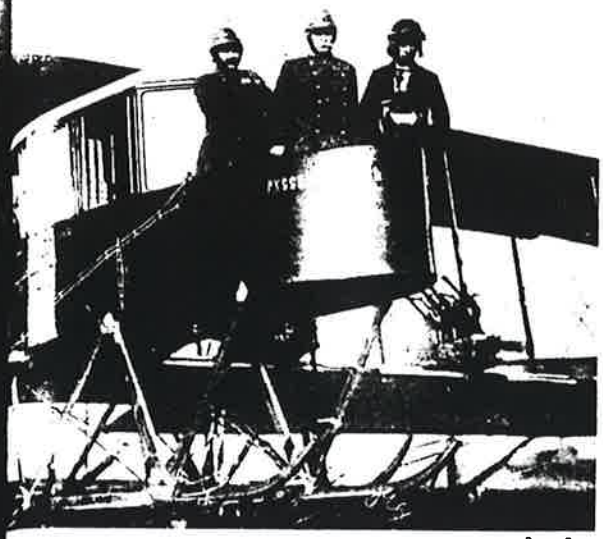
SILICON, *in chemistry,* one of the non-metallic elements, symbol Si, atomic weight 28.4. Next to oxygen it is the most abundant element found in the earth. It does not occur in nature in the free state but in combination with oxygen (silica) and with oxygen and various metallic elements as potassium, sodium, aluminium, calcium, etc., in the form of silicates. Silicon may be prepared by heating a mixture of metallic sodium and the double fluoride of sodium and silicon ($Na_2SiF_6+Na_4=6NaF+Si$); also by action of heat on a mixture of magnesium and silica (sand). It exists in three allotropic forms, an amorphous brown powder, a graphitoidal and a crystalline variety. The amorphous form is insoluble in all acids except hydrofluoric; it dissolves in potassium hydroxide to form a silicate, and burns in the air at high temperatures to SiO_2. The crystalline variety is very hard, is but little if at all attacked by hydrofluoric acid or potassium hydroxide and cannot be burned. Silicon forms compounds with oxygen, sulphur, chlorine and some others but the most important are the oxide SiO_2 and the salts derived from the various silicic acids.

Silica, SiO_2, oxide of silicon, occurs very abundantly in nature both in crystalline and amorphous forms. Quartz, a very pure form of silica, crystallizes in six-sided prisms terminated by six-sided pyramids. The finer crystals of quartz are called rock crystal, while the imperfectly crystalline varieties occur in a number of forms. Of the cryptocrystalline and amorphous forms we have opal, agate, amethyst, flint, sand, etc. Silica can be obtained in a fine

state by melting sand or a silicate with sodium carbonate whereby a silicate of sodium is formed. This is dissolved in water and hydrochloric acid added. Silicic acid separates in a gelatinous condition. The whole is evaporated to dryness, heated for a time a little above the boiling point of water and then washed with dilute hydrochloric acid. The silica is left behind as a gritty white powder insoluble in water and in most acids. Hydrofluoric acid dissolves it, however, with the formation of silicon tetrafluoride (SiF_4). It also dissolves in alkalies to form silicates. Silica is not acted on by heat except that of the oxyhydrogen blowpipe which fuses it. Silica, generally in the form of sand, is used largely in the preparation of mortar, glass and pottery. In metallurgical operations it is used as a flux with ores containing limestone with which it forms a glassy slag which floats on the molten metal carrying with it many impurities from the ore. Silica forms a number of hydrates which have acid properties and from which a vast number of salts are derived. A great many very complex salts of these silicic acids are found in the earth's crust, the metallic elements being usually sodium, potassium, magnesium, aluminium, calcium and frequently small amounts of other elements. Some of the best known silicates are the minerals feldspar, mica, garnet, talc, meerschaum, etc. Clay is largely a silicate. See QUARTZ; ELECTROCHEMICAL INDUSTRIES.

SILICON CARBIDE. See ELECTROCHEMICAL INDUSTRIES.

SILIUS, Titus Catius Italicus, Roman poet: flourished about 25–101 A.D. At Rome he applied himself to the bar, and became a celebrated orator and advocate. He was consul at the time of Nero's death and incurred some reproach for assisting in that tyrant's prosecutions, but acquired honor from his conduct in the proconsulate of Asia, assigned to him by Vespasian, from which he retired into private life, and collected books, statues and busts of eminent men. He finally retired to his seat in Campania, where he died. The only work of Silius which has reached modern times is an epic 'Punica' in 16 books, written with more diligence than genius. It takes as its theme the Second Punic War, according to Livy and Polybius, and contains occasional splendid passages; the description of the passage of Hannibal across the Alps is particularly admired. There are editions by Drakenborch (1717), Ruperti (Göttingen 1795–98, two vols.), and Bauer (Leipzig 1891–92). Consult Butler, H. E., 'Post-Augustan Poetry' (Oxford 1909) and Schanz, Martin, 'Geschichte der römischen Litteratur' (Vol. II, pt. 2, 3d ed., Munich 1913).



