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JEFFREY F. McCORMICK
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City Of Grants Pass

TECHNICAL MEMORANDUM NO. 8

Water Restoration Plant Facility Plan

Solids Treatment Alternatives

FINAL

April 2014

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City Of Grants Pass

TECHNICAL MEMORANDUM NO. 8

Water Restoration Plant Facility Plan
Solids Treatment Alternatives

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SOLIDS TREATMENT ALTERNATIVES

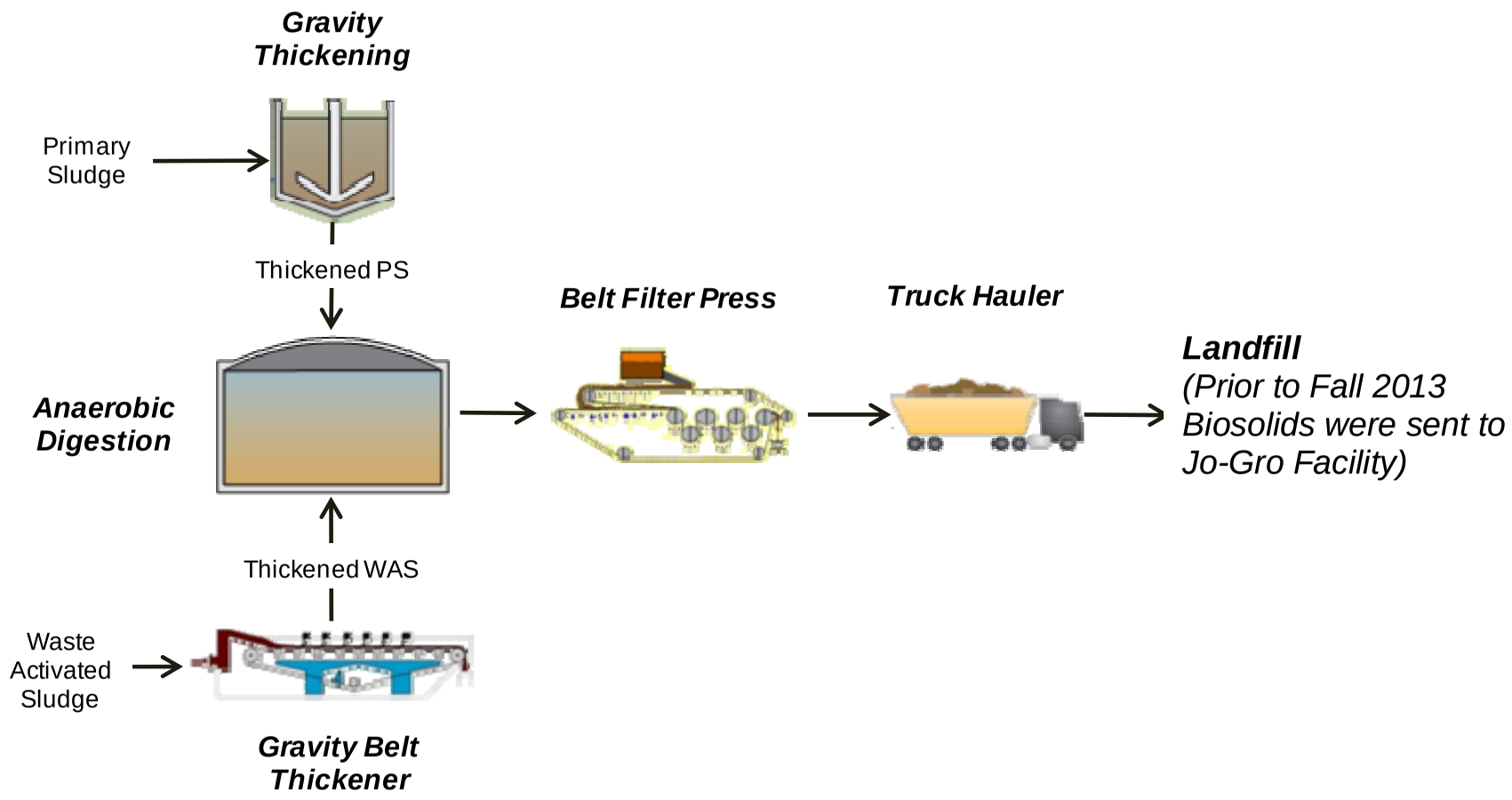
1.0 INTRODUCTION

This memorandum summarizes the solids treatment alternatives evaluated for the Grants Pass Water Restoration Plant (WRP). The evaluation included alternatives for solids treatment and biosolids dewatering and handling. Flows and loads assumed for the study are presented in Influent Flows and Loads Technical Memorandum (TM 4) (Carollo, 2013).

The WRP started as a primary treatment facility in 1935, including two small sludge digestion tanks. The WRP was upgraded to provide secondary treatment in 1962. An anaerobic digester, gravity thickener, and dewatering centrifuge were added in 1974 alongside the activated sludge treatment system. In 1975, the dewatering centrifuge was retired and a trailer mounted belt filter press was added in its place. A permanent belt filter press was added in 2003. The JO-GRO™ Composting Facility was added in 2001.

A schematic diagram of the solid stream process is shown in Figure 1. The WRP includes the following major unit process elements:

- Gravity Thickener.
- Gravity Belt Thickener.
- Anaerobic Digester.
- Belt Filter Press.



PROCESS SCHEMATIC FOR EXISTING SOLIDS TREATMENT

FIGURE 1

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

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2.0 SOLIDS LOADING PROJECTION AND DESIGN CRITERIA

The solids loading to the plant was determined based on the flows and loads analysis presented in the Flows and Loads TM. The flows and loads were input into a Biotran model calibrated with historical data and developed for the Liquid Treatment Alternatives TM (Carollo, 2013). The solids loading and flow rates calculated by the Biotran model for both annual average and maximum month dry weather conditions are summarized in Table 1. A summary of design criteria used for this evaluation is summarized in Table 2.

Table 1 Year 2035 Solids Projections
City of Grants Pass – Solids Treatment Alternatives

Parameter	Loading, ppd	Flow, mgd
Primary Sludge		
Annual Average	7,800	0.09
Maximum Month Dry Weather	10,800	0.13
Waste Activated Sludge		
Annual Average	5,200	0.08
Maximum Month Dry Weather	6,900	0.11
Digested Sludge		
Annual Average	6,600	0.03
Maximum Month Dry Weather	9,300	0.04

Table 2 Design Criteria for Existing Equipment and Processes
City of Grants Pass – Solids Treatment Alternatives

Unit Process	Value	Design Criteria	Comments
Primary Sludge Thickening			
Gravity Thickener	25 ppd/sf/day	Solids loading rate	Maximum month dry weather solids loading
WAS Thickening			
Gravity Belt Thickener	150 gpm/m(1)	24 hours/ 7 days/week	Maximum month dry weather flow
Anaerobic Digestion			
All units in service	20 days 0.15 ppd VS/day	HRT Volatile Solids Loading	Maximum month dry weather solids loading
Largest unit out of service	15 days 0.20 ppd VS/day	HRT Volatile Solids Loading	Average dry weather solids loading

Table 2	Design Criteria for Existing Equipment and Processes *City of Grants Pass – Solids Treatment Alternatives*		
Unit Process	**Value**	**Design Criteria**	**Comments**
Dewatering			
Belt Filter Press	900 lbs/hr-m	6 hours/ 5 days/week	Maximum month dry weather solids loading
Composting			
Mixing	4,000 sf	30 days	Average dry weather solids loading
Composting	2,200 cy	30 days	
Curing	2,100 cy	30 days	
Storage	1,800 cy	90 days	
Green Waste	6,400 sf	30 days	
Wood Waste	7,100 sf	30 days	
Notes: (1) gpm/m = gallons per minute per meter			

3.0 SOLIDS TREATMENT PROCESSES

3.1 Primary Sludge Thickening

Primary sludge (PS) is presently thickened in a 30-foot diameter gravity thickener (GT), constructed in 1974. At present, the mechanical system is showing severe corrosion, the concrete has exposed aggregate, and poor performance of the auger that removes sludge from the tank limits the overall performance of thickener. Current solids loading is approximately 8 lbs/day-ft^2 during maximum month dry weather conditions (MMDW). The underflow, limited by the poorly performing auger, has a total solids concentration of 3.6 percent. Figure 2 presents the capacity of the existing gravity thickener and the projected solids loadings for the planning period.

