Analysis of the Visual Impact of the Treatment Plants in Monfragüe National Park, Cáceres

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Abstract. In recent years, there has been a considerable increase in the construction of wastewater treatment plants (WWTPs) in rural settings as a result of the obligations set forth in Directive 91/271 and Framework Directive 2000/60, which require an improvement in the quality of wastewater effluent in order to meet certain quality parameters in the discharge receiving waters. These new structures substantially modify the landscape in the vicinity of the facility locations. Therefore, this study aims to provide certain solutions in an effort to reduce the visual impact of these facilities on their natural environments. To conduct this research, four treatment plants located in Monfragüe National Park (Cáceres) and the surrounding area were selected. In order to perform the analysis of the visual impact, the quantitative landscape assessment method was applied, taking images of both the initial situation and different simulations, and using continuity and contrast models to identify the degree of integration of a WWTP into its surroundings. Subsequently, a survey was conducted to compare the results of the quantitative analysis and the visual perceptions of individuals with no knowledge of the methodology employed in the analysis. When the process was finished, the conclusion was reached that an ideal solution might be to bury these structures underground. As this solution is not feasible, recreation of the immediate natural setting is considered the most suitable option for mitigating the visual impact that the WWTP could have on the views seen by an observer from the outside.

1. Introduction
The indiscriminate dumping of untreated wastewater has led to a considerable increase in contamination in some rivers and natural watercourses. In order to address this issue, the European Union has adopted certain measures that aim to mitigate the negative impact incurred. One of the proposed solutions is to make treatment of municipal wastewater compulsory, regardless of the number of inhabitants [1]. For this reason, construction of these types of facilities (WWTPs) has increased in towns and associations of municipalities, thus modifying the landscape in the vicinity of these areas. The study conducted in this article arises within the framework of the need to counteract the possible negative visual effects of these structures once they are in operation in their permanent location.

The landscape, defined as natural, cultural and historical heritage, is becoming increasingly relevant as an environmental factor in demand by the general public, and interest is growing in taking landscape resources into consideration when preparing policies, planning and managing resources to guarantee sustainable development [2, 3]. European landscapes face changes linked to globalisation and its...
associated increasing flows of technology, investment and trade; intensification and homogenisation; urbanisation and proliferation of built infrastructure; marginalisation and abandonment; and renewable power provision [4]. There is increasing acceptance of the need for a cross-disciplinary approach to the design of constructions in rural settings, which is further bolstered by the recognition of the multi-faceted role of agriculture [5]. Such collaborative initiatives have been termed “integrated landscape initiatives (ILIs)” [6, 7] or “landscape stewardship initiatives” [8]. Adaptation to the context is deemed a new component to be taken into account in the study, as a relationship may develop between these elements [9]. The study of the options for reducing the visual impact generated by wastewater treatment plants in Monfragüe National Park results from the need to integrate these facilities into the rural environment.

Buildings were carefully sited and oriented, resulting in a close relationship between the building and the landscape [10]. The locations of outfalls are considered to be one of the most essential elements that affect the surrounding water quality and aquatic wildlife [11]. It is necessary to address the issue of suitable locations for the sewage treatment plants and sewage outfalls [12]. The location or placement of a treatment plant within the landscape is like a set, viewed from an external perspective at a sufficient distance to observe it within its rural setting. In each scene, the colour of the main elements should be considered (vegetation, soil, other buildings, textures, lines and forms…etc.). A methodology for data acquisition needs to be established, some important features can be taken from [13, 14]. As other authors have noted [15] & [16], vegetation is one of the most important features to be taken into account in the landscape. The specific properties of a plant affect the perception of space in green zones. The colour of trees and bushes is known to be an important factor in generating spatial effects [17].

1.1. Defining the study area

The WWTPs located in Monfragüe National Park, which is located approximately in the centre of the province of Cáceres, in the triangle formed by the well-known cities of Plasencia, Trujillo and Cáceres, were chosen for this study because this area is home to highly valuable landscapes. The defining features of this landscape are the Tagus River running through it and low mountains surrounded by extensive pasturelands, or dehesas. In 1991, the park was declared a Special Protection Area for Birds, and this classification was later extended in May 2004 to cover the current SPA for Birds known as "Monfragüe and Surrounding Dehesas". The dehesa is an anthropogenic eco-system, which was generated by human intervention in the original woodland, deforesting it by fire or through the introduction of livestock, causing the shrub land to disappear and creating open spaces within this ‘woodland-park’ [18].

