Hydrogeologic Characterization

Aquifer Test

Advanced Investment Corporation
Triangle Lake Property

January 25, 2004

PRIVILEGED AND CONFIDENTIAL

Aquifer Pump Test

Larry Brown Well L08850
92702 Triangle Lake Resort Road
Triangle Lake, OR

Principal Authors: Steven LaFranchi, RG

Prepared For:
Mr. Marty Hall
Advanced Investment Corp.
321 Goodpasture Island Road
Eugene, OR 97401

Site Description:
Larry Brown Domestic Well
ORWD ID L08850
92702 Triangle Lake Resort Road
Triangle Lake, OR 97412
T16S, R7W, Sec. 19; Tax lot 105

Prepared By:
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01/25/2004

Mr. Marty Hall
Advanced Investment Corp.
321 Goodpasture Island Road
Eugene, OR 97401

RE: AQUIFER TEST RESULTS
92702 Triangle Lake Resort Road
Triangle Lake, Oregon 97412
Well ID L08850

Dear Mr. Hall:

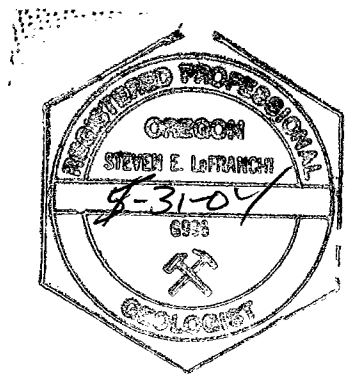
Environmental Science Associates, Inc. (***ESA***) is pleased to submit this report detailing the results of our recent aquifer test for the above referenced property. The purpose of the aquifer test was to determine the aquifer transmissivity, permeability, storage coefficient and specific capacity.

This report is intended for your exclusive use and duly appointed agents. Any other parties, without the express written permission of ***ESA***, should not rely upon the contents. The findings are based on conditions existing at the time of our site work.

We trust this report satisfies your immediate needs relative to this project. ***ESA*** appreciates the opportunity to be of service to you. Please review this report at your earliest convenience and contact me if you have any questions or comments.

Sincerely,

Steve LaFranchi, RG
Environmental Science Associates, Inc.



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1 Introduction

1.1 Purpose

Advanced Investment Corporation retained Environmental Science Associates, Inc. to perform an aquifer test on a well located at 92702 Triangle Lake Resort Road, Triangle Lake Oregon. The property is described as tax lot 105, Map 16 07 19 11, Lane County, Oregon. Figures 1, 2, 3 and 4 in Appendix A provide location, tax lot, aerial and topographic setting of the Site. The wells examined for the pumping test are owned by Mr. Larry Brown residing at 2301 Van Ness Street, Eugene, Oregon.

The aquifer test was performed to provide information on the long-term water supply available in the aquifer. Sufficient data was collected for analysis and determination of transmissivity, permeability, storage coefficient and specific yield.

The purpose of the aquifer test is to meet the conditions of tentative approval for the replat of a portion of the Lake View Subdivision to create 14 lots within the Rural Residential (RR-2) Zone as per Lane Code Chapter 13.050 and 16.244. Pertinent sections of the Lane Code that apply to the purpose and design of the aquifer test are:

(13) Water Supply. Lots and parcels shall be served by an approved public, community or individual water system. No construction or development work on proposed lots or parcels shall be started until information pertaining to water availability and quality is submitted to and approved by the Department. Water system shall be in accordance with and subject to applicable provisions of ORS, as well as all appropriate rules, regulations and policies promulgated under authority of these statutes, Lane Code and Manual. The establishment of rural water systems shall be consistent with RCP Goal 2 policy #24 and RCP Goal 11 policies.

(b) Individual Water Systems. When lots or parcels are to be served by individual water systems, sufficient evidence shall be submitted to show that each parcel or lot will have available at time of development an adequate supply of potable water which will meet minimum County standards for drinking water. Aquifer and quality tests as discussed in LC 13.050(13)(c) below may be required.

