July 15, 2013

Richard Kahn
HBRK Associates Inc.
[redacted]
New York, New York 10022

RE: Zorro Ranch – Pool/Natatorium System Analysis
Project #9357.00

EXECUTIVE SUMMARY

Beaudin Ganze Consulting Engineers was tasked to investigate/analyze and provide recommendations for the ongoing issues related to the existing pool area/natatorium conditioning system. The Existing system is not maintaining industry standards or owner/user required space temperature and or humidification levels. The mechanical system components are not regional and are problematic related to service and maintenance.

The site investigation determined that the existing pool conditioning unit is currently inoperable and at the point of diminishing return on repairs versus replacement. Recommendation is replacement with new unit sized to pool room/Natatorium conditions and desired temperatures and humidity.

Options for levels of replacement are provided within the report for determination of next step. BGCE always recommends the full modifications to help insure that the end result is a system that function to the best of the owners expectations. BGCE is also aware that budgetary and scheduling constraints have to be accounted for.

There are specific baseline modifications that are required for any of the proposed options to perform to any degree of pool space conditioning. The baseline modifications in general are to provide a vapor barrier to control moisture migration into the surround structure and to assist in condensate control.

Sincerely,

Morgan Royce, PE
Associate Principal

MBR:mbr

Zorro Ranch
Stanley, NM

Pool/Natatorium System Review

PREPARED FOR:

Richard Kahn
HBRK Associates Inc.
[redacted]
New York, New York 10022

BY:

BEAUDIN GANZE CONSULTING ENGINEERS, INC.

7007 Wyoming NE, Suite F-2, Albuquerque, NM 87109 • p. [redacted] ALBUQUERQUE
ALBUQUERQUE DENVER FORT COLLINS VAIL

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INTRODUCTION

Beaudin Ganze Consulting Engineers was tasked to investigate/analyze and provide recommendations for the ongoing issues related to the existing pool area/natatorium conditioning system. The Existing system is not maintaining industry standards or owner/user required space temperature and or humidification levels. The mechanical system components are not regional and are problematic related to service and maintenance.

A site investigation/interview was performed in May of 2013 with Brice Gordon. Owner/User requirements space temperature/humidity and pool temperatures were confirmed and documented for use in the analysis. Existing conditions were noted and available record drawings were made available for use in the analysis.

Records of repairs, previous recommendations from manufacturer/contractors, and material quotes were made available for use in the analysis/recommendations.

A ductwork camera inspection was performed by JB Henderson to insure that the existing ductwork was in good condition and was not collapsed or restricted in anyway. The inspection determined that there were no obstructions visible and that the ductwork was in good condition.

Calculations have been performed in the selection of the proposed replacement equipment to insure viability of connection to the existing utilities. Modifications to the existing system are noted within the report.

EXISTING CONDITIONS

The Pool area was completed Circa 2000. The pool area appears to be an upgrade from the original spa room design. There is little documentation related to the alterations made between the spa room to the present pool room.

A pool conditioning unit was installed to provide conditioning of the pool space. The unit's operating capacity was scheduled to be a Nominal 5 Ton unit capable of 25 pounds per hour of water with 2,400 cfm air flow at 0.60 inches of external static pressure. The unit power is 208 volt 1 phase 60 hertz with 56 full load amps and an MOCP of 70 amps (fuse size). The unit is water cooled through the main building condenser loop system. The unit is designed to draw a percentage of outside/ventilation air in through a common non pressurized ventilation air duct/plenum that also serves the remainder of the building conditioning systems with ventilation air. The unit is controlled through a room thermostat/humidistat and is connected to the building control system. The unit is provided with condensate drainage. The unit is not connected to the pool heating water system located in a separate area. The unit is fully ducted to the pool room through separate supply and return galvanized sheet metal duct systems. The unit is located in a central mechanical room located in the main building adjacent to the gym/pool. Refer to attached SUP 1 drawing for reference.

The pool room is ducted from the pool conditioning unit through a single below grade supply duct (16" diameter per design) that supplies five floor registers located at sole exterior wall with doors with integral windows. Return air is ducted back to the pool conditioning unit through two side wall and two ceiling return grilles located opposite the supply. There is no mechanical exhaust from the pool area.

