

**LETTER FROM THE SECRETARY OF  
WAR, TRANSMITTING THE  
REPORT OF THE COMMISSION TO  
EXAMINE AND REPORT UPON  
THE SUTRO TUNNEL, IN NEVADA**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649317219

Letter from the Secretary of War, Transmitting the Report of the Commission to Examine and Report Upon the Sutro Tunnel, in Nevada by Wm. W. Belknap

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.  
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

[www.triestepublishing.com](http://www.triestepublishing.com)

**WM. W. BELKNAP**

**LETTER FROM THE SECRETARY OF  
WAR, TRANSMITTING THE  
REPORT OF THE COMMISSION TO  
EXAMINE AND REPORT UPON  
THE SUTRO TUNNEL, IN NEVADA**



LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

*The report of the commission to examine and report upon the Sutro Tunnel, in Nevada.*

---

JANUARY 9, 1872.—Referred to the Committee on Mines and Mining and ordered to be printed.

---

WAR DEPARTMENT,  
January 6, 1872.

The Secretary of War has the honor to submit to the United States Senate and House of Representatives the report of the commission appointed by the President, under act of Congress approved April 4, 1871, to examine and report upon the Sutro Tunnel, in Nevada.

WM. W. BELKNAP,  
*Secretary of War.*

---

OFFICE OF THE CHIEF OF ENGINEERS,  
Washington, D. C., January 4, 1872.

SIR: I transmit herewith the report and accompanying papers of the commission appointed under the authority of the act of Congress approved April 4, 1871, "to examine and report upon the Sutro Tunnel, in the State of Nevada, authorized to be constructed by an act of Congress approved July 25, 1866, with special reference to the importance, feasibility, cost, and time required to construct the same; the value of the bullion extracted from mines on the Comstock lode; their present and probable future production; also, the geological and practical value of said tunnel as an exploring work, and its general bearing upon our mining and other national interests in ascertaining the practicability of deep mining."

The report presents the views of the commission briefly and clearly.

Under the head of *importance of the tunnel*, the commission is of the opinion that the tunnel is not a necessity for ventilation or drainage, but that any scheme which promises increased economy in working the mines and rendering valuable the vast amount of now worthless low-grade ores in the Comstock lode, becomes of national importance. Whether the Sutro Tunnel project fulfills this condition of economy depends, in the opinion of the commission, upon the practicability of securing a sufficient water-power from the Carson River, at all seasons, for the reduction of the ores, and upon the efficacy of the methods

employed in Germany and other countries in Europe for the concentration of ores. On the first point the commission has no doubt. On the second it has not been able to obtain the desired information.

On the *feasibility of the tunnel*, the opinion of the commission is in favor of the entire feasibility of the project, so far as its construction is concerned.

The *cost of the tunnel*, the branch and all the shafts, is estimated at \$4,418,329 50 in gold.

The *time of completion* is estimated at three and one-half years, which may be reduced to two and one-third years, if machinery be judiciously employed.

The *value of the bullion* extracted from the mines of the Comstock lode, according to the information the commission was able to gather, is \$125,000,000.

The *present annual production* the commission place at \$15,000,000.

As regards the *probable future yield*, the commission says:

No claim can be made to anything like accuracy, except in the few instances in which ore-bodies are now developed. The commission has already stated its belief in the lode being what is known as a true fissure-vein, or as continuing downward indefinitely in the crust of the earth; but whether the vein will continue to be ore-bearing cannot be predicted with any degree of certainty. It is a matter of opinion, to be based, however, upon probabilities and the actual results experienced in deep mining in other parts of the world. These, in the judgment of the commission, favor the finding of ore down to the lowest depths that can be reached; and that this opinion is shared by most of the mining authorities, seems to be shown by their continued downward search.

The report concludes with the opinion that, as an exploring work for deep mining, the Sutro Tunnel may justly claim favorable consideration.

The information to be obtained from an examination by a commission of the methods followed in the mines of Germany and England, appears to be of such importance as to recommend itself to the favorable consideration of Congress.

Very respectfully, your obedient servant,

A. A. HUMPHREYS,

*Brigadier General and Chief of Engineers.*

The Hon. the SECRETARY OF WAR.

## REPORT OF THE SUTRO TUNNEL COMMISSION.

OFFICE SUTRO TUNNEL COMMISSION,

*New York, December 1, 1871.*

GENERAL: I have the honor to forward herewith the report of the Sutro Tunnel commission, and in separate packages, the following:

Package containing maps, plans, and drawings, marked from 1 to 11, inclusive.

Package containing estimate, circular letter, reports of superintendents of mining companies, &c., marked from A to L, inclusive.