1.2. Aims

The general aim of the study is to provide basic guidelines intended to reduce the visual impact of WWTPs on the rural environments of towns. To perform the work, the following must be considered:

- The natural environment in which the WWTP is located.
- The layout and aesthetics of the elements composing the treatment plant.
- The views that observers may have of the WWTP and the setting as a whole.

To achieve the established aim, a series of images must be attained from original photographs and simulations. These images were analysed using the Cañas method for assessing the quality of the visual landscape [19]. Next, the analysis conducted as indicated above was compared with the findings from a survey of the population. In generating the alternative images, it is advisable to use a colour that is common in the vicinity of the WWTP and offers low contrast in relation to the adjacent colours, so that the image attained is as harmonious as possible. Decreasing the visual impact of this type of facility would reduce or eliminate distractions for (moving) observers, given that these facilities are often located in the vicinity of towns where people regularly drive [20].

2. Methodology

In order to conduct an analysis of the visual impact of a WWTP, concise, reliable data are needed. In this regard, direct observation on site is the most effective method. The observer must travel to the site
to be viewed with a map of the zone, and the elements observed are noted on the map [21]. To establish the visual assessment, three approaches and techniques used in landscape studies are identified. In the first of these, the researcher or professional considers the specific characteristics or features of the area, using maps, photographs and field trips to search for consensus. The second aims to describe the landscape component by component or as a whole, in which case the components must be identified and each of them quantified. The third approach is based on surveys of the population, which help to identify the perceptions and preferences of these people [22]. This article compares the results of the approach offered by researchers with the knowledge needed to make a physical analysis of the landscapes and the findings attained through surveys conducted on people with no knowledge of visual analysis techniques and methods.

2.1. Description of the setting in which the studied WWTPs are located

To conduct this research, four treatment plants located in Monfragüe National Park and the surrounding area were selected (figure 1):

Figure 1. Map and geographic location of Monfragüe National Park and its catchment area

2.1.1. Malpartida de Plasencia

The land surrounding the treatment plant features significant quantities of vegetation, which affords the setting with an image of lively nature. The most important and characteristic species are holm oaks, pastures and bushes. The first of these is the most abundant and most typical of the area in which the treatment plant is located (figure 2). The different plots or properties are separated by traditional stone walls and in some cases, with metal fence extensions. There are landscaped zones around some of the wastewater treatment processing elements and, surrounding the treatment plant to protect it from possible intrusion, there is a 1.5-metre high metal perimeter fence.
2.1.2. Torrejón el Rubio
The land adjacent to the treatment plant is used for grazing, mainly by sheep, and there is also a large amount of Mediterranean scrub and wildflowers. The property lines are made of stonemasonry walls. On the land that is furthest from the treatment plant, there are numerous holm oaks (figure 3). Along the perimeter, there are Arizonica plant species of varying heights. These plants may have been chosen because they require little maintenance. There is also a metal fence surrounding the treatment plant.

2.1.3. Serradilla
The vegetation present in the area is composed of Mediterranean scrub, certain aquatic plant species and holm oaks (figure 4). The adjacent land mainly consists of pastures and all the plots have numerous holm oaks that create a screen across some of the buildings located on nearby properties. The property lines are made of stonemasonry walls. There are Arizonica plant species along the perimeter and a metal fence surrounds the treatment plant.

Figure 2. Image of the Malpartida de Plasencia treatment plant

Figure 3. Image of the Torrejón el Rubio treatment plant.

Figure 4. Image of the Serradilla treatment plant
2.1.4. Villarreal de San Carlos

The treatment plant is located within Monfragüe National Park and partially constructed under a hiking trail (figure 5). Running along the path there is abundant holm oak, brush and rockrose. There is also a small plot with fruit trees next to the path. Due to the limited population it serves and its location, it was possible to build this treatment plant underground. From the outside, only two well covers and three ventilation shafts can be seen.

