Commission Staff Report

To Facilities Committee

DATE: April 28, 2016

COMMISSION MEETING DATE: May 26, 2016

SUBJECT: 2016 Geothermal Facility Operating Protocol – Steam Field Operations Forecast Report April 2016; Applicable to the following projects: Geothermal

AGENDA CATEGORY: Consent

FROM:	Ken Speer Assistant General Manager	**METHOD OF SELECTION:**
Division:	Generation Services	N/A
Dept.	Geothermal	

IMPACTED MEMBERS:

All Members		**City of Lodi**	X	**City of Ukiah**	X
Alameda Municipal Power	X	**City of Lompoc**	X	**Plumas-Sierra REC**	X
Bay Area Rapid Transit		**City of Palo Alto**		**Port of Oakland**	
City of Biggs	X	**City of Redding**		**Truckee Donner PUD**	
City of Gridley	X	**City of Roseville**	X	**Other**	
City of Healdsburg	X	**City of Santa Clara**	X		

If other, please specify.

Place an X in the box next to the applicable Member(s) above.

SR: xxx:16

RECOMMENDATION:

Adopt Resolution 16-XX approving the 2016 Steam Field Operations Forecast Report dated April 2016 as the Geothermal Operating Protocol effective July 1, 2016. This Operating Protocol is to remain in effect until replaced by the Commission.

BACKGROUND:

The 2016 Steam Field Operations Forecast Report is an in depth study of The Geysers reservoir relative to the operation of NCPA's Geothermal facility and provides a generation forecast of the facility. This report will act as the Operating Protocol with the goal of maximizing the generation output.

The Operating Protocol currently uses a two zone strategy with wells on the west side of the NCPA lease producing to both Units #1and #2 of Plant #1. Wells on the east side of the NCPA lease produce to Plant #2, Unit #4. This Protocol will maximize generation while allowing for scheduling flexibility and reduction of load under the proper economic conditions. The Protocol establishes a 2016 annual generation target of 100.3 MW gross.

FISCAL IMPACT:

The 2016-17 approved Geothermal budget covers the proposed action.

SELECTION PROCESS:

Not applicable.

ENVIRONMENTAL ANALYSIS:

This activity would not result in a direct or reasonably foreseeable indirect change in the physical environment and is therefore not a "project" for purposes of Section 21065 the California Environmental Quality Act. No environmental review is necessary.

COMMITTEE REVIEW:

The recommendation above was reviewed by the Facilities Committee (*on May 4, 2016 and was recommended for Commission approval.*) *For Facilities Committee meetings where a quorum was not present:* No formal action was taken due to the lack of a quorum, however, the Project participants present at the meeting voiced their support for the recommendation below and no other meeting attendees had any objections.

Respectfully submitted,

RANDY S. HOWARD
General Manager

Attachments (2):
- Resolution
- Steam Field Operations Forecast Report – April 2016

SR: xxx:16

RESOLUTION 16-XX

RESOLUTION OF THE NORTHERN CALIFORNIA POWER AGENCY APPROVING THE 2016 STEAM FIELD OPERATIONS FORECAST REPORT AS THE 2016 GEOTHERMAL OPERATING PROTOCOL

(Reference Staff Report #xxx:16)

WHEREAS, the Northern California Power Agency (NCPA) operates and maintains on behalf of the project owners a Geothermal Facility near Middletown, CA, consisting of two power plants with containment areas, and 80 steam production and injection wells connected by roads; and

WHEREAS, the 2016 Steam Field Operations Forecast Report is an in depth study of The Geysers reservoir relative to the operation of NCPA's GEO facility and provides a generation forecast of the facility. This report will act as the Operating Protocol with the goal of maximizing the generation output. The Operating Protocol currently uses a two zone strategy with wells on the west side of the NCPA lease producing to both Units #1 and #2 of Plant #1. Wells on the east side of the NCPA lease produce to Plant #2, Unit #4. This Protocol will maximize generation while allowing for scheduling flexibility and reduction of load under the proper economic conditions. The Protocol establishes a 2016 annual generation target of 100.3 MW gross; and

WHEREAS, 2016-17 approved budget covers the proposed action; and

WHEREAS, this activity would not result in a direct or reasonably foreseeable indirect change in the physical environment and is therefore not a "project" for purposes of Section 21065 the California Environmental Quality Act. No environmental review is necessary; and

NOW, THEREFORE BE IT RESOLVED that the Commission of the Northern California Power Agency approves the Steam Field Operations and Forecast Report dated April 2016 as the Geothermal Operating Protocol effective July 1, 2016, to remain in effect until replaced by the Commission.

PASSED, ADOPTED and APPROVED this _____ day of _____ 2016, by the following vote on roll call:

	Vote	Abstained	Absent
Alameda			
BART			
Biggs			
Gridley			
Healdsburg			
Lodi			
Lompoc			
Palo Alto			
Port of Oakland			
Redding			
Roseville			
Santa Clara			
Truckee Donner			

Ukiah			
Plumas-Sierra			

CAROL GARCIA
CHAIRPERSON

ATTEST: CARY A. PADGETT
ASSISTANT SECRETARY

GEOTHERMAL FACILITIES

NCPA
NORTHERN CALIFORNIA POWER AGENCY

Steam Field Operations

Forecast Report – April 2016

NCPA
Generation Services – Geothermal Facilities

Steam Field Operations and Forecast Report

April 2016

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NCPA
Generation Services Business Unit
Steam Field Operations and Forecast Report

April 2016

Introduction

This report provides an update on the status of the NCPA Geothermal Project. There are three main sections:

I. A review of steam field operations including annual production and injection volumes, the Geothermal Operating Plan, water injection program, and projects.

II. A review of 2015 reservoir performance and generation.

III. A 2016 generation forecast.

Analysis of geothermal reservoir during 2015 indicates a better than expected increase in steam production. The 2016 decline rate is projected to be about 1.9% versus last year's 2.3% projection. The average generating capacity for 2015 was 103.1 MW gross or 95.6 MW net. Gross generation for the year was 903.3 GWhrs with net generation of 837.4 GWhrs.

Water injection continues to be a major contributor to maintaining reservoir pressure and mitigating steam production decline rates. Due to statewide drought conditions, there was a reduction in flow from the Southeast Geysers Effluent Pipeline (SEGEP) project during the first four months of the 2015. The SEGEP water is a combination of wastewater and freshwater which is used to supplement injection at The Geysers. Under drought conditions, the freshwater component became unavailable from April 30, 2014 through May 1, 2015. Once restored, injection rates increased and water injection for 2015 was up 20% from 2014 and averaged 3,398 gpm.

The 2016 generation forecast projects the average generating levels to be 100.3 MW gross or 91.5 MW net for the year. The 2016 levels are reduced mainly because Plant #2 had a five week overhaul in April 2016 and will also have another two week outage this coming fall to tie-in the new Unit #4 main steam pipeline. It is calculated that the NCPA geothermal facilities will generate 882.8 GWhrs gross or 802.2 GWhrs net in 2016. The 25 year projected gross reserves are estimated to be 18,419 GWhrs or 16,609 GWhrs net.

In terms of fiscal year, the gross generation is estimated to be 869.4 GWhrs with net generation of 802.6 GWhrs in FY 2016. The respective gross and net generation projected for FY 2017 is 890.6 GWhrs and 812.5 GWhrs.

I. STEAM FIELD OPERATIONS

In This Section

- Overview of Annual Production and Injection
- Geothermal Operating Plan
- Water Injection Program
- Steam field Projects

A. Overview of 2015 Production and Injection

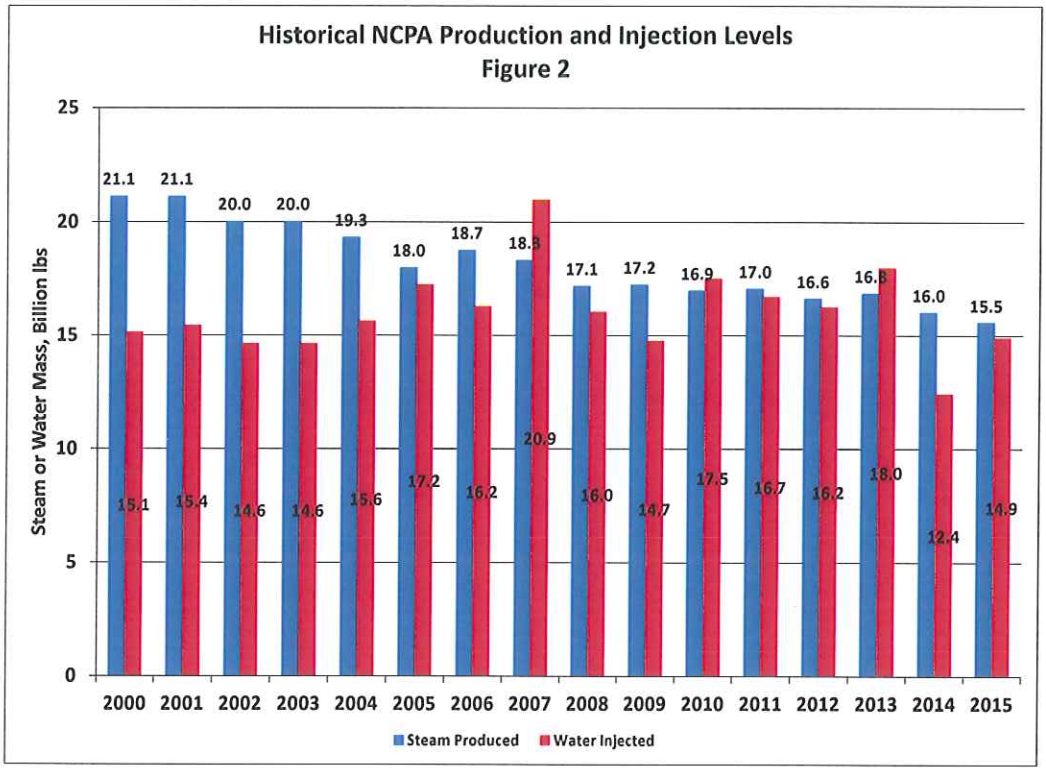
NCPA continued to operate the Geothermal Project as a base load facility in 2015. Steam production for the year was 15.5 Glbs with water injection of 14.9 Glbs for an annual mass replacement ratio of 96.1%. Water injection on the NCPA lease is a combination of steam condensate recovered from the cooling towers and wastewater from the Southeast Geysers Effluent Pipeline (SEGEP). In 2014, drought conditions resulted in lower lake levels in Clearlake which by agreement forced a reduction in the amount of wastewater being supplied to The Geysers. Increased rainfall and a higher lake level restored this component on May 1, 2015. As a result, the average injection rate increased approximately 20% from the previous year to 3,398 gpm.

The cumulative mass replacement ratio from plant startup in 1983 through 2015 was 63.4% *(Figure 1)*. The net mass withdrawal of steam from the reservoir (Mass Produced less Mass Injected) through 2015 is 229.4 billion lbs.

The average annual generation for 2015 was 103.1 MW gross or 95.6 MW net. The average generation is down from 2015 because of continued steam field decline. In 2016, generation levels are projected to be 100.3 MW gross or 91.5 MW net.

Production Highlights during 2015 include:

- Annual average gross generation in 2015 was 103.1 MW or 95.6 MW net.
- Average annual mass replacement (i.e., the percentage of steam production replaced by water injection) was 96.1% in 2015 compared to 77.5% for 2014. The 2015 average injection rate was 3,398 gpm which was about a 20% increase over the previous year. The increase was due to higher amounts of rainfall and easing of restrictions associated with the drought.
- In 2016, the average generation is projected to be 100.3 MW gross or 91.5 MW net.



B. Geothermal Operating Plan

The Geothermal Project Operating Agreement requires the NCPA Commission to establish an Operating Plan and an annual operating level for the Geothermal Units. The purpose of the plan is to maximize the efficient use of the geothermal resource, protect the power plants and equipment, and meet all regulatory and permitting requirements.

A Geothermal Operating Plan, effective July 1, 2015, was approved and recommended by the Coordinated Operating Group (COG), the Generation Services Business Unit, and the NCPA Commission during the May 21, 2015 meeting. The Plan establishes an Operating Protocol that maintains a Two Zone operation within the NCPA lease. The Two Zone Operation was implemented to improve operational response time during a unit trip at Plant #1 and maximize generation on the NCPA lease while minimizing reservoir communication with nearby competitor operations.

Under the current Protocol, steam production from the west side of the lease, Zone 1, is directed to Units #1 and #2 at Plant #1. Steam production from the east side of the lease, Zone 2, is directed to Plant #2, Unit #4 *(Figure 5)*. Combining zones is periodically tested to determine if the overall generation from both plants can be increased, but has generally resulted in a net loss of generation. The current Protocol effectively utilizes steam production, improves performance at the plants, and is in compliance with existing permits and regulations.

While the Protocol maximizes generation, it does allow for scheduling flexibility and reduction of load under the proper economic conditions. Sustained curtailments of Plants #1 and #2 are possible, but not recommended because recovery of the curtailed generation would take an extended number of years.

C. Water Injection Program

NCPA continues to operate the steam field in the manner intended to maximize the recovery of injected water. In order to maximize recovery, it is important to have sufficient water and distribute it over the widest possible area of the field. It is also necessary to inject water at the lowest possible rate to maximize the heat transfer between the reservoir rock and water. Other factors that weigh into water injection strategy are targeting hotter zones of the field and higher gas concentrations within the reservoir. The water injection program discusses NCPA's supplemental water source, the Southeast Geysers Effluent Pipeline (SEGEP), current injection operations, micro-earthquake activity and non-condensible gas trends as a result of the injection.

1. Southeast Geysers Effluent Pipeline (SEGEP)

The Southeast Geysers Effluent Pipeline (SEGEP) project is a pipeline bringing water to The Geysers for the purpose of supplementing water injection in the field. During normal years, NCPA receives an average 2,700 gpm out of 5,600 gpm water that is delivered. Injection of this water into The Geysers reservoir helps mitigate reservoir pressure declines and increases steam reserves. *Figure 6* shows the historical SEGEP deliveries for NCPA and the total for the project.

Beginning May 1, 2014, SEGEP deliveries were sharply reduced due to drought conditions in California. This was due to the fact that SEGEP water is comprised of approximately 65% fresh water from Clear Lake and 35% secondary treated waste water from Lake County. By agreement with Lake County, if the lake level is below 3.5 ft on the Rumsey gauge on May 1, the fresh water component is not available for extraction for one year. This occurred in 2014 because of drought conditions and as a result, the project delivered only wastewater at a rate of 1,776 gpm that year.

Steam production and generation production were not impacted largely because the SEGEP pipeline has been in operation for over 18 years and past injection helped minimize the effects of reduced injection for one year. The water level in Clear Lake was above 4 ft in late April 2015, so SEGEP water deliveries returned to normal on May 1, 2015 and the average flow rate for 2015 was 2,865 gpm.

