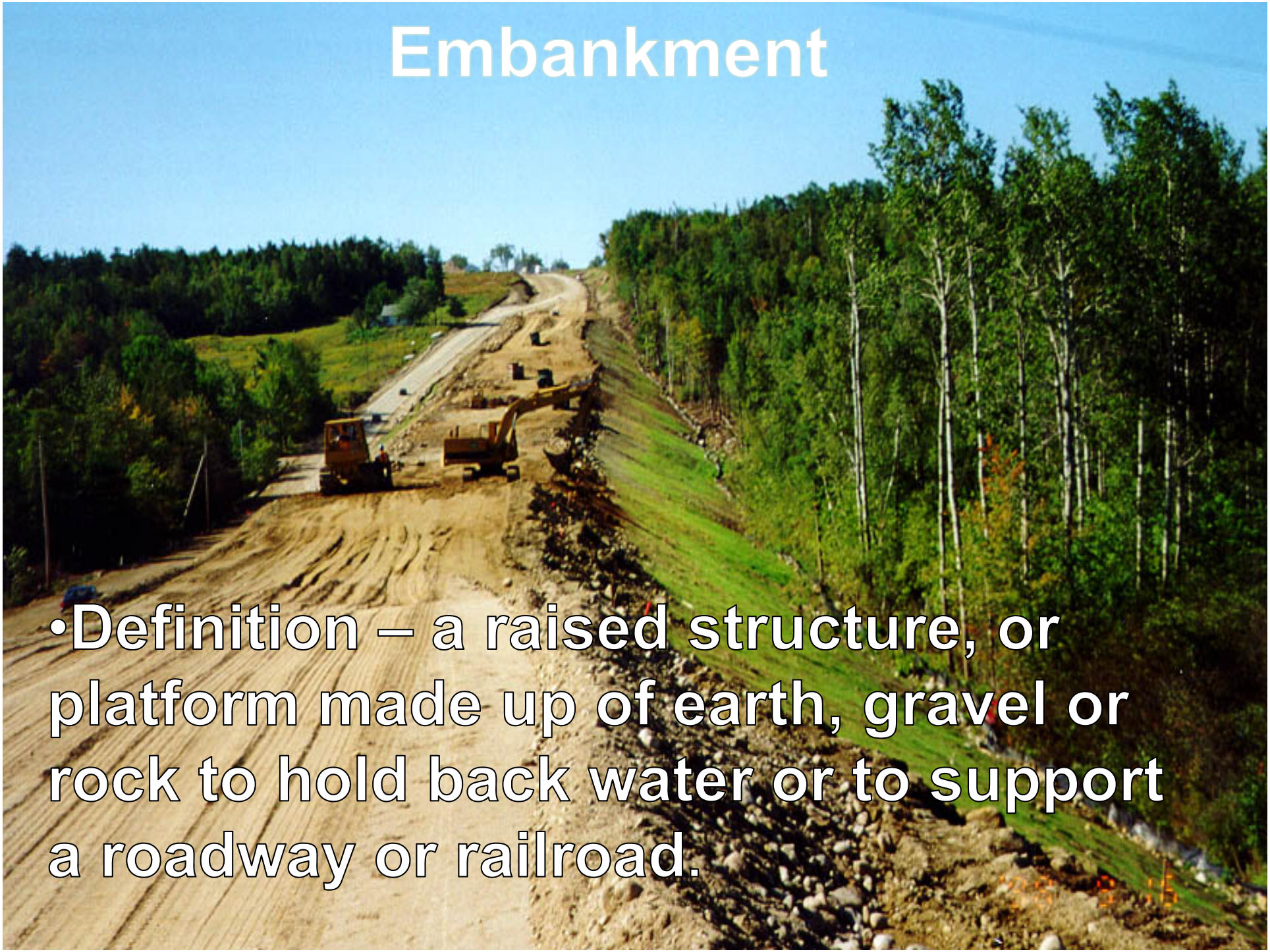

Section 203 Embankment

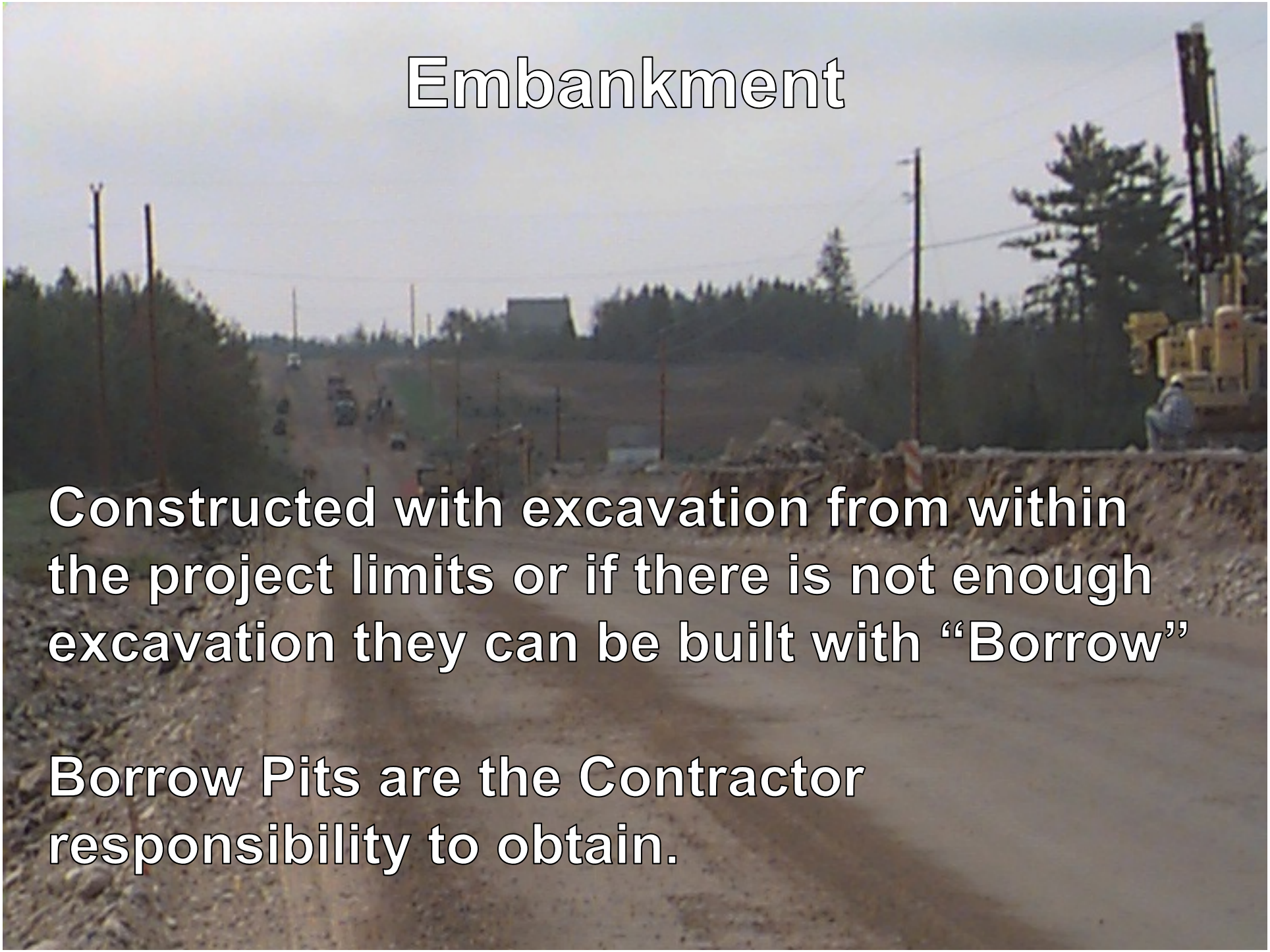
Embankment



- Definition – a raised structure, or platform made up of earth, gravel or rock to hold back water or to support a roadway or railroad.


Embankment
Three Keys to a Good Embankment
1.) Proper preparation of the foundation
2.) Use of suitable materials
3.)Proper placement and compaction of materials