There is sufficient capacity in the current gravity thickener to process the max month dry weather sludge loadings in year 2035. However, there is no process redundancy and much of the gravity thickener is at the end of its useful life. The City has the option of constructing two new 25-foot gravity thickeners or rehabilitate the existing gravity thickener. Rehabilitation would include structural work and concrete repair in addition to replacing the sludge mechanism, auger, and pumps. Both options will provide greater solids concentrations (upwards of 5.5%) and reliable primary sludge thickening. However, process redundancy will only be achieved through constructing the new thickeners.

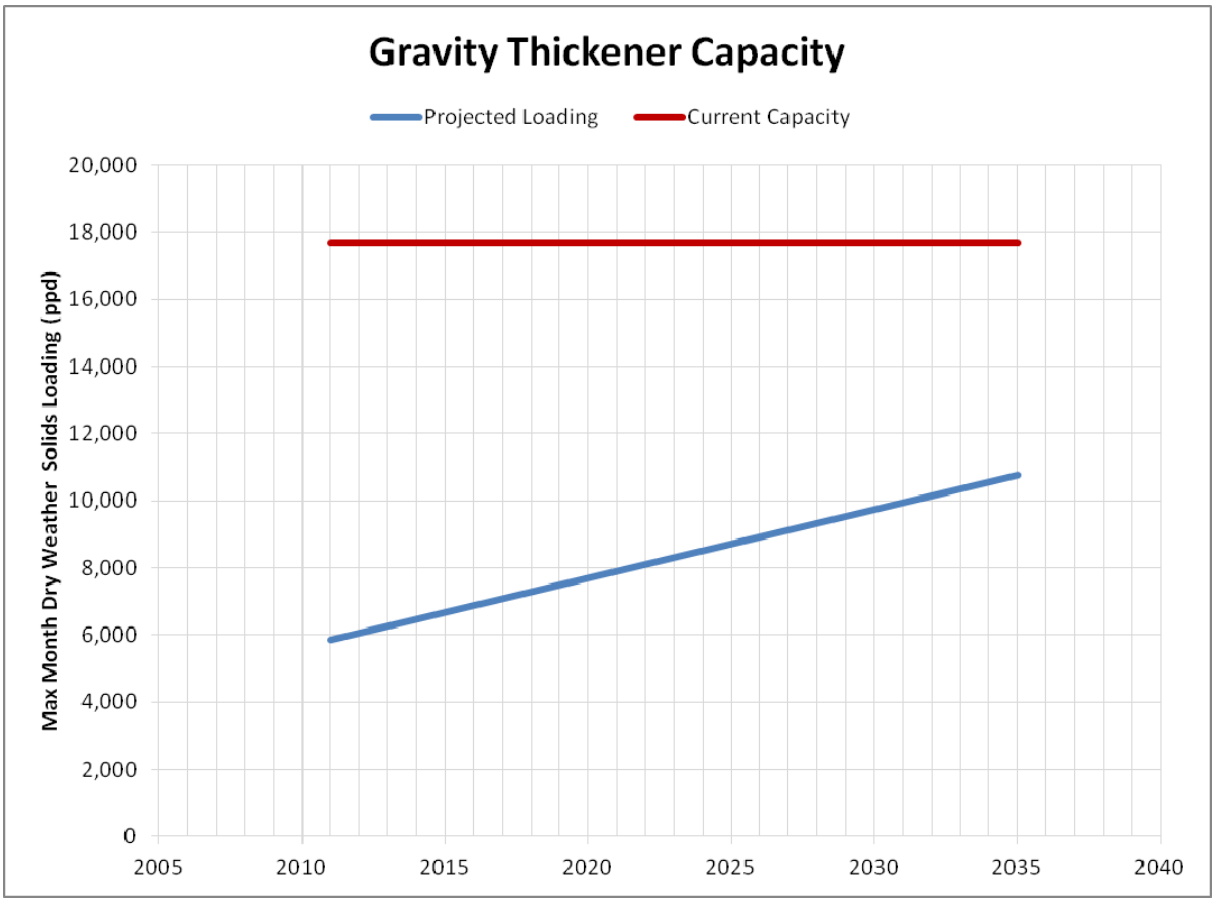


Figure 2 Existing Primary Sludge Thickening Capacity

3.2 Waste Activated Sludge Thickening

Waste activated sludge (WAS) is pumped to and thickened on a 1.5-meter Gravity Belt Thickener (GBT) installed in 1994. Current hydraulic loading is approximately 28 gallons per minute (gpm) per meter for MMDW conditions. The GBT approximately captures 95 percent of the solids and produces a solids steam with a total solids concentration, on average, of 5.4 percent. Figure 3 presents the capacity of the existing gravity belt thickener and the projected solids loadings for the planning period.

The capacity of the existing equipment used for WAS thickening is sufficient through the planning period including reasonable downtime for cleaning and routine maintenance. However, there is no redundancy for WAS thickening. In the case of the GBT failing, there is sufficient capacity in the aeration basins to store solids for one day and maintain mixed liquor concentrations below 4,000 mg/L. A pipe from the WAS line should be connected to the new Gravity Thickeners (GTs), and be used to provide solids thickening and storage as well. This would allow extended periods of equipment downtime in the case of catastrophic system failure. Given those two storage options, an additional GBT for redundancy considerations is not recommended.

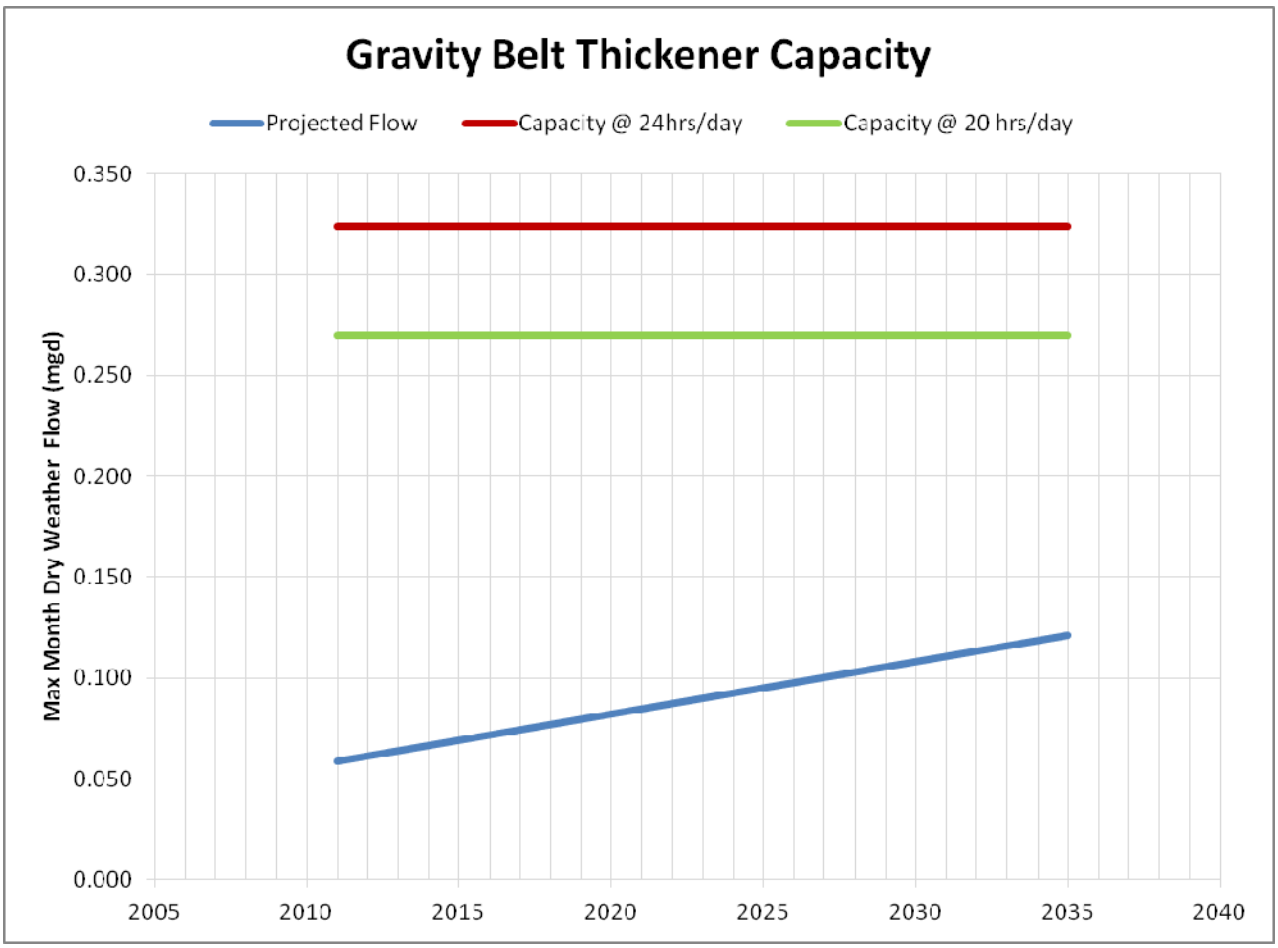


Figure 3 Waste Activated Sludge Thickening Capacity

3.3 Biosolids Production and Handling Processes

Post WAS and PS thickening, there are a number of different alternatives available for the treatment of biosolids. A number of these alternatives affect both anaerobic digestion and dewatering requirements. Therefore, recommendations for those processes will be discussed in conjunction with the solids treatment alternatives.