The special information asked for by Mr. Sutro was received in time to be used in making the report; but the papers which he was requested to furnish, inasmuch as the opponents of the project had been invited to do the same, has not come to hand. It may be expected daily, and

when received will be forwarded with request that it be added to the papers accompanying the report.

Very respectfully, your obedient servant,

H. G. WRIGHT,

*Lieutenant Colonel of Engineers, Brevet Major General,  
Senior Officer of Commission.*

Brigadier General A. A. HUMPHREYS,

*Chief of Engineers, United States Army,  
Washington, D. C.*

Trans:  
LH

OFFICE SUTRO TUNNEL COMMISSION,  
*New York, November 30, 1871.*

GENERAL: The commission appointed under the authority of the act of Congress approved April 4, 1871, "to examine and report upon the Sutro Tunnel in the State of Nevada," having completed the duties assigned to it under said act, has the honor to submit the following report:

The members of the commission met in this city, in pursuance of your instructions, on the 9th of June, and after organizing and making the necessary preliminary arrangements, including a visit to, and examination of the Hoosac Tunnel in Massachusetts, proceeded to Nevada, arriving at Virginia City on the 29th of that month, and at once entered upon the duties with which they were charged. From that date to the 7th of August the commission was constantly occupied with its investigations, during which period it examined pretty thoroughly the mines on the Comstock and other lodes in the vicinity, the country in the neighborhood within a general radius of fifteen miles, with a view to ascertaining its topographical and geological character, and conferred with the mining authorities, miners, and others interested in the great and almost sole industrial interest of that section of Nevada.

Every facility was afforded the commission by the mining authorities and the people generally; the desire seeming to be on all hands to give the opportunity for a full and complete investigation of a subject in which the entire community was so deeply interested. To the superintendents of the various mines the commission is especially indebted for the large mass of information afforded by them, both verbally and in writing, in relation to the mines under their control. The latter portion will be found in their reports in the appendix, made in response to the interrogatories of the commission, a copy of which is also appended. To those papers frequent reference will be made in the course of this report. Mr. Sutro, the projector of the tunnel, was also present during most of the time the commission was in Nevada, and was always ready to afford information, and, from his familiarity with the subject, to suggest ready means for obtaining information from other sources.

The duties of the commission, as prescribed by the law under which it was appointed, were, "to examine and report upon the Sutro Tunnel, in the State of Nevada, authorized to be constructed by an act of Congress approved July 25, 1866, with special reference to the importance, feasibility, cost, and time required to construct the same; the value of the bullion extracted from the mines on the Comstock lode; their present and probable future production; also, the geological and practical value of said tunnel as an exploring work, and its general bearing upon our

mining and other national interests in ascertaining the practicability of deep mining."

To the above points the investigations of the commission, although naturally embracing a wide range, were particularly directed, and to them this report will be strictly confined, treating of them in the order in which they are given in the act above quoted.

#### IMPORTANCE OF THE TUNNEL.

In treating of the importance of this work, it seems proper to give a brief general description of the Comstock lode, referring for an account of its geological character to that part of the report which treats of the "geological and practical value of said tunnel as an exploring work."

The term *lode* is applied to "any regular vein, whether metallic or not, but commonly to a metallic vein," and will in this report be considered as applying to that fissure in Nevada which traverses Virginia City and Gold Hill, and is generally known as the "Comstock." This fissure or rent in the earth has an extent not yet fully developed, but which reaches certainly from the Ophir mine on the north to the Uncle Sam and Overman on the south, a distance of 12,000 feet. Beyond these points the lode is supposed to extend to the north and south to the Seven-mile Cañon in the former direction, and to the American Flat in the latter. It may, therefore, be said that while the fissure itself is believed to have been traced from the diggings known as the Utah mines on the north to the locality known as the American Flat or "American City" on the south, a length of about 22,000 feet, yet the portion of the lode now worked is comprised between the Ophir on the north and Overman on the south, or a distance of about 12,000 feet, or, say, two and one-quarter miles. This portion of the lode may, as is usually done, be divided into three groups, the "Ophir," the "Gould & Curry," and the "Gold Hill." The two former may be considered as within the limits of Virginia City, the last being in the town of Gold Hill; the two towns being, however, so connected that the stranger is at a loss to determine where one ends and the other commences. Both of these towns rest absolutely upon the lode, and the mine-shafts rise directly in the midst of the streets and houses. The lode has a dip or angle of inclination to the east of about 45°, varying in either direction some 10°. This variation, as might be expected, often occurs within small limits of extent of the vein, but generally keeps within those of 38° and 55° of inclination to the horizon.