(c) Aquifer and Quality Tests or Geological Evaluation. Aquifer and quality tests or geological evaluation may be required by Lane County for any lot or parcel. These requirements may include, but need not be limited to, evaluation of existing well logs and preparation of a geological report on the area, an evaluation of the site by a professional geologist or engineering geologist or full scale aquifer tests as required. In determining the detail of analysis required, the following apply:

(i) Areas designated by Board order as having problems in the quantity or quality of available water as adopted, documented in Lane Manual and filed in the office of the Department shall meet the following requirements for all parcels less than 20 acres in size. The applicant must affirmatively demonstrate, in a manner acceptable to Lane County, that the proposed subdivision/partition is capable of sustaining the development anticipated with sufficient potable water. This demonstration must include, but need not be limited to, aquifer tests. More specifically, the aquifer test shall show coefficient of transmissivity, permeability, storage and the specific yield. The bacteriology/chemical tests shall show compliance with standards set by the Oregon State Health Division and

Lane County. The test procedure shall utilize standard acceptable practices for aquifer tests using pumped and observation wells and records of static water level, date, clock, elapsed time (in min.), depth of water, drawdown and recovery. Analysis using the non-equilibrium method (or other methods where appropriate) must be performed by a licensed geologist or engineer. A copy of all field notes and test results shall be submitted with the report, together with summary statements which indicate whether the proposed use of the aquifer could adversely impact the neighboring wells or properties or deplete the aquifer and the general impact of the proposed use.

(d) For all areas not designated as problem areas by the procedures documented in LC 13.050(13)(a) above, a pump test report or a well log report shall be supplied, unless determined by Lane County to be not necessary. Pump test and well log reports shall be prepared according to the following criteria:

(i) Pump Test. The test shall be a minimum five-hour pumping duration and record the following information: static water level, pumping level, drawdown, recovery, residual drawdown, well yield (pumping rate) and specific capacity. Measurements shall be made before pumping begins, during the pumping phase and during the recovery phase as necessary.

(ii) Well log reports shall include tax map showing the subject property and surrounding area, all well logs of record from adjacent and surrounding properties and the location of the wells on the tax lot map.

2 Site Description

On September 16th thru September 22nd, 2003, Mr. Steve LaFranchi, registered professional geologist with Environmental Science Associates, Inc. performed an aquifer test on a domestic well owned by Mr. Larry Brown. Mr. Brown familiarized Mr. LaFranchi with the operation and design of the well and water storage system. A second, inactive well located 400 feet south of the pumped well was utilized as an observation well.

2.1 Location and Description

The pumped well (OWRD ID L08850) is situated at 92702 Triangle Lake Resort Road near Triangle Lake, Oregon. The property is described as tax lot 105, Map 16 07 19 11 by the Lane County tax assessor. The observation well (OWRD ID L22509) is located on tax lot 100 Map 16 07 19 11 approximately 400 feet southeast of the pumping well.

Figures 1, 2, 3 and 4 in Appendix A provide map location, tax lot outline, an aerial overview and topography of the Site.

2.2 Physical Setting

2.2.1 Topography and Drainage

The well and subject property are located on a ridge saddle at an elevation of approximately 810 feet above mean sea level. Regional topography is very steep.

The Lake Creek watershed is located northwest of Eugene and covers approximately 68,772 acres. The watershed is within the Coast Range Province. The communities of Blachly, Horton, and Triangle Lake are within the watershed boundaries. The watershed is 94 percent forested with 6 percent composed of a variety of other nonforest vegetation types.

Triangle Lake is the largest water body in the Lake Creek Watershed. Triangle Lake is one of only two large natural lakes within the Oregon Coast Range. Triangle Lake is approximately 97 feet deep at its deepest point and is about 279 acres in size with a volume of about 14,500 acre/feet.

2.2.2 Climate

The Lake Creek watershed has a maritime climate characterized by mild temperatures with prolonged cloudy/overcast periods, wet winters, relatively dry summers, and a long frost free growing season. The temperatures are relatively mild with narrow diurnal fluctuations. Winter temperatures average 42° F. with the average daily minimum temperature being 35°; occasional periods of below freezing

conditions occur. In summer the average temperature is 64° F. with the average daily maximum being about 76° F. The precipitation ranges from 62 inches to 114 inches, with the majority (75 to 85%) occurring between October and April.

2.2.3 Geology and Geomorphology

The site is located in the Coast Range Physiographic Province which includes coastal mountains of Western Oregon from the Columbia River to the Middle Fork of the Coquille River, and from the continental shelf to the western edge of the Willamette Valley.

Stratigraphy: Four geologic units are exposed in outcrops, roadside excavations, and stream deposits in the Lake Creek Watershed. The most common rock formation of the watershed is the Flournoy Formation, which was deposited during the early to middle Eocene epoch. This rock unit consists of four to five thousand feet of very thick bedded sandstone with minor sequences of thinly-bedded siltstone and fine grained graded sandstone beds.