3.3.1 Anaerobic Digestion

There is one heated anaerobic digester on site. The digester was constructed in 1975 and is 50 feet in diameter with a maximum side water depth of 30 feet. Historically, it has volatile solids destruction of 54 percent. At present, the hydraulic residence time and volatile solids loading rate in the digester is at 15 days and 0.14 lbs/day-ft^3, respectively, during MMDW conditions. Of the two capacity conditions, hydraulic and solids, hydraulic capacity is limiting. MMDW is the more limiting weather condition. Plots of the capacities of the digester are presented in Figures 4 and 5. No redundant facilities are available for digestion.

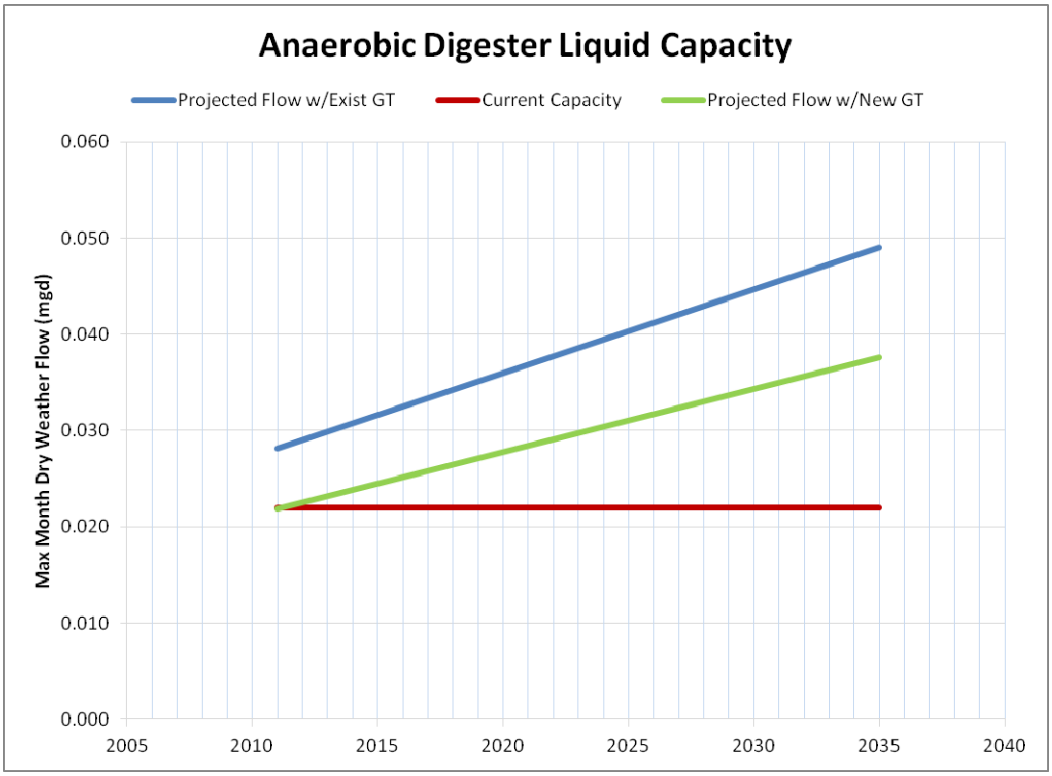


Figure 4 **Anaerobic Digester Liquid Capacity Based on a 20-Day Hydraulic Residence Time**

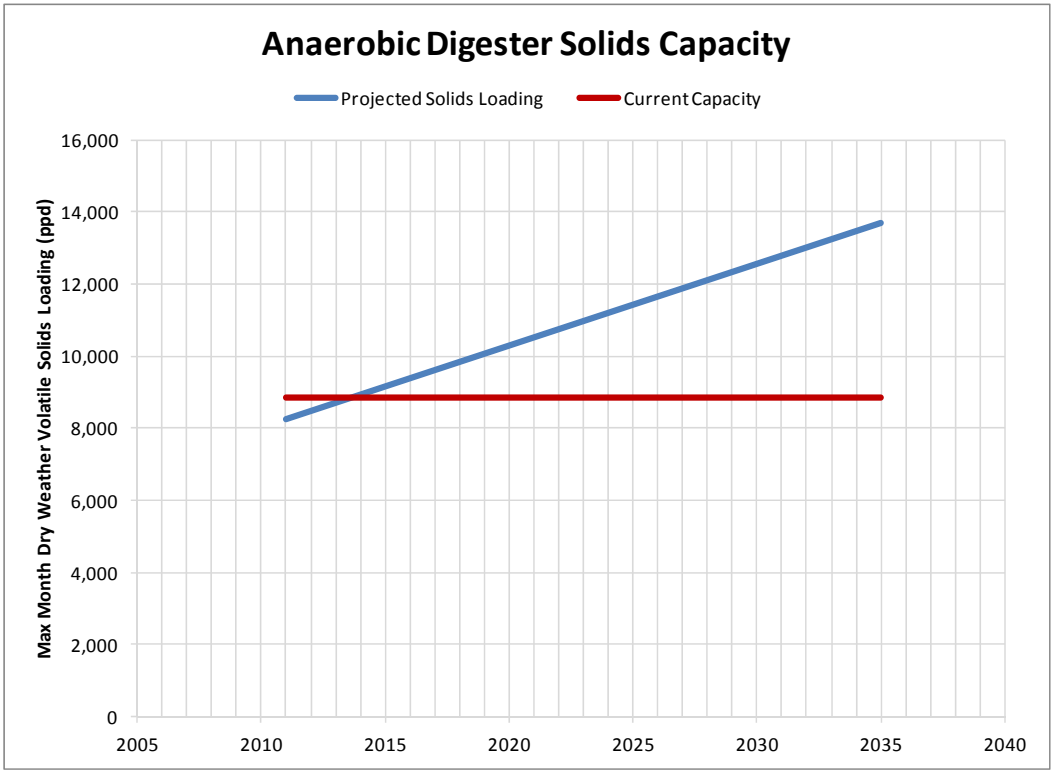


Figure 5 **Anaerobic Digester Volatile Solids Capacity Based on a Loading Rate of 0.15 Lbs VSS/cf-Day**

3.3.2 Sludge Dewatering

Digested sludge is dewatered to 13 percent total solids concentration on a 2.2-meter belt filter press (BFP), installed in 2003. Under current operation, the belt press is assumed to run 6 hours a day, 5 days a week. Solids loading is projected to exceed the capacity of the press in the year 2029. At that time, it is recommended that the City simply increase the hours of operation by the equivalent of 5 hours per week versus installing a new larger BFP or second unit. No redundant equipment is available for dewatering. However, the sludge storage tank on site can provide emergency storage. The City may require odor control if the sludge storage tank is used consistently. Additionally with some modification, the former chlorine contact basin can also be used for sludge storage. These modifications include removing slide gates to prevent accidental sludge spills into the final effluent. Hence, no new equipment is recommended for dewatering. Figure 6 presents the capacity of the existing belt filter press and the projected solids loadings for the planning period.