The croppings or surface indications of the lode are generally west of the towns of Virginia City and Gold Hill, which, as before remarked, are in most part over the workings of the lode.

In the earlier days of mining upon the Comstock, the work was prosecuted to some extent by means of adits or horizontal tunnels; but as depth was attained, this process was necessarily abandoned owing to the configuration of the country immediately about it, and working by means of vertical shafts was exclusively followed. All the mines of the lode now worked are operated in this manner—that is, a vertical shaft is sunk in the "east country" rock, which, at a depth that can be pretty closely estimated, will reach the lode, and after passing through it into the "west country" rock, is generally continued in the latter upon an angle corresponding with the inclination of the west wall at the point of junction. From these shafts at various depths or "levels," usually about 100 feet apart, drifts or small tunnels are run horizontally in various directions through the lode to ascertain its ore-bearing char-



acter; and through them the ore and débris are brought to the shafts and raised to the surface by steam-power. The water met with in the workings is pumped to the surface through these shafts by the agency of some steam machinery, and air for ventilation is forced by blowers down the shafts, through wooden boxes, and distributed through pipes to the various working headings.

The ore thus brought to the surface is taken from the "dumps," in which it is first deposited, by wagons or railway-cars, and transported to the mills for reduction. These mills are scattered over the country wherever water is to be found, the greatest distance being about eighteen miles. With the exception of those on the Carson River, which are run by water-power, these mills are worked by steam; the water to be obtained being sufficient for the purposes of reduction only, and not for power. Indeed many of these steam-mills were idle during our visit, for the want of water, and the water-mills on the Carson River were generally working up to a part only of their capacities for the same reason.

In the early days of mining on the Comstock lode, several excellent wagon-roads of easy grades were constructed, leading to the mill-sites and to the sources of supply of the lumber and the fuel needed in the working of the mines; but these are now in a great degree supplanted by a railroad recently constructed from Virginia City to Carson City, passing through Gold Hill, and having branches leading to the principal reduction-works. By this road a large part of the ore extracted from the mines is transported to the mills, and most of the lumber and wood used for mining purposes is brought back on the return trips. This road, which is a fine example of railway engineering over a different country, is about twenty-two miles in length, not including its branches, and is reported to have cost about \$2,000,000. It is about to be connected with Reno, a station on the Central Pacific Railroad, by an extension from Carson City to the latter point, but at the time of our visit its principal business was the transportation of ore from the mines to the mills, and of lumber and fuel for the supply of the mines.

One of the objects of the tunnel, as will be seen further on, is to change almost wholly the mode of working the mines just described. The tunnel, which is to be nearly rectangular in cross-section, having a height of 12 feet, with a width at bottom of 14 feet, and at top of 13 feet, commences at a point in the valley of the Carson River, and running in a direction nearly perpendicular to the Comstock ledge, is to intersect it at a level of 1,898½ feet below the point of the croppings, marked A on the map, to which the various levels of the mines are referred. At or near this point of intersection a cross-tunnel of similar dimensions is to run along the ledge, and to communicate with all the mines. A commencement of 70 feet only in length has been made on the main tunnel, more with a view to showing what is designed than for any other purpose, and a drift six feet by seven in cross section had been extended under the intervening mountains about 2,300 feet at the time of our visit. It is understood that this length had been increased to 2,530 feet on the 14th of November. The map No. 1, herewith, of the country in the vicinity of the Comstock, shows the positions and directions of the main and cross tunnels, and the sheet marked No. 2, a section and profile of the grounds on the line of the tunnel. The cross section of the tunnel and of the drift or preliminary tunnel, upon which work is at present prosecuted, are shown on sheet marked No. 3. The length of the main tunnel will be 19,790 feet, or about three and three quarter miles, and the cross tunnel, if extended only so far as to include

the mines now being worked, about 12,000 feet, or about two and one-quarter miles. Should the ledge north of the Ophir and south of the Uncle Sam and Overman be again worked, the cross-tunnel must be increased in length correspondingly. In our estimates of costs we have considered the main and cross tunnels separately, and have restricted the latter to the limits of the Ophir on the north and the Uncle Sam and Overman on the south. Drawings exhibiting plans of all the mines within the above limits will be found with this report, marked 4, 5, 6, 7, 8, 9, 10, and 11.

The principal advantages of the proposed tunnel in relation to the mines, as claimed by Mr. Sutro, may be stated briefly as follows.

1st. The improved ventilation of the mines, resulting from the current of air which, entering the tunnel at its outer extremity, and passing through it and up into the mines and out at their present shafts, will so cool and purify the heated, stagnant atmosphere of the drifts and stopes as to preserve the health of the miner, and enable him to accomplish a greater amount of labor than would otherwise be possible.