During Pleistocene times (between 0.01 - 1.6 million years ago), a block of Flournoy sandstone and siltstone moved from the north slope of the Lake Creek drainage, downhill to block Lake Creek. This large landslide resulted in the formation of Triangle Lake approximately 10,300 years ago (radiocarbon dating). Lake Creek eventually found an outlet near the south canyon wall, where it is incised in bedrock rather than in the landslide debris. Triangle Lake is only the remnant of a former larger body of water that extended upstream beyond Horton. Most of the old lake has been filled in with alluvium, and Triangle Lake is reportedly 97 feet at its deepest. Little Lake formed uphill from the landslide block and is believed by some to be a large "sagpond" which is typical of rotational landslide terrain.

Alluvium, of Holocene and Pleistocene age, is deposited along Lake Creek and its main tributaries upstream from Triangle Lake. This material is comprised of floodplain and stream channel sediments consisting of clay, silt, sand, and gravel.

In mapping conducted by Ewart Baldwin in 1956 [. Baldwin, E.M. 1956. " Geologic Map of the Lower Siuslaw River Area, Oregon ". U.S. Geological Survey, Oil and Gas Investigations Map OM 186.] , a fault trending in a southwest-northeast direction was identified east of Triangle Lake on the eastern end of the Lake Creek Watershed. The downthrown side is on the east side of the fault.

The subject property is located on or near the terminus of the landslide that blocked Lake Creek forming Triangle Lake.

The geomorphology of the area in the vicinity of the site is characterized by sharp ridges with steep, uniform sideslopes from the ridgetop to the valley bottom. The landscape is sharply dissected by numerous stream channels that may become

extremely steep in the upper reaches. Translation landslides (debris torrents) appear to be a dominant factor in shaping the landscape and contributing sediment (both coarse and fine) to the stream system.

3 Aquifer Pump Test

On September 17-22, 2003, ESA conducted a 126-hour aquifer test to characterize the hydrogeology for well ID L08850 owned by Mr. Larry Brown. Mr. Steven LaFranchi, registered Oregon geologist (#G996) performed the test. The well, pump, storage vault and discharge valve from the vault were operated by Mr. LaFranchi. Access to the pressure tank, valve, power supply and storage vault was secured by a locked door.

The pumping well is located on tax lot 105, Lane County map 16 07 19 11. Well ID L22509 located approximately 400 feet to the southeast of well L08850 was monitored to determine if drawdown in groundwater level was observed during the pump test. A Solinst Levelogger™ pressure transducer was placed in both wells to record groundwater level throughout the pump test. Barometric compensation corrections to data collected by the Leveloggers were performed using a Solinst Barologger™ pressure tranducer. The Leveloggers and Barologger were programmed to record the same interval and time synchronized.

Background data was collected for 31 hours beginning September 17th at 1100 Hrs to establish the aquifer had ***"sufficient rest time from the time it was last pumped to be at completely static conditions"***.

The Solnist Leveloggers were set at a depth of approximately 310 feet in pumping well L08850 (~ 210 feet below static water level) and at 152 feet in observation well L22509 (~38 feet below static water level). The static water level was 102.38 feet at the beginning of the test in well L08850. At the end of the test the static water level was 103.25 feet. Static water level in the observation well (L22509) was 114.69 feet at the beginning of the test and 114.85 at the end of the test.

The pumping test was initiated on September 17th at 1100 Hrs and ended on September 22nd at 1721 Hrs. The installed Grundfos 10S10 submersible well pump could not be isolated for the pumping test from the pressure tank and water storage system. A valve next to the pressure tank was turned open and a discharge rate of 1.7 gallons per minute maintained throughout the aquifer test from the water storage vault.

A discharge rate of 1.86 gallons per minute is approximately 0.465% of the well yield observed during the well test conducted by C&M Pump Company on August 5th, 1997. Because the well pumps to a storage system, the well pump is only activated after approximately 650 gallons of water have been removed from the storage vault. The storage capacity of the vault is 3000 gallons. A float switch actuates the pump once the water level in the vault drops to a preset level representing ~650 gallons.

To compensate for the inability to isolate the pumping well from the pressure tank and storage vault, a long duration aquifer test was performed to establish the aquifer transmissivity, hydraulic conductivity and storage coefficient. The specific capacity was derived from the C&M pump test (4 gallons/min no further drawdown in well with pumping duration of ~ two hours).

Driscoll (1986) describes how draw-down from an intermittently pumped well can be utilized to estimate aquifer characteristics by employing the average draw-downs, and consequently calculated hydrologic parameters. According to Driscoll (1986), the hydrologic values determined from the data are within 1 to 2 percent of values calculated with steady pumping rates. Similar observations have been made by Jenkins (1970) in relation to drawdown at a distance from an intermittently pumping well.