Brown Bros.

Igor Sikorsky, *right,* built and piloted the first successful four-engine airplane in 1913.

a company in 1923 which produced flying boats. This company became part of the United Aircraft Corporation (now United Technologies Corporation) in 1934. Sikorsky then worked on designing and building helicopters. Robert B. Hotz

See also **Airplane** (Other pioneer planes and fliers; picture).

Silesia, *sih LEE zhuh,* is a region in southwestern Poland and north-central Czechoslovakia. It includes the upper Oder River Valley and the Sudetes Mountains. Silesia covers about 19,000 square miles (49,000 square kilometers) and has a population of about 10 million. Katowice and Wroclaw, Poland, are the principal cities.

Silesia manufactures machinery, metals, and other products. Its minerals include coal and iron. Farmers in Silesia raise grains, potatoes, and sugar beets.

The region became part of Poland in the 900's. Austria took over Silesia in 1526 and Prussia seized northern Silesia from Austria in 1742. In 1919, after World War I, Germany and Poland divided northern Silesia and southern Silesia became part of Czechoslovakia. Poland gained control of the entire northern part in 1945, after World War II. Adam Bromke

Silica, *SIHL uh kuh,* is silicon dioxide, a chemical compound consisting of silicon and oxygen. Its chemical formula is SiO_2. Silica occurs widely in rock-forming minerals called *silicates,* which make up much of the earth's crust and mantle (see **Earth** [Outside and inside the earth]). Such silicates as amphiboles, feldspars, micas, and pyroxenes consist of silica combined with various chemical elements. Quartz and a few other minerals consist entirely of silica.

Silica occurs in two forms, *crystalline* and *amorphous.* Crystalline varieties of silica, which include coesite, cristobalite, quartz, and stishovite, have a definite crystal structure. Amorphous silica forms, such as lechatelierite and opal, have no such structure.

Silica minerals have many uses. For example, quartz crystals serve as part of the transmitting equipment of radios and most kinds of radar. Special lenses for certain optical instruments are made from quartz. Quartz crystals also are used in various kinds of watches. Several varieties of quartz and opals are cut and polished as gemstones. Mary Emma Wagner

Related articles in *World Book* include:

Ceramics	Glass	Opal	Silica gel
Feldspar	Mica	Quartz	Silicosis

Silica gel, *SIHL uh kuh jehl,* is a sandlike substance widely used as a demoisturizer. Each particle of silica gel has many small pores and thus a relatively large surface area. As a result, silica gel can *adsorb* (collect) large amounts of water vapor and certain other gases.

Silica gel has many uses. Small packets of it are packaged with certain foods to reduce moisture and preserve freshness. Manufacturers also use silica gel in making inks, paints, and *catalysts.* Catalysts are substances that speed up chemical reactions in pollution control systems and in petroleum refining.

Silica gel contains hydrogen, oxygen, and silicon and has the chemical formula SiO_2. It is made by adding an acid to a solution of a compound called *sodium silicate.* The resulting gel is dried to produce coarse particles. Kenneth Schug

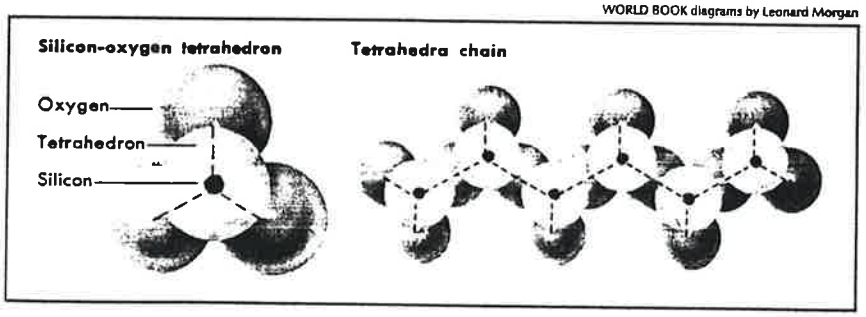
Silicate, *SIHL uh kiht* or *SIHL uh kayt,* is any of a group of minerals that contain silicon, oxygen, and one or more metallic elements. Silicates make up about 95 per cent of the earth's crust. Soil consists chiefly of silicates, as do most rocks.

All silicates have a crystal structure composed of units called *silicon-oxygen tetrahedra.* Each of these units consists of one silicon ion surrounded by four oxygen ions, which form a pyramidlike figure with four triangular faces—that is, a tetrahedron. Such units may exist independently. But they also may be linked with others, forming more complex structures. These structures, in turn, may be loosely held together by *cations*

Silicate crystal structure

Silicate minerals have a structure comprised of units called *silicon-oxygen tetrahedra.* Each of these units consists of one silicon ion surrounded by four oxygen ions, which form a pyramidlike figure. Such units may exist independently, *right,* or they may be joined together as a chain, *far right,* and other more complex structures.