Embankment



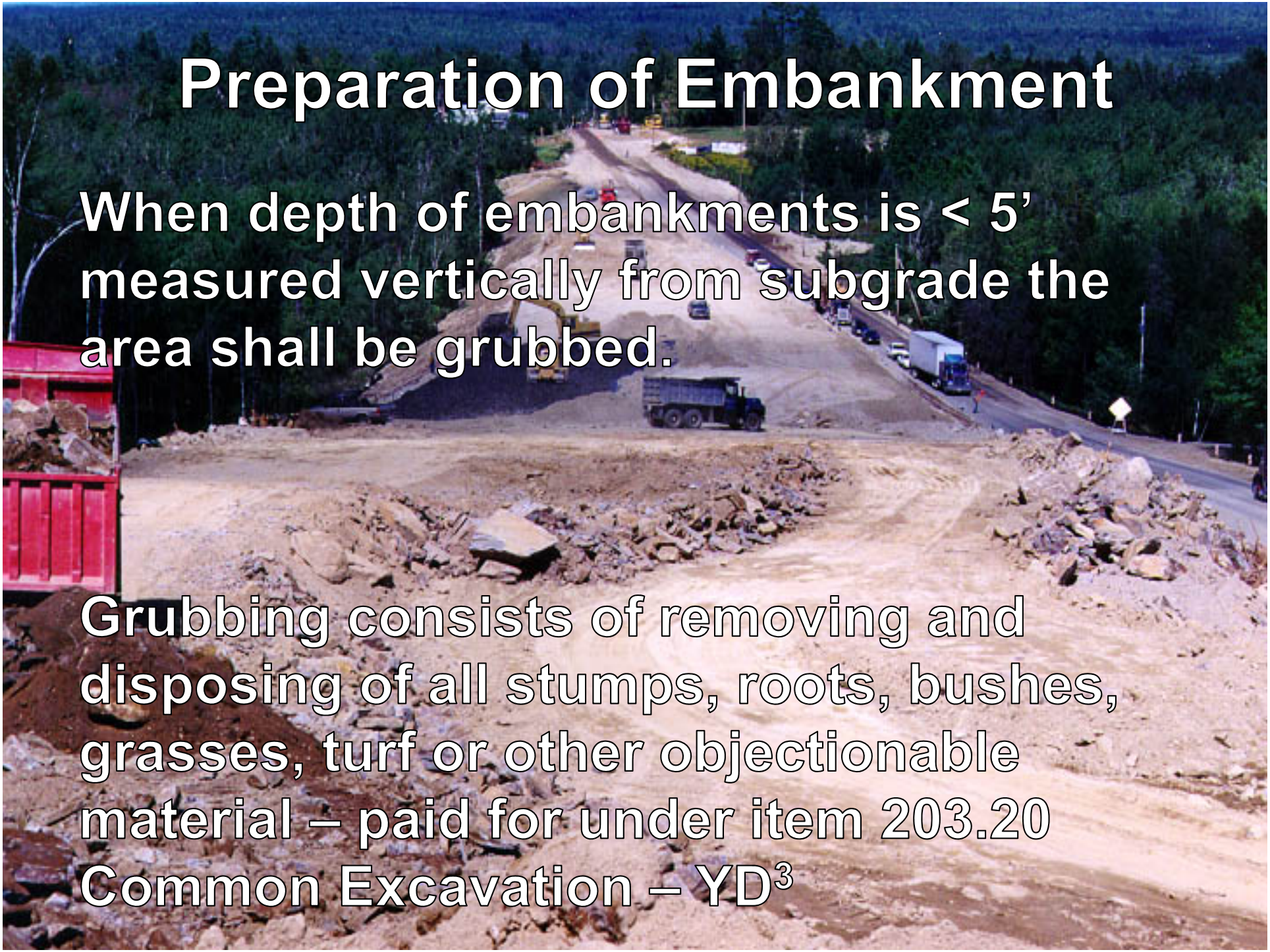
Constructed with excavation from within the project limits or if there is not enough excavation they can be built with “Borrow”

Borrow Pits are the Contractor responsibility to obtain.

Embankment

Before borrow is used – all project excavation should be used first. If borrow is used before all the excavation is completed and it is found that we have excess excavation. The excess excavation will be measured by the method deemed most appropriate and 115% will be deducted from the borrow

Preparation of Embankment



When depth of embankments is < 5’ measured vertically from subgrade the area shall be grubbed.

Grubbing consists of removing and disposing of all stumps, roots, bushes, grasses, turf or other objectionable material – paid for under item 203.20 Common Excavation – YD^3

Preparation of Embankment Cont.

When the Depth of embankment > 5’ from subgrade grubbing is not needed the vegetation shall be cut as specified in section 201 Clearing of Right-of-Way