![Figure 5. Front and back view images of the Villarreal de San Carlos treatment plant](image)

2.2. Researcher's approach.

To assess the different units that compose the group of landscape settings in the area, a specific method was used, which is adapted to the inherent features of the studied area, the quantitative landscape assessment method, which comprises 16 attributes grouped into three types (physical, aesthetic and psychological). This is the model used to measure the quality of the image. The assessment applied to each type of landscape is established using a scoring system from 0 to 100 points and, with the rating attained, a landscape classification is made according to the table shown below:

| OVERALL CLASSIFICATION | INTERVALS |
|------------------------|-----------|
| Deteriorated           | 0         |
|                       | <20       |
| Deficient              | 20        |
|                       | 32        |
| Mediocre               | 33        |
|                       | 44        |
| Satisfactory           | 45        |
|                       | 56        |
| Good                   | 57        |
|                       | 68        |
| Very Good              | 69        |
|                       | <80       |
| Excellent              | 80        |
|                       | 100       |

Table 1. Quantitative method classification intervals [19]

Thus, the method has a high degree of sensitivity, meaning that it is sensitive to minor changes that occur in the landscape as such changes are reflected in the assessment or the notes thereto. The assessment was conducted using photographs taken on site by the researcher at the study location. They were taken enough from far away to enable the viewer to discern the placement of the WWTP in its context and also include the surrounding landscape. In order to make all the required information more easily visible, these photographs must be panoramic shots. Two models are defined with the aim of verifying the degree of integration of a WWTP into its surroundings:

- **Continuity**: the edges of the treatment plant reproduce the most immediate surroundings. This prevents a disruption of the harmony of the landscape.
- **Contrast**: the WWTP does not have elements that reproduce the immediate surroundings.
To verify these models, three simulations were done using Adobe Photoshop software on the original panoramic photos: two of them use natural elements present in the zone, while the third utilises an artificial element. To conduct the physical analysis of the treatment plant, two essential aspects must be taken into account: the technical features of the treatment plant and its location in relation to the urban setting. The determining factors for selecting the treatment plant location are divided among data related to the land and climate data [23]. Therefore, the location in relation to the urban setting is a feature to be kept in mind, even though it cannot be changed.

2.3. Surveys
In order to discern the impressions that viewers have when observing the images, surveys were taken of people with no knowledge of the method used for the physical analysis of the landscape. To this end, 80 surveys were conducted of individuals at random within an age range of 18 to 55 years old. The original panoramic photographs and the computer-generated simulations were displayed in the surveys. The use of photographs to garner viewers' perceptions has proven to be highly useful in diverse research studies [24] & [13]. Each of these images was assessed in accordance with the intervals in the quantitative method. Thus, it is possible to compare the findings from the surveys with the results attained by applying the quantitative method. There are two completely separate parts to the survey: in the first, the individuals taking the survey are classified and, in the second, their perception of the landscape is discerned. There are two questions in the first part: one asks the respondents’ age and the other, their educational level. In the second part, the different images attained of each treatment plant are shown in the following order: image of the initial situation, simulation with plant features present in the vicinity, simulation with plant features not located in the vicinity and, finally, the contrast simulation containing a stonemasonry wall.

All the surveys were taken using the Google Docs web application and were sent to the participants by email with a link. The sample size was estimated based on the following formula [25]:

\[ n_0 = \left( \frac{\sigma^2 z (1 - \alpha^2)}{d^2} \right)^2 \]  (1)

The standard deviation in the work [24, 25] ranges from 0.48 to 0.50, and the latter value has been used in this study.

3. Results and discussions
This section provides the assessments attained under the quantitative landscape assessment method using the images (researcher approach) of both the initial situation and the different simulations and applying the continuity and contrast models. The findings of the landscape perception surveys are also discussed.

3.1. Quantitative Method

3.1.1. Malpartida de Plasencia
The photographs were taken from a small hill located north of the treatment plant. The influent pipe, which is built on artificial fill, is located on the right side of the image. The incoming influent pipe is exposed and the metal pipe has been painted green to better integrate it into the setting. There are two different types of vegetation in the surrounding area, with large numbers of holm oaks encircling the treatment plant to the south and grass and bushes being more prevalent to the north. In the first simulation shown (figure 6), a screen of holm oaks similar to those in the vicinity has been added. The chosen tree is typical of this zone, and the influent pipe was also concealed by extending the artificial fill area. The holm oaks do not prevent some of the treatment plant's features from being visible, especially those located at the same height as the tree trunks.
In figure 7, the natural slope on the left side of the image has been extended in order to avoid introducing foreign elements in the setting. With this solution, views of the treatment plant are almost entirely eliminated and the influent pipe is concealed. The two existing holm oaks have been kept in their original location in an attempt to modify the initial situation as little as possible.