The pool area is fully enclosed with five French doors leading to the exterior and a single French door leading to the interior gym. The pool is located on the ground level of the building with one exterior wall, one interior common wall (gym area) and two sub grade walls (one common to the pool equipment room). Typical wall construction is concrete. The exterior and interior common walls also utilize steel frame construction. The pool has solid surface throughout consisting of plaster ceilings/walls and concrete/tile deck. The roof of the pool is a terrace/porch/deck of the main floor of the building. The insulation values or presence of a vapor barrier cannot be determined or confirmed.

Operating conditions of the pool/spa are as follows:

Unoccupied:

Pool water temperature:	75 Deg F
Spa water temperature:	75 Deg F
Pool Area Space Temp:	85 Deg F
Pool Area Humidity:	Max 50%

Occupied:

Pool water temperature:	85 Deg F
Spa water temperature :	104 Deg F
Pool Area Space Temp:	85 Deg F
Pool Area Humidity:	Max 50%

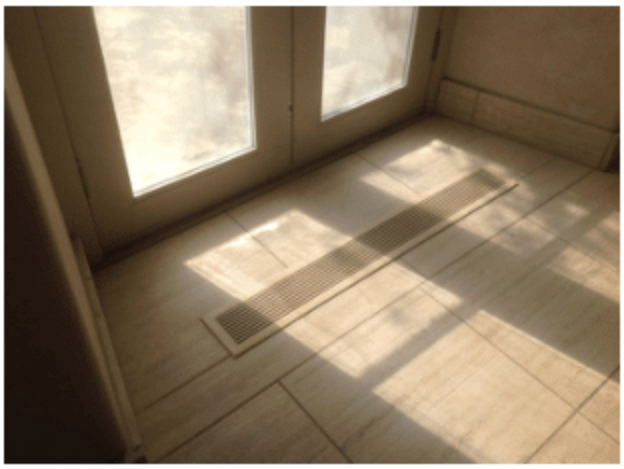
Occupancy can occur anytime during the year. Prime period of occupancy is May through September.

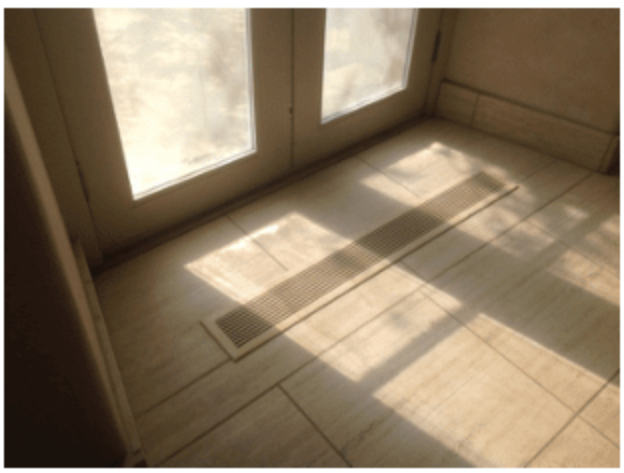
Pool Area Conditions relative to size of pool and surroundings are as follows:

Pool Surface Area – Approximately 750 square feet
Spa Surface Area – Approximately 120 square feet

Wet Deck Area – Approximately 460 square feet
Room Volume – Approximately 22,000 cubic feet





Pictures: Natatorium Layout

ANALYSIS

By simple observation of the pool conditioning unit maintenance/repair records it is apparent that the unit is not maintaining the pool area at the desired/standard space conditions. The unit is at the end of its useful life based on standard engineering practice and based on the amount of repairs the equipment has received over the recent years.

The question is not whether a new unit of sufficient capacity should be installed; it is whether a new unit can be installed in the existing system conditions and performs as desired/needed to maintain the standard space conditions. The answer is not likely without additional modifications.

The best way to approach what modifications should or could be performed is to look at the standard design practices and compare against the existing pool setup.

Indoor Pools or natatoriums are one of the most difficult facilities to design. They are designed for human comfort and enjoyment. And for this reason they have to consider human health and the health of the building.