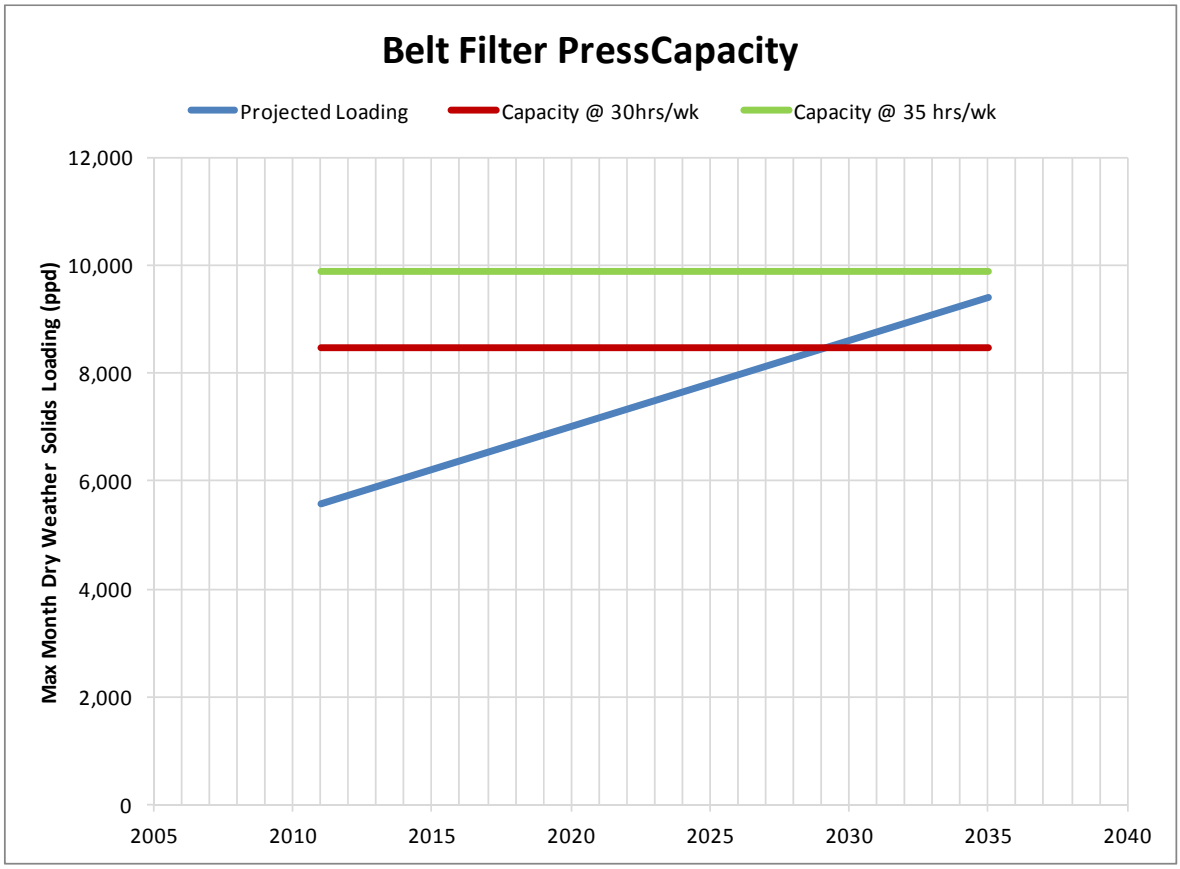


Figure 6 Belt Filter Press Solids Capacity

3.3.3 Composting

Dewatered biosolids are trucked to the JO-GRO™ composting facility and combined with green waste and undergoes the composting process for 60 to 120 days. The composting process consists of the following steps:

1. Batch Mixing:
    a. Consists of biosolids, shredded green waste, and screened returns.
    b. 3:1 to 4:1 bulking agents to biosolids ratio.
2. Extended Aerated Compost Pile:
    a. 30-day residence time.
3. Aerated Curing:
    a. 30-day residence time.
4. Screening:
    a. Screened material is taken to batch mixing process.
5. Compost Storage:
    a. 60 days, or as needed.

Both the extended aeration composting and the curing steps occur in covered areas. Existing covered storage area is used only temporarily to screen the compost product. After screening, the compost is stored in large piles around the site. Stormwater is routed and collected in an onsite stormwater pond. The operational staff rotates the compost once every 30 days in large batches. The original design intended that only a few days of on-site storage would be needed.

Capacity of the JO-GRO™ facility was determined through review of operating data, discussions with staff and modeling of the inputs and outputs of the facility. The results of the analysis are presented in Table 3 and represent approximate capacity needs based on the current operations.

Table 3 JO-GRO™ Capacity Needs
City of Grants Pass – Solids Treatment Alternatives

Process	Rated	Current	2035
Mixing	4,000 sf	6,800 sf	11,000 sf
Composting	2,200 cy	2,000 cy	3,200 cy
Curing	2,100 cy	1,300 cy	2,100 cy
Storage(1)	1,800 cy	1,900 cy	3,100 cy
Green Waste	6,400 sf	5,900 sf	8,000 sf
Wood Waste	7,100 sf	4,300 sf	6,000 sf

Notes:
1) Assumes current storage issues are resolved.

The JO-GRO™ facility is out of capacity currently for mixing area and storage. By 2035, the facility is out of capacity in every process, excluding wood waste storage. This analysis assumes that the current finished compost stockpiling issues at the JO-GRO™ facility are remedied.

4.0 SOLIDS TREATMENT ALTERNATIVES

A total of eight different solids treatment and biosolids handling alternatives were initially evaluated. They are as follows:

1. Continue Composting at JO-GRO™.
2. Landfill.
3. Class B Land Application.
4. Sludge Lagoon and Drying Bed.
5. Greenhouse Dryers.
6. Poplar Tree Farm.
7. Heated Dryer.
8. JO-GRO™ and Landfill.

Alternatives No. 4, 5, and 7 were eliminated from detailed evaluation due to concerns of efficacy and cost. The remaining alternatives are detailed below. Table 4 presents the parameters used to calculate the operational costs associated with solids treatment alternatives.

Table 4 Alternatives Analysis Parameters
City of Grants Pass – Solids Treatment Alternatives

Item	Unit	Cost	Source
Electricity	$/kWh	0.07	Derived from total monthly costs divided by kWh consumed
Natural Gas	$/therm	0.88	Rate from natural gas statement
Polymer	$/active dry pound	2.50	Calculated from Grants Pass historical data
Labor	$/hr	68	Average of total personnel for WRP
Landfill			
Hauling & Disposal	$/wet ton	40	Landfill operator quote. Price includes tipping fee.