The extension of the artificial fill where the influent pipe is located is shown in figure 8. In this case, the chosen solution is an element unlike those found in the natural setting, although it must be noted that it is present nearby and therefore is not unknown to the viewers. The maximum height was chosen so as to conceal the influent pipe. In this case, views of the interior of the facility are almost completely eliminated. The fill materials chosen are similar in colour to the hues found in the surroundings, in an effort to reduce the visual impact.

Out of the modifications or simulations made, the extension of the natural slope (figure 7) received the highest score, with a total of 65 points (very good).
Table 2. Assessment of the different WWTPs

| Malparida de Plasencia WWTP | Torrejón el Rubio WWTP | Serradilla WWTP | Villarreal de San Carlos WWTP |
|-----------------------------|-----------------------|----------------|-----------------------------|
| Initial situation           | Holm oak screen       | Natural slope  | Artificial slope            | Initial situation | Holm oak screen | Screen of Arizonica plants | Stonemasonry wall | Initial situation | Holm oak screen and rockrose | Screen of Arizonica plants | Stonemasonry wall | Initial situation |
| 1 Water                     | 0                     | 0              | 0                           | 0                | 5.5             | 5.5            | 5.5                        | 4                | 4              | 4                     | 4                     | 4                      | 0                         |
| 2 Land form                 | 6                     | 6              | 6                           | 6                | 3               | 3             | 3                          | 3                | 3              | 3                     | 3                     | 3                      | 8                         |
| 3 Vegetation                | 12.5                  | 13.75          | 15                          | 12.5             | 12.5            | 12.5            | 12.5                       | 15               | 15             | 15                    | 15                    | 15                     | 19.5                       |
| 4 Snow                      | 0                     | 0              | 0                           | 0                | 0               | 0              | 0                          | 0                | 0              | 0                     | 0                     | 0                      | 0                         |
| 5 Fauna                     | 3                     | 3              | 3                           | 3                | 4               | 4              | 4                          | 4                | 3              | 3                     | 3                     | 3                      | 11                        |
| 6 Land use                  | 11                    | 11             | 11                          | 11               | 11              | 11             | 11                         | 11               | 11             | 11                    | 11                    | 11                     | 18                        |
| 7 Views                     | 3                     | 3              | 3                           | 3                | 3               | 3              | 3                          | 3                | 3              | 3                     | 3                     | 3                      | 1                         |
| 8 Sounds                    | 2                     | 2              | 2                           | 2                | 2               | 2              | 2                          | 2                | 2              | 2                     | 2                     | 2                      | 4                         |
| 9 Scents                    | 2                     | 2              | 2                           | 2                | 2               | 2              | 2                          | 2                | 2              | 2                     | 2                     | 2                      | 2                         |
| 10 Cultural resources       | 0                     | 0              | 0                           | 0                | 0               | 0              | 0                          | 0                | 0              | 0                     | 0                     | 0                      | 0                         |
| 11 Elements that alter the character | -5                      | -1,25          | -2,5                        | -10              | -10             | -7,5            | -7,5                       | -7,5             | -10            | -5                    | -5                    | -17,5                  | -1,25                      |
| 12 Shape                    | 1,5                   | 1,75           | 2,5                         | 3,75             | 1.5             | 2.75            | 3                          | 3                | -0.5          | 7.5                   | 6.25                  | 1.5                    | 6.25                       |
| 13 Colour                   | 1.5                   | 2.5            | 4                           | 0.5              | 1               | 3              | 2                          | 0.5              | -1.5          | 8.25                  | 7                     | 0.5                    | 5.5                        |
| 14 Texture                  | 0.5                   | 2.5            | 4                           | -0.25            | -1              | -0.25           | -0.75                      | -0.75            | -0.5          | 4.75                  | 4                     | -0.5                   | 4                          |
| 15 EInt                     | 0                     | 5              | 5                           | 8.5              | 6.5             | 6              | 6.5                        | 6.5              | 5              | 5.5                   | 4                     | 5                      | 4                          |
| 16 Expression               | 0                     | 7              | 10                          | 2                | 2               | 5              | 4                          | 2                | 1              | 5                     | 4                     | 0                      | 12                        |