When embankment is to be constructed against a hillside it is important to bench into the existing material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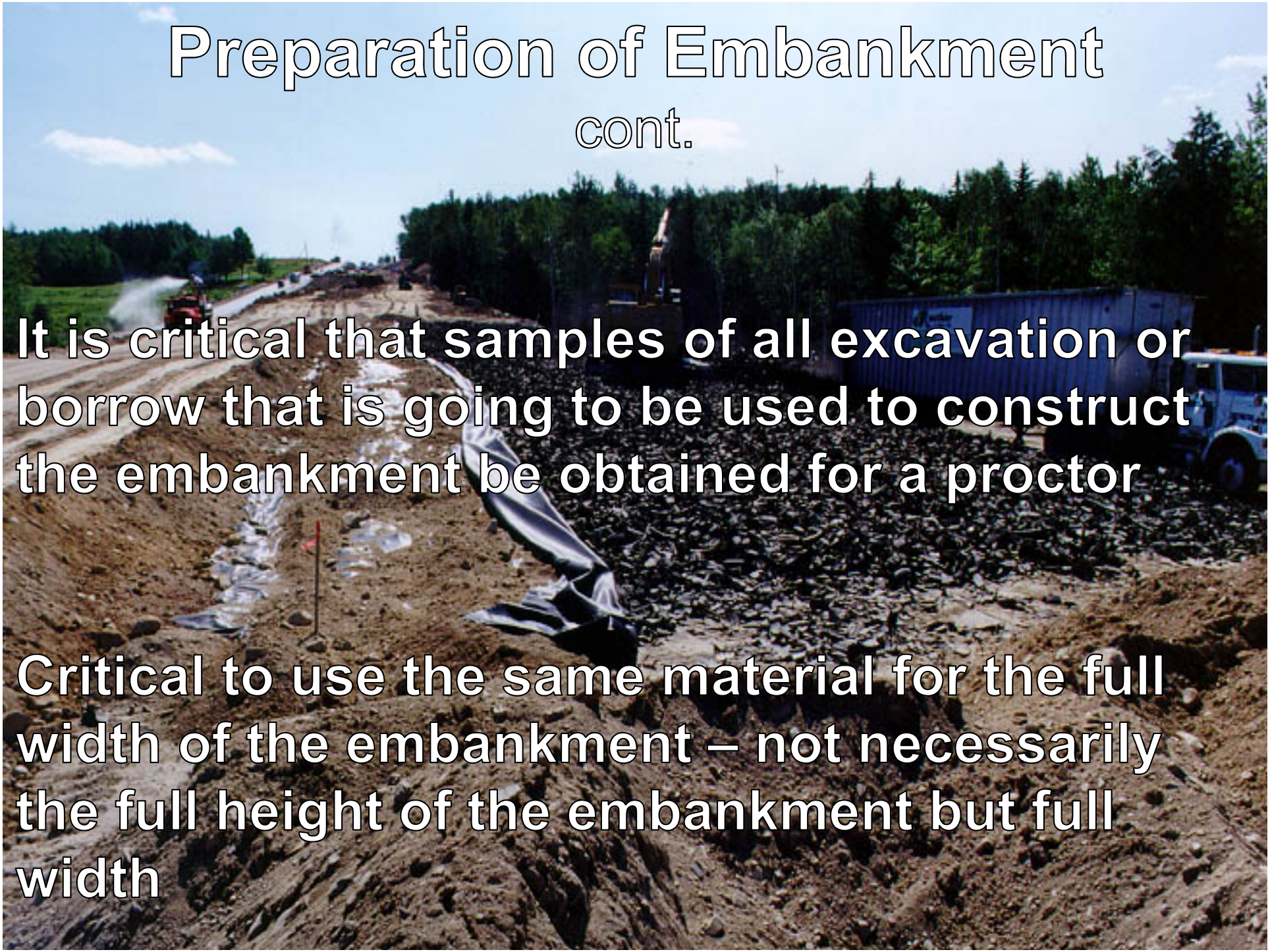
Preparation of Embankment

cont.



It is critical that samples of all excavation or borrow that is going to be used to construct the embankment be obtained for a proctor

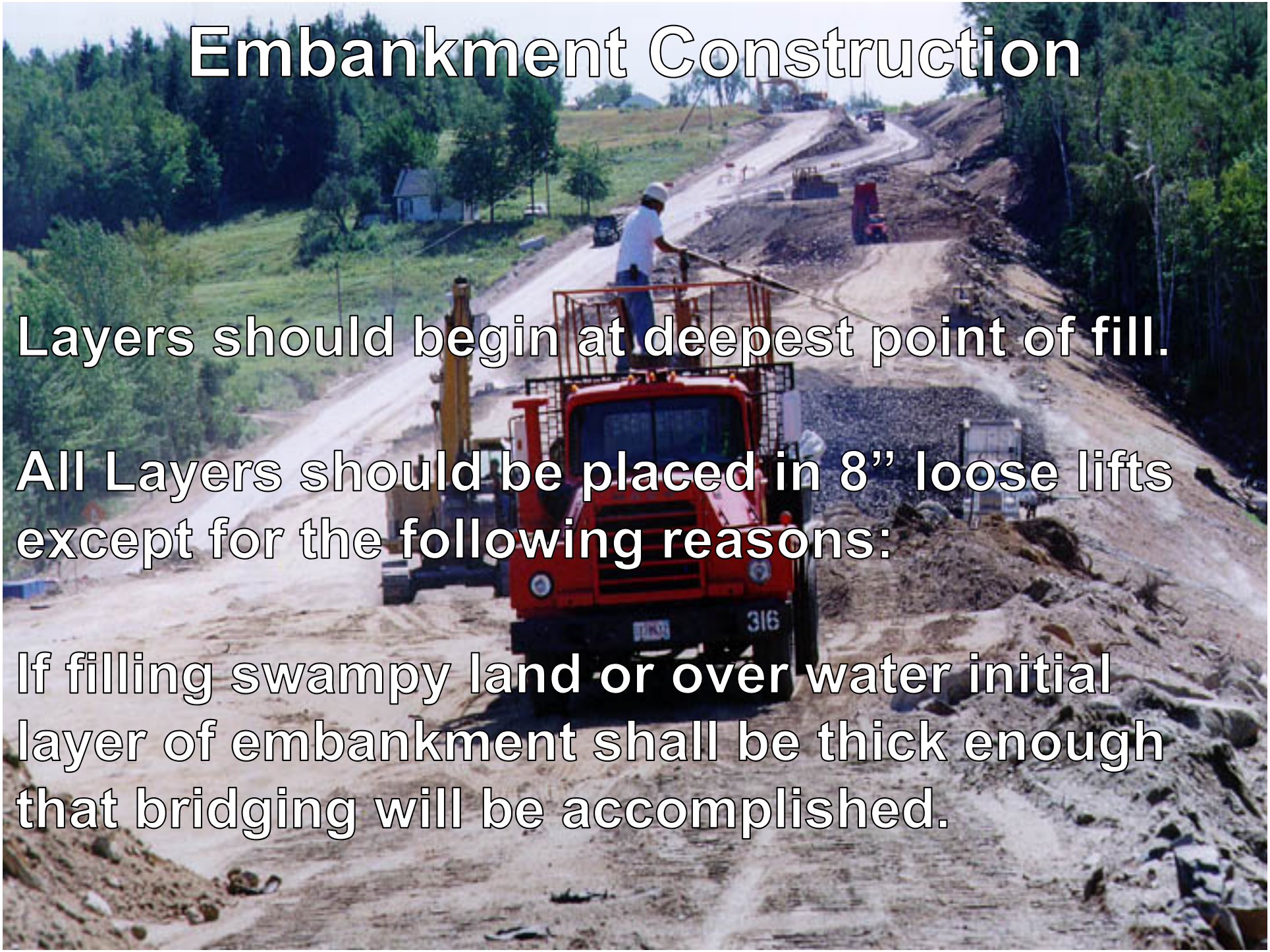
Critical to use the same material for the full width of the embankment – not necessarily the full height of the embankment but full width