2. Injection Operations

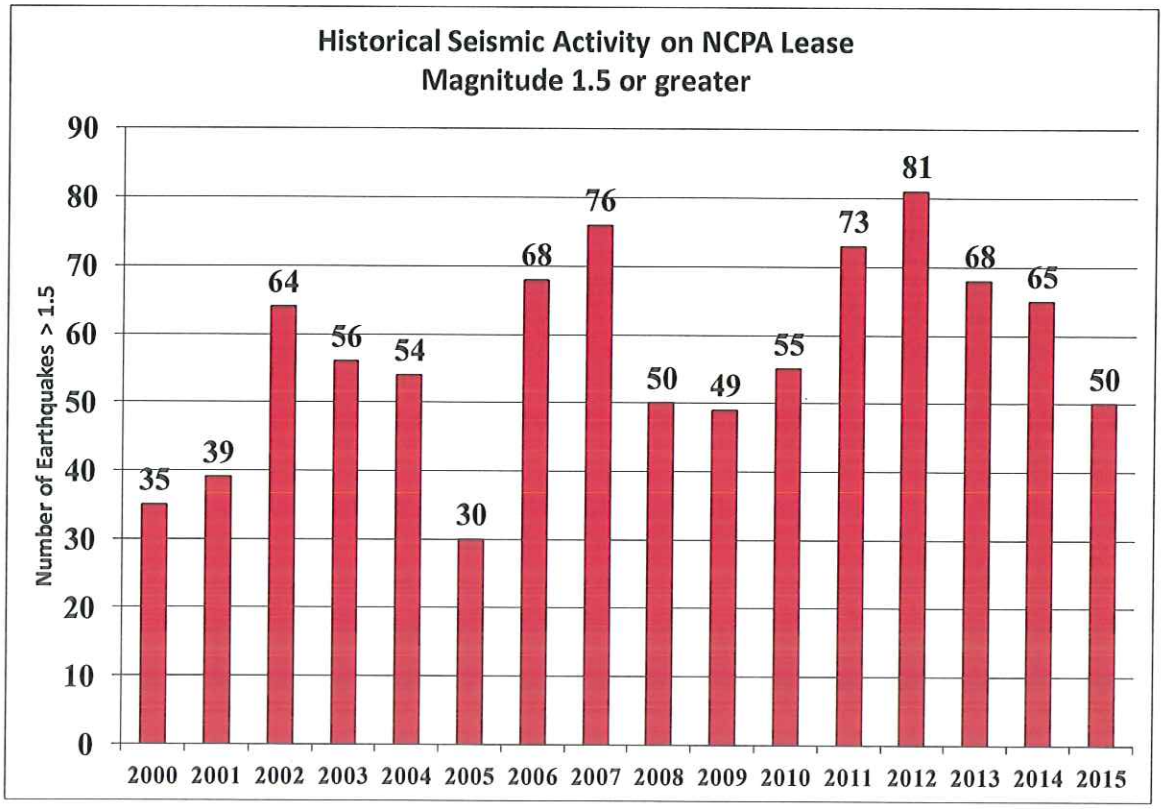
There were 14 different wells used for injection in 2015. The injection strategy continues to be an effort to spread water over large geographic area and limit injection rates down individual wells as much as possible. As part of this effort, the production wells, Q-4 and Q-7, were switched to injection wells on a temporary basis.

Figure 7 shows the relative location of the 14 injection wells on the NCPA lease. Eight of these wells, B-6, E-8, H-4, P-9, Q-1, Q-4, Q-7, and Q-10 were only connected to the SEGEP pipeline and therefore received only effluent or wastewater. One well, J-6, is a dedicated condensate injection well receiving water from Plant #2. The remaining five wells received a combination of condensate and wastewater. *Figure 8* and *Table 1* show the relative amounts and type of water each well received in 2015.

3. *Micro-earthquake Activity*

Studies by the United States Geological Survey (USGS) and others have demonstrated that the steam production and water injection at The Geysers can cause frequent micro seismic events to occur. As a result, NCPA and the other operators are required to continuously monitor and report on the earthquakes that occur within The Geysers geothermal field. *Figure 9* is a map showing the locations of the 757 seismic events of magnitude 1.5 and larger that occurred within The Geysers field during 2015. Seven of these events had an earthquake magnitude of 3.0 or greater. The largest seismic event was a magnitude 3.83 on a competitor lease.

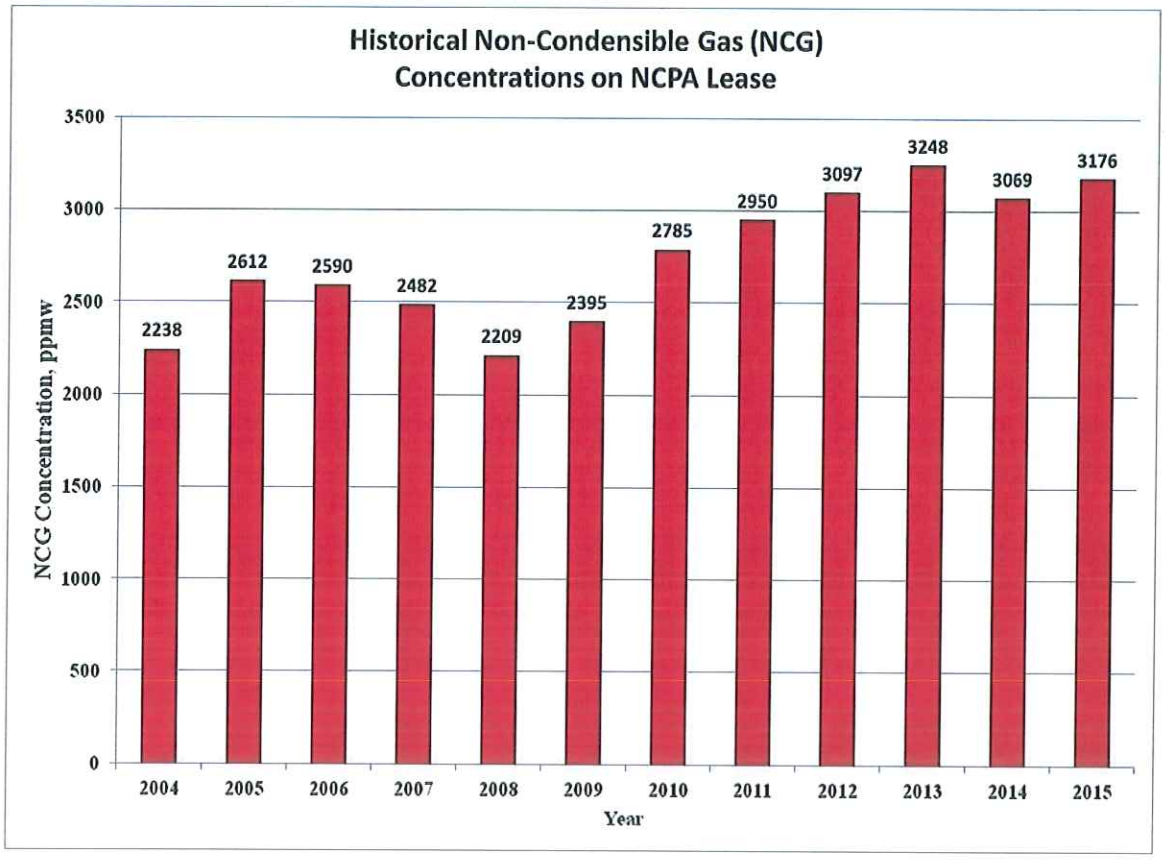
On the NCPA lease, there were 50 events of M=1.5 or greater. The largest event was a magnitude of 2.99 and occurred near NCPA's southern lease line. The figure below shows the historical seismic activity for the NCPA lease from 2000 through 2015. The seismic activity for 2015 was lower than the activity in 2014.



4. *Non-condensible Gas (NCG) Trends*

Non-Condensable Gas (NCG) is a natural product of the reservoir and may be present in varying concentrations within the steam that is produced at The Geysers. NCG production reduces plant efficiency and increases chemical treatment costs. The values vary significantly based on operating guidelines for the field, plant outages, or injection strategy. Water injection in areas of high gas concentration generally reduces NCG production and improves plant efficiency.

Table 4 shows an annual sampling of all the producing wells in the field and the analysis for NCG's. These values can vary somewhat based on daily operational changes and the adjustment of injection strategies within the field, but are considered to be 'typical concentrations' of NCG's for these wells. In spite of increased injection for the year, NCG concentrations were slightly up from the previous year. Figure 10 shows a comparison of the relative changes throughout the field.



D. Geothermal Facility Projects

Major projects completed in 2015 were:

- Geothermal Facility Road Repairs – The main road to the NCPA's Geothermal Plants #1 and #2 was repaired and re-striped. The project cost was $361,715 and completed on July 10, 2015.
- Q-Site Condensate Tank Replacement – The Q-Site condensate tank was heavily corroded and subsequently replaced. The project cost was $90,995 and it was completed on December 10, 2015.
- Plant #2 Yard Repair – A large 40 ft x 140 ft concrete pad was constructed in the Plant #2 yard to prevent asphalt damage from continued storage of phase separators and sulfur bins. Additional repairs to existing asphalt were also done. The project cost $281,892 and was completed on November 13, 2015.
- 21 KV Line Repair – On September 12, 2015, the Valley Fire destroyed the 21 KV line which supplies power to the Southeast Geysers Effluent Pipeline (SEGEP). It also destroyed the fiber optic line which provides the controls and instrumentation for the SEGEP pipeline. Several member cities sent their utility crews to restore both the 21 KV and fiber optic lines. The SEGEP pipeline was operating within three weeks after the shutdown and allowed the Lake County Sanitation District to return to operation. The repairs cost approximately $1,000,000.

In 2016, major projects that have been completed or will be initiated are:

- Ridge Road Guardrails – Following the Valley Fire, severe drop offs along Ridge Road developed due to the loss of trees. New guardrails were installed to improve safety along the road. The project cost was $135,200 and was completed on January 29, 2016.
- Plant #1 Cooling Tower Fan Blade Replacement – The Plant #1 cooling tower fan blades became worn out after years of service. The blades were replaced in January 2016 at a project cost of $145,475.
- Plant #1 and #2 Bridge Cranes – The bridge crane controls and motors for both Plants #1 and #2 have degraded with time and become unreliable. The controls and motors for Plant #2 were replaced in early 2016 in preparation for the Plant #2 overhaul. The controls and motors for the Plant #1 bridge crane are being replaced now. The total project cost is estimated at $200,000.
- Plant #2 Fire Line Replacement – The Plant #2 fire line is currently undergoing replacement and is about 30% complete. The project was originally budgeted for $300,000, but since it is being done with in-house labor, project costs should be significantly lower. Approximately $31,000 has been spent on the project to date.
- Unit #4 Main Steam Pipeline – A new Unit #4 main steam pipeline is being constructed for the purposes of reducing pressure losses and a minimum gain of 1 MW

in generation is expected. Phase 1 of establishing a tie-in point for the new pipeline has recently been completed. Phase 2 will begin in May 2016 with the construction of the main body of the pipeline. Phase 3 will be done sometime in Fall 2016 where the new pipeline will be tied into the plant and the new pipeline becomes active. The project was approved for the bid amount of $882,908 with additional contingency funds of $67,092 (15% above bid amount). Total project costs are not expected to exceed $950,000 with a project completion date of October 31, 2016.

- Knockout Pot Repair – Heat loss in the steam production pipelines causes some steam condensate or water to form in the lines. It is collected by knockout pots for reinjection back into the reservoir. Some of the knockout pots have collected significant debris and need to be repaired. Approximately 50 knockout pots have been checked, cleaned or modified. A project cost of $146,000 was authorized for the repair or refurbishment of the knockout pots. Approximately $67,000 has been spent to date. Completion of the project is expected in Fall 2016.
- Sedimentation Basin Repair – The concrete on the Sedimentation Basin needs to be repaired and re-coated to prevent any structural damage. Requests for bids were recently sent out and bid walks were conducted on April 14 and 18, 2016. The project was budgeted for $300,000 and it should be completed by June 30, 2016.

II. 2015 RESERVOIR PERFORMANCE REVIEW

In This Section

- Reservoir Pressure Distribution
- Reservoir Pressure and Flowrate Decline
- 2015 Generation Review
- 2016 Generation Forecast

Reservoir performance can be affected by a number of factors such as changes in the location or amount of water injected, the operating pressure of the field, gain or loss of production wells, or changes in the operation of nearby competitor leases. The effects of these changes on the reservoir are normally monitored by conducting pressure build-up tests on production wells, tracer tests on injection wells, and a continuous review of pressure, temperature, and flowrate data from the field. This section will discuss recent changes in reservoir pressure distribution, reservoir pressure decline, and steam field flowrate decline.

A. Reservoir Pressure Distribution

One of the most important parameters in predicting and explaining reservoir performance is static reservoir pressure. *Figure 11* shows areal pressure distributions of static reservoir pressures for April 2015 and April 2016. In general, wells on the west side of the field have the lowest reservoir pressures (< 80 psig) and the east side of the field continues to be the higher pressure area. Comparing reservoir pressures over the last year shows that wells in the southeast area of the field have increased in pressure. In general, the area of lowest reservoir pressures (<80 psig), has more than doubled in size over the last seven years.

B. Reservoir Pressure and Flowrate Decline

Changes in reservoir pressure over time are a function of the mass-replacement ratio. By injecting steam condensate and supplementing it with run-off fresh water and secondary treated waste water from the Southeast Geysers Project, the decline in reservoir pressures has moderated or slowed with time.

In 2015, 45 wells were shut-in at various times to conduct pressure build-up tests. The tests revealed that the average wellhead shut-in pressure was 84.3 psig or an average increase in wellhead pressure of 6.1 psig. This may be attributed to reduced injection earlier in the year and increased flashing of water to steam from higher reservoir temperatures. The average well on the NCPA lease flows 27,500 lb/hr at 43.1 psig.

The projected flowrate decline is shown in *Figure 13*. In 2015, the overall steam field flow rate averaged 1,833 klbs/hr. This flow rate is projected to be 1,792 klbs/hr in 2016. The projected overall steam field decline is a harmonic 1.9%. Continued and strategic injection of water over a wide area of the reservoir is expected to enhance recovery and provide better reservoir pressure support in future years.

C. 2015 Generation Review

Gross generation for the NCPA Geo Facilities in 2015 was 903.3 GWhr with net generation of 837.4 GWhr. For FY 2016, gross generation is estimated to be 869.4 GWhrs with net generation of 802.6 GWhrs. The 2015 gross generation capacity was an average of 103.3 MW while net generation capacity averaged 95.6 MW.

D. 2016 Generation Forecast

The updated forecast of future reservoir performance, and the resulting energy generation forecast for the NCPA geothermal plants, was developed using decline curve analysis in conjunction with a review of the 2015 computerized reservoir model projection. Included in the forecast are:

1. Operation of the steam field in a two zone operation.
2. Installation of new turbines in Units #1 and #2 in the spring and fall of 2013.
3. Although reduced in first four months of 2015, the continued benefits being derived from the Southeast Geysers Effluent Pipeline Project.

The most recently developed forecast of steam field operations is illustrated in *Figure 12*. This graph shows NCPA's 33 year historical data for both steam production and water injection, and forecasts of production and injection out to year 2040. With the startup of the Effluent Pipeline in September 1997, and with its continuous operation projected thereafter, it can be seen that the annual mass replacement is close to 100%. Starting around 2016, water injection will continually exceed production and a gradual decline in the level of steam production will approach a near-sustainable level of 80% of the mass of water injected.