WORLD BOOK diagrams by Leonard Morgan



(positively charged atoms) of aluminum, iron, or other metals present in a given silicate mineral.

Silicates are classified according to the way their silicon-oxygen (SiO_4) units are arranged. An *independent tetrahedral silicate* consists of isolated groups of SiO_4 tetrahedra held together by metal cations. Olivine is a mineral of this type. A *double tetrahedral silicate* is composed of two tetrahedral groups. The mineral epidote contains such double tetrahedra. A *ring silicate* consists primarily of rings of three or six tetrahedra. The mineral beryl is an example of a six-membered ring silicate. A *chain silicate* has numerous tetrahedra linked together in either single or double chains. Amphiboles and pyroxenes are chain silicates. A *sheet silicate,* such as mica, consists of sheets of tetrahedra with metal cations sandwiched between them. A *framework silicate* is comprised of tetrahedra linked in three-dimensional networks that extend in all directions. Feldspar and quartz, the most abundant minerals in the earth's crust, belong to this group. William B. Simmons

Silicon, *SIHL uh kuhn,* is a hard, dark gray nonmetallic element. It makes up about 28 per cent of the earth's crust and is the second most abundant element. Only oxygen is more abundant. Silicon occurs only in combination with other elements, chiefly with oxygen as *silicon dioxide.* This compound, called *silica,* is the main ingredient of sand. It is also a major ingredient of various minerals that form rocks. These minerals include feldspar, pyroxene, and quartz. Lava from volcanoes consists primarily of molten silicon dioxide, which, when relatively pure, hardens into *obsidian,* a natural glass.

Silicon has the chemical symbol *Si.* Its atomic number is 14, and its atomic weight is 28.0855. Pure silicon melts at 1,410° C and boils at 2,355° C. At 20° C, silicon has a density of 2.33 grams per cubic centimeter.

Silicon and its compounds have many important uses. Pure silicon is used in the manufacture of integrated circuits, transistors, solar cells, and similar electronic devices because it is a good *semiconductor* (see **Semiconductor**). *Silicon dioxide* is the main ingredient of glass (see **Glass**). *Silicon carbide,* one of the hardest materials known, is used to grind and polish other materials. Synthetic compounds called *silicones,* in which carbon and silicon are combined with oxygen, have numerous industrial uses. For example, silicones can be made into synthetic rubber. Silicones are also used as insulators, lubricants, and water repellents. See **Silicone.**

Silicon was first isolated by the Swedish chemist Jöns J. Berzelius in 1823. He obtained it by combining potassium fluorosilicate with potassium. Grant Urry

See also **Element, Chemical** (tables); **Silica; Transistor.**

Silicone, *SIHL uh kohn,* is any of a group of synthetic materials. It is unlike anything found in nature. Silicones are a cross between organic materials such as oil, rubber, and plastics; and inorganic materials such as sand, glass, and quartz. Their key material is silicon. Except for oxygen, silicon is the most abundant material in the earth's crust.

Uses. Silicones, which come in solid, liquid, and gaseous forms, are now in use in thousands of industries. Scientists are continually discovering new applications for silicones. As release agents, silicones keep bread from sticking to pans in commercial bakeries. Clean and smokeless, they work better than grease. They also keep tires and other rubber and plastic parts from sticking in the molds. Silicone fluids are used in waxes and polishing agents for automobiles, furniture, and eyeglasses. Fabric and leather treated with silicone will not absorb water or water-based products such as ink and tomato juice. Repeated washing or dry cleaning will not remove the silicone. Yet silicone will not stiffen the fabric.

Many silicones are not harmful to the human body. They also are not affected by chemicals in the body. For these reasons, they are used in making artificial human parts, including breasts and heart valves, which can be permanently implanted in the body.

Silicone oils and greases serve as permanent lubricants for clocks and ball bearings. Silicone water repellents keep brick and concrete walls dry in the rain. Silicones are also widely used as waterproof sealants for bathroom and kitchen tiling. Paints made with silicone resins do not blister and peel off at temperatures of 500° to 1000° F. (260° to 540° C). Outdoor weathering does not make them lose their gloss and color. Silicone paints are often used on ships.

As electrical insulating materials, silicones make hard-working motors, generators, and transformers last 10 to 100 times as long as they ever did before. They enable a 10-horsepower (7.5-kilowatt) motor to do as much work as a 15-horsepower (11-kilowatt) motor.

Silicone rubber does not melt at oven temperatures or become hard and brittle at temperatures as low as −110° F. (−79° C). It is used to seal oven doors and rocker boxes on aircraft and tank engines. Silicone rubber insulates communications cables on ships and motor coils in diesel-electric locomotives.