Embankment Construction

Embankment should be placed at full width – but if not practical partial widths may authorized – needs to be well documented to ensure that everything gets compacted

But it is important to make sure that they are benching – cutting into previous placed embankment

Embankment Construction



Layers should begin at deepest point of fill.

All Layers should be placed in 8” loose lifts except for the following reasons:

If filling swampy land or over water initial layer of embankment shall be thick enough that bridging will be accomplished.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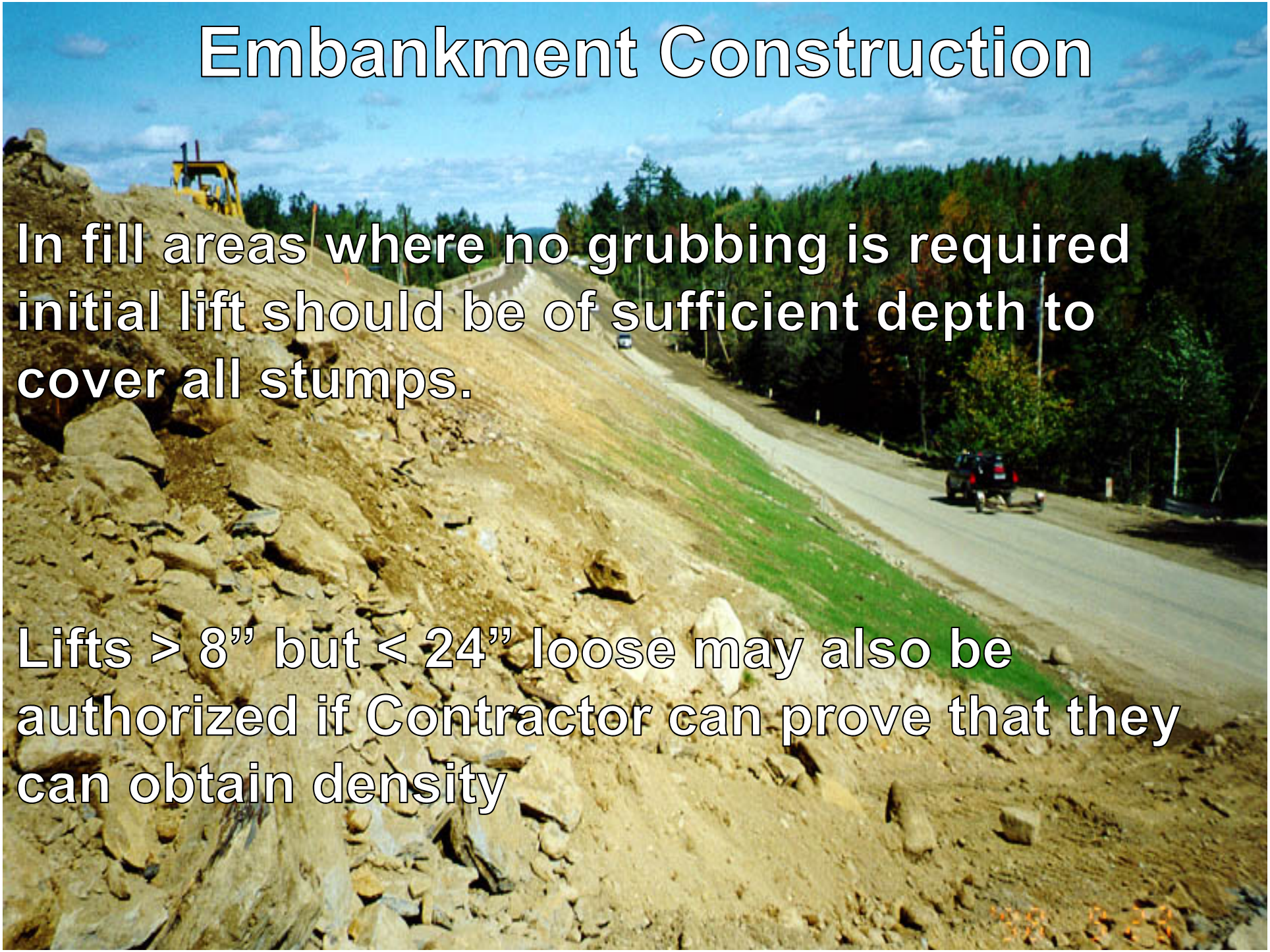
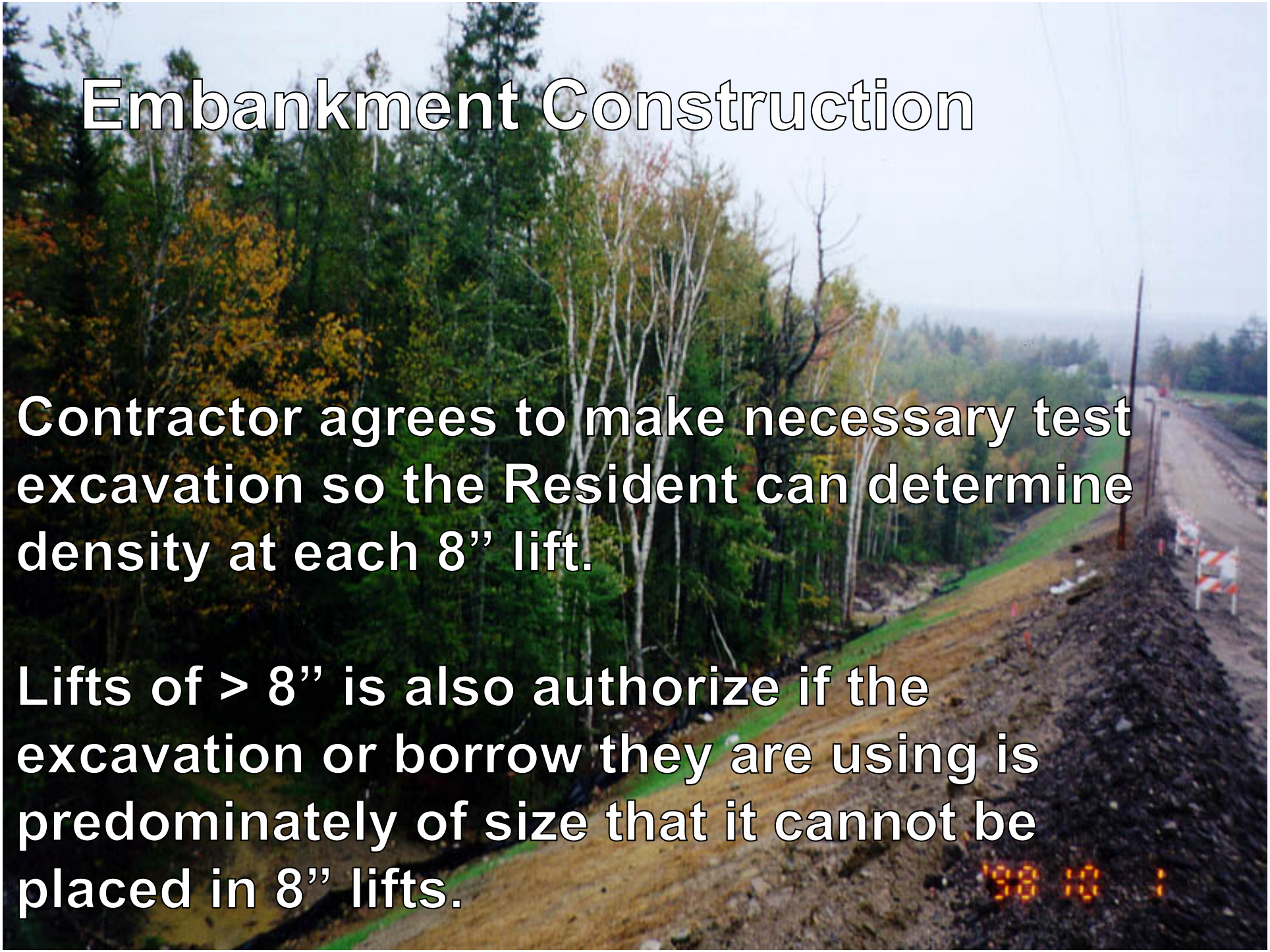
Embankment Construction



In fill areas where no grubbing is required initial lift should be of sufficient depth to cover all stumps.