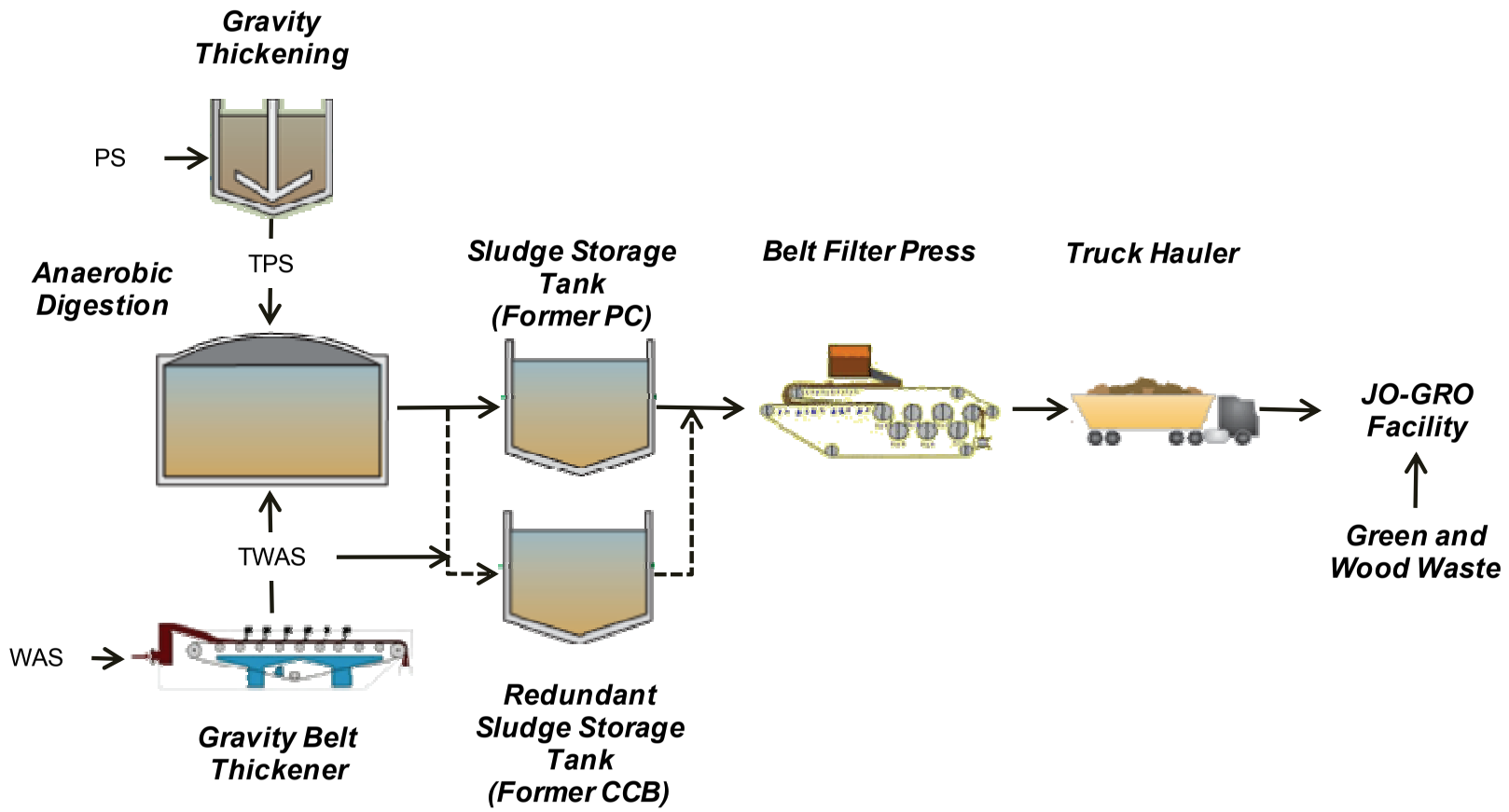
Table 4	Alternatives Analysis Parameters *City of Grants Pass – Solids Treatment Alternatives*		
Item	**Unit**	**Cost**	**Source**
Land Apply			
Western OR	$/wet ton	25	Estimate from private operator
Eastern OR	$/wet ton	40	Estimate from private operator
JO-GRO™			
Hauling	$/wet ton	9.50	Assumed 2 hour travel/loading time, 16-mile roundtrip, and 18 wet tons per load
O&M	$/wet ton	93	Historical data
Wood Waste	$/cy	2.00	Average of last three years
Green Waste	$/cy	1.70	Average of last five years
Compost	$/cy	15.00	Current price

4.1 Alternative No. 1 – Continue Composting at JO-GRO™

Alternative No. 1 assumes that the City will maintain current operations at the plant and treat biosolids at the JO-GRO™ facility. The JO-GRO™ facility is out of capacity in a number of processes as highlighted in Table 3 and is in need of expansion. The capital investment required at JO-GRO™ is approximately $2.0 million dollars and includes an expansion of stormwater treatment at the composting site, a biosolids and green waste covered mixing area, expansion of primary composting facilities, site development, and a covered finished compost area.

In addition to upgrades at the JO-GRO™ facility, Alternative No. 1 requires addressing anaerobic digestion capacity at the WRP. The anaerobic digester is currently out of capacity. A diversion pipeline to transfer a portion of WAS directly to the old primary clarifier basin will allow maximum digester capacity without process upset. Some modifications to the sludge holding tank will need to occur, including removal of the failing sludge mechanism and installation of a new mixer. The unused chlorine contact basin can also be modified by removing the baffle walls and installing mixers to allow storage of sludge during future max month conditions, or when the BFP is out of service for extensive maintenance. Treatment plant modifications, as mentioned above, will cost approximately $440,000. A simplified schematic of the proposed solids stream for Alternative No. 1 is presented in Figure 7.

There are a number of advantages and disadvantages in proceeding with Alternative No. 1. The overall advantages include maintaining the status quo in terms of both treatment operations and community benefits. However, demand for JO-GRO™ has declined and compost inventory has been increasing on site since the initiation of the price change in 2010. For JO-GRO™ to continue as a viable alternative this trend would need to be addressed. A list of the advantages and disadvantages of Alternative No. 1 is presented in Table 5.



PROCESS SCHEMATIC FOR ALTERNATIVE NO. 1 – CONTINUE COMPOSTING AT JO-GRO™

FIGURE 7

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

Table 5	Non-Cost Evaluation of Alternative No. 1 – Continue Composting at JO-GRO™ *City of Grants Pass – Solids Treatment Alternatives*	
Category	**Advantages**	**Disadvantages**
Treatment	• Familiar process • Treatment plant site not affected	• Difficult to sell compost product at current pricing scheme
Environment	• Beneficial use of Class A biosolids product	• Requires stormwater control
Community	• No change in truck traffic out of plant • Community accepts facility and compost product	

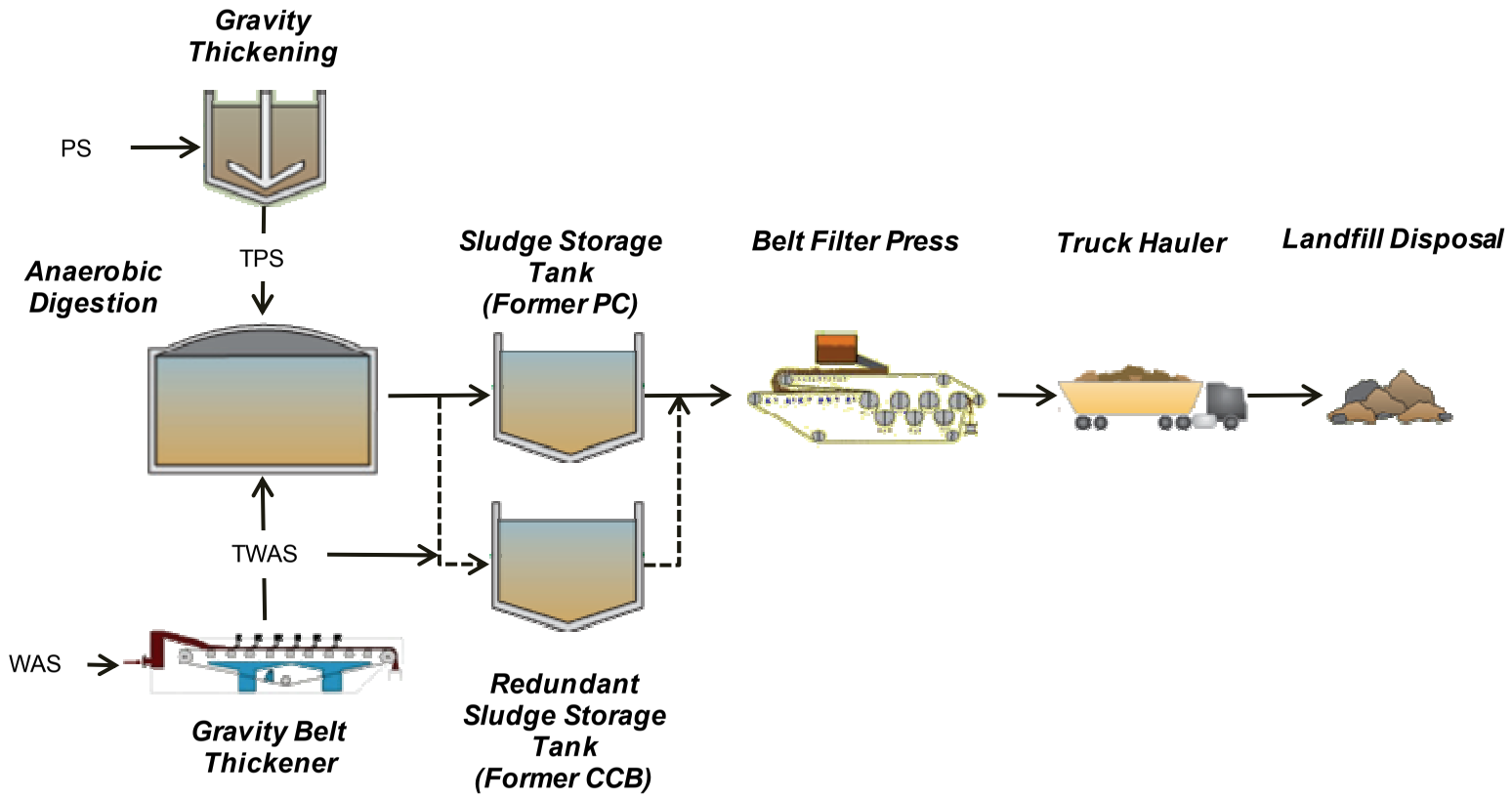
4.2 Alternative No. 2 – Landfill

Alternative No. 2 assumes that operations will continue as is, except that the biosolids will be transported to the landfill for disposal instead of producing compost at the JO-GRO™ facility. Identical to Alternative No. 1, a WAS diversion pipeline and the basin upgrades for the sludge storage tank and chlorine contact basin are required. A simplified process schematic is presented in Figure 8.