Composition. The amount of heat, weathering, and aging a material can stand is determined by the strength of the bond that holds the atoms together. Silicones are several times as heat-stable and weather-resistant as organic materials. Like sand, glass, and quartz, silicones have a molecular skeleton of alternate silicon and oxygen atoms. And the links in this chain are strong. The linkage, or bond strength, between silicon and oxygen is about one and a half times as great as the carbon-to-carbon bond that holds organic molecules together.

In making silicone products, "flesh" is put on the silicon-oxygen skeleton with organic groups that give the silicones such useful properties as water repellency, lubricating properties, flexibility, and ease of handling. Silicones can be made in the form of fluids, resins, and varnishes or gums. Silicone greases and compounds are made by adding fillers. Marvis E. Hartman

Silicosis is a lung disease caused by inhaling crystalline silica dust. Exposure to silica dust—and thus the risk of contracting silicosis—is especially high among iron and steel foundry workers, sandblasters, rock drillers, miners, and workers who produce pottery, glass, and abrasives.

There are three forms of silicosis: *simple, complicated,* and *acute.* After a particle of silica is inhaled, it eventually becomes surrounded by fibrous scar tissue. The scar tissue forms a small *nodule* (lump) in the lung. Simple silicosis is recognized by the presence of many small nodules on a chest X ray. It usually takes 10 to 20 years to develop. Simple silicosis generally does not affect the function of the lungs. It may, however, progress to complicated silicosis, in wh
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to complicated silicosis, in which nodules cluster together to form masses of fibrous tissue. When more than a third of a lung becomes fibrous, the patient experiences shortness of breath and abnormal lung function. Complicated silicosis sometimes leads to death. Acute silicosis develops much more rapidly than complicated silicosis and is usually fatal in two or three years. It causes the air sacs of the lungs to fill with fluid. It occurs in workers exposed to extremely high concentrations of silica dust, such as sandblasters and rock drillers.

There is no effective treatment for silicosis. Prevention is best achieved by using ventilation systems and engineering techniques that limit silica dust exposure in the workplace.

W. Keith C. Morgan

Silk is a strong, shiny *fiber* (threadlike substance) that is used to make cloth. Silk has a natural beauty that few other fibers can equal and is often called the *queen of fibers*. Silk fiber is made from the cocoons of caterpillars called *silkworms*. Many other animals, including spiders and lacewings, spin silk threads. But their silk cannot economically be made into cloth.

Silk is the strongest of all natural fibers. A thread of silk is stronger than the same size thread of some kinds of steel. Silk is highly elastic. It can be stretched and will still return to its original shape. Silk garments are extremely light in weight, and are warmer than cotton, linen, or rayon clothing. Dyed silk cloth has a deeper, richer appearance than most other dyed fabrics. Silk can be ironed easily, and it resists wrinkling.

Silk is used widely in making men's and women's fashionable clothing. It is also used in upholstery and curtain materials, especially in mixed fabrics.

China produces more raw silk than any other country. Japan ranks second. Other leading silk producers include Brazil, India, South Korea, the Soviet Union, and Thailand. The United States is the world's leading manufacturer of silk products.

Sources of silk

Cultivated silk is spun by silkworms that are raised on silk farms. Almost all commercial silk is cultivated. Most high quality cultivated silk is produced by the caterpillars, or larvae, of a moth called *Bombyx mori*. The first part of its name comes from *Bombycidae*, the family of moths to which it belongs. The last part comes from *Morus multicaulis*, the scientific name of the mulberry tree, on which it feeds.

The *Bombyx mori* is a rather large white moth, with black-lined wings. From wing tip to wing tip, the moth measures a little more than 2 inches (5 centimeters). Its body is short and thick, and its legs are stout.

Wild silk, called *tussah,* comes from silkworms that feed chiefly on oak leaves. These worms grow wild, mainly in China and India. Tussah is difficult to bleach because its natural color is tan or brown. It is less shiny than cultivated silk. Tussah is used as a filling in fabrics and is often blended with other fibers.

Raising silkworms

The raising of silkworms requires a great deal of care and patience. Silk farmers treat the *Bombyx mori* as carefully as they would a newborn baby. They raise it under carefully controlled temperatures. They protect it from mosquitoes, flies, and other insects.

Eastfoto

The luxurious qualities of silk have earned it the nickname *queen of fibers.* Dyed silk fabric has a radiant beauty that makes it a popular material for fashionable clothing.

Production of silkworms. In early summer, a female *Bombyx mori* lays from 300 to 500 eggs. It deposits them on special strips of paper provided by the silk farmer. The moth dies soon after it lays its eggs. The eggs undergo many tests to make sure they contain perfect, disease-free worms. Then they are put in cold storage. Early the next spring, the silk farmer puts the eggs in an incubator. An *incubator* is a device for keeping the eggs at a suitable temperature for hatching. About 20 days later, the eggs hatch into tiny silkworms.