The total amount of steam capable of being produced by NCPA through year 2040 is currently estimated at 323.5 billion pounds. Remaining gross generation reserves are estimated to be 18,419 GWhr with net reserves of 16,609 GWhr. *Figures 14* and *15* respectively show the projected net generation capacity and total net generation amount for 2016 through 2040. *Table 4* details the annual gross and net generation. A more detailed monthly five year forecast can be found in *Table 5*.

In 2016, it is estimated that the Geo Facilities will generate 882.8 GWhrs gross or 802.2 GWhrs net. Respective gross and net generation capacity levels for the year are projected to be 100.3 MW gross and 91.5 MW net. For, FY 2016, the respective gross and net generation amounts are projected to be 869.4 GWhrs and 802.6 GWhrs.

SUMMARY

Steam Field Operations

- The NCPA lease produced 15.5 Glbs steam while injecting 14.9 Glbs of water resulting in an average mass replacement of 96.1% for the year.
- The average gross generation capacity for 2015 was 103.1 MW gross while the net generation capacity was 95.6 MW net.
- The average water injection increased from 2,832 in 2014 to 3,398 gpm in 2015. This was mainly due to the restoration of wastewater from the Southeast Geysers Effluent Pipeline Project (SEGEP). Flows from the SEGEP Project were reduced in 2014 through the first four months of 2015 due to drought conditions. Flows from the pipeline were restored on May 1, 2015.
- Water recovery as Injection-Derived-Steam needs to be maintained to continue to benefit from the SEGEP Pipeline. The injection strategy going forward is to inject available water supplies over a greater area with the intent of maximizing its recovery over a shorter time period.

2015 Reservoir Performance Review

- There was a slight recovery of reservoir pressures mainly in the eastern area of the field due to reduced injection. This is attributed to the reduced injection levels, increased reservoir temperatures, and water reserves from past injection boiling off at an increased rate.
- Average shut-in wellhead pressure for the NCPA lease was 84.3 psig. The average well produces 27.5 kph at 43.1 psig.
- The steam field deliverability was 1,833 klbs/hr in 2015. The projected 2016 deliverability is 1,792 klbs/hr. The projected harmonic decline rate going forward is 1.9%.

2015 Generation Review and 2016 Generation Forecast

- Gross generation for 2015 was 903.3 GWhrs with net generation of 837.4 GWhrs. For FY 2016, gross generation is estimated to be 869.4 GWhrs with net generation of 802.6 GWhrs.
- The generation forecast covers the period from 2016-2040. Recoverable steam reserves are estimated at 323.5 billion pounds with the total amount of remaining gross generation estimated at 18,419 GWhr or net generation of 16,609 GWhr.
- The gross generation capacity for 2016 is projected to be 100.3 MW or 91.5 MW net. Gross generation for the year is projected to be 882.8 GWhrs or 802.2 GWhr net. For FY 2017, the respective gross and net generation amounts are projected to be 890.6 GWhrs and 812.5 GWhrs.

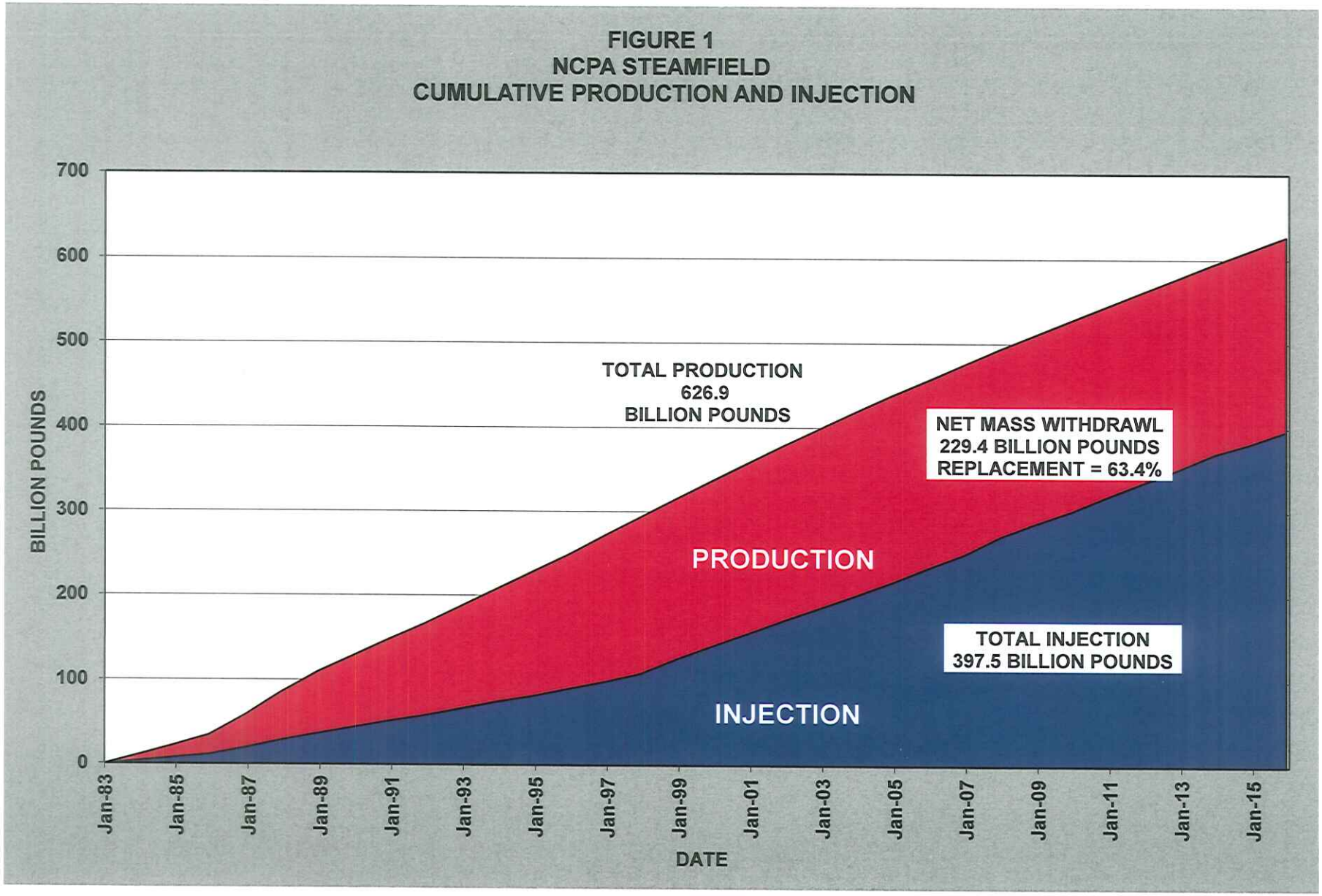


FIGURE 1
NCPA STEAMFIELD
CUMULATIVE PRODUCTION AND INJECTION
BILLION POUNDS
700
600
500
400
300
200
100
0
TOTAL PRODUCTION
626.9
BILLION POUNDS
NET MASS WITHDRAWL
229.4 BILLION POUNDS
REPLACEMENT = 63.4%
PRODUCTION
TOTAL INJECTION
397.5 BILLION POUNDS
INJECTION
Jan-83
Jan-85
Jan-87
Jan-89
Jan-91
Jan-93
Jan-95
Jan-97
Jan-99
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
DATE

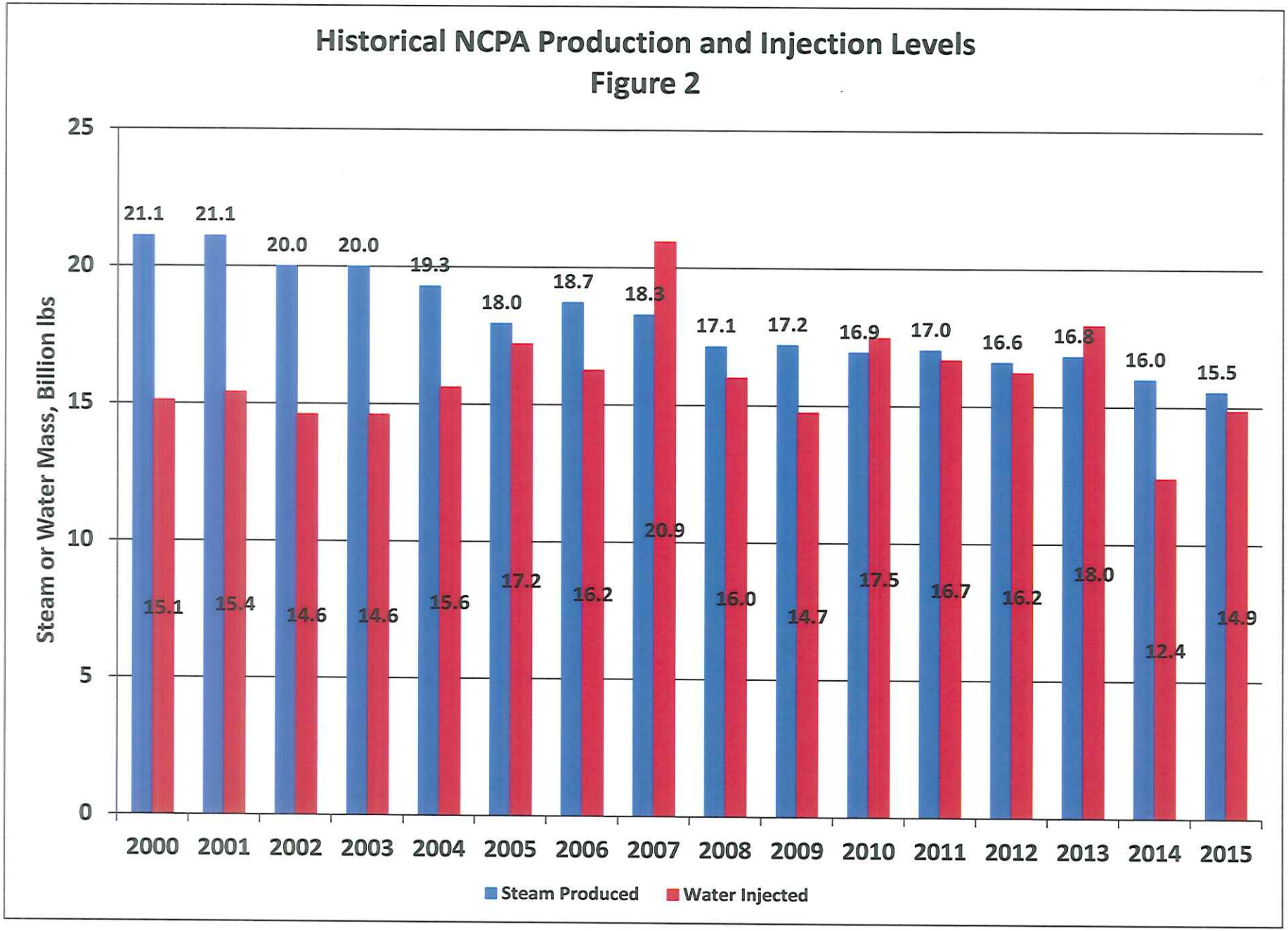
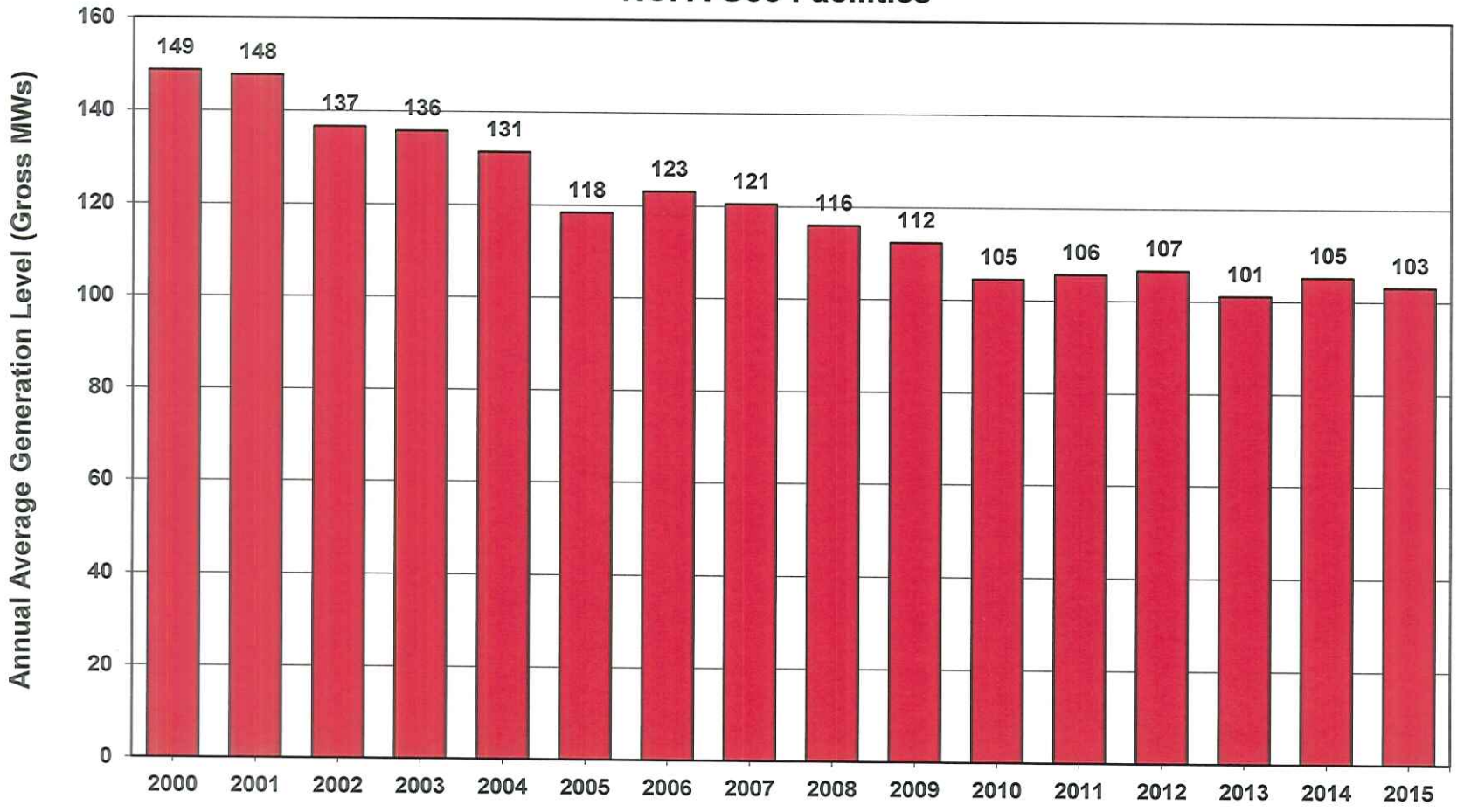

Historical NCPA Production and Injection Levels
Figure 2
Steam or Water Mass, Billion lbs
25
20
15
10
5
0
21.1
21.1
20.0
20.0
19.3
18.0
18.7
18.3
17.1
17.2
16.9
17.0
16.6
16.8
16.0
15.5
15.1
15.4
14.6
14.6
15.6
17.2
16.2
20.9
16.0
14.7
17.5
16.7
16.2
18.0
12.4
14.9
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Steam Produced
Water Injected