Review of the well displacement vs. time graphs in Appendix B and C demonstrate the uniform pumping cycle and recovery for the well during the test. The average cycle time of drawdown and recovery was 415 minutes or approximately 3.5 cycles per day. A total of 11 drawdown and recovery phase cycles were completed during the aquifer test.

At a constant discharge rate of 1.86 gallons/minute, the well furnished 2,678 gallons of water per day. The static water level in the well at the beginning of the well test was 102.38 feet. Drawdown during the test averaged 89.9 feet per cycle with minimal deviation on the order of less than one foot. This is confirmed by the uniform storage volume discharged and replaced during the 415 minute cycle.

Based on the well depth of 340 feet the water column in the well was 237.62 feet. The well screen was set from consisting of 3/16 inch perforations, 6 inches long (52 total) are located from 320 – 340 feet in the well. During the pumping test approximately 120 feet of water column remained in the well above the Grundfos pump after each drawdown pumping cycle.

The pumping data was analyzed using AqteSolv for Windows ver. 3.50 software and the Papadopulos-Cooper method. A mathematical solution, Papadopulos-Cooper (1968) is useful for determining hydraulic properties (transmissivity, hydraulic conductivity and storativity) and includes solutions for well bore storage effects for pumping tests performed in confined, unconfined, leaky and fractured aquifers. Analysis involves matching the solution to water-level displacement data collected during a pumping test.

The Papadopulos-Cooper method calculated the following aquifer characteristics:

The Storage Coefficient or storativity (S) defined as the volume of water a unit volume of aquifer release from storage under a unit decline in hydraulic head. The Papadopulos-Cooper method yielded a value of S = 3.318E-6.

Transmissivity (T) is a measure of the amount of water that can be transmitted horizontally through a unit width by the full saturated thickness of the aquifer under a hydraulic gradient of 1. Papadopulos-Cooper produced a value of T = 16.16 ft2/day.

Hydraulic conductivity is a measure of the capability of a formation (geologic formation) to transmit water. The hydraulic conductivity is given the symbol K and has dimensions of L/T (L is length, T is time). The value of K derived from the pumping test is K = 0.06463 ft/day.

The Specific Capacity of the well of C was determined by the well test conducted by C&M Pump Company on August 5th, 1997. The well was able to produce a sustained yield of 4 gallons per minute without change in the aquifer level. A specific capacity (C_s) of 3.42 was calculated using $C_s=Q/\Delta h_w$. The units of specific capacity are ft^3/day/ft.

Based on the yield test conducted by C&M, the calculated sustained daily production from well L088550 is 5,760 gallons/day. The pump test demonstrated at a discharge rate of 1.86 gallons/minute or 2,678 gallons/day the aquifer recovered and no effect was seen in water level of the observation well L22509.

Generally accepted practice is if two methods of calculating an aquifer characteristic are within an order of magnitude (10x) they are considered to have reasonably good agreement. The calculated rate for pumping determined by the ESA aquifer test (22,454 gallons/day, i.e. Cooper-Jacob straight line method $T = 2.3Q/4\pi\Delta(h_o-h)$) where Q is pumping rate) is 15.59 gallons/minute or 3.9 times the calculated value from the C&M pump test (5,760 gallons/day, i.e. 4 gpm x 1440 min). The difference in pumping rates is primarily a function of h_o-h from incomplete drawdown during the pumping test because the well pump could not be isolated from the water storage/pressure tank system.

The calculated value of 15.59 gallons/min is similar to the C&M pump test value of 12.5 gallons/min for the observation well.

The transmissivity (T) calculated from the C&M pump test is 76.6 ft^2/day (Razack and Huntley, 1991 $T=33.6(Q/(h_o-h)^{0.67})$ or 4.7 times the aquifer test derived value of 16.16 ft^2/day using Papadoupulos-Cooper and the Levelogger data.

4 Groundwater Resource

The Advanced Investment Corp. plans to replat their property into seven parcels with a single residence on each parcel. The water use of a typical residence is 50 gallons per day per person with a range of 20-80 gallons per person (Fair and Geyer, 1958). Others place the average residential per capita water consumption at 110 gallons per day with a range of 100-130 gallons (Hammer, 1986). Both estimates include water use for irrigation of a residential lot.

Based on an average family of three per dwelling and using the most conservative estimates of consumption a value of 390 gallons per day is calculated. The pumping test completed by ESA demonstrated the well met a daily demand of approximately 2,678 gallons without any significant decay in well recovery or effect on the observation well (L22509). Using a conservative consumption rate of 500 gallons per day per household the existing well (L08850) and water storage system could support five residences.