Comfort related to this installation is primarily based on the desired temperature of the water and space. Per the occupied/unoccupied conditions stated the facility is within standard practices, nothing out of the norm.

Humidity control related to this installation is based to the space relative humidity and is a direct relation to the comfort conditions and physical conditions of the pool. The optimum condition is 40-60% and is in line with the requested level. This condition is the primary driver on sizing of the pool conditioning equipment.

Indoor air quality requirements are typically related to commercial natatoriums but recent studies also recommend for residential facilities. Indoor air quality relates to the chemicals being used in the pool water quality and the amount of people expected in the pool. Certain pool chemical can produce byproducts that are best mitigated using fresh air. Fresh air should be introduced into the pool conditioning system at a rate based on the pool area conditions and intended occupancy. For this project 500 cfm of fresh air is recommended. With the introduction of fresh air comes a need to maintain a negative pressure within the pool air versus the surrounding spaces. The negative pressure insures odors common to a pool are contained within the natatorium. Typical exhaust rates are 20% higher than the fresh air rate or in this case 600 cfm. In natatoriums with spas it is recommended to locate the exhaust intake closest to the spa to capture the highest humidity air and reject to the exterior versus conditioning through the mechanical systems. The existing facility currently has no provisions for exhausting the pool area. Outside air intake is provided but the amount is questionable since the existing pool conditioning unit is not capable of supplying the need air flow to the space.

Condensate control is less of condensation occurring but insuring it occurs in the right area. Given the Comfort and humidity factors condensation will occur to some degree. Controlling the degree to which it occurs is the purpose of the condensate control. The two main factors are building envelope and space air flow.

> Per current design recommendations pool surfaces should be constructed to provide a vapor barrier and thermal barrier compliant with current codes. The simply means a vapor barrier would be provided on the warm side of the walls (winter condition) and insulation would be provided on the exterior side of the vapor barrier. This insures that if condensate does form it does not form within the building structure causing additional damage to the surroundings. Condensation occurs when air (water air mixture) comes into contact with a surface temperature below its dew point, essentially the point at which a gas becomes a liquid. This point and all points for a water air mixture of gas have an associated vapor pressure. This pressure is what is being controlled by the vapor barrier. If no barrier

the vapor pressure of the water air mixture will permeate through almost any structure or material to some degree, including concrete. If allowed to condense within the material the material will typical experience an adverse effect. Most common is cracking, mold, and efflorescence (cement materials). It is unclear of the insulation level, presence of a vapor barrier or the arrangement of these materials throughout the natatorium.

On this same note interior surfaces that are likely to produce condensate are washed with supply air to absorb condensate and increase the wall surface temperature before damage can occur. This is primary driver in the configuration of the air distribution system. Windows, skylights, areas of low insulation values require air washing to increase the surface temperature. In large volume pools air movement or air change rates typically provide for all other wall ceiling surfaces when vapor barriers and insulation are provided. But area/volumes in ceilings that allow for pockets of stagnant air must also be air washed or broken up to insure condensate does not form or if it does that it is absorbed in the air stream and the surface temperature is increased. Pockets of trapped or stagnant are can have relative humidity levels that can exceed 80% even when the system return is reading 50%. At this time the only surfaces that are provided with an air wash are the windows.

Health is related to all the factors discussed. If too hot or too cold or too humid it can cause adverse effect to humans. If condensation forms within structure it can cause mold growth, rust structures, cause excessive un accounted weight to structures, all potential health concerns.

Natatoriums are also one of the most costly facilities to maintain and operate even when constructed properly to all design requirements. If anyone of the above factors is not considered correctly then the costs and likely repairs can spiral out of control.

Sup 1 Total drawing is provided to show one possible complete mechanical solution to the natatorium conditioning given the current building construction constraints. It does not address the vapor barrier or insulation requirements.