There are financial and non-financial benefits for this alternative. Financially, the capital expenditures for this alternative are minimal. They include only the $440,000 in tank mixing and piping construction projects. However, the hauling and disposal costs are controlled by outside entities, and therefore at risk for fluctuation and increase.

The non-financial benefits include maintaining future operations similar to current. The disadvantages are community and environmentally based. By landfilling biosolids, the plant is no longer producing a compost product that is environmentally friendly and enjoyed by the community. One way a benefit can still be realized with this option is if the biosolids can be used as an alternative daily cover (ADC) at the landfill. A summary of these non-cost advantages and disadvantages is presented in Table 6.

Table 6	Non-Cost Evaluation of Alternative No. 2 – Landfill *City of Grants Pass – Solids Treatment Alternatives*	
Category	**Advantages**	**Disadvantages**
Treatment	• Familiar process • Treatment plant site not affected • No significant construction	
Environment	• Beneficial use if used as ADC	• No beneficial use if land filled
Community	• No change in truck traffic out of plant	• Potential odor impact at landfill • Community loss of compost



PROCESS SCHEMATIC FOR ALTERNATIVE NO. 2 – LANDFILL

FIGURE 8

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

4.3 Alternative No. 3 – Class B Land Application

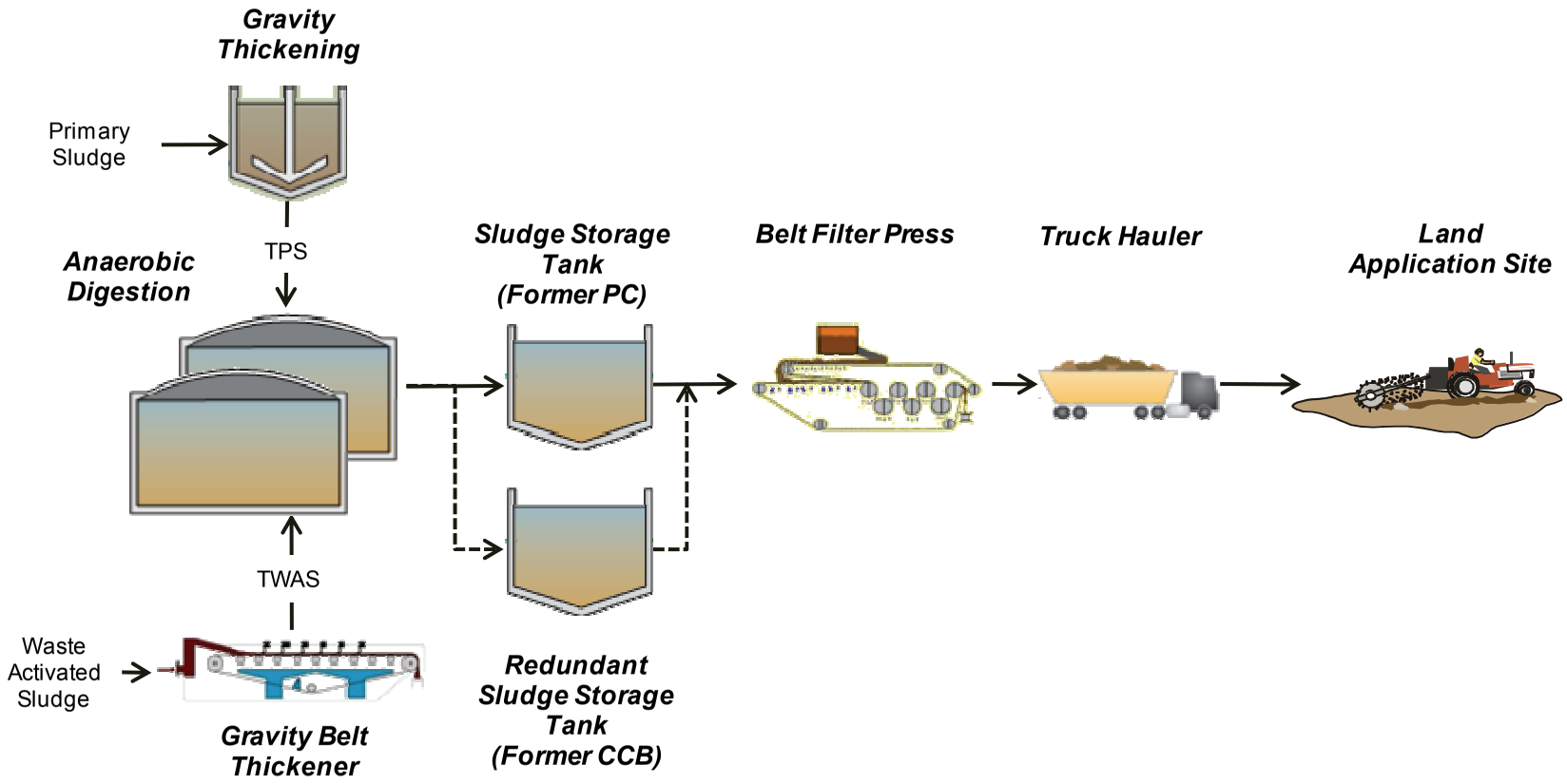
Alternative No. 3 assumes the construction of a new anaerobic digester and the ancillary facilities needed to operate a second digester, including boiler, heat exchanger system, and piping modifications. This new digester will be placed in the same location as the existing Digester No. 2. Unlike the other alternatives, this alternative does not include the WAS diversion pipeline, but it still requires the basin upgrades to the chlorine contact basin and sludge holding tank to provide sludge storage. Under this option, JO-GRO™ will no longer be operated. Instead, Class B biosolids will be land applied locally or in central Oregon. A simplified process schematic is presented in Figure 9.

This alternative requires significantly more capital investment than either Alternative No. 1 or 2. Approximately $5.1 million will need to be invested to realize the previously mentioned modifications. However, the operation and maintenance costs with this alternative are the low (similar to Alternative 2).

There are a number of non-financial advantages and disadvantages for this alternative. The primary benefit is that the operational process is similar to the current plant operation. The major disadvantages surround the unknowns around land application of the biosolids. Namely, the Class B product is not perceived by the public as positively as the JO-GRO™ compost, and there may be odor issues at the land application sites. Because of this, there may be resistance in the local area to land apply the biosolids. A list of the non-financial advantage and disadvantages are presented in Table 7.

Table 7 Non-Cost Evaluation of Alternative No. 3 – Class B Land Application
City of Grants Pass – Solids Treatment Alternatives

Category	Advantages	Disadvantages
Treatment	• Familiar process • Constructible	
Environment	• Beneficial use of biosolids	
Community	• No change in truck traffic out of plant	• Potential odor impact at land application site • Public perception of land application • Community loss of compost