Figure 3. Historical Power Generation Levels
NCPA Geo Facilities



*Generation levels include downtime for unit outages and overhauls

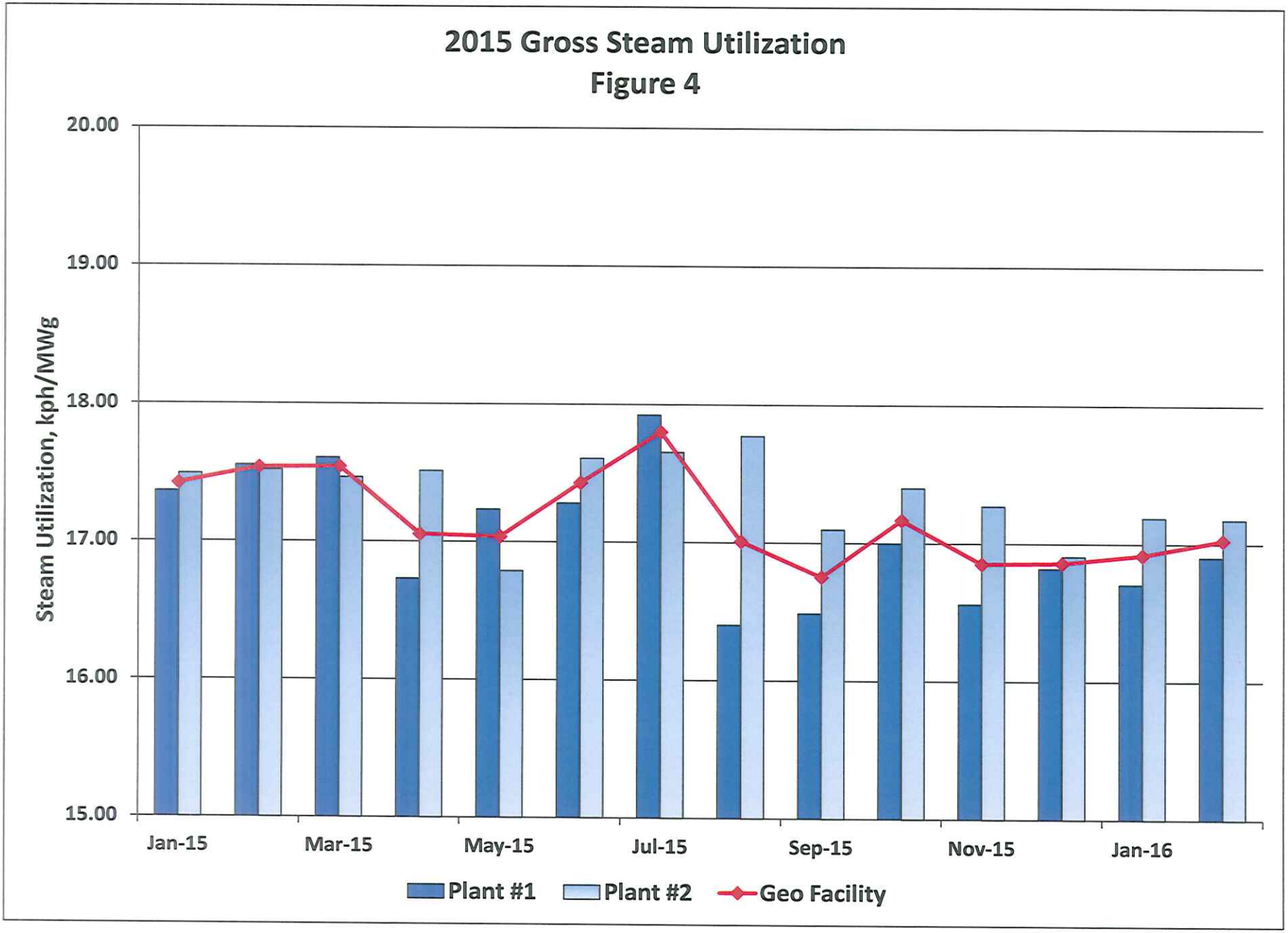
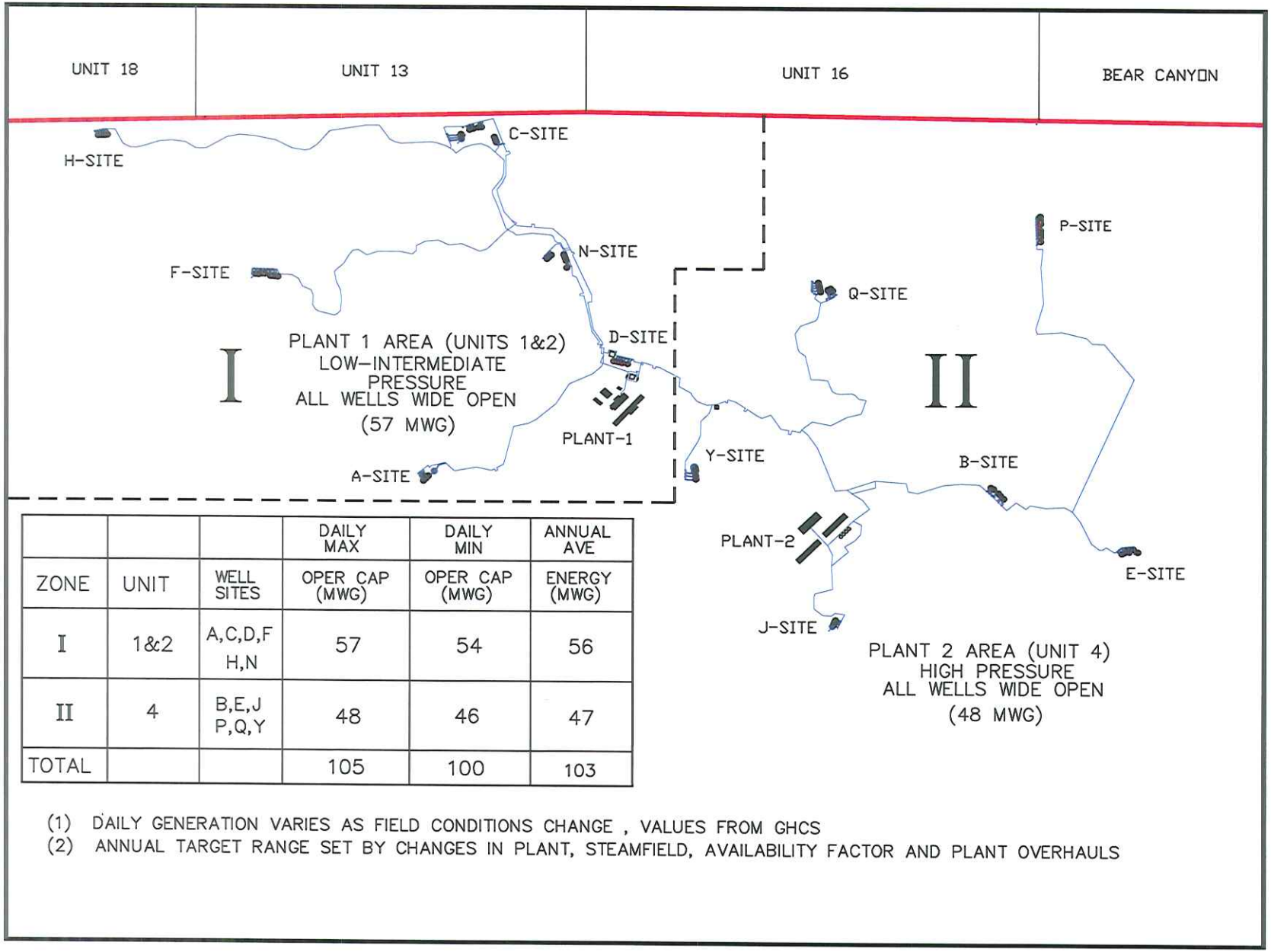

2015 Gross Steam Utilization
Figure 4
Steam Utilization, kph/MWg
20.00
19.00
18.00
17.00
16.00
15.00
Jan-15
Mar-15
May-15
Jul-15
Sep-15
Nov-15
Jan-16
Plant #1
Plant #2
Geo Facility

Figure 5. GEOTHERMAL OPERATIONAL PLAN 2016



			DAILY MAX	DAILY MIN	ANNUAL AVE
ZONE	UNIT	WELL SITES	OPER CAP (MWG)	OPER CAP (MWG)	ENERGY (MWG)
I	1&2	A,C,D,F H,N	57	54	56
II	4	B,E,J P,Q,Y	48	46	47
TOTAL			105	100	103

(1) DAILY GENERATION VARIES AS FIELD CONDITIONS CHANGE , VALUES FROM GHCS
(2) ANNUAL TARGET RANGE SET BY CHANGES IN PLANT, STEAMFIELD, AVAILABILITY FACTOR AND PLANT OVERHAULS

Figure 6. History of SEGEP Deliveries Total and NCPA (Annual Average GPM)