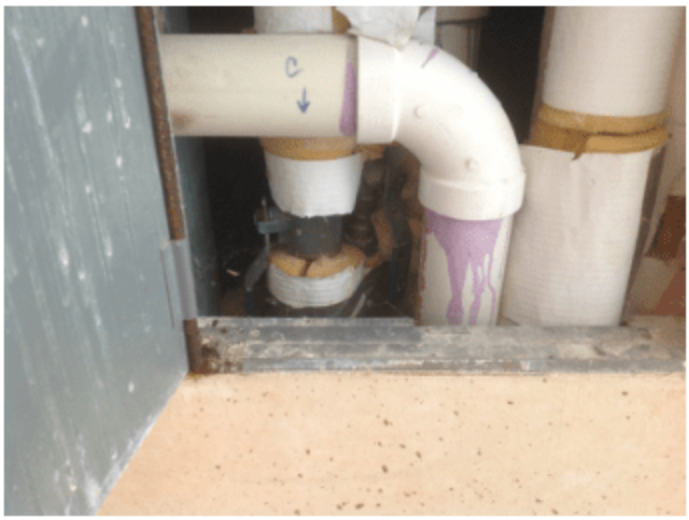
RECOMMENDATIONS

The following are mechanical/electrical/plumbing recommendations arranged in order of least cost only. Ranking of solution is typically directly related to cost but will be discussed later in the report. Costs are to be confirmed by contractor/supplier and are opinions at this time, not quotes. For any of the option to be viable certain building element or architectural changes are required. These are considered to be baseline requirements for any of the options presented.

Baseline:

Provide a water/vapor barrier in the form of a coating that is applied to all the existing interior surfaces of the pool walls and ceiling (One common Manufacturer is Tnemec). Seal all air leaks from the exterior to interior; this includes the air leak from the supply duct into the wall cavity at the water isolation valves.

Cost: To be determined by Architect/Contractor dependent on desired final aesthetics of the area but owner.



Picture: Access panel to Wall Void – Air Leakage into chase from supply duct below grade.

Option #1
Refer to SUP Option 1 Drawing

Install a new pool conditioning unit in the exact location of the existing and connect to the existing system conditions (specifically ducting, condenser water, electrical). The new unit will be capable of removing 36 pounds per hour of water at occupied conditions, 95 MBH total cooling capacity, and 67.1 MBH sensible cooling capacity at altitude. Unit air flow is 3800 cfm at 1.5 inches external static pressure and with a variable frequency drive motor for operational turn down during non occupied conditions.

Adjustments to air release rates at the supply diffusers, outside air intake and condenser water flow rate. Integration of new unit into existing control system for monitoring operation.

Modifications are required to the electrical service at the unit to increase from a 70 amp breaker to an 80 amp breaker. In addition reconfiguration of ductwork at the unit connections and relocation of humidistat/thermostat are required (conduit path to be determined).

Cost of Equipment: (quote from Supplier + 2yr Parts/Labor Warranty) $46,171 + NMGRT

Cost of Installation/Modifications/adjustments to systems:	$23,000 +NMGRT
Total Cost:	$69,000 +NMGRT

Option #2
Refer to SUP Option 2 Drawing

Same as Option #1 but to include the following:

Install an exhaust fan capable of 600 cfm continuously from the pool area. Preferred location of the exhaust intake is above the spa. This unfortunately is not economically viable.

Alternate locations of the exhaust fan are:

1. In the wall cavity of the exterior wall (requires access panel, interior/exterior grille, power, ducting, control).
2. In the Pool Equipment Vault (requires concrete wall cut, grille, connection to existing exhaust duct, power, and control).
3. Multiple other options dependent on available budget.

Option #1 Cost:	$69,000+ NMGRT
Cost of Exhaust:	$5,000 + NMGRT
Total Cost:	$74,000 +NMGRT

Option #3
Refer to SUP Option 3 Drawing

Same as Option #1 but to include the following:

Install a new return path from the pool with exhaust; utilize the existing return air path as a supply air path. Pool heating water from the pool conditioning unit will be provided.

The existing wall patch located at the common wall of the mechanical room and pool shall be used as the new return air path from the pool area. A soffit shall be created to enclose the new return duct with multiple high return grilles. The path will also allow for piping from the pool conditioning unit to the pool water heating system. The path will also allow for the relocation of the existing humidistat/thermostat to the exterior wall by allowing for a conduit path. The existing return air path will be modified to provide supply air to the ceiling area using the two existing side wall grilles (the ceiling returns will be capped). The exhaust fan will be located in the pool equipment room.