The installation of 3 new wells with similar construction and intersection in the aquifer, and use of a water storage tank system could conservatively meet demand of the proposed fourteen households with a buffer of over 500 gallons.

The aquifer test and C&M pump test demonstrates there is ample supply from the groundwater resource to meet the anticipated needs required by the replat.

Analysis of well logs surrounding the proposed replat and tested well (T16S, R7W, Sec 19) indicates that for 10 recorded wells with Oregon Water Resources, the average production is 24.4 gallons per minute. The number is very close to the calculated pumping rate calculated from the data collected during the pumping test (15.59 gallons/minute). A pumping test on well L22509 (observation well) performed by C&M in 1998 demonstrated a well capacity of 12.5 gallons/minute.

Well outputs in the vicinity of the site ranged from 6 to 50 gallons per minute.

The aquifer test conducted in September, a period when recharge is low and demand high indicates the aquifer will meet the additional demand proposed by the development. In addition, the absence of any measured drawdown in the observation well located 400 feet south of the pumping well confirms the aquifer can meet greater demands without deleterious impact to the aquifer.

5 Summary and Conclusions

A aquifer pumping test was performed for Advanced Investment Corp on using a well located on property described as tax lot 105, Map 16 07 19 11 by the Lane County tax assessor. The well pumped is identified by Oregon Water Resources as L08850. A second well (L22509) located 400 feet southeast of the pumped well was used as an observation well. Both wells are owned by Mr. Larry Brown and were used with his permission for this hydrogeologic study.

Monitoring of the wells was accomplished by placing Solnist Levelogger pressure transducers in the well. The Leveloggers recorded well information on 30 second intervals for the entire test. A Solnist Barologger pressure transducer recorded changes in barometric pressure for use in barometric compensation of the well data.

The pumping well could not be pumped at a constant rate for the test because the well is connected to a pressure tank and water storage vault that contains approximately 3000 gallons of water. The well pump is actuated when a float valve indicates approximately 650 gallons of water have been removed from the storage containment. A valve was opened at a constant rate of 1.86 gallons or approximately 0.465% of the well yield indicated by an August 1997 well test performed by C&M Pump Company.

The aquifer demonstrated through eleven pumping cycles the ability to drawdown and recover without evidence of a decline in recovery over the duration of the test.

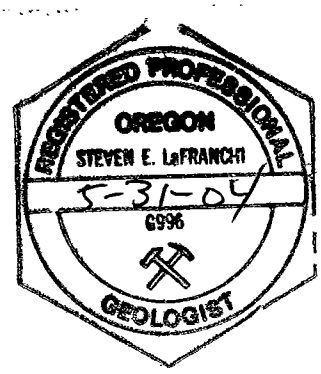
At a system discharge rate of 1.86 gallons/minute the aquifer delivered 2,678 gallons of water per day to the water storage tank.

Data collected by the Solnist Leveloggers was analyzed using AqteSolv for Windows ver. 3.50 software. The Papadopulos-Cooper method was used to determine the aquifer parameters of transmissivity, hydraulic conductivity and storativity. Based on the pumping test and analysis of collected data, transmissivity (T) is 16.16 ft^2/day, hydraulic conductivity (K) is 0.6463 ft/day and storativity is 3.318E-6. The specific capacity was derived from the earlier pumping test of C&M and is 3.42 ft^3/day/ft.

Based on the information collected from the pumping test there is adequate water supply from the existing Brown well to conservatively meet the needs of an additional four households using approximately 500 gallons/day. The pump test did not identify conditions that would indicate the Brown well would have problems providing the water necessary. The aquifer characteristics observed during this test support installation of additional similarly configured wells and storage systems within the proposed replat. The absence of any drawdown effect on the observation well located 400 feet southeast of the pumping well demonstrates the aquifers ability to recharge at pumping rates required for residential consumption and density proposed by the replat.

ENVIRONMENTAL SCIENCE ASSOCIATES, INC.

Steven LaFranchi, RG



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7 Limitations

Environmental Science Associates, Inc. has performed the professional services contained herein with the degree of care and skill exercised by reputable environmental consultants in this region. Our findings and recommendations have been prepared in accordance with customary principles and practices in the field of hydrogeology. ESA is not responsible for the independent conclusions, opinion or recommendations made by others based on the records review, site observations, and field exploration presented in this report. ESA assumes no liability or responsibility on any opinions or recommendations contained herein.