TOTAL 38                  58            65            58            16            44            43            52            100          43           68           63           30           94

Mediocre Good Very good Mediocre Good Good Mediocre Good Mediocre Very good Very good Deficient Excellent

The elements that alter the character of the landscape (including those that negatively modify or alter the natural landscape) are the attributes that make the biggest difference amongst the different images. The unity attribute analyses the relationships between the different elements located in the scene. In this case, the continuity of shapes and proportions in sizes are the descriptors to be taken into account. Expression describes the sensations created by the landscape, which is quantified by how natural the observer deems the image or situation to be. In this case, the natural slope receives the highest score, as continuity with the setting is considered positive, unlike the initial situation, in which the treatment plant can be seen. It is interesting to note that the simulation containing the foreign element is given a higher score than the initial situation. This result is only found for this treatment plant and may be due to how well it was integrated originally by creating the artificial slope, which considerably reduces the visual impact of the structure in the natural setting.

3.1.2. Torrejón el Rubio

The photographs were taken from a vantage point located at a slight elevation to the southeast of the treatment plant. The vegetation surrounding the WWTP is composed of Mediterranean scrub, wildflowers and holm oak. Three simulations, which are described below, were done for the integration of the treatment plant into the setting. In figure 9, a row of holm oaks similar to those in the vicinity of the treatment plant is placed around the perimeter (outside the premises).

The chosen oaks are similar in size to the Arizonica species present in order to conceal the building (the most prominent feature) as much as possible. An effort is also made not to draw attention to the facility by placing especially large elements there.

At present, there are Arizonica plant species planted along part of the facility perimeter. Therefore, figure 10 shows a simulation using this type of vegetation in the areas that lack any visual barrier between the viewer and the treatment plant. This type of plant was chosen because of its low maintenance, rapid growth and acceptable foliage, which helps considerably reduce views of the treatment plant's features.
Finally, as seen in Figure 11, a 2-metre high stonemasonry wall was chosen to create a visual separation in a colour that is not present in the vicinity of the treatment plant. This solution has a significant impact on the observer’s views. In addition, it must be noted that the interior is partially visible from the height at which the photograph was taken, but this would not be possible if the viewer were at the same height.

The metal perimeter fence is concealed in all three alternatives. The assessments attained are detailed in Table 2. The simulation created with a holm oak screen received the highest score, rated as (satisfactory). The placement of the treatment plant in a flat zone with little neighbouring tree cover greatly alters the setting. This can be seen clearly in the elements that alter the character. In addition, the unity and expression attributes also confirm this situation, as they highlight the sensations that foreign elements in the natural landscape spark in observers.

3.1.3. Serradilla
The treatment plant's location near slight rises in the terrain reduces the views of the facility, thereby creating a lower visual impact. The landscaped areas inside the facility consist of grasses instead of natural lawn. These grasses are also found naturally in the area surrounding the treatment plant, which
contributes to the continuity of the landscape. The abundance of holm oaks and rockrose in the vicinity prompted an initial simulation with these features, the result of which is shown in figure 12. In this case, one senses that, behind these plants there is a construction.

**Figure 12** Retouched image of the Serradilla treatment plant with a screen of holm oaks and rockrose

Around the WWTP, certain *Arizonica* species have also been planted along the perimeter. In order to create continuity with this situation, in figure 13 the simulation was done by adding a screen of *Arizonica* plants similar to those already present. This plant is not typical of the zone but was chosen for the reasons discussed above. This species eliminates the view of everything that is behind it.

**Figure 13** Simulated image of the Serradilla treatment plant with a screen of Arizonica plants

For the contrast solution, a stonemasonry wall was used. In the image, adjacent stone walls can be seen, but the chosen wall bears no similarity to them. The wall is equal in height to the *Arizonica* plants that are currently found along the perimeter of the property. In this example, views of the interior premises are completely eliminated but, on the other hand, the observer's attention is caught, (figure 14).

**Figure 14** Simulated image of the Serradilla treatment plant with a stonemasonry wall.
The metal fence is concealed in all three alternatives. Applying the quantitative landscape assessment method to the four images (initial situation and three simulations) the assessments attained are shown in table 2. The holm oak and rockrose screen solution received the best score, closely followed by the Arizonica screen solution. The difference between the two lies in the aesthetic attributes (shape, colour and texture). The holm oaks and rockrose afford greater continuity to the scene.

