

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

HUGHES,
cer for Irrigation

MISCELLANEOUS.

G.O., No. 118 Im.

DATED 18-1-98.

INDEXED. *Ch*

[Despatch Abstract.]

Red Hills Tank

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible *except between 15th October and 15th December* when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute *weir crest* for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained :—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute *weir crest* for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained :—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

No. 118 M., 18th JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
„ Superintending Engineer, V Circle.
„ Local and Municipal Department.
„ Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Enclosures

1898.

Spare copies

Recd.

Regd.

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.
LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Enclosures

1898.

Regd.

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 27.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

Enclosures

1898.

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Enclosures

1898.

Regd.

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Regd. Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet; in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Re *Hills Tank.*

Communicating to the Municipality Order, Public Works Department, referring the notes of inspection of the — by

Commissioners of Madras, with remark, Government to the Local and Municipal Department for consideration of Chief Engineer for Irrigation.

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

1898.

Enclosures

Regd.

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper:—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper:—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Enclosures

Regd.

Spare copies

1898.

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

2
No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.
LOCAL AND MUNICIPAL DEPARTMENT.

Read—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Enclosures

1898.

Regd.

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

No. 118 M., 18TH JANUARY 1898.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper:—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper:—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It

appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute *weir crest* for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to and of last irrigation season tabulated and submitted.

For 1895 the following results were obtained :—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
.. Superintending Engineer, V Circle.
.. Local and Municipal Department.
.. Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President, Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the rise in the level could not be altogether removed, it could be reduced to a minimum. The weir crest at 44.67 (its present level) and using hinged shutters to raise the level to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

No. 118 M., 18TH JANUARY 1898.

level from 15th June to 23rd October 131 days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 27th November, 91 days. The average comes to 33½ days a year, and as the pumping it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted the weirs, we could engage to refuse water for second crops when the level fell to or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching would not be altogether removed, it could be reduced to a minimum by keeping the crest at 44.67 (its present level) and using hinged shutters to retain the water to S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam 1½ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and 1½ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 8. Both the Cholvaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

	Evaporation.	INCHES.
January		4.56
February		4.57
March		6.28
April		7.07
May		8.37
June		8.36
July (29 days)		5.04
August (25½ days)		4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible *except between 15th October and 15th December* when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute *weir crest* for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.									INCHES.
January	..	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25 $\frac{1}{2}$ days)	..	..	..	..	..	..	..	4.48

the average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
„ Superintending Engineer, V Circle.
„ Local and Municipal Department.
„ Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.										INCHES.
January	..	..	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
„ Superintending Engineer, V Circle.
„ Local and Municipal Department.
„ Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute *weir crest* for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible *except between 15th October and 15th December* when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
„ Superintending Engineer, V Circle.
„ Local and Municipal Department.
„ Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained :—

Evaporation.										INCHES.
January	..	..	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible *except between 15th October and 15th December* when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

December in the 8th rule for the regulation of water quoted in the margin and substitute *weir crest* for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.									INCHES.
January	..	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILKINSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
.. Superintending Engineer, V Circle.
.. Local and Municipal Department.
.. Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131 days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to 33½ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47·67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44·67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam 1½ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and 1½ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

	Evaporation.								INCHES.
January	..	..	..	..	..	..	..	..	4·56
February	..	..	..	..	..	..	..	..	4·57
March	..	..	..	..	..	..	..	..	6·28
April	..	..	..	..	..	..	..	..	7·07
May	..	..	..	..	..	..	..	..	8·37
June	..	..	..	..	..	..	..	..	8·36
July (29 days)	..	..	..	..	..	..	..	..	5·04
August (25½ days)	..	..	..	..	..	..	..	..	4·48

The average comes to ·21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J.
Under Secretary to
Irrigation,
Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

Evaporation.								INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
„ Superintending Engineer, V Circle.
„ Local and Municipal Department.
„ Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained:—

	Evaporation.								INCHES.
January	..	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President Municipal Commission, Madras.

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It

Rule 8. Both the Cholvaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute weir crest for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained :—

Evaporation.									INCHES.
January	..	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

} 1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.
Cno 1820 h/98							

Government of Madras.

LOCAL AND MUNICIPAL DEPARTMENT.

MISCELLANEOUS.

Recd.

Regd.

1898.

Enclosures

Spare copies

G.O., No. 118 M., 18th January 1898.

Red Hills Tank.

Communicating to the Municipal Commissioners of Madras, with remark, Government Order, Public Works Department, referring to the Local and Municipal Department for consideration the notes of inspection of the — by the Chief Engineer for Irrigation.

GOVERNMENT OF MADRAS.

LOCAL AND MUNICIPAL DEPARTMENT.

READ—the following paper :—

G.O., No. 1127 I., dated 15th December 1897.