Lifts > 8” but < 24” loose may also be authorized if Contractor can prove that they can obtain density



Embankment Construction

Contractor agrees to make necessary test excavation so the Resident can determine density at each 8” lift.

Lifts of > 8” is also authorize if the excavation or borrow they are using is predominately of size that it cannot be placed in 8” lifts.

Embankment Construction

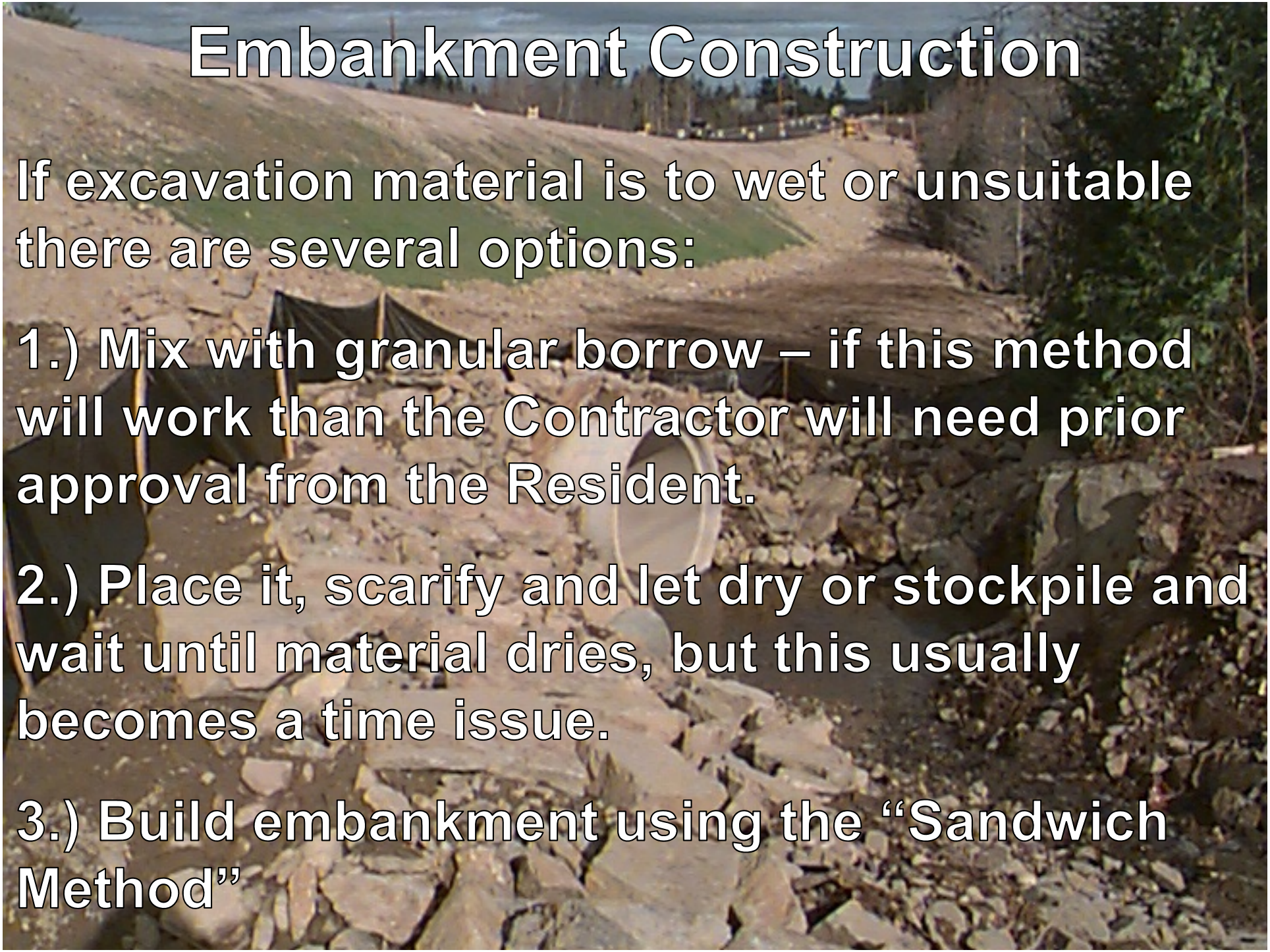
Layer size still can not exceed 24” and rocks larger than that will have to be removed and collectively placed in a rock embankment.

If the material is coming from a sectioned Borrow Pit than the oversized rock separated at the pit will need to be deducted.

Embankment Construction

If oversize rocks are separated at the embankment and place in the waster storage areas of the embankments no deduction is necessary

Waste storage areas are defined as the vertical slope extending 1 vertical and 11/2 horizontal from the edge of the finished shoulder to existing ground. Any waste material can be placed here and will be required to be compacted only to the extent that stability of the slope is assured.