Option #1 Cost:	$69,000+ NMGRT
Cost of additions:	$20,000 + NMGRT
Total Cost:	$89,000 +NMGRT

Option #4
Refer to SUP Option 4 Drawing

Same as Option #3 but to include the following:

Provide additional supply grilles in the ceiling of the pool area. This would require a fair amount of ceiling demolition and patching.

Option #3 Cost:	$89,000+ NMGRT

Cost of additions:	$8,000 + NMGRT
Total Cost:	$97,000 +NMGRT

BENEFITS TO COST COMPARISON

First it has to be stated that the only insurable way that a natatorium can be maintained to user expectations is through maintenance of the pool temperature and water chemistry. Any drastic change in these conditions will cause the remaining components to become ineffective. Second is the space temperature and understanding that the pool conditioning system is selected base on set temperature and humidity points. Alterations to these points will keep the system from performing as designed.

Baseline requirements if not incorporated will continue to cause degradation of the structure and surfaces of the natatorium and surrounding areas. It will also not guarantee that the pool conditioning system is size appropriately.

Option 1 is the minimal modifications that can be done with the hopes of maintaining the natatorium at the desire conditions. This is less of an option as it is a requirement since the current unit is essentially defunct.

The benefits of the option are a pool conditioning unit that is sized to handle the pool conditions. The negative to this option is a larger horsepower supply air fan to overcome increased duct static pressure caused by a necessary increase in air flow to the space. Subsequently air noise through the floor grilles will increase based on the 50% increase in air flow. It is unclear as to what level of noise will be experienced. This is similar at the return grilles. It is still likely that the ceilings will form condensation in the winter. It is a guaranteed that the pool odors will continue to spread to the adjacent spaces of the house.

Option 2 will benefit beyond option 1 by controlling the odors currently released to the adjacent house and will provide an increased level of indoor air quality. The negative to this option are the same for option 1.

Option 3 will benefit beyond Option 2/3 by allowing for additional control of air washing over the ceiling and reduced noise at the floor registers. It will also allow for a smaller supply air fan motor horse power or operational point based on reduced duct static pressure (less energy is consumed). The benefit of the heat rejection of the pool conditioning unit to the pool water heating system is made viable by an easy path of installation. The negatives to this option are increased cost and modifications to the aesthetics of the space.

Option 4 will benefit beyond Option 3 by provide additional air washing to the ceiling area. The negatives to this option are increased cost and modifications to the aesthetics of the space.

End Report

MECH RM

OUTSIDE AIR DUCT

RETURN AIR DUCT

Pool Conditioning Unit - Vertical

Supply Duct

Condenser Water Piping and Power Connection

Capped form in existing wall

Pool Control System

Supply Duct in ceiling space (Actual location → 4' to corner)

LOW CEILING RETURN TYP.2

HIGH CEILING RETURN TYP.2

Floor Supply Grilles Typ. 5

existing exhaust from pool equip rm.

TYP. @ 4 CORNERS

TRAVERTINE SLABS THREE FACES

CERAMIC TILE

TRAVERTINE (ITALY)

WATER LINE TILE

PLASTER POOL

WHITE/ SUB-BLUE

PARTIAL BASEMENT FLOOR PLAN

SCALE 1/4" = 1'-0"

FINISH NOTES - POOL SPA

CEILING - FLEXI ON 5/8" DEFS-SHIELD

FRAME WALL - 2 LAYERS 5/8" DEFS GUARD MATCH EXTERIOR SYSTEM.

CONC WALL - METAL LATH, MATCH EXTER. SYS.