2d. The drainage of the mines above the level of the tunnel—an object which is now accomplished by means of costly machinery and at great expense. On the connection of the tunnel with a mine, the water in the latter would discharge itself without the intervention of machinery and without cost.

3d. A largely increased economy in the working of the mines by taking the ore through the tunnel to reduction works at its mouth, instead of raising the same to the surface and transporting it, often to a much greater distance, to the mills now established.

4th. Its value as an exploring work in cutting at considerable depths several mineral veins or lodes known to exist to the eastward of the Comstock, all of which have been, and at some points continue to be, worked for the precious metals; also, in a geological point of view, in determining the depth at which precious ores will be found in our country in what may be considered as true fissure-veins.

These claims on the part of the advocates of the tunnel will be considered in the order in which they have been stated, with the exception of the last, which can be more properly treated under the head of "the practical value of said tunnel as an exploring work."

#### VENTILATION.

At the time the tunnel was projected, and the act of Congress of July 25, 1866, was passed, the mines on the Comstock lode were undoubtedly much embarrassed in their operations by the lack of proper ventilation. The atmosphere in their stopes and drifts was hot and stagnant, and any relief, such as was promised by the tunnel, might well be viewed as indispensable by the mining authorities and miners to the further prosecution of their search for the precious metals. A stagnant atmosphere and a temperature of over one hundred degrees might well occasion misgivings of success in their attempts upon the lower and therefore hotter levels. At that time each mine was worked independently of the others, upon its own ground, with its single shaft forming the only communication between its stopes and drifts and the surface. Without the aid of mechanical ventilation, it is not surprising that, at a depth of three or four hundred feet even, the air of the mines should have severely taxed the miner's powers, and induced the belief that further search into the heated bowels of the earth would be impossible,

unless some artificial aid, such as the proposed tunnel promised to afford, should be provided.

But this very necessity for an improved and increased ventilation indicated one of the means by which it might, in a great degree at any rate, be accomplished. The drifts of contiguous mines were connected together, an air current was established down the shaft of one and up the other, passing in its transit through such of the drifts, stopes, and winzes as were between them, thus purifying and cooling the atmosphere in those parts of both. For the portions of the mines which were influenced imperfectly or not at all by the current of air thus established, recourse was had to blowers operated by the steam-power employed in hoisting. By means of these blowers air could be forced through pipes to all parts of the mines not affected sufficiently by the natural ventilation established by the subterranean connection just alluded to. At the time of our visit, the mines were generally well ventilated, and the miners with whom we conversed did not complain; and in the cases in which a more effective change of air was needed, steps were being taken to accomplish it.

It is, therefore, the opinion of the commission that, while the proposed tunnel would increase and improve the ventilation of the mines and possibly dispense with the use of some part of the means for artificial ventilation now employed, it is not a necessity for ventilation. Even with all the aid that the tunnel can be expected to afford, it is the opinion of the commission that mechanical ventilation by blowers, operated by steam or other power, would still be needed at the headings and in the stopes where the air from the tunnel would not penetrate.

According to natural laws as at present understood and received, the air entering the proposed tunnel would pass through it and up the shafts of the mines by the easiest and therefore by the most direct channels, thereby conferring little if any benefit upon the stopes and drifts not in the line of such direct transit. Hence the necessity which is assumed for a continuance of mechanical ventilation for certain portions of the mines after the completion of the tunnel.

And here it may be proper to allude to certain anomalies observed in the ventilation of the mines on the Comstock lode, as well as in mines upon lodes lying to the eastward. According to the received laws of ventilation it would have been assumed that, in the case of two shafts connected at bottom by drifts, the air current would pass down the lower and through the drifts up the higher, and that this rule would be without exception where not influenced by circumstances of situation or artificial causes; that, in the case of a long adit or tunnel, the inner extremity of which was connected with the surface by a shaft, the outer being directly upon the side of the mountain, the current would be through the tunnel and up the shaft. In the former case the current was found to be sometimes in one direction and sometimes in the other, it having been permanently changed in one instance, after the occurrence of a fire in one of the mines thus connected; the down-draught having been through the shorter shaft before the fire, and through the longer ever since. In the latter case, which applies to two tunnels visited by the commission, the down-draught was into and downward through the shafts and out of the tunnels in a very strongly perceptible current. In view, therefore, of these anomalies, it would seem uncertain whether the current of air would pass through the proposed tunnel into the mines and out through the shafts, or the reverse. So far as the ventilation is concerned, it will be of little importance which way the current should pass. Probably the mines would be the