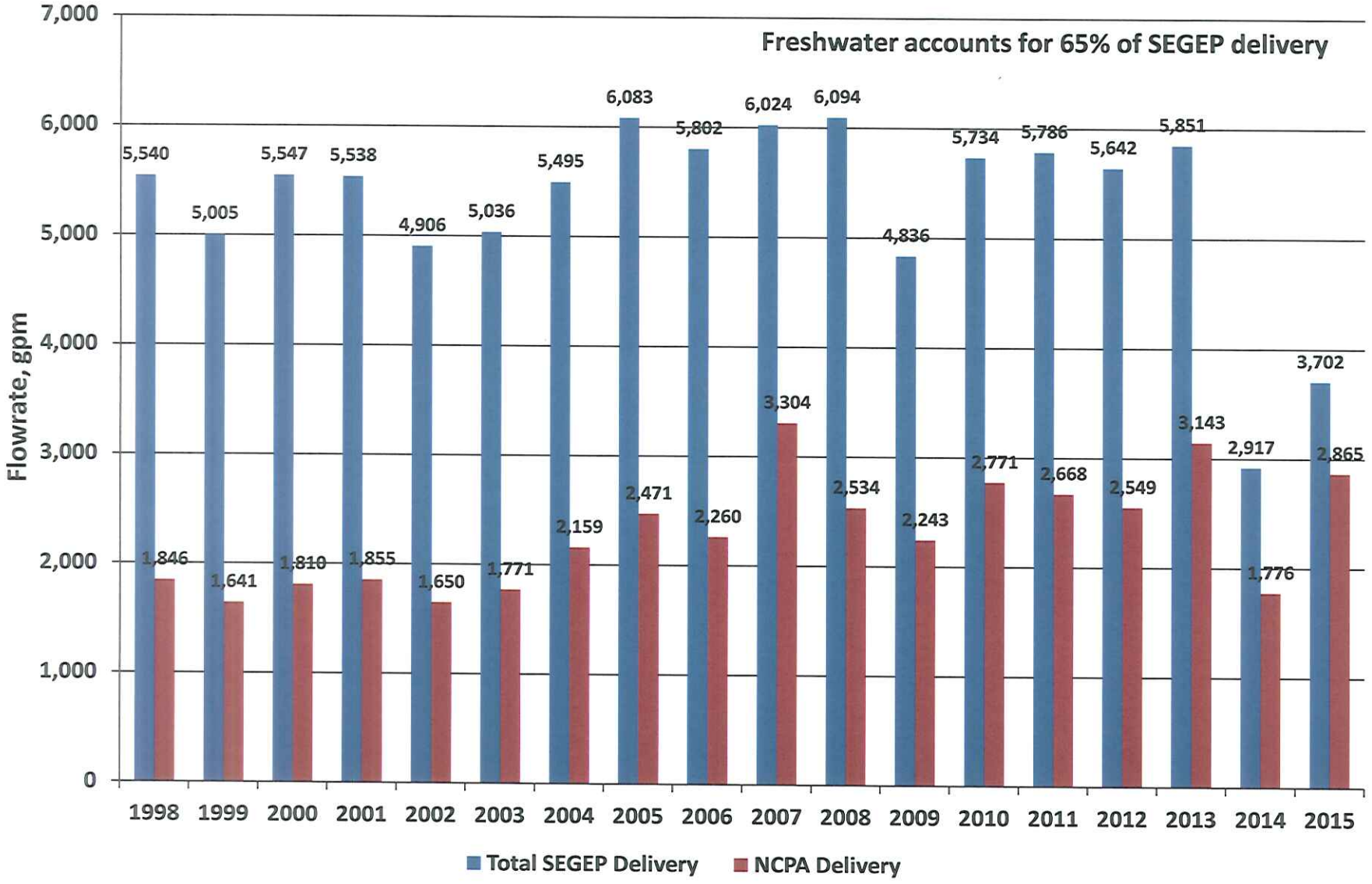


Figure 6 - Historical SEGEP Delivery.xlsx

FIGURE 7 MODIFIED PLAN OF INJECTION

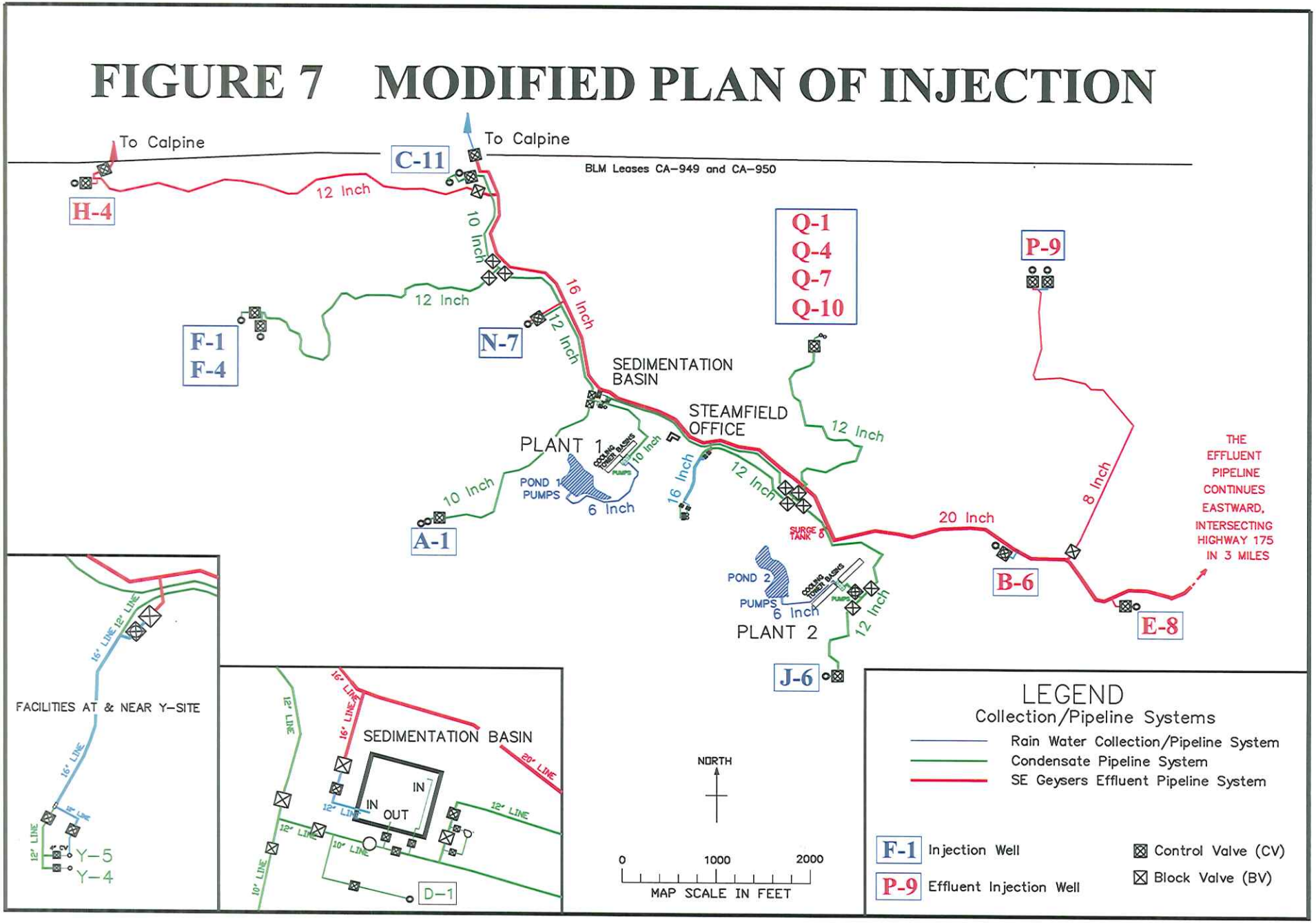
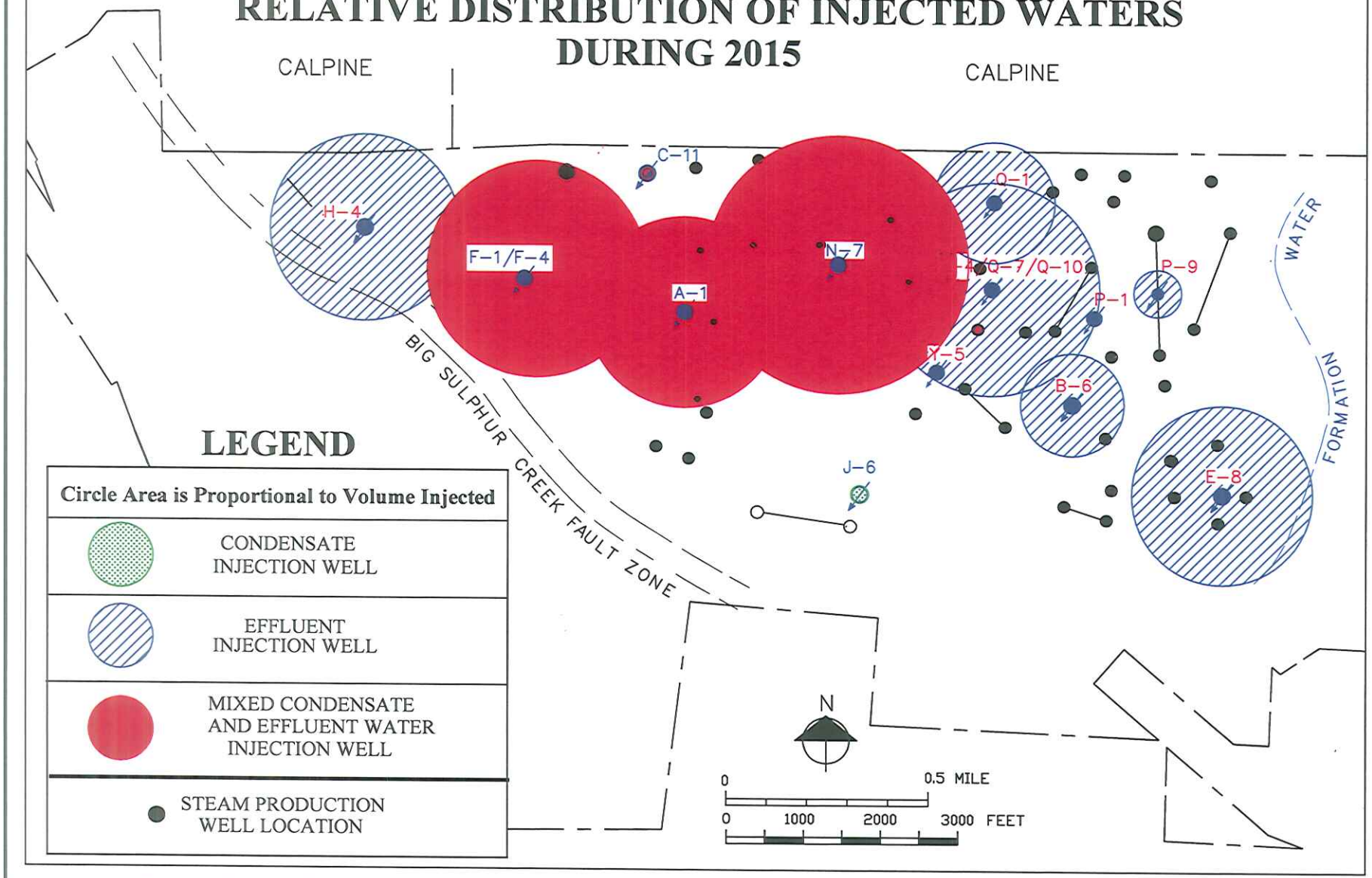


FIGURE 8
NCPA STEAM FIELD
RELATIVE DISTRIBUTION OF INJECTED WATERS
DURING 2015



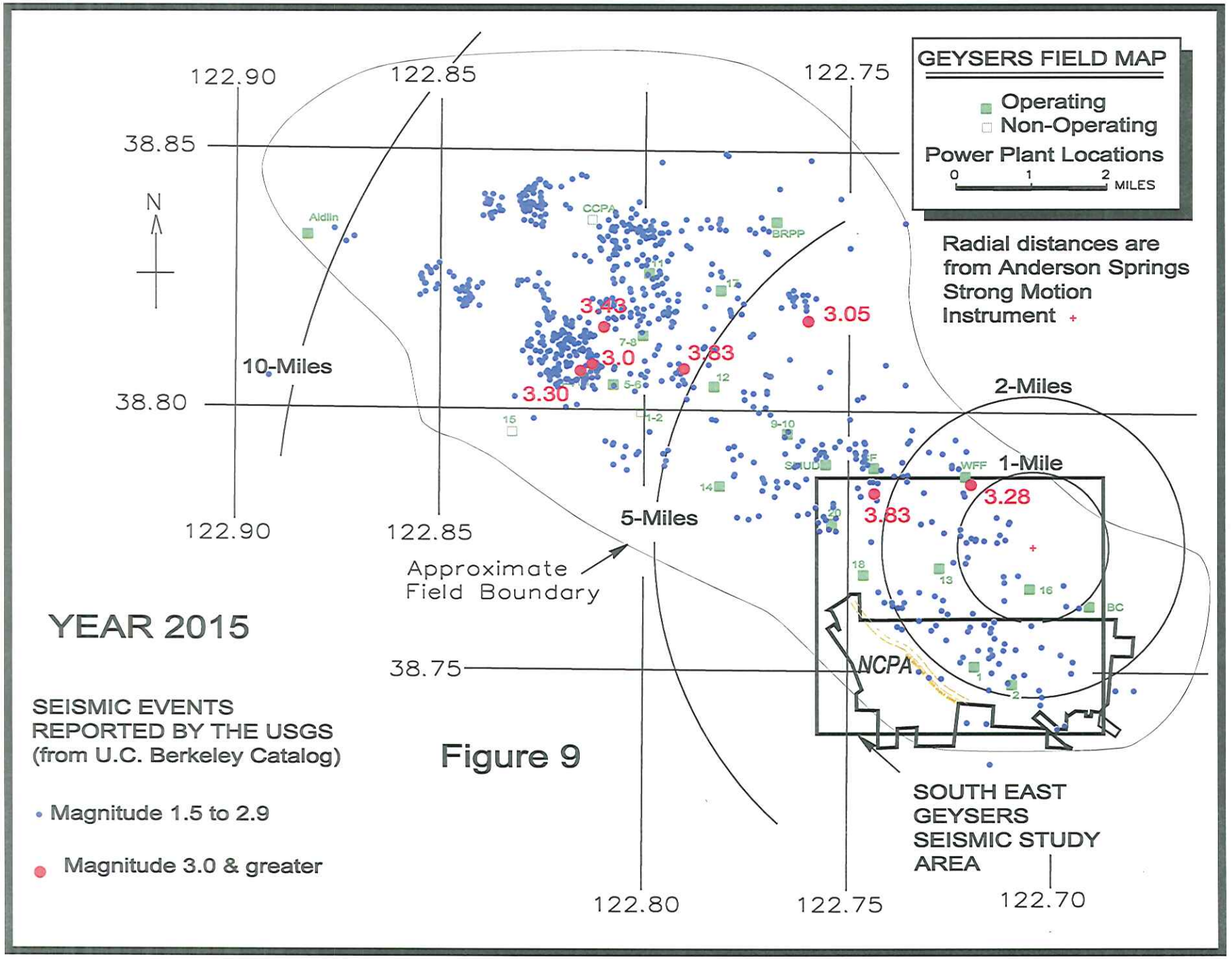

GEYSERS FIELD MAP
Operating
Non-Operating
Power Plant Locations
0 1 2 MILES
Radial distances are from Anderson Springs Strong Motion Instrument +
122.90
122.85
122.75
38.85
38.80
38.75
N
10-Miles
2-Miles
1-Mile
5-Miles
3.43
3.05
3.0
3.83
3.30
3.28
3.83
Aidlin
CCPA
BRPP
WFF
SRUD
BC
NCPA
Approximate Field Boundary
YEAR 2015
SEISMIC EVENTS REPORTED BY THE USGS (from U.C. Berkeley Catalog)
Magnitude 1.5 to 2.9
Magnitude 3.0 & greater
Figure 9
SOUTH EAST GEYSERS SEISMIC STUDY AREA
122.80
122.70

FIGURE 10
NONCONDENSABLE GAS CONCENTRATIONS IN NCPA STEAM (ppm)

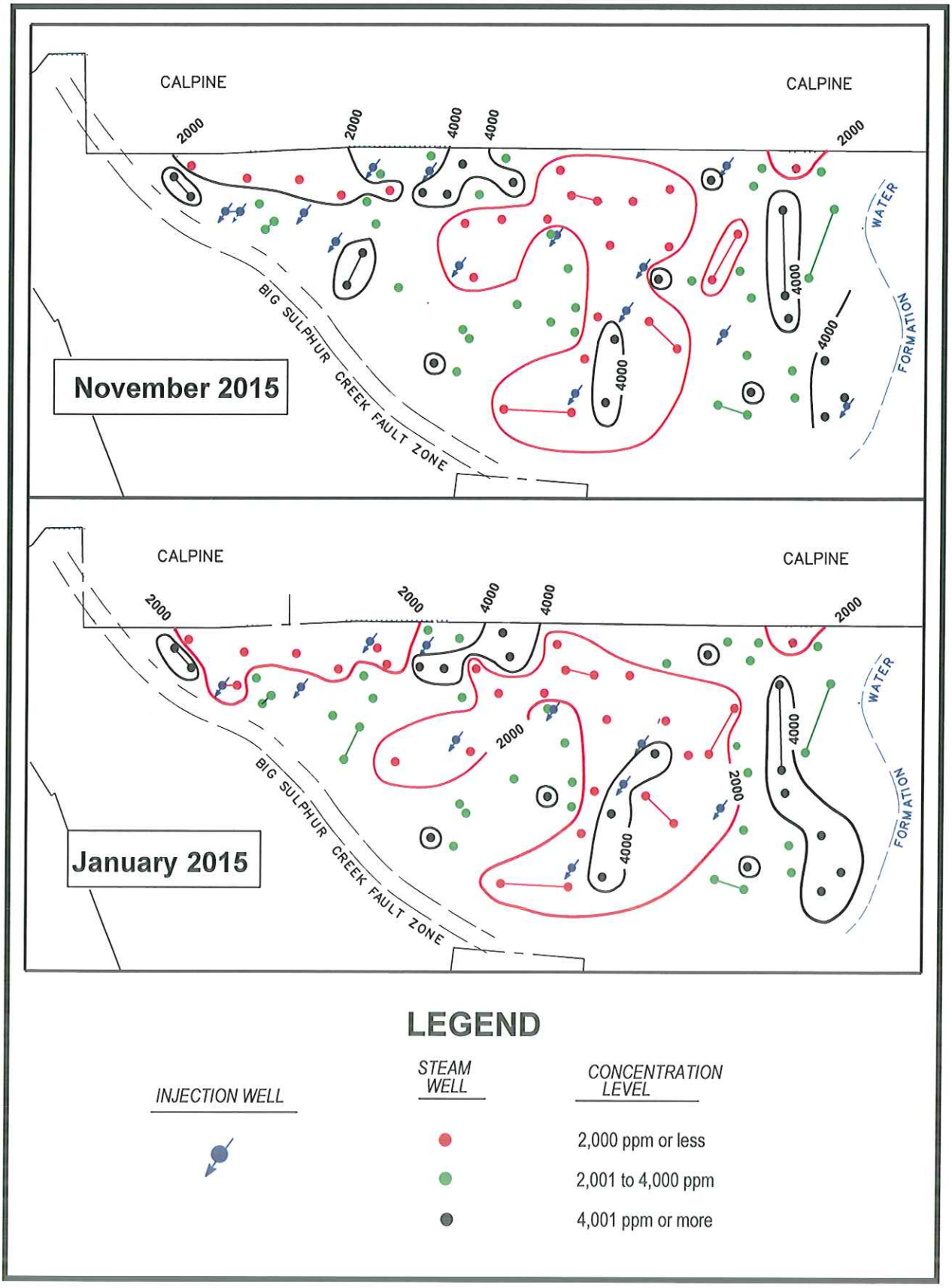
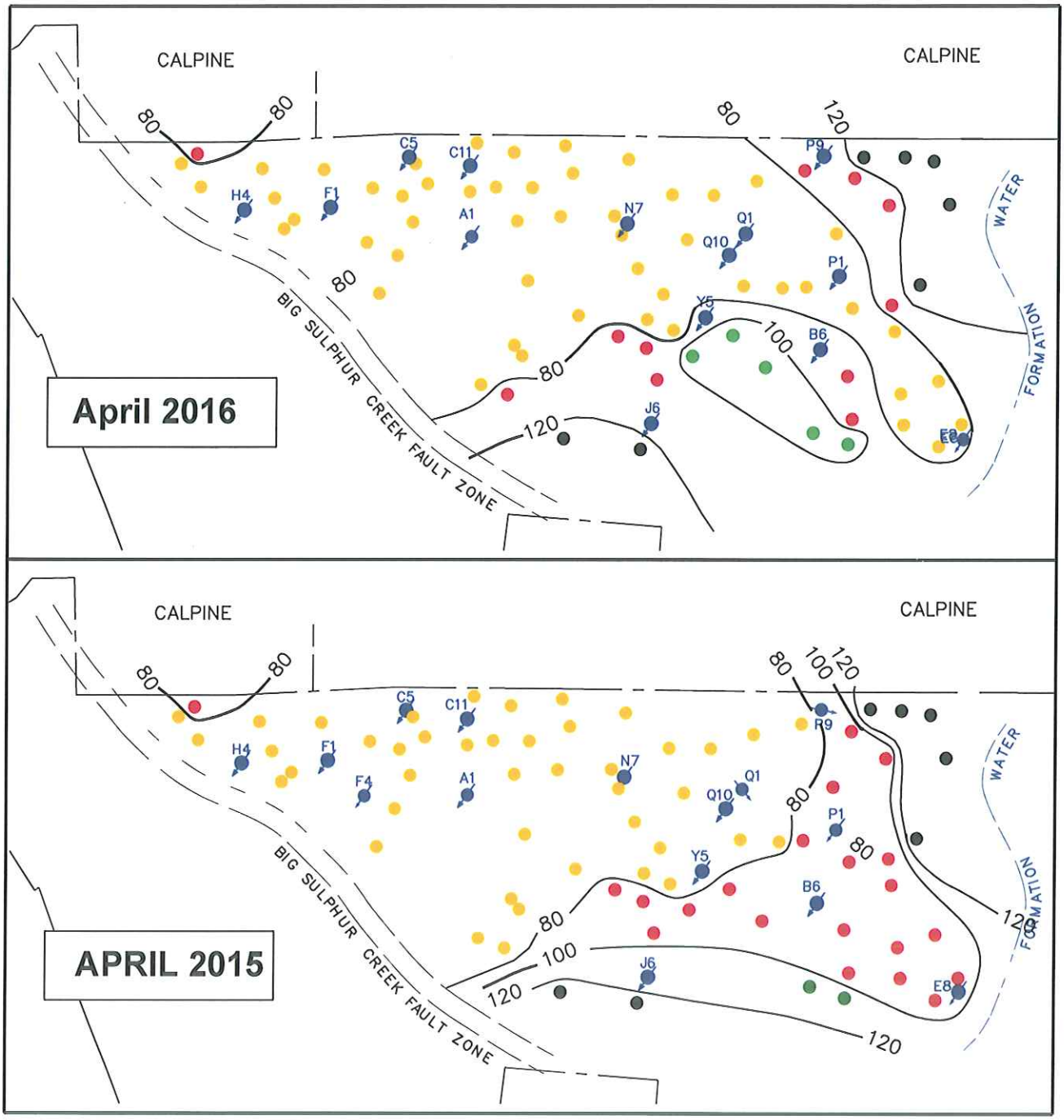