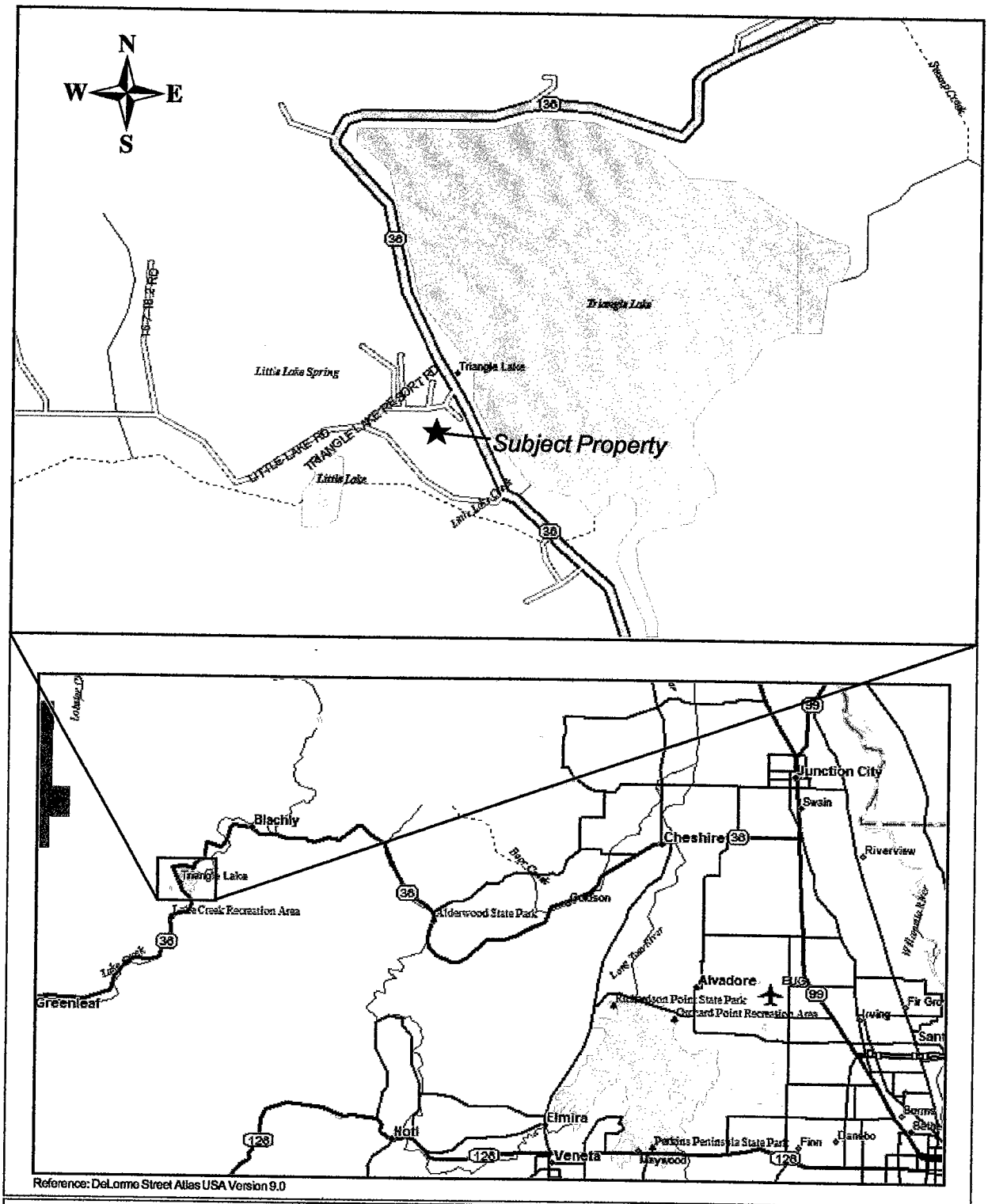
Please note hydrogeologic investigations are inherently limited in the sense conclusions are drawn and recommendations developed from information obtained from limited research and site evaluation. For these types of evaluations it is often necessary to use information prepared by others and ESA cannot be responsible for the accuracy of such information. In addition, the passage of time may result in a change in the geology or hydrogeology at this site and surrounding properties. This report does not warrant against future operations or conditions, nor does this warrant operations or conditions present of a type or at a location not investigated.

The opinions and recommendations are based on the time of the investigation. We are unable to report on or accurately predict events, whether occurring naturally or caused by external forces, that may change Site conditions.