3.1.4. Villarreal de San Carlos

In this case, no simulations were done because the WWTP is underground and the above-ground elements are well integrated due to their size, shape and colour. Table 2 shows the assessments attained by applying the quantitative method. This image attained an excellent score (94) and therefore, it is considered that, in its present situation, an observer could view the scene from the outside without noting foreign elements or features that differ from those in the vicinity.

3.2. Surveys

The findings for the different treatment plants analysed are shown below in the following table.

Table 3. Results of the survey of the different WWTPs in percentage (%)

| Malpartida de Plasencia WWTP | Torrejón el Rubio WWTP | Serradilla WWTP |
|-----------------------------|-----------------------|-----------------|
| Initial situation | Holm oak screen | Natural slope | Artificial slope | Initial situation | Holm oak screen | Screen of Arizonica plants | Stonemasonry wall | Initial situation | Holm oak screen and rockrose | Screen of Arizonica plants | Stonemasonry wall |
| Deteriorated | 8,5 | 1,2 | 3,7 | 3,7 | 4,9 | 1,3 | 1,2 | 3,7 | 14,8 | 1,2 | 2,4 | 13,4 |
| Deficient | 20,7 | 6,1 | 8,6 | 14,6 | 13,4 | 6,3 | 4,9 | 9,8 | 14,8 | 4,9 | 8,5 | 25,6 |
| Mediocre | 25,6 | 17,1 | 16,1 | 45,1 | 24,4 | 23,8 | 9,9 | 31,7 | 33,3 | 14,8 | 17,1 | 36,6 |
| Satisfactory | 30,5 | 41,5 | 45,7 | 31,7 | 47,6 | 45,0 | 42,0 | 50,0 | 28,4 | 50,6 | 42,7 | 18,3 |
| Good | 2,4 | 9,8 | 7,4 | 2,4 | 3,7 | 3,8 | 6,2 | 1,2 | 2,5 | 7,4 | 6,1 | 1,2 |
| Very good | 12,2 | 24,4 | 16,1 | 2,4 | 6,1 | 18,8 | 34,6 | 2,4 | 6,2 | 21,0 | 20,7 | 3,7 |
| Excellent | 0,0 | 0,0 | 2,5 | 0,0 | 0,0 | 1,3 | 1,2 | 1,2 | 0,0 | 0,0 | 2,4 | 1,2 |

In the case of the Malpartida de Plasencia treatment plant, figure 6 shows that the simulation made by placing holm oaks receives the highest score for visual integration into the setting, since more than 75% of the survey respondents have a positive response to this intervention. Figure 10, showing the simulation made with Arizonica species in Torrejón el Rubio WWTP, receives the highest score for visual integration into the setting, since more than 83% of the survey respondents have a positive view of this intervention. Figure 12, showing the simulation made with screen of holm oaks and rockrose in Serradilla treatment plant, receives the highest score for visual integration into the setting, since a high percentage of the survey respondents find this solution pleasing. The Villarreal de San Carlos treatment plant was not included in the study because a visual analysis cannot be made, given its underground location.

4. Conclusions

After performing the analysis of the visual impact of the treatment plants in Monfragüe NP, it can be inferred that, amongst the options studied, the underground solution is ideal because it does not have any impact on the landscape and the elements located at surface level are correctly integrated in terms of size, shape and colour. However, this option would only be feasible for municipalities with small populations and therefore other interventions are required that afford a lower visual impact on the natural environment in which the treatment plants are located.

In this regard, after examining the results of the study, it has been found that placement of vegetation (consisting of trees and bushes that are present in the area) around the perimeter of the treatment plant fence significantly reduces the visual impact of these facilities. The simulations of this kind received better visual integration ratings than the initial situation images.
In the case of treatment plants built on hillsides, adequate integration is achieved through the extension of the natural slope in horizontal areas or even cut slopes, thus allowing for a considerable decrease in the visual impact on the natural environment. The proposed solutions using elements not found in the vicinity further draw the viewer's attention, so that, even though they eliminate the views of the inside of the treatment plant, they are not suitable for the intended purpose, given that they receive mediocre ratings in general when applying both the quantitative method and in the perception surveys.

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