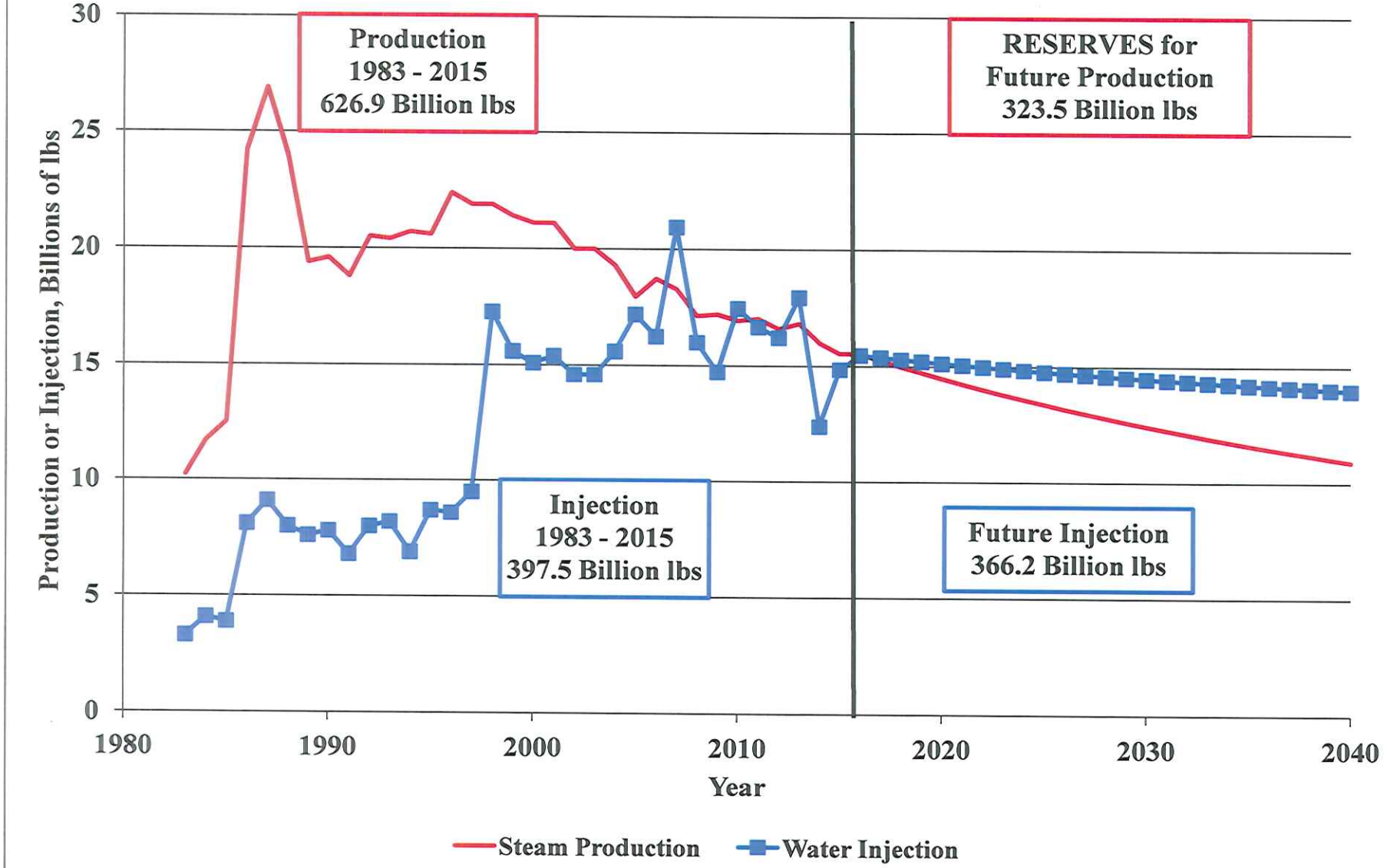
FIGURE 11
NCPA STEAM FIELD RESERVOIR PRESSURE

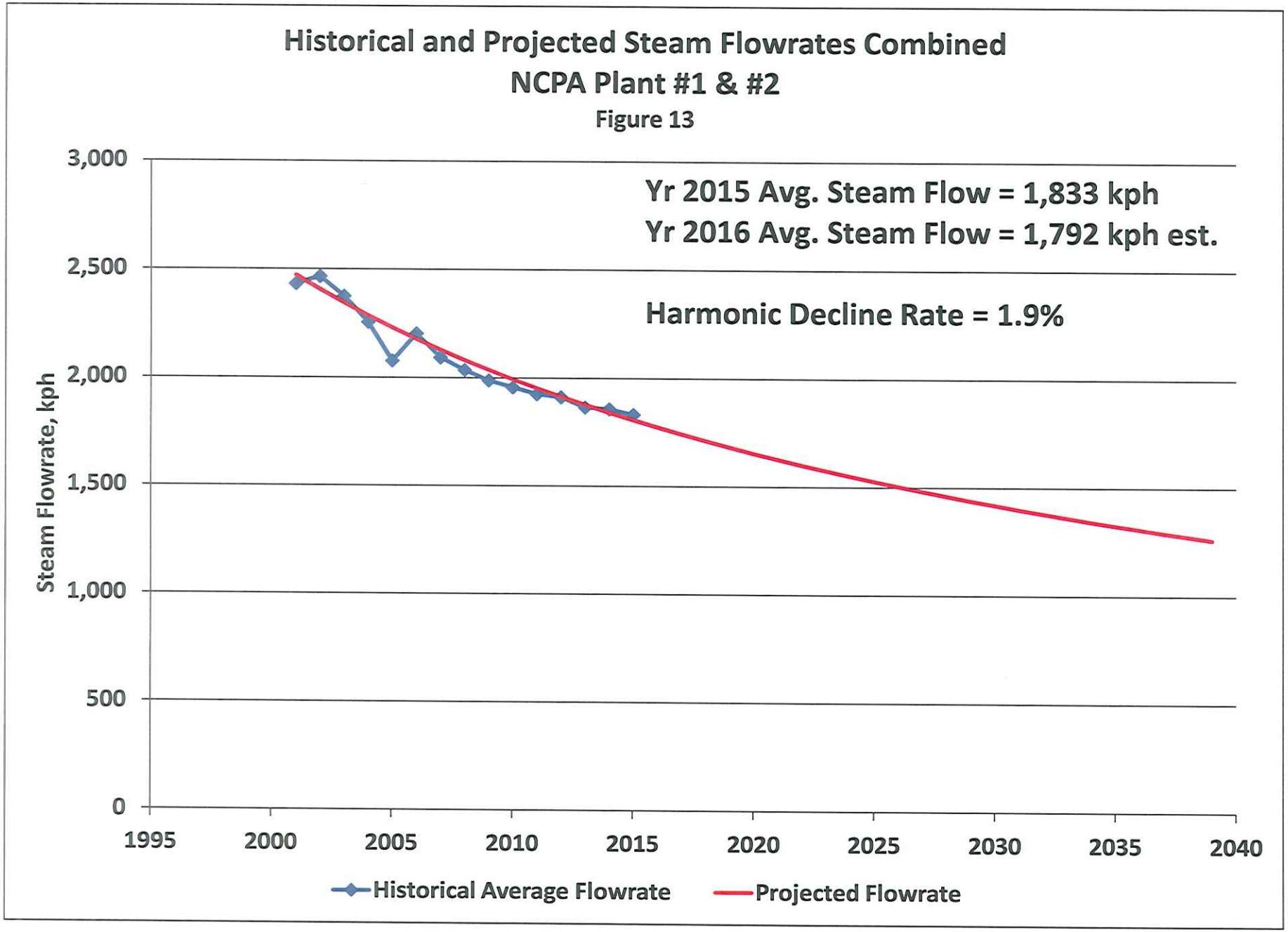


LEGEND

ISOBARIC CONTOUR	AREA	STEAM WELL LOCATION	RESERVOIR PRESSURE (PSIG)
120 — 120	LOW	●	< 80
	MEDIUM LOW	●	80 - 100
	MEDIUM HIGH	●	101 - 120
	HIGH	●	> 120

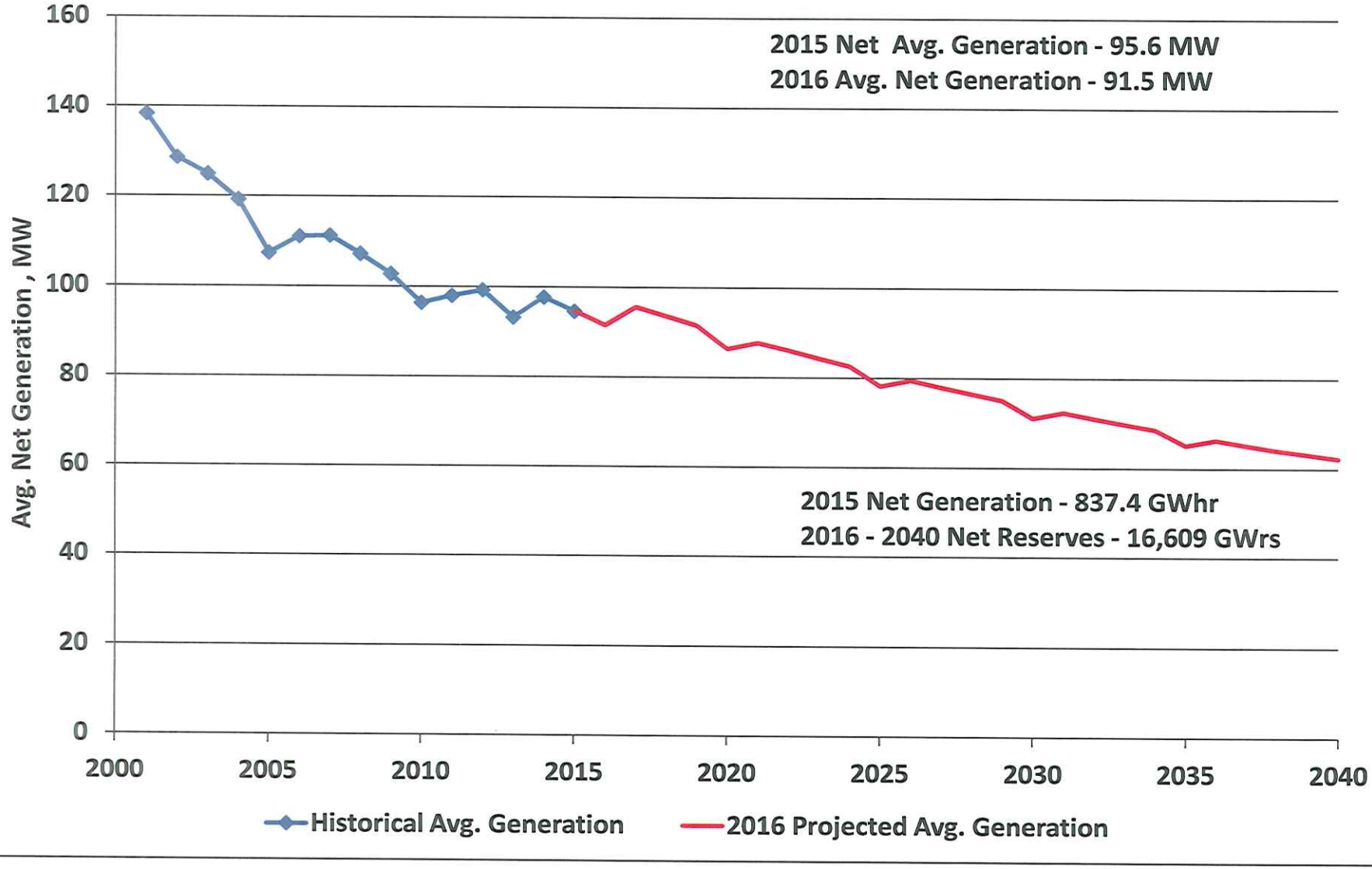
Historical and Forecast Steam Production & Water Injection
Figure 12