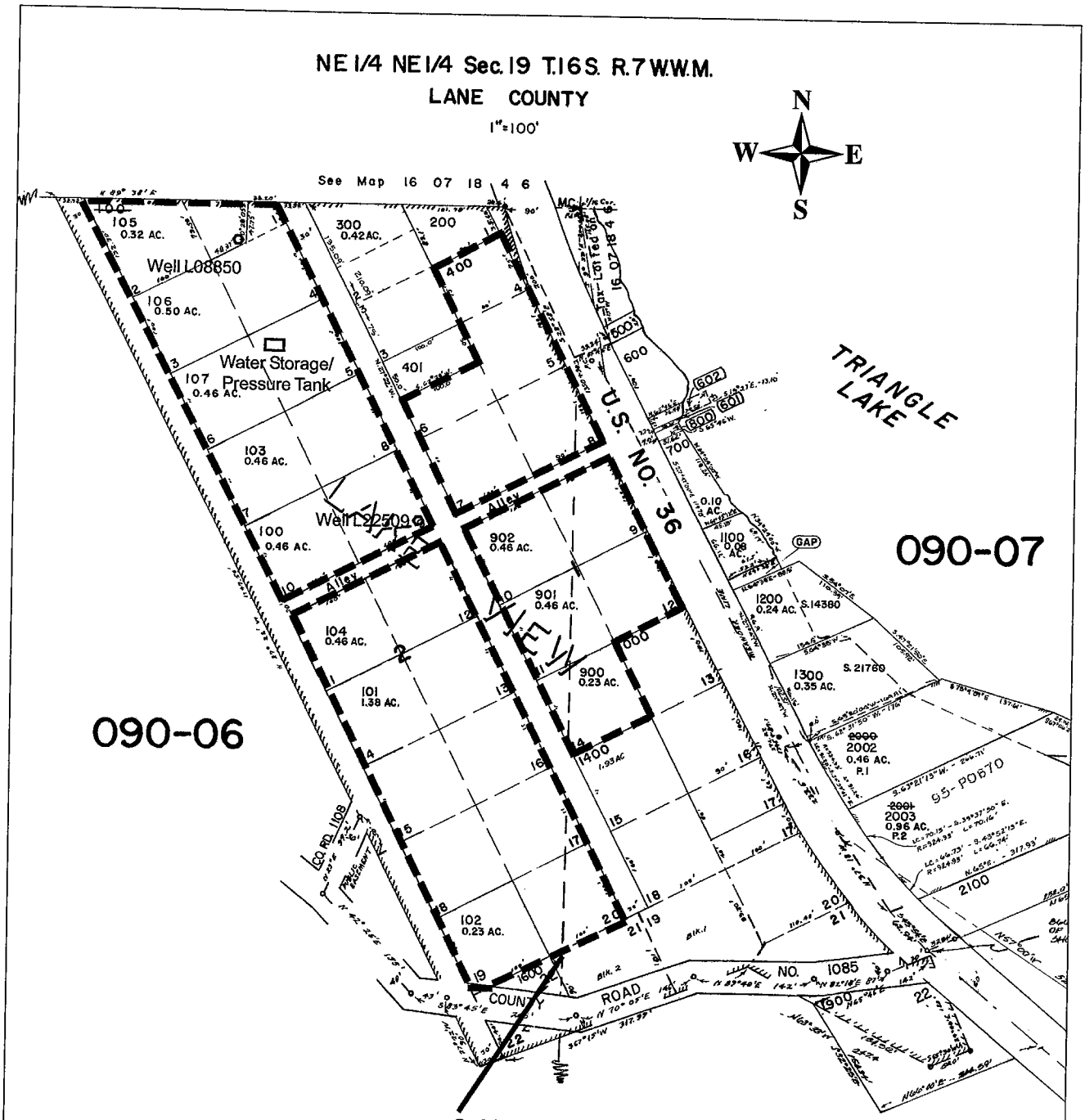
This report is intended for the sole use of Advanced Investment Corp. Our services were performed in accordance with ***ESA***'s agreement and understanding with, and solely for the use of, the client. Opinions and/or recommendations are intended for the client, purpose, site, location, time frame and project parameters indicated. ***ESA*** is not responsible for subsequent separation, detachment or partial use of this document. Any use of this report by a third party shall require the express consent of ***ESA*** and the client. Use of this report by said third party shall be at their sole risk.