Read—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this

level from 15th June to 23rd October 131, days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible except between 15th October and 15th December when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute *weir crest* for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last few years. The observations only for the first 8 months of 1895 have been sent to the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results obtained :—

	m.							INCHES.
January	..	..	..	..	..	..	..	4.56
February	..	..	..	..	..	..	..	4.57
March	..	..	..	..	..	..	..	6.28
April	..	..	..	..	..	..	..	7.07
May	..	..	..	..	..	..	..	8.37
June	..	..	..	..	..	..	..	8.36
July (29 days)	..	..	..	..	..	..	..	5.04
August (25½ days)	..	..	..	..	..	..	..	4.48

The average comes to .21 inch a day.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

No. 118 M., 18TH JANUARY 1898.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

W. HUGHES,
Chief Engineer for Irrigation.

Order—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

F. J. WILSON,
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

Order—No. 118 M., dated 18th January 1898.

Communicated to the Municipal Commissioners of Madras for remarks with reference to paragraph 2 of the Chief Engineer's note.

(True Extract.)

H. TREMENHEERE,
Secretary to Government.

To the President, Municipal Commission, Madras.

IRRIGATION.

Government {1897} of Madras.
PUBLIC WORKS.

Recd.

1897.

Enclosures

Regd.

Spare copies



G.O., No. 1127 I., 15th December 1897.

DECEMBER.

Order No. 118 M. 2/18.1.98
Communicated to the Municipal
Commissioners of Madras for remarks
with reference to para. 2 of the
Chief Engineer's note.

1.3
14/1/98

17/1/98

To The President, Municipal Commission, Madras.
O. 27/1/98

Red Hills Tank

Notes of Inspection by the Chief Engineer for Irrigation of the —, communicated to the Superintending Engineer, V Circle; and paragraph 2 of the notes referred to the Local and Municipal Department for consideration whether the Madras Municipality can be asked to pay for fitting shutters on the crests of the weirs of the tank.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Irrigation.

READ—the following paper :—

No. 277 I.

NOTES OF INSPECTION BY THE CHIEF ENGINEER FOR IRRIGATION (14TH AND 15TH NOVEMBER 1897).

Red Hills Tank.

The bund gave much trouble for some years after its construction. A full account of the remedies adopted is given in Mr. Vincent's monograph written in 1882. The bund was greatly improved, and, just before the cyclone of 21st November 1884, was reported by the Superintending Engineer to be in good order showing no signs of weakness. The subsequent breach in the tank was entirely due to water being blown over the bund and cutting away the rear slope. The history of this accident and the means of making the tank secure for the future are very fully discussed by Colonel Hasted in his note printed with G.O., No. 229 I. of 5th March 1885. The measures recommended and sanctioned consisted in lowering the weir 3 feet, in closing the breach with a wall with top level $1\frac{1}{2}$ feet above full supply, thus forming an additional escape 582 feet long, and in rebuilding the parapet of the revetment in mortar and with the lower course projected as a strong course to break waves running up the slope. It is to be remembered that, in the storm of 1884, the surplus sluices were not opened at all owing to the wind and waves preventing men standing on them and that these sluices can, when fully open, discharge about 5,500 cubic feet per second which is more than the greatest inflow hitherto observed. They are sufficiently powerful to prevent the water ever rising above any desired level and, when there is no water entering the tank, can lower the water level at the rate of 1 foot in 8 hours. In addition to the sluices, there is a weir 800 feet long with crest at full tank level, another—that in the site of the old breach—582 feet long with crest at $1\frac{1}{2}$ feet above F.T.L. and a ground escape 600 feet long. With the sluices open, the level of still water is never likely to rise much above the crest of the lower weir and the weirs are chiefly of use in case of accident to the sluices and because in rough weather, when it is desirable to lower the water quickly, a large quantity will be washed over them in waves. Just before the storm of 1884, the water was 3 inches below the then F.S.L. The level at the time the bund gave way is not known, but it must have been at least 3 feet and may have been much more above what it can reach with the present surplus works in effective operation. The bund is now 9 feet above F.S.L. and the parapet 3 feet higher, so that there is really a margin of 12 feet, and waves must rise this height before they can do any harm. At the sluices also there is the additional margin of 3 feet, but in the absence of a parapet to the platform, it is doubtful whether men could work the sluices in a very violent storm. The Superintending Engineer has had an estimate prepared for building a parapet and for renewing the woodwork of the sluice shutters which is very much decayed. This work will be carried out next year.

2. As the demand for the supply of Madras increases, it has become of somewhat pressing importance to consider whether the full supply level cannot be raised to its original level, or such lower level as may be necessary to enable a sufficient supply to be retained to avoid pumping. On examining the registers of the last ten years it is

found that in the seven years—1888 to 1890 and 1894 to 1897—the water did not fall below 37.0, the level at which pumping has to be begun. In 1891 it was below this level from 15th June to 23rd October, 131 days; in 1892 from 7th May to 27th August, 113 days; and in 1893 from 7th August to 5th November, 91 days. The average comes to $33\frac{1}{2}$ days a year, and as the pumping is said to cost Rs. 100 a day, it would be a good investment for the Municipality to pay for the weir shutters required to hold up the water. If shutters were fitted on the weirs, we could engage to refuse water for second crops when the level fell to 1 or 2 feet above that at which irrigation water is now cut off, and this is all that the Municipality would require. Government has scarcely any pecuniary interest in the matter.