Development of silkworms. The young silkworms are put on trays that are kept spotlessly clean to prevent disease. At first, the silkworms have enormous appetites. They eat almost continually, both night and day. The silk farmer supplies them with fresh mulberry leaves every two or three hours. The worms grow to about 70 times their original size and shed their skins four times. After four to five weeks, the silkworm is about 3 inches (8 centimeters) long and nearly 1 inch (2.5 centimeters) thick. Its body has 12 sections and three pairs of legs.

Spinning the cocoon. When fully grown, the silkworm stops eating and is ready to spin its *cocoon* (outer wrapping). The worm creeps into a tiny wooden compartment containing twigs or stems of straw that the farmer has prepared. The worm spins a net or web to hold itself to a twig or stem. It then forms a cocoon, which is the silk. To do this, it swings its head from side to side in a series of figure-eight movements. Two glands near the silkworm's lower jaw give off a fluid that hardens into fine silk threads as it hits the air. At the same time, it gives off a gum called *sericin.* The sericin cements the two threads of silk together.

The silkworm spins the silk around and around its body, until all the fluid has been used. After about three days of spinning, the cocoon is completed. The worm then changes into a *pupa,* which is the third stage of its life cycle. If permitted to live, the pupa becomes a moth in about three weeks, thus completing the life cycle, or *metamorphosis,* of the *Bombyx mori*—egg, silkworm

W/1744 This is NIOSH's (Nat. Institute Occupational Safety & Health) explanation for their workplace standards.

the drinking water of pregnant rats increased postnatal mortality significantly (Bus and Gibson 1975/Ex. 1-539).

In humans, 69 accidental deaths and 81 suicides were attributed to the effects of paraquat exposure up to 1972 (Chipman Chemicals 1972, as cited in ACGIH 1986/Ex. 1-3, p. 456). Bouletreau, Ducluzeau, Bui-Xuan et al. (1977/Ex. 1-538) reported 31 cases of renal insufficiency, and a spray applicator was killed when he absorbed a lethal dose of inadequately diluted paraquat through the skin (Jaros 1978/Ex. 1-513). Workers using a 0.05- to 1-percent solution of paraquat developed skin and mucous membrane irritation but experienced no symptoms of systemic poisoning (Howard 1978/Ex. 1-512). Fugita, Suzuki, and Ochiai (1976, as cited in ACGIH 1986/Ex. 1-3, p. 456) reported five cases of reversible kerato-conjunctivitis, with corneal injury, after one month of exposure to paraquat. Only NIOSH commented on paraquat.

OSHA is establishing an 8-hour TWA limit of 0.1 mg/m³ for paraquat, with a skin notation. The Agency concludes that this limit will protect workers from the significant risk of skin, eye, and pulmonary irritation observed in animals exposed to aerosols of respirable size at levels below OSHA's former PEL for paraquat. The Agency considers the irritant effects of paraquat to be material impairments of health. OSHA is retaining the skin notation for this substance because of its capacity to penetrate the skin.

SILICA, CRYSTALLINE—CRISTOBALITE

CAS: 14464-46-1; Chemical Formula: SiO_2
H.S. No. 1354

The former OSHA PEL for respirable cristobalite was one-half the value calculated from the mass formula for quartz, measured as respirable dust. This limit corresponds to a range of 0.04 to 0.05 mg/m³, measured as silica, for dusts containing 10 to 100 percent quartz. The ACGIH recommends an 8-hour TWA limit of 0.05 mg/m³, measured as respirable silica dust. Although expressed differently, the current ACGIH and former OSHA limit for cristobalite are comparable. The ACGIH's mg/m³ limit, adopted in 1985, does not reflect a re-evaluation of cristobalite's toxicity but was adopted merely to simplify the monitoring of cristobalite dust concentrations. The ACGIH limit is based on a study by Gardner (1938, as cited in ACGIH 1986/Ex. 1-3, p. 522) that was confirmed by King, Mohanty, Harrison, and Nagelschmidt (1953/Ex. 1-85). Experimental animals injected with cristobalite showed a more severe response than that produced by quartz, and the fibrosis that followed was diffuse rather than nondular. OSHA proposed, and the final rule establishes, a permissible exposure limit of 0.05 mg/m³ TWA for cristobalite, measured as respirable silica dust. Cristobalite, one of the three major forms of silicon dioxide, is transparant, tasteless, and stable at high temperatures.

The final rule replaces OSHA's former limit for cristobalite, which is expressed, as described above, with a numerically equivalent limit of 0.05 mg/m³; the Agency is establishing this time-weighted average limit to simplify employee exposure monitoring. NIOSH (Ex. 8-47, Table N6A; Tr. pp. 3-96 to 3-97) concurred with the selection of this limit but recommended that cristobalite be designated as a potential human carcinogen. OSHA's discussion of this and other rulemaking issues appears in the following entry describing the record evidence on quartz dust.