APPENDIX A

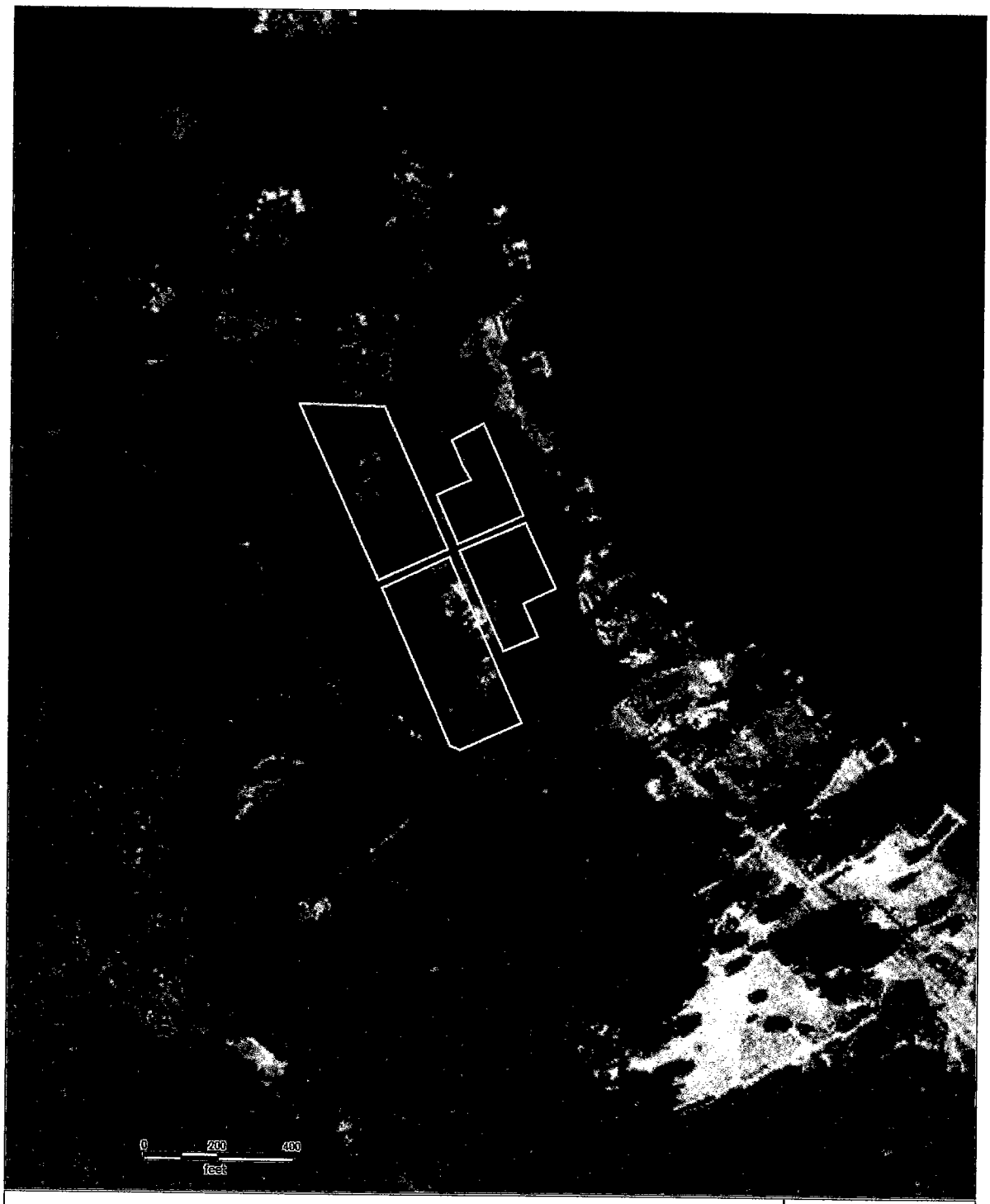
FIGURES



Larry Brown/Advanced Investment Corp. Triangle Lake, Oregon 97412 Tax Map 16-07-19-11; Tax lots 100-107, 400 & 900-902	**SITE LOCATION MAP**	FIGURE 1
Environmental Science Associates, Inc.	Drawn by: SLF	09/04/03



Larry Brown/Advanced Investment Corp Triangle Lake, Oregon Map 16 07 19 11; Tax lots 100-107, 400 & 900-902	**TAX LOT/WELL LOCATION MAP**		FIGURE 2
Source: Lane County Tax Assessor	Environmental Science Associates, Inc.	01/26/04	



Larry Brown/Advanced Investment Corp.
Triangle Lake, Oregon
Map 16 07 19 11 Tax lots 100-107, 400, & 900-902

2000 AERIAL

FIGURE 3

Source: USGS 2000 DOQ t44123-b5	Environmental Science Associates, Inc. 1/26/04	Scale: 1" = 400'