3. With regard to the question whether it would be safe to raise the water level by weir shutters, Colonel Mullins expressed the opinion in his remarks on the report of the cyclone of 1879 that (with F.T.L. at 47.67), though the risk of breaching could not be altogether removed, it could be reduced to a minimum by keeping the weir crest at 44.67 (its present level) and using hinged shutters to retain the water to F.S.L. This opinion is quoted by Colonel Hasted who, in the note referred to above, gives his own opinion that "should it appear later on that the demand for water for Madras requires additional storage, it will be possible to raise the water surface by placing falling shutters on the weir crest and constructing a small parapet on the top of the masonry dam. This could be done, it is considered, without endangering the safety of the reservoir, as the falling shutters could all be lowered in a very short time when necessary." The reason of the suggestion to build a parapet on the masonry dam instead of fitting shutters is probably owing to its not being safe to discharge over the dam unless a strong apron be built, but this could easily be done. The Superintending Engineer proposes to fit 3 feet shutters on the crest of the weir and lower the masonry dam $1\frac{1}{2}$ feet and fit 3 feet shutters on that also. I think it would be preferable to leave the crests as they are and fit 3 feet shutters on one and $1\frac{1}{2}$ feet shutters on the other.

4. Of the storms which have occurred between 1787 and 1884, one has occurred in March, 12 in May, 5 in October, 8 in November and 3 in December, but none has begun later than the 10th December. It appears safe to substitute this date for 15th December in the 8th rule for the regulation of water quoted in the margin and substitute *weir crest* for one foot below full tank level. The shutters would, in such case, be up only after 10th December.

Rule 8. Both the Cholavaram and Red Hills tanks should be kept to as near full tank level as possible *except between 15th October and 15th December* when the Red Hills tank should not be allowed to rise higher than one foot below full tank level.

Rule 10 (b) has never been acted on. If it had been, the tank supply would have often run short as the intimation of the approach of cyclones has been as often falsified as justified, but these intimations at least keep the tank establishment on the alert.

5. The statistics of evaporation printed with Mr. Vincent's monograph are evidently very unreliable and give results quite at variance with the more careful observations of the last three years. The observations only for the first 8 months of 1895 have been sent to this office, the Superintending Engineer should have the rest up to end of last irrigation season tabulated and submitted.

For 1895 the following results were obtained :—

Evaporation.							INCHES.
January	...	...	...	...	...	...	4.56
February	...	...	...	...	...	...	4.57
March	...	...	...	...	...	...	6.28
April	...	...	...	...	...	...	7.07
May	...	...	...	...	...	...	8.37
June	...	...	...	...	...	...	8.36
July (29 days)	...	...	...	...	...	...	5.04
August (25½ days)	...	...	...	...	...	...	4.48

The average comes to 21 inch a day.

No. 1127 I., 15TH DECEMBER 1897.

The water discharged for irrigation has also been measured, but the results not submitted except for 3 months of 1895. It is hoped that they will be tabulated soon as they will give most valuable information.

6. The tank bund and masonry works are in good order. There has been some leakage under the bund almost since its construction, but this was reduced by the means described in the monograph and has certainly not increased since I inspected the tank in 1892. It is quite harmless as the foot of the bund is well drained.

KURNOOL,
1st December 1897.

(Signed) W. HUGHES,
Chief Engineer for Irrigation.

ORDER—No. 1127 I., dated 15th December 1897.

Communicated to the Superintending Engineer, V Circle, for information and guidance.

2. Paragraph 2 of the notes read above will be referred to the Local and Municipal Department for consideration, whether the Municipality can be asked to pay for fitting shutters on the crests of the weirs of the Red Hills tank.

(True Extract.)

H. Williams
Under Secretary to Government,
Irrigation Branch.

To the Chief Engineer for Irrigation.
" Superintending Engineer, V Circle.
" Local and Municipal Department.
" Revenue Department.

beides

Ed. T. K. Narayana Aiyangar.

When given for copying _____
When copied _____
When examined _____
When signed _____

189

READ AGAIN G.O. No. _____
189

DATED

CURRENT No.

32 M of 1898

A

48

ENCLOSURES TO G. No.

ORDER OF GOVERNMENT

A A A A A A A

LETTER OF GOVERNMENT.

STATEMENT WITH DITTO.

PAPERS NOT FILED UP, BEING MEANT FOR DESPATCH
IN ORIGINAL.

N.B.—

A = Copy in full.
B = Not to be copied.
P = Copy abstract only.
Q = Copy heading only.

2882
3/1/56