SILICA, CRYSTALLINE—QUARTZ

CAS: 14808-60-7; Chemical Formula: None
H.S. No. 1355

The former OSHA limit for silica-containing dusts is a respirable dust limit expressed as the following formula:

(10 mg/m³)/(% respirable quartz + 2).

At one time, the ACGIH also expressed its silica limit in terms of this formula. However, the current ACGIH TLV is 0.1 mg/m³, measured as respirable quartz dust. OSHA proposed, and the final rule establishes, a permissible exposure limit of 0.1 mg/m³ TWA, as respirable quartz. Quartz is a colorless, odorless, noncombustible solid.

The ACGIH does not see this change in the value of its limit for occupational exposure to silica as significant; instead, the ACGIH made this change to conform its limit for this dust to its TLVs for other dusts. If the former OSHA formula is used to calculate a limit for a dust containing 100 percent quartz, the limit would be 0.098 mg/m³, a value that is not appreciably different from the ACGIH's revised limit of 0.1 mg/m³ for respirable quartz dust. For quartz dusts containing less than 100 percent free silica, the former OSHA formula would yield a limit of, for example, 0.83 mg/m³ for respirable dust containing 10 percent quartz. This result is somewhat more stringent than the ACGIH's TLV of 0.1 mg/m³. For cristobalite and tridymite, the former OSHA formula and the ACGIH limits yield approximately the same results: both are approximately one-half the limit established by these two entities for quartz dust (see the discussions below).

Occupational exposure to free silica has been known for many years to produce silicosis, a chronic, disabling lung disease characterized by the formation of silica-containing nodules of scar tissue in the lungs. Simple silicosis, in which the nodules are less than 1 cm in diamater (as measured on chest X-ray films) is generally asymptomatic but can be slowly progessive, even in the absence of continued exposure. Complicated silicosis (i.e., with nodules greater than 1 cm in diameter) is more often associated with disability and can also progress in the absence of continuing exposure.

The health basis underlying the ACGIH's limit for crystalline silica is the work of Russell et al. (1929/Ex. 1-156), which suggested that a limit of 10 mppcf would protect workers from the effects of exposure to granite dust; a study by Ayer (1969/Ex. 1-129) demonstrated that 10 mppcf of granite dust is approximately equal to 0.1 mg/m³ of respirable quartz dust (ACGIH 1986/Ex. 1-3).

NIOSH has recommended an exposure limit of 0.05 mg/m³ as respirable free silica for all crystalline forms of silica. As applied to cristobalite and tridymite, the NIOSH REL is 0.05 mg/m³, the same as the ACGIH TLV, but NIOSH's 0.05-mg/m³ REL for quartz dust is one-half the value of the ACGIH TLV for quartz dust. To support its more stringent REL for quartz dust, NIOSH cites the work of Hosey, Ashe, and Trasko (1957, as cited in ACGIH 1986/Ex. 1-3, p. 524), which reported that no new cases of silicosis occurred in workers in Vermont granite sheds who were generally exposed to 0.05 mg/m³ or less of granite dust. The recommendation was also partly based on studies by Theriault, Burgess, DiBerardinis et al. (1974/Ex. 1-94a); Theriault, Peters, and Fine (1974/Ex. 1-110); and Theriault, Peters, and Johnson (1974/Ex. 1-94b), which found that annual declines in pulmonary function and abnormal chest X-rays occurred among 192 granite shed workers exposed to an average quartz concentration of 0.05 mg/m³. NIOSH noted that the exposure estimates reported in the Theriault et al. (1974/Exs. 1-94a, 1-94b, and 1-110) studies failed to account for the higher exposures that probably occurred in the years before exposure sampling was initiated and, therefore, that the Theriault et al. (1974) exposure data may have understated average exposures to quartz. Thus, NIOSH believes that the exposures responsible for the declines in pulmonary function were actually above 0.05 mg/m³. The

percent. Experiments by Miller and Sayers (1941/Ex. 1–595) showed no measurable toxic effects in guinea pigs injected intraperitoneally with various samples of soapstone. No comments were received on soapstone other than those submitted by NIOSH.

The final rule expresses the limit for soapstone as total dust in mg/m^3, rather than mppcf, to simplify employee sampling and analysis. The total dust limit being established, 6 mg/m^3, is equivalent to the previsious limit of 20 mppcf, and the new limit of 3 mg/m^3 for respirable dust is actually implicit in the total dust limit.