PROCESS SCHEMATIC FOR ALTERNATIVE NO. 3 – CLASS B LAND APPLICATION

FIGURE 9

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

4.4 Alternative No. 6 – Poplar Tree Farm

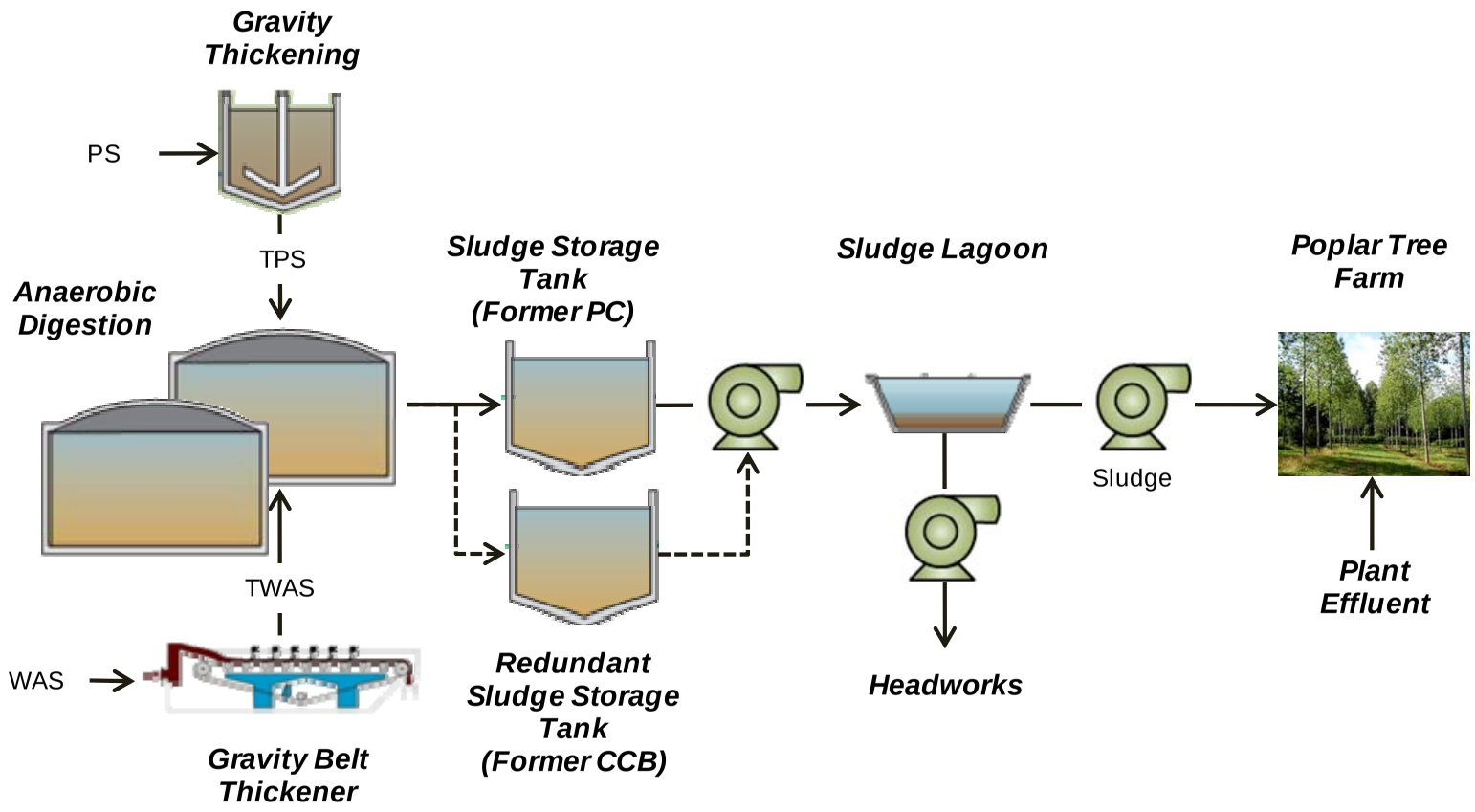
Alternative No. 6 represents the largest operational change of all the alternatives. Under this option, the JO-GRO™ facility is abandoned and in its place, a poplar tree farm is constructed at the River Reserve. A new anaerobic digester will be built to allow the production of Class B biosolids to land apply on the tree farm. The belt filter press will be taken out of service and instead the digested sludge will be pumped to a sludge lagoon where it will be allowed to settle and thicken. The lagoon solids will be land applied at the poplar farm and the separated liquid will be pumped back to the head of the treatment plant. Water for the farm will be supplied by treatment plant effluent. Identical to all the other alternatives, basin upgrades will need to take place on the chlorine contact basin and sludge holding tank. A simplified process schematic is presented in Figure 10.

The operation and maintenance costs for this alternative are low, second only to Alternatives No. 2 and 3. However, the capital expenditures necessary for this project are the highest of all the alternatives at $14.9 million. Financially, this alternative requires an investment into poplar trees; a market that is weak and historically volatile.

Non-financial advantages for this alternative include removal of dewatering at the treatment site, continued beneficial use of biosolids, beneficial use of plant effluent, elimination of biosolids trucks, and excellent public acceptance of tree farms. The disadvantages include the need for a new pipeline constructed to deliver sludge to the lagoon, return decanted liquid from the lagoon to the plant and treated plant effluent to water the farm. For this project, there will also be significant construction at the River Reserve location for the lagoon and farm. A summary of the non-financial advantages and disadvantages are presented in Table 8.

Table 8 Non-Cost Evaluation of Alternative No. 6 – Poplar Tree Farm
City of Grants Pass – Solids Treatment Alternatives

Category	Advantages	Disadvantages
Treatment	• Reduce solids operations at plant	• Major construction at River Reserve • New pipeline construction • Market for trees is small
Environment	• Beneficial use of biosolids	
Community	• Less truck traffic at plant • No visual impacts • Public perception of planting trees • Public perception of land application	• Construction noise and traffic at River Reserve



PROCESS SCHEMATIC FOR ALTERNATIVE NO. 6 – POPLAR TREE FARM

FIGURE 10

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

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4.5 Alternative No. 8 – JO-GRO™ and Landfill

To preserve the financial benefits from land filling to the City in addition to the community benefit of the JO-GRO™ compost, an eighth alternative was developed of a combination of both Alternative Nos. 1 and 2.

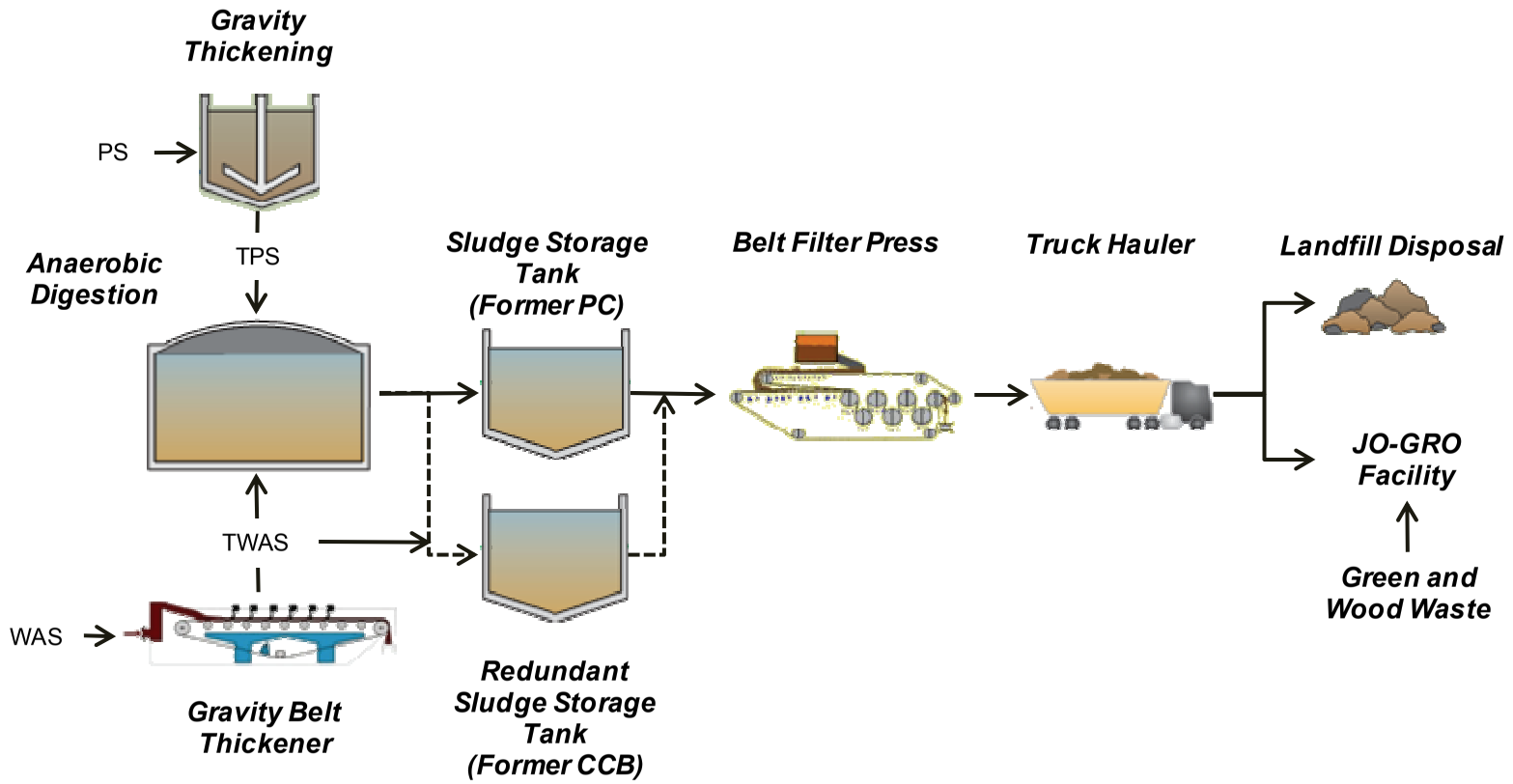
Under Alternative No. 8, the City would continue use of the JO-GRO™ facility and maximize its production capacity. Any biosolids produced at the plant in excess of what is processed at the JO-GRO™ facility would be trucked to the landfill for disposal. To accomplish this, key capital investments at the JO-GRO™ facility would need to occur, such as expansion of the stormwater system, addition of a covered mixing area, expansion of the primary composting building, and paving for more green/wood waste storage. Construction of the WAS diversion pipeline and the basin upgrades to the chlorine contact basin and sludge holding tank would need to occur as well. A simplified process schematic for this alternative is presented in Figure 11.