FLOOR - TRAVERTINE PAVERS

BALCONY REV LOGGIA

MASTER SHOWER

STEAM ROOM

FINISHES

EXHAUST AIR INTAKE

RAIL

TERRACE

POOL/SPA

CEILING & FINISHES

DRAWING KEY 1/8"

THIS SET OF DRAWINGS LABELED "SUP", FOR SUPPLEMENTAL, IS PREPARED BY THE GENERAL CONTRACTOR AS A SUMMARY OF VERBAL INFORMATION, DIRECTIVES AND SKETCHES PROVIDED BY THE OWNER AND HIS DESIGN CONSULTANTS.

Bradbury Stamm Construction

Bradbury Stamm

ZORRO RANCH

Stanley, New Mexico

Description

PARTIAL BASEMENT FLOOR PLAN

REV. 6-9-99

Date 3-8-99

Bradbury Stamm

SUP 1

EFTA01083788

Outside air Duct

NEW UNIT Connect to existing services

Combine existing supply/return to supply w/ volume dampers

New Return duct in FURROUT with (4) return grilles

Return grilles removed/capped.

existing return converted to supply

new supply grilles

existing return converted to supply

New Supply grille

New Pool Heating Waterlines in FURROUT and connected to Pool Heating system

Relocated Humidistat/THERMOSTAT

New wall penetration

New exhaust Fan

Existing Sup[redacted] to remain Typ 5

PARTIAL BASEMENT FLOOR PLAN
SCALE 1/4"

FINISH NOTES - POOL SPA

CEILING - 'REREX' OI 5/8" DENS-SHIELD

FRAME WALL - 2 LAYERS 5/8" DENS GLASS MATCH EXTERIOR SYSTEM.

CONC WALL - METAL LATH, MATCH EXTERIOR

FLOOR - TRAVERTINE PAVERS

DRAWING KEY 1/8"

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Bradbury Stamm Construction

Bradbury Stamm

ZORRO RANCH

Stanley, New Mexico

Description

PARTIAL BASEMENT FLOOR PLAN

REV. 2-9-99

Date 3-8-99

Bradbury Stamm

SUP 1 TOTAL

EFTA01083789

MECH RM

OUTSIDE AIR DUCT

RETURN AIR DUCT

POOL CONDITIONING UNIT - VERTICAL

REPLACE UNIT & reconnect to existing utilities & controls

INCREASE BREAKER TO 80 AMP - AIR BALANCE

Existing Humidistat / THERMOSTAT

LOW CEILING RETURN TYP.2

HIGH CEILING RETURN TYP2

Supply Duct

CONDENSER WATER PIPING AND POWER CONNECTION

Supply Duct IN CEILING SPACE (ACTUAL LOCATION → 4' to CORNER

CAPPED FORM IN EXISTING WALL

AIR BALANCE

Pool Control System

existing exhaust FROM POOL EQUIP RM.

Floor Supply GRILLES Typ.

PARTIAL BASEMENT FLOOR PLAN

SCALE 1/4" = 1'-0"

DRAWING KEY 1/8"

FINISH NOTES - POOL SPA

CEILING - "GREX" ON 5/8" DEFS-SHIELD

EXTR. WALL - 2 LAYERS 5/8" DEFS GLASS MATCH EXTERIOR SYSTEM.

CONC. WALL - METAL LATH, MATCH EXTER. FINISH

FLOOR - TRAVERTINE PAVERS

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Bradbury Stamm Construction

ZORRO RANCH

Stanley, New Mexico

Description

PARTIAL BASEMENT FLOOR PLAN

REV 3-9-99

Date 3-8-99

Bradbury Stamm

SUP

OPTION 1

EFTA01083790

MECH RM

OUTSIDE AIR DUCT

RETURN AIR DUCT

REPLACE UNIT & reconnect to existing utilities & controls
INCREASE BREAKER TO 80 AMP - AIR BALANCE

Pool Conditioning UNIT - VERTICAL

Existing Humidistat / THERMOSTAT

LOW CEILING RETURN TYP.2

HIGH CEILING RETURN TYP2

Supply Duct

CONDENSER WATER PIPING AND POWER CONNECTION

Supply Duct IN CEILING SPACE (ACTUAL LOCATION → 4' to CORNER

CAPPED FORM IN EXISTING WALL

AIR BALANCE

Pool Control System

Floor Supply GRILLES TYP.

existing exhaust FROM POOL EQUIP RM.