SULFUR DIOXIDE

CAS: 7446–09–5; Chemical formula: SO_2
H.S. No. 1375

OSHA's former limit for sulfur dioxide (SO_2) was 5 ppm as an 8-hour TWA. The Agency proposed to revise this limit to 2 ppm as an 8-hour TWA and to supplement this limit with a 15-minute STEL of 5 ppm. Although NIOSH recommends a limit of 0.5 ppm for sulfur dioxide, NIOSH did concur (Ex. 8–47, Table N1) with the proposed limits. The ACGIH has a TLV–TWA of 2 ppm and a TLV–STEL of 5 ppm. In the final rule, OSHA is establishing a 2-ppm 8-hour TWA and a 5-ppm 15-minute STEL for SO_2. Sulfur dioxide is a colorless, nonflammable gas or liquid with a suffocating odor.

OSHA has studied the effects of occupational exposure to SO_2 for several years. The Agency's 5-ppm limit for this substance was established in 1971 on the basis of the 1968 ACGIH TLV–TWA. In 1975, OSHA proposed to revise this limit downward to 2 ppm and held public hearings to gather information on industrial exposures to SO_2. In response to shifting priorities within the Agency, OSHA did not promulgate a final standard at that time. The following discussion summarizes the record evidence relevant to SO_2 both from the earlier (1975–1976) record and from the record of the present rulemaking.

Workplace exposure to sulfur dioxide causes both acute and chronic effects. The chronic effects of exposure include permanent pulmonary impairment, which is caused by repeated episodes of bronchoconstriction. A number of human and animal studies demonstrate this effect (Skalpe 1964/Ex. 1–438; Smith, Peters, Reading, and Castle 1977/Ex. 1–805; Archer and Gillam 1978/Ex. 1–711; Ministry of Health (Canada) 1976/Ex. 1–1208; Lewis, Campbell, and Vaughan 1969, as cited in ACGIH 1986/Ex. 1–3, p. 542).

Kehoe, Machle, Kitzmiller, and LeBlanc (1932/Ex. 1–339) studied two groups of male refrigeration workers with long-term (average of four years) exposures to average SO_2 concentrations of 20 to 30 ppm, with a range of exposures from 10 to 70 ppm. These workers were believed to have been exposed prior to 1927 to SO_2 levels considerably higher and averaging from 80 to 100 ppm. This study showed that SO_2 exposure caused an increased incidence of nasopharyngitis, shortness of breath on exertion (dyspnea), and chronic fatigue (Kehoe, Machle, Kitzmiller, and LeBlanc 1932/Ex. 1–339).

In a study of Norwegian paperpulp mill workers, Skalpe (1964/Ex. 1–438) reported that average SO_2 concentrations were believed to range from 2 to 36 ppm. Results showed a significantly higher frequency of respiratory disease symptoms, including coughing, expectoration, and dyspnea, among workers less than 50 years of age (i.e., those with the shortest exposure). Workers older than 50, however, did not display symptomatology different from that of controls.

More recently, Smith, Peters, Reading, and Castle (1977/Ex. 1–805) studied a group of smelter workers exposed, on average, to less than 2 ppm SO_2 but concurrently exposed to respirable particulate at levels generally less than 2 mg/m^3. These workers showed a decrement in forced vital capacity (FVC) and forced expiratory volume (FEV_1) of 4.8 percent when compared with controls. These authors concluded that workers exposed to SO_2 levels above 1 ppm had an accelerated loss of pulmonary function. This study has been criticized on the grounds that the control population itself may have been exposed to respiratory toxins and that other contaminants, such as iron sulfites, may have contributed to the pulmonary decrement seen in these smelter workers. On average, 60 percent more of the workers exposed to greater than 1 ppm SO_2 reported symptoms of chronic cough than did workers who were exposed to SO_2 at a concentration below 1 ppm. The prevalence of chronic sputum production was elevated for workers who had never smoked and who were exposed above 1 ppm.

Archer and Gillam (1978/Ex. 1–711) studied workers at the same smelter facility and obtained results similar to those of Smith, Peters, Reading, and Castle (1977/Ex. 1–805). Significant reductions in FVC and FEV_1 were found to be associated with chronic exposures to 0.4 to 3 ppm SO_2 (TWA) with concomitant exposure to particulate. These authors also found a corresponding increase in some symptoms of respiratory disease (chronic bronchitis) that was not attributable to smoking. Tomono and coworkers (1961, as cited in ACGIH 1986/Ex. 1–3, p. 542) found that 1.6 ppm was the lowest concentration that produced bronchoconstriction in 46 healthy male subjects.

OSHA's June 7, 1988 proposal also discussed the basis for NIOSH's recommendation of a 0.5-ppm 8-hour TWA limit for SO_2. In addition to the studies by Archer and Gillam (1977/Ex. 1–711) and Smith, Peters, Reading, and Castle (1977/Ex. 1–805) described above, NIOSH relied on a third study (Ministry of Health (Canada) 1976/Ex. 1–1208) of smelter workers exposed to SO_2 levels of 2.5 ppm for 10 or more years, which showed an increased incidence of respiratory disease in these workers. A fourth study cited by NIOSH (NIOSH 1977m, as cited in ACGIH 1986/Ex. 1–3, p. 542) reported that 10,000 workers exposed to SO_2 at levels of 0.35 ppm showed no adverse exposure-related effects.