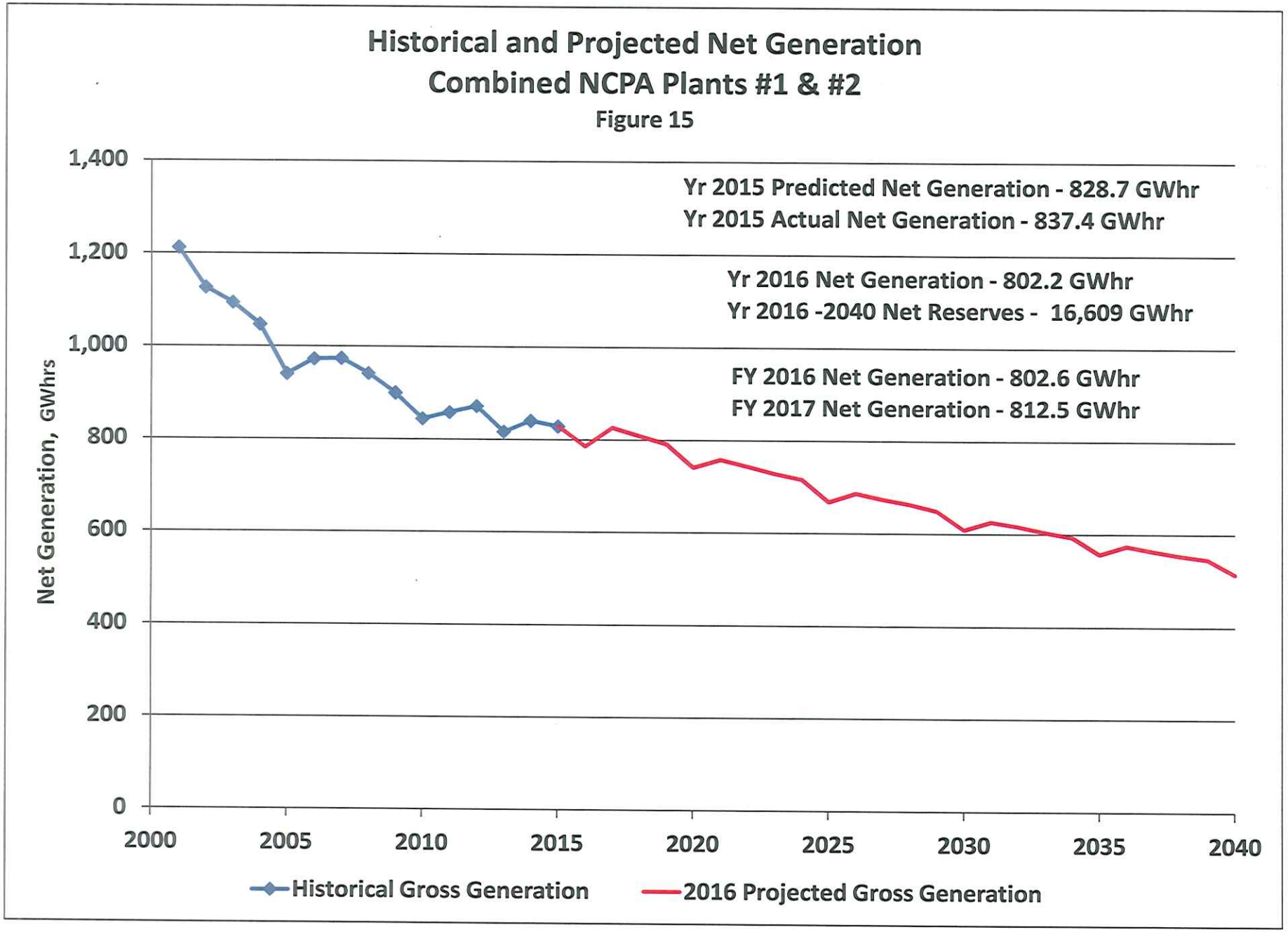



Historical and Projected Steam Flowrates Combined
NCPA Plant #1 & #2
Figure 13
Yr 2015 Avg. Steam Flow = 1,833 kph
Yr 2016 Avg. Steam Flow = 1,792 kph est.
Harmonic Decline Rate = 1.9%
Steam Flowrate, kph
3,000
2,500
2,000
1,500
1,000
500
0
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
Historical Average Flowrate
Projected Flowrate

Historical and Projected Average Net Generation Level
Combined NCPA Plants #1 & #2

Figure 14




Historical and Projected Net Generation
Combined NCPA Plants #1 & #2
Figure 15
Yr 2015 Predicted Net Generation - 828.7 GWhr
Yr 2015 Actual Net Generation - 837.4 GWhr
Yr 2016 Net Generation - 802.2 GWhr
Yr 2016 -2040 Net Reserves - 16,609 GWhr
FY 2016 Net Generation - 802.6 GWhr
FY 2017 Net Generation - 812.5 GWhr
Net Generation, GWhrs
1,400
1,200
1,000
800
600
400
200
0
2000
2005
2010
2015
2020
2025
2030
2035
2040
Historical Gross Generation
2016 Projected Gross Generation

2015 Injection

Table 1. ANNUAL REPORT OF NCPA INJECTION AT THE GEYSERS STEAM FIELD for Year 2015 (in 1000 Gallons)

Well		Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Condensate[1]	Effluent[2]	Well Total
A-1	Condensate	18,670	20,622	11,493	22,750	16,206	9,837	11,357	9,858	4,428	11,716	18,241	27,101	**182,280**		**251,788**
	Effluent	34	1,769	5,345	2,975	11,237	9,747	10,012	9,156	3,362	8,940	6,032	900		**69,508**	
B-6	Effluent	4,129	6,600	296	-	16,321	13,727	11,385	14,474	5,718	59	-	-		72,709	72,709
C-11	Condensate	-	-	588	-	-	-	-	-	-	-	-	-	588		996
	Effluent	-	-	408	-	-	-	-	-	-	-	-	-		408	
E-8	Effluent	10,921	10,963	14,727	14,073	24,650	18,561	17,783	19,324	8,046	28,529	24,536	28,996		221,109	
F-1	Condensate	-	-	893	-	-	-	-	-	-	-	-	-	893		893
	Effluent	-	-	-	-	-	-	-	-	-	-	-	-		-	
F-4	Condensate	25,894	25,011	22,845	10,012	16,804	13,643	15,761	14,138	11,312	18,431	26,527	34,691	235,068		324,516
	Effluent	70	2,158	7,068	2,399	10,213	13,985	14,114	12,060	4,071	13,917	8,084	1,308		89,448	
H-4	Effluent	6,263	3,802	13,006	25,127	25,375	20,417	18,486	20,457	8,387	36,714	30,932	32,096		241,062	241,062
J-6	Condensate	-	1,929	-	-	-	-	-	-	-	-	-	179	2,108		2,108
N-7	Condensate	2,703	8,435	5,308	9,173	9,600	4,035	2,575	4,800	933	6,883	8,830	20,490	83,766		461,164
	Effluent	4,437	10,087	32,446	35,845	44,987	35,609	34,027	35,293	12,328	41,665	50,241	40,434		377,398	
P-9	Effluent	-	-	-	-	-	1,931	4,525	6,354	2,724	-	-	-		15,534	15,534
Q-1	Effluent	-	-	-	-	8,466	14,604	12,444	10,165	6,509	17,298	16,875	14,185		100,546	100,546
Q-4	Effluent	-	-	-	-	-	-	884	2,187	4,369	1,020	16,933	19,736		45,129	45,129
Q-7	Effluent	-	-	-	-	-	-	-	308	-	-	-	-		308	308
Q-10	Condensate	-	-	-	-	-	-	-	-	-	-	-	-	0		269,394
	Effluent	4,372	5,844	24,085	33,739	35,536	27,251	19,208	19,215	8,623	35,632	26,676	29,213		269,394	
Totals		77,493	97,220	138,508	156,093	219,395	183,347	172,561	177,789	80,810	220,804	233,907	249,329	**Condensate(1)** 504,703	**Effluent(2)** 1,502,553	**Total** 1,786,147

During each month the % of Effluent Pipeline water that was fresh water withdrawn from Clear Lake:

Notes:
1. "Effluent" (pipeline) volumes are water from Clear Lake together with LACOSAN and Clearlake Oaks treated wastewater.
2. The 8 **Bold** well names in ***italics*** are located in Lake County (Central Valley Region), the 10 others are in Sonoma County (North Coast Region).

TABLE 2. GEOTHERMAL FACILITIES
Summary Table

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Generation (gross)										
(MWh)	1,078,293	1,055,813	1,018,904	981,100	916,437	926,368	936,868	886,004	922,995	903,299
(MW)	123.1	120.5	116.0	112.0	104.6	105.7	106.7	101.1	105.4	103.1
Generation (net)										
(MWh)	972,918	974,387	942,153	900,599	844,642	858,747	872,422	816,824	862,842	837,379
(MW)	111.1	111.2	107.3	102.8	96.4	98.0	99.3	93.2	98.5	95.6
Protocol										
(MW)	126	122	116	113	108	108	108	108	107	107
Steam Conversion										
(Lbs / Kw)	16.59	16.66	16.83	17.53	18.33	18.39	17.72	18.99	17.33	17.20
Steam Delivered										
(Billion Lbs)	17.893	17.59	17.145	17.2	16.8	17.04	16.60	16.83	16.00	15.54
Load Flexibility (gross)										
Monthly High (MW)	133	126	121	117	109	109	110	109	110	110
Monthly Low (MW)	106	106	101	108	63	106	105	82	104	104
Injection										
Total (Billion Lbs)	16.25	20.94	16.00	14.74	17.45	16.66	16.22	17.96	12.39	14.86
Condensate (Billion Lbs)	6.20	6.23	4.87	2.87	4.96	4.79	5.00	4.21	4.62	4.20
Effluent (Billion Lbs)	9.90	14.47	10.83	9.82	12.13	11.82	11.18	13.75	7.77	12.50
Mass Replacement										
Annual (%)	90.8%	119.0%	93.3%	85.7%	103.9%	97.8%	97.7%	106.7%	77.5%	95.6%
Cumulative (%)	52.9%	55.2%	56.2%	57.2%	58.6%	59.8%	60.9%	62.2%	62.6%	63.4%
Wells Used For Injection										
	8	7	8	8	11	15	15	13	12	13
NCPA Micro-seismic Activity M> = 1.5	68	76	50	49	55	73	81	68	58	50
NCPA Micro-seismic Activity Maximum Magnitude Event	3.12	2.91	2.97	2.64	2.99	3.3	2.91	3.76	4.38	2.99
NCG Concentration (ppmw)	2,590	2,482	2,209	2,395	2,785	2,950	3,097	3,248	3,069	3,176

Table 3
RESERVOIR PRESSURE
BY WELL 2016

WELL	PRESS
A-3	71.0
A-4	73.2
A-5	70.5
A-6	69.3
A-SITE	71.0
B-2	80.9
B-3	79.2
B-4	78.0
B-5	75.5
B-6	70.3
B-SITE	76.8
C-1	62.1
C-2	
C-4	65.7
C-5	
C-6	
C-7	
C-8	
C-9	
C-10	57.6
C-SITE	61.7

WELL	PRESS
D-1	65.8
D-2	
D-6	74.5
D-7	
D-8	
D-SITE	70.1
E-1	77.5
E-2	77.0
E-3	90.1
E-4	76.1
E-5	79.0
E-6	77.4
E-8	
E-SITE	79.5
F-1	64.1
F-2	
F-3	
F-4	
F-5	78.1
F-6	72.2
F-7	
F-SITE	71.5

WELL	PRESS
H-1	75.5
H-2	
H-3	
H-4	64.3
H-5	
H-SITE	69.9
J-2	103.8
J-3	106.5
J-4	102.0
J-5	133.0
J-SITE	111.3
N-1	65.4
N-2	
N-3	
N-4	60.0
N-5	
N-6	65.4
N-SITE	63.6

WELL	PRESS
P-1	
P-2	120.2
P-4	78.8
P-5	162.4
P-6	148.2
P-7	92.3
P-8	158.0
P-9	127.4
P-SITE	126.8
Q-1	
Q-3	
Q-4	62.8
Q-5	75.5
Q-6	
Q-7	83.8
Q-8	
Q-9	
Q-SITE	69.1
Y-1	
Y-2	67.8
Y-3	82.0
Y-4	72.6
Y-5	
Y-SITE	67.8

VALUES ARE FROM PRESSURE BUILD- UP TESTS
SHADED NUMBERS ARE FOR DATA OBTAINED FROM OTHER STATIC PRESSURE OBSERVATIONS

45 WELLS TESTED AVE. WELL PRESS EQUALS 84.3 psig

AVE SITE PRESS EQUALS 78.3 psig

AVE. FLOWRATE = 29.2 kph at 44.3 psig

TABLE 4 NCG CONCENTRATIONS (PPMW) 2015
BY WELL, AND SITE AND PROJECT

WELL	NCG
A-3	8222
A-4	3267
A-5	2708
A-6	3454
A-SITE	**4413**
B-2	2333
B-3	4241
B-4	2363
B-5	2132
B-6	
B-SITE	**2767**
C-1	2981
C-2	4056
C-4	3828
C-5	13030
C-6	6535
C-7	5937
C-8	3885
C-9	6347
C-A	1953
C-SITE	**5395**

WELL	NCG
D-1	2596
D-2	2475
D-6	3349
D-7	1919
D-8	1956
D-SITE	**2459**
E-1	9709
E-2	3282
E-3	3340
E-4	4712
E-5	5510
E-6	2712
E-SITE	**4878**
F-1	1359
F-2	2221
F-3	2157
F-4	
F-5	636
F-6	943
F-7	1630
F-SITE	**1491**

WELL	NCG
H-1	1854
H-2	864
H-3	4116
H-4	
H-5	3285
H-SITE	**2530**
J-2	4291
J-3	730
J-4	2206
J-5	1263
J-SITE	**2123**
N-1	1299
N-2	1347
N-3	550
N-4	1240
N-5	3818
N-6	2840
N-SITE	**1849**

WELL	NCG
P-1	
P-2	2784
P-4	1334
P-5	919
P-6	2336
P-7	4139
P-8	3259
P-9	
P-SITE	**2462**
Q-1	
Q-3	4757
Q-4	1708
Q-5	1598
Q-6	1615
Q-7	5596
Q-8	1748
Q-9	2189
Q-A	
Q-SITE	**2744**
Y-1	2094
Y-2	4226
Y-3	3157
Y-4	4447
Y-5	4224
Y-SITE	**3481**

VALUES ARE FROM NCPA CHEM LAB ANALYSIS

Number of wells samples wells sampled=	**66**
AVG. WELL NCG =	**3176**
AVG. SITE NCG =	**3049**
NCG Flow Weighted Avg. =	**2964**

2016 Generation - 25 Year Forecast
Table 5

	Total Geo Facilities		Plant #1		Plant #2	
	Gross Generation	Net Generation	Gross Generation	Net Generation	Gross Generation	Net Generation
Year	GWHr	GWHr	GWHr	GWHr	GWHr	GWHr
2016	882.8	802.2	537.3	484.4	345.5	317.8
2017	897.2	826.2	516.2	467.6	381.0	358.6
2018	883.6	808.4	511.8	459.0	371.8	349.4
2019	866.4	791.2	503.3	450.6	363.0	340.6
2020	809.4	740.6	492.2	443.4	317.2	297.2
2021	829.2	758.2	482.5	433.9	346.7	324.3
2022	814.9	743.9	475.8	427.2	339.1	316.7
2023	803.3	728.4	471.5	419.0	331.8	309.4
2024	791.0	716.0	465.3	412.7	325.7	303.2
2025	736.6	668.0	453.0	404.4	283.6	263.6
2026	757.6	686.6	446.0	397.4	311.7	289.3
2027	744.6	673.7	439.2	390.6	305.5	283.1
2028	737.7	662.9	437.3	385.0	300.4	277.9
2029	723.4	648.9	429.6	377.4	293.8	271.4
2030	676.8	608.2	419.7	371.1	257.1	237.1
2031	696.5	625.5	413.5	364.9	283.0	260.6
2032	687.2	616.1	408.5	359.8	278.7	256.2
2033	677.9	603.5	404.9	352.9	273.0	250.6
2034	667.3	593.0	399.0	347.2	268.3	245.9
2035	625.2	556.6	390.1	341.5	235.1	215.2
2036	645.6	574.4	385.6	336.9	260.0	237.5
2037	634.1	563.1	379.2	330.6	255.0	232.6
2038	627.8	553.7	377.0	325.3	250.8	228.4
2039	619.8	545.7	373.0	321.3	246.8	224.4
2040	582.6	514.0	366.0	317.4	216.6	196.6

Notes:

1. Assumes 3 unit operation.
2. Steam Reserves: 323 Billion lb.
3. Gross Reserves: 18,419 GWhr
4. Net Reserves: 16,609 GWhr
5. Plant #1 Auxiliary Load is fixed at 5.68 MW.
   Plant #2 Auxiliary Load is fixed at 2.58 MW.
6. Plant availaibility is 99.5% or a forced outage rate of 43.8 hrs per year.
7. See Table 5B for scheduled outages.