INSTALL EXHAUST FAN IN CAVITY (EITHER). PROVIDE ACCESS, POWER CONTROL

PARTIAL BASEMENT FLOOR PLAN
SCALE 1/4" = 1'-0"

DRAWING KEY 1/8"

FINISH NOTES - POOL SPA

CEILING - FLEX ON 5/8" DENS-SHIELD

STATE WALL - 2 LAYERS 5/8" DENS GLASS MATON EXTERIOR SIDE

CONC WALL - METAL LATH, MUDDED EXTR SIDE

FLOOR - TRAVERTINE PAVERS

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Bradbury Stamm Construction

ZORRO RANCH

Stanley, New Mexico

Description

PARTIAL BASEMENT FLOOR PLAN

REV 2-9-99

Date 3-8-99

Bradbury Stamm

SUP

OPTION 2

EFTA01083791

MECH RM

OUTSIDE AIR DUCT

RETURN AIR DUCT

NEW UNIT OPTION #1

Pool Conditioning UNIT - VERTICAL

supply w/ volume Dampers

REMOVE & CAP LOW CEILING RETURN TYP 2

HIGH CEILING RETURN TYP 2 Convert to supply typ 2

Supply Duct

CONDENSER WATER PIPING AND POWER CONNECTION

supply Duct IN CEILING SPACE (ACTUAL LOCATION → 4' to CORNER

CAPPED FORM IN EXISTING WALL

NEW RETURN AIR IN FURROUT WITH RETURN GRILLES

Pool Htg Wtr PIPING

Pool Control System

Relocated Humidistat/Thermostat

Exhaust FAN

Floor Supply GRILLES Typ. 6

existing exhaust FROM POOLER[redacted] RM.

PARTIAL BASEMENT FLOOR PLAN

SCALE 1/4" = 1'-0"

FINISH NOTES - POOL SPA

CEILING - PLASTEX 01 5/8" DENS-SHIELD

FRAME WALL - 2 LAYERS 5/8" DENS GLASS MATCH EXTERIOR SYSTEM.

CONC WALL - METAL LATH, MATCH EXTERIOR

FLOOR - TRAVERTINE PAVERS

BALCONY REV LOGGIA

MASTER SHOWER

STEAM ROOM

FINISHES

CEILING & FINISHES

EXERCISE

POOL/SPA

EXHAUST AIR INTAKE

RAIL

TERRACE

DRAWING KEY 1/8"

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Bradbury Stamm Construction

Bradbury Stamm

ZORRO RANCH

Stanley, New Mexico

Description

PARTIAL BASEMENT FLOOR PLAN

REV 2-9-99

Date 3-8-99

Bradbury Stamm

SUP

OPTIONS

EFTA01083792

MECH RM

OUTSIDE AIR DUCT

RETURN AIR DUCT

NEW UNIT OPTION #1

Supply w/ volume Dampers

Pool Conditioning Unit - Vertical

Supply Duct

Condenser Water Piping and Power Connection

Capped form in existing wall

Supply Duct in ceiling space (actual location → 4' to corner)

New return air in fur-out with return grilles

Pool Htg Wtr Piping

Pool Control System

Relocated Humidistat/Thermostat

Exhaust Fan

Floor Supply Grilles Typ. 5

existing exhaust from pool equip rm.

REMOVE & CAP LOW CEILING RETURN TYP. 2

HIGH CEILING RETURN TYP 2 Convert to supply typ 2

ADD ADDITIONAL SUPPLY AT CEILING

PARTIAL BASEMENT FLOOR PLAN

SCALE 1/4" = 1'-0"

BALCONY REV LOGGIA

EXHAUST AIR INTAKE

RAIL

TERRACE

POOL/SPA

CEILING & FINISHES

EXERCISE

DRAWING KEY 1/8"

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Bradbury Stamm Construction

ZORRO RANCH

Stanley, New Mexico

Description

PARTIAL BASEMENT FLOOR PLAN

[redacted] 2-9-99

Date 3-8-99

Bradbury Stamm

SUP

OPTION 4

EFTA01083793