Alarie and co-workers (1970 and 1972, as cited in ACGIH 1986/Ex. 1–3, p. 542) found that guinea pigs exposed to SO_2 by inhalation showed no decrement in pulmonary function at SO_2 levels of 5 ppm; monkeys exposed to 1.3 ppm for 78 weeks also showed no deficit (Alarie, Ulrich, Busey et al. 1970 and 1972, both as cited in ACGIH 1986/Ex. 1–3, p. 542). However, in another study, dogs exposed continuously to 5 ppm for 225 days showed increased pulmonary flow resistance and a decrease in lung compliance (Lewis, Campbell, and Vaughan 1969, as cited in ACGIH 1986/Ex. 1–3, p. 542). In addition, rats exposed to 10 ppm SO_2 daily for six weeks developed a thickening of the mucous layer that interfered with effective particle clearance (Dalhamn 1956, as cited in ACGIH 1986/Ex. 1–3, p. 542).

The acute effects of SO_2 exposure have been recognized for years in industrial settings; symptoms of acute overexposure include upper respiratory tract irritation, rhinorrhea, choking, and coughing. These symptoms are so disagreeable that most persons will not tolerate exposure for longer than 15 minutes. Within 5 to 15 minutes of the onset of exposure, workers develop temporary reflex broncho-constriction and increased airway resistance. Short-term exposure causes measurable bronchoconstriction (Frank, Amdur, Worcester, and Whittenburger 1962, as cited in ACGIH 1986/Ex. 1–3, p. 542; Weir, Stevens, and Bromberg 1972/Ex. 1–401); the ACGIH (1986/Ex. 1–3, p. 542) reports that this bronchoconstriction is dose-related and is manifested as an increase in pulmonary flow resistance.

Efforts have been made to quantify the acute no-adverse-effect level for

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GROUND-WATER RESOURCES AND SIMULATED EFFECTS OF WITHDRAWALS IN THE EAST SHORE AREA OF GREAT SALT LAKE, UTAH

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areas near North Ogden also exceeded 50 feet, but were caused primarily by decreases in recharge. The computed water-level decline pattern in layer 2 is similar to the pattern in figure 67 for layer 3; however, the declines in layer 2 were about 10 feet less in the flowing-well area, and 2 to 5 feet less in the principal pumping center. The total simulated decrease in storage for the 20-year period was 115,000 acre-feet, or about 5 percent of the total discharge during that period. At the end of the 20-year period, simulated discharge to drains had decreased about 15,000 acre-feet per year, and discharge to Great Salt Lake, through general-head boundary cells, decreased about 4,000 acre-feet per year.

During the predictive simulations, when water levels in the confined areas west of the mouth of Weber Canyon declined to the extent that they dropped below the bottom of the overlying confining layer, the model simulated these areas as unconfined, using specific-yield values instead of storage coefficients typical of confined conditions. The changes in storage indicated during the predictive simulations include the effects of this conversion.

The results of the predictive simulations indicate that continued increases in withdrawals for municipal and industrial use will cause further declines in water levels in areas of large withdrawals. These declines would be larger if recharge decreased to less-than-normal rates, such as occurred during 1959-68, when precipitation and streamflow were less than normal. Water-level declines of this magnitude would cause the static water levels to fall below land surface in a wide area, causing additional flowing wells to cease flowing, and also causing water levels in some wells to decline below present pump settings. The declines also would cause a decrease in the rates of natural ground-water discharge to drains, by evapotranspiration, and to Great Salt Lake, thereby salvaging or intercepting water.

Results of predictive simulations based on changes in withdrawals or recharge are probably valid over a large area; however, they may not be valid at a specific location because of generalizations made in hydraulic parameters such as the vertical hydraulic conductivity. Simulated water levels in recharge areas may not be accurate because changes in recharge from the transient-state rates apparently have more effect than increases in withdrawals.

SUMMARY AND CONCLUSIONS

The East Shore aquifer system in the basin-fill deposits of an elongate trough (graben) between the Wasatch Range and Great Salt Lake is primarily a confined system with unconfined parts along the mountain front. The aquifer system contains about 100 cubic miles of saturated sediments and has approximately 135 million acre-feet of water in storage, of which an estimated maximum of 37 million acre-feet is theoretically recoverable. It is not known, however, how much dewatering of the system could occur without undesirable side effects on the ground-water system, such as water levels declining to depths from which it is uneconomical to pump, movement of saline water to wells, and land subsidence. An estimated 13,000 acre-feet of water has been removed from storage from the unconfined part of the aquifer system near the mouth of Weber Canyon due to water-level declines since 1953.