The necessary capital investments for Alternative No. 8 total approximately $1.5 million. The operational and maintenance costs for this alternative are between that of Alternative No. 1 and 2. The non-financial advantages and disadvantages are a combination of Alternatives Nos. 1 and 2.

Namely, operations will not change, the plant will continue to accept green/wood waste from the City, and compost product is produced. The disadvantages include the public perception and lack of environmental benefits of landfilling biosolids. Table 9 lists the non-cost advantages and disadvantages.

Table 9 Non-Cost Evaluation of Alternative No. 8 – JO-GRO™ and Landfill
City of Grants Pass – Solids Treatment Alternatives

Category	Advantages	Disadvantages
Treatment	• Familiar process • Treatment plant site not affected	• Difficult to sell compost product at current pricing scheme
Environment	• Beneficial use of Class A biosolids product	• Requires stormwater control • No beneficial use if land filled
Community	• No change in truck traffic out of plant • Community accepts facility and compost product	• Potential odor impact at landfill



PROCESS SCHEMATIC FOR ALTERNATIVES NO. 8 – JO-GRO™ AND LANDFILL

FIGURE 11

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

4.6 Overall Comparison and Recommended Alternative

As a basis of comparison, the 20-year life cycle costs for all the solids treatment evaluated are alternatives is presented in Table 10. As the construction of two gravity thickeners is common to all alternatives, it is not included in the costs presented in Table 10. The overall least-cost alternative is Alternative No. 2 and Alternative No. 6 has the highest cost. Alternatives with the lowest capital costs and operation and maintenance costs are those that include landfill of solids. The Poplar tree farm option will be removed from further consideration because of the comparatively high financial costs.

Table 10 Alternatives 20-year Life Cycle Costs
City of Grants Pass – Solids Treatment Alternatives

Alternative	Capital Cost, $M	O&M Cost, $M	Total Cost, $M
Alt 1 – JO-GRO™	$1.8	$11.1	$12.9
Alt 2 – Landfill	$0.4	$7.5	$7.9
Alt 3 – Land Apply	$5.1	$7.5	$12.6
Alt 6 – Poplar Farm	$14.9	$8.8	$23.7
Alt 8 - JO-GRO™ and Landfill	$1.0(1)	$10.2	$11.2

Notes:
1) Lower capital cost assumes eliminating storage facility.

Of the remaining alternatives, there is a significant difference in both the cost and non-cost impacts. Selecting land application or either of the JO-GRO™ alternatives allows the plant to continue to provide a service/commodity for the City. Currently there are no catastrophic issues at the JO-GRO™ facility that need to be corrected to continue to provide service. The capacity issues at JO-GRO™ can be addressed in a stepwise fashion. At any point, the City can begin landfilling biosolids if the JO-GRO™ facility reaches capacity, undergoes a catastrophic failure of equipment/facilities, or the market, maintenance, or operations cost change significantly.

Selecting Alternative No. 3 locks the City into investing into another digester and thereby commits it to pursue land application to recover capital costs through lower operation and maintenance costs. There is no driver to pursue land application when the JO-GRO™ facility is available, preferred by the community, and its present operations are not in jeopardy. However, disposing biosolids at the landfill under Alternative No. 2 provides a solution that may save approximately $5 million over the next 20 years. Based on the financial benefit, the Council decided that the City pursue Alternative No. 2.

4.7 Recommended Gravity Thickener Alternative

Four alternatives were evaluated to upgrade the gravity thickener process as summarized in Table 11. The City has the option of constructing two new 25-ft diameter gravity thickeners with 17-ft walls (Alt G1) or rehabilitating the existing 30-ft diameter gravity thickener (Alt G2). The projects would include two new progressive cavity pumps for underflow pumping and scum

pumps. Other alternatives available are rehabilitating the existing gravity thickener and constructing one new 25-ft gravity thickener (Alt G3), or rehabilitating the existing gravity thickener and adding piping modifications, small structure, and pumps to allow primary sludge to be transferred directly to the GBT to provide redundancy (Alt G4), or constructing one new gravity thickener and adding piping modifications, small structure, and pumps to allow primary sludge to be transferred directly to the GBT to provide redundancy (Alt G5). Table 11 lists both the redundancy capabilities and the capital costs for each of these alternatives.

Table 11 Gravity Thickener Alternatives Capital Costs
City of Grants Pass – Solids Treatment Alternatives

Alternative	Capital Cost, $M	Redundancy
Alt G1 - Two New Thickeners	$1.4	Yes
Alt G2 - Rehabilitate GT	$0.4	No
Alt G3 - Rehabilitate GT and One New GT	$1.1	Yes
Alt G4 - Rehabilitate GT and PS Diversion	$0.6	Yes; Through GBT
Alt G5 - One new GT and PS Diversion	$0.9	Yes

In order to landfill the biosolids, it is essential that primary sludge is digested at all times. For this reason, it is not recommended that the City purse Alternative No. G2. This option offers no redundancy and there will be times when the thickener is inoperative and unthickened sludge will have to be sent directly to the digester or aeration basin. Current digester capacity is insufficient to pride enough residence time for unthickened sludge to be digested. This would lead to highly odorous sludge that the landfill would likely not accept.

Alternative No. G3 is the recommended alternative of the remaining four alternatives. This is primarily because of cost savings associated with constructing one new gravity thickener. It is anticipated that the work needed to rehabilitate the gravity thickener would likely take it out of service for a three to four month period. The project can be phased such that contract processing of PS would not be needed during this period. Alternative No. G3 provides a consistent, reliable, and long-lasting investment as compared to the remaining alternatives. It is recommended that Alternative No. G3 be pursued immediately because the poor condition of the existing thickener.

5.0 RECOMMENDED SOLIDS ALTERNATIVE PHASING

Based on the City Council decision, the recommended alternative is to dispose of biosolids at the landfill and upgrade the necessary facilities at the plant. Phasing for this alternative is presented in Table 12. Total project cost is approximately $1,540,000.

Table 12	**Phasing for Recommended Alternative** ***City of Grants Pass – Solids Treatment Alternatives***	
Equipment	**Year**	**Project Cost, M[1]**
Rehabilitate GT and One New GT	2014	$1.10
WAS Diversion Pipeline and Mixing Upgrades	2021	$0.44
TOTAL		**$1.54**
Notes: 1) 2012 dollars.		

The recommended equipment and facilities improvements are as follows:

Gravity Thickeners. This project assumes construction of one 25-ft diameter gravity thickeners with 17 ft walls and rehabilitating the existing gravity thickener. Two progressive cavity pumps for underflow pumping and scum pumps are also included. As the current gravity thickener is in poor condition, it is assumed these would be constructed immediately.

WAS Diversion Pipeline and Mixing Upgrades. The WAS diversion pipeline includes the installation of a pipeline to provide a TWAS bypass for the digester. This pipeline would connect the GBT to the sludge holding tank. Mixer and basin upgrades would also need to occur at the sludge holding tank and chlorine contact basin to allow sludge storage to allow for catastrophic downtime for the BFP. Basin upgrades include replacing the existing sludge mechanism in the sludge holding tank with a mixer, as it is in poor condition, and removing the baffle walls and installing a mixer in the chlorine contact basin. The pipeline and basin upgrades are not necessary until year 2021.