2015 Generation Level - 25 Year Forecast
Table 5A

	Plant #1		Plant #2		Total	
Year	Avg. Gross Gen. MW	Avg. Net Gen. MW	Avg. Gross Gen. MW	Avg. Net Gen. MW	Avg. Gross Gen. MW	Avg. Net Gen. MW
2016	60.8	55.2	39.5	36.3	100.3	91.5
2017	59.7	54.1	44.1	41.5	103.8	95.6
2018	58.7	53.1	43.0	40.4	101.7	93.5
2019	57.7	52.1	42.0	39.4	99.7	91.5
2020	56.8	51.2	37.6	35.2	94.4	86.4
2021	55.8	50.2	40.1	37.5	95.9	87.7
2022	55.0	49.4	39.2	36.6	94.3	86.1
2023	54.1	48.5	38.4	35.8	92.5	84.3
2024	53.2	47.6	37.6	35.0	90.8	82.6
2025	52.4	46.8	33.7	31.3	86.1	78.1
2026	51.6	46.0	36.1	33.5	87.7	79.4
2027	50.8	45.2	35.3	32.8	86.1	77.9
2028	50.0	44.4	34.7	32.1	84.7	76.5
2029	49.3	43.7	34.0	31.4	83.3	75.1
2030	48.6	42.9	30.6	28.2	79.1	71.1
2031	47.8	42.2	32.7	30.2	80.6	72.4
2032	47.1	41.5	32.2	29.6	79.3	71.1
2033	46.4	40.8	31.6	29.0	78.0	69.8
2034	45.8	40.2	31.0	28.4	76.8	68.6
2035	45.1	39.5	28.0	25.6	73.1	65.1
2036	44.5	38.9	30.0	27.4	74.5	66.3
2037	43.9	38.2	29.5	26.9	73.4	65.1
2038	43.3	37.6	29.0	26.4	72.3	64.1
2039	42.8	37.2	28.6	26.0	71.3	63.1
2040	42.3	36.7	28.1	25.5	70.4	62.2

* Average generation levels plants are capable of achieving.

2016 Scheduled Outages - 25 Year Forecast
Table 5B

Year	Plant #1 Unit 1 Scheduled Outages hrs	Plant #1 Unit 2 Scheduled Outages hrs	Plant #2 Unit 4 Scheduled Outages hrs
2016	36	36	1200
2017	36	36	72
2018	1008	36	72
2019	36	1008	72
2020	36	36	1008
2021	36	36	72
2022	36	36	72
2023	1008	36	72
2024	36	1008	72
2025	36	36	1008
2026	36	36	72
2027	36	36	72
2028	1008	36	72
2029	36	1008	72
2030	36	36	1008
2031	36	36	72
2032	36	36	72
2033	1008	36	72
2034	36	1008	72
2035	36	36	1008
2036	36	36	72
2037	36	36	72
2038	1008	36	72
2039	36	1008	72
2040	36	36	1008

2016 Generation - 5 Year Forecast
Table 6

	Total Geo Facilities		Plant #1		Plant #2	
	Gross	Net	Gross	Net	Gross	Net
	Generation	Generation	Generation	Generation	Generation	Generation
Date	GWHr	GWHr	GWHr	GWHr	GWHr	GWHr
Jan-16	80.3	73.1	45.3	40.0	35.0	33.1
Feb-16	71.2	65.4	37.9	33.9	33.3	31.5
Mar-16	76.9	69.9	46.9	41.7	30.0	28.3
Apr-16	52.3	46.9	52.3	46.9	0.0	0.0
May-16	78.6	72.6	45.1	40.9	33.6	31.6
Jun-16	76.0	70.1	43.6	39.5	32.4	30.6
Jul-16	78.4	72.3	45.0	40.8	33.4	31.5
Aug-16	78.3	72.2	44.9	40.8	33.3	31.4
Sep-16	59.5	46.5	43.4	39.4	16.1	7.1
Oct-16	78.0	72.0	44.8	40.7	33.2	31.3
Nov-16	75.4	69.5	43.3	39.3	32.1	30.2
Dec-16	77.8	71.7	44.7	40.6	33.1	31.2
Jan-17	77.5	71.4	44.5	40.3	33.0	31.1
Feb-17	69.9	64.4	40.1	36.4	29.7	28.0
Mar-17	74.1	68.2	44.4	40.2	29.7	27.9
Apr-17	70.3	64.9	38.6	35.0	31.7	29.9
May-17	77.0	70.9	44.3	40.1	32.7	30.8
Jun-17	74.4	68.5	42.8	38.8	31.6	29.8
Jul-17	76.8	70.7	44.2	40.0	32.6	30.7
Aug-17	76.7	70.6	44.1	40.0	32.5	30.6
Sep-17	74.1	68.2	42.7	38.6	31.4	29.6
Oct-17	76.4	70.3	44.0	39.9	32.4	30.5
Nov-17	73.8	68.0	42.6	38.5	31.3	29.4
Dec-17	76.2	70.1	43.9	39.8	32.3	30.3
Jan-18	75.9	69.9	43.7	39.6	32.2	30.3
Feb-18	68.5	63.0	39.5	35.7	29.0	27.3
Mar-18	72.6	66.7	43.6	39.5	29.0	27.2
Apr-18	73.2	63.5	42.2	34.3	31.0	29.1
May-18	75.5	69.4	43.6	39.4	31.9	30.0
Jun-18	72.9	67.1	42.1	38.1	30.8	29.0
Jul-18	75.3	69.2	43.4	39.3	31.8	29.9
Aug-18	75.1	69.1	43.4	39.2	31.7	29.8
Sep-18	72.6	66.7	42.0	37.9	30.7	28.8
Oct-18	74.9	68.8	43.3	39.1	31.6	29.7
Nov-18	72.4	66.5	41.9	37.8	30.5	28.7
Dec-18	74.7	68.6	43.2	39.0	31.5	29.6
Jan-19	74.4	68.4	43.0	38.8	31.4	29.5
Feb-19	67.1	61.6	38.8	35.0	28.3	26.6
Mar-19	71.2	65.3	42.9	38.8	28.3	26.5
Apr-19	71.7	62.1	41.5	33.7	30.2	28.4
May-19	74.0	67.9	42.8	38.7	31.2	29.3
Jun-19	71.5	65.6	41.4	37.4	30.1	28.3
Jul-19	73.8	67.7	42.7	38.6	31.1	29.1
Aug-19	73.7	67.6	42.7	38.5	31.0	29.1
Sep-19	71.2	65.3	41.3	37.2	29.9	28.1
Oct-19	73.5	67.4	42.6	38.4	30.9	29.0
Nov-19	71.0	65.1	41.2	37.1	29.8	28.0
Dec-19	73.2	67.2	42.5	38.3	30.8	28.8
Jan-20	73.0	66.9	42.3	38.1	30.7	28.8
Feb-20	68.2	62.5	39.5	35.6	28.7	26.9
Mar-20	42.2	38.0	42.2	38.0	0.0	0.0
Apr-20	55.4	50.6	36.7	33.1	18.7	17.5
May-20	72.6	66.5	42.1	37.9	30.5	28.5
Jun-20	70.1	64.2	40.7	36.7	29.4	27.6
Jul-20	72.4	66.3	42.0	37.8	30.3	28.4
Aug-20	72.3	66.2	42.0	37.8	30.3	28.4
Sep-20	69.8	63.9	40.6	36.5	29.3	27.4
Oct-20	72.0	66.0	41.9	37.7	30.2	28.3
Nov-20	69.6	63.7	40.5	36.4	29.1	27.3
Dec-20	71.8	65.8	41.8	37.6	30.1	28.1

2016 Generation Level - 5 Year Forecast*
Table 6A

	Plant #1		Plant #2		Total	
Year	Avg. Gross Gen. MW	Avg. Net Gen. MW	Avg. Gross Gen. MW	Avg. Net Gen. MW	Avg. Gross Gen. MW	Avg. Net Gen. MW
Jan-16	59.8	53.8	47.1	44.4	106.9	98.2
Feb-16	53.6	48.7	47.9	45.3	101.5	94.0
Mar-16	63.0	56.0	40.3	38.0	103.3	94.0
Apr-16	72.7	64.5	0.0	0.0	72.7	64.5
May-16	60.9	55.3	45.3	42.7	106.2	98.0
Jun-16	60.8	55.2	45.2	42.6	106.1	97.9
Jul-16	60.8	55.1	45.1	42.6	105.9	97.7
Aug-16	60.7	55.1	45.0	42.5	105.7	97.5
Sep-16	60.6	55.0	22.5	9.9	83.1	64.9
Oct-16	60.5	54.9	44.9	42.3	105.4	97.2
Nov-16	60.5	54.9	44.8	42.2	105.2	97.0
Dec-16	60.4	54.8	44.7	42.1	105.1	96.9
Jan-17	60.1	54.5	44.6	42.0	104.7	96.5
Feb-17	60.0	54.4	44.5	41.9	104.5	96.3
Mar-17	60.0	54.3	44.4	41.8	104.4	96.1
Apr-17	59.9	54.3	44.3	41.7	104.2	96.0
May-17	59.8	54.2	44.2	41.6	104.0	95.8
Jun-17	59.8	54.1	44.1	41.5	103.9	95.7
Jul-17	59.7	54.1	44.0	41.4	103.7	95.5
Aug-17	59.6	54.0	43.9	41.3	103.6	95.3
Sep-17	59.5	53.9	43.8	41.3	103.4	95.2
Oct-17	59.5	53.9	43.8	41.2	103.2	95.0
Nov-17	59.4	53.8	43.7	41.1	103.1	94.9
Dec-17	59.3	53.7	43.6	41.0	102.9	94.7
Jan-18	59.1	53.5	43.5	40.9	102.6	94.4
Feb-18	59.0	53.4	43.4	40.8	102.4	94.2
Mar-18	59.0	53.3	43.3	40.7	102.3	94.1
Apr-18	58.9	53.3	43.2	40.6	102.1	93.9
May-18	58.8	53.2	43.1	40.6	102.0	93.8
Jun-18	58.8	53.1	43.1	40.5	101.8	93.6
Jul-18	58.7	53.1	43.0	40.4	101.7	93.5
Aug-18	58.6	53.0	42.9	40.3	101.5	93.3
Sep-18	58.6	52.9	42.8	40.2	101.4	93.1
Oct-18	58.5	52.9	42.7	40.1	101.2	93.0
Nov-18	58.4	52.8	42.6	40.0	101.1	92.8
Dec-18	58.4	52.7	42.5	40.0	100.9	92.7
Jan-19	58.1	52.5	42.5	39.9	100.6	92.3
Feb-19	58.0	52.4	42.4	39.8	100.4	92.2
Mar-19	58.0	52.3	42.3	39.7	100.3	92.1
Apr-19	57.9	52.3	42.2	39.6	100.1	91.9
May-19	57.8	52.2	42.1	39.5	100.0	91.8
Jun-19	57.8	52.2	42.0	39.5	99.8	91.6
Jul-19	57.7	52.1	42.0	39.4	99.7	91.5
Aug-19	57.6	52.0	41.9	39.3	99.5	91.3
Sep-19	57.6	52.0	41.8	39.2	99.4	91.2
Oct-19	57.5	51.9	41.7	39.1	99.2	91.0
Nov-19	57.5	51.8	41.6	39.0	99.1	90.9
Dec-19	57.4	51.8	41.6	39.0	98.9	90.7
Jan-20	57.1	51.5	41.5	38.9	98.6	90.4
Feb-20	57.1	51.4	41.4	38.8	98.4	90.2
Mar-20	57.0	51.4	0.0	0.0	57.0	51.4
Apr-20	56.9	51.3	41.2	38.6	98.2	90.0
May-20	56.9	51.3	41.2	38.6	98.0	89.8
Jun-20	56.8	51.2	41.1	38.5	97.9	89.7
Jul-20	56.7	51.1	41.0	38.4	97.7	89.5
Aug-20	56.7	51.1	40.9	38.3	97.6	89.4
Sep-20	56.6	51.0	40.8	38.2	97.5	89.2
Oct-20	56.6	50.9	40.8	38.2	97.3	89.1
Nov-20	56.5	50.9	40.7	38.1	97.2	89.0
Dec-20	56.4	50.8	40.6	38.0	97.0	88.8

* Average generation levels plants are capable of achieving.

TABLE 7
2016 FORECAST OF GEOTHERMAL PRODUCTION AND INJECTION

TIME STEP	DATE	STEAM PROD. BLBS	COND INJ BLBS	WATER INJ BLBS
1	2016	15.5	5.0	15.5
2	2017	15.3	4.9	15.4
3	2018	15.0	4.8	15.3
4	2019	14.7	4.7	15.2
5	2020	14.5	4.6	15.1
6	2021	14.2	4.6	15.1
7	2022	14.0	4.5	15.0
8	2023	13.8	4.4	14.9
9	2024	13.6	4.3	14.9
10	2025	13.4	4.3	14.8
11	2026	13.2	4.2	14.7
12	2027	13.0	4.2	14.7
13	2028	12.8	4.1	14.6
14	2029	12.6	4.0	14.5
15	2030	12.4	4.0	14.5
16	2031	12.3	3.9	14.4
17	2032	12.1	3.9	14.4
18	2033	11.9	3.8	14.3
19	2034	11.8	3.8	14.3
20	2035	11.6	3.7	14.2
21	2036	11.5	3.7	14.2
22	2037	11.3	3.6	14.1
23	2038	11.2	3.6	14.1
24	2039	11.0	3.5	14.0
25	2040	10.9	3.5	14.0

NOTES :

1. CUM. PRODUCTION AND INJECTION 1983-2015 — 626.9 Billion Lbs Steam; 397.5 Billion Lbs Water
2. TOTAL WATER IS CONDENSATE + EFFLUENT + LAKE + POND
3. FUTURE STEAM PRODUCTION 2016-2040 = 323.5 Billion Lbs
4. FUTURE WATER INJECTION 2016-2040 = 366.2 Billion Lbs