Embankment Construction

If excavation material is to wet or unsuitable there are several options:

1.) Mix with granular borrow – if this method will work than the Contractor will need prior approval from the Resident.

2.) Place it, scarify and let dry or stockpile and wait until material dries, but this usually becomes a time issue.

3.) Build embankment using the “Sandwich Method”

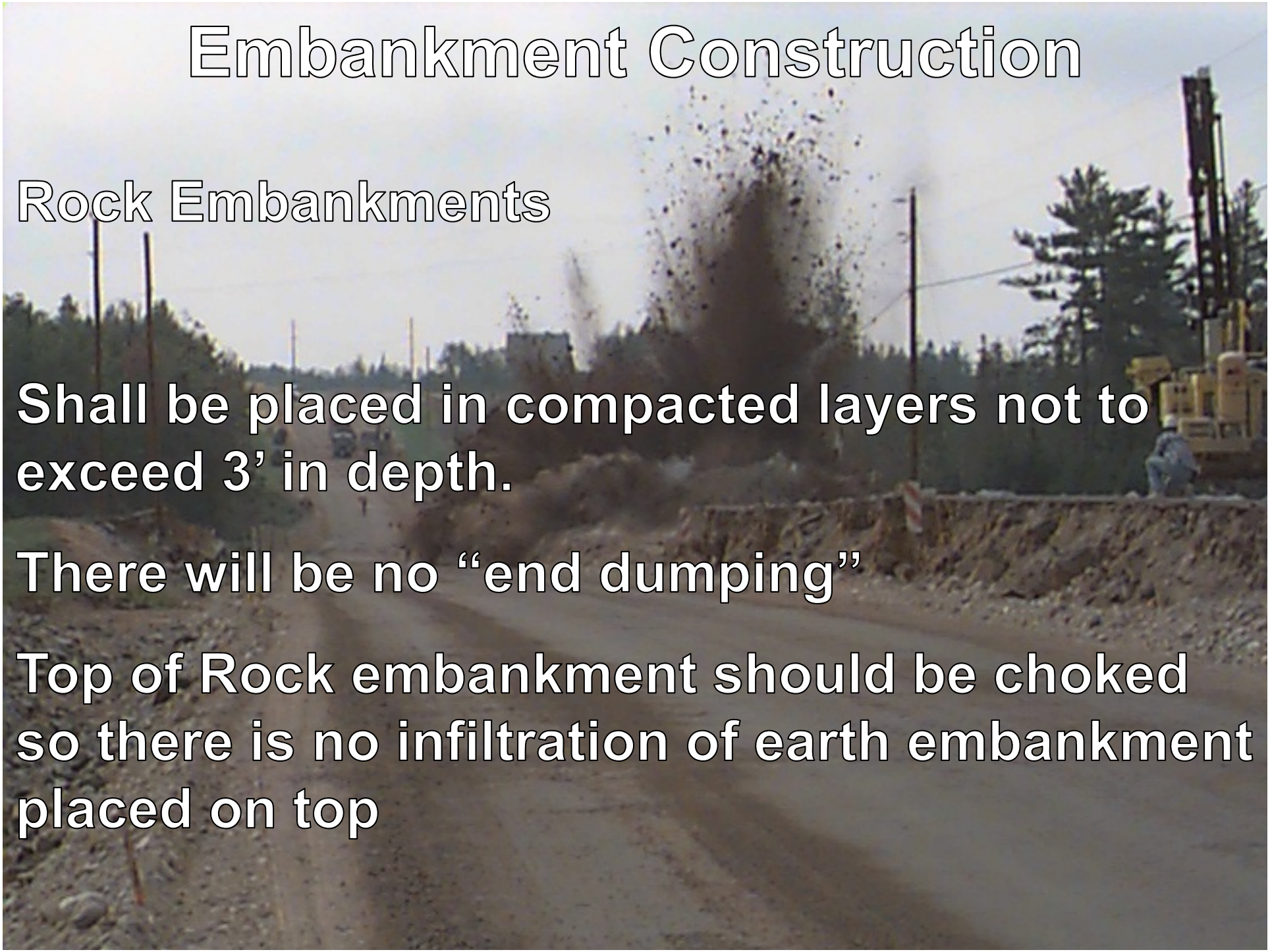
Embankment Construction

The “Sandwich” method is alternating layers of wet clays and granular materials.

The granular layers also works as a drainage layer which increase consolidation and stability.

Sometimes density can be achieve on the clay layer after the placement of the granular layer but most often when using this method the Resident will need to write a contract mod for a waiver of the density requirements of the clay layer.

Embankment Construction



Rock Embankments

Shall be placed in compacted layers not to exceed 3’ in depth.

There will be no “end dumping”

Top of Rock embankment should be choked so there is no infiltration of earth embankment placed on top

Embankment Construction

Rock Embankments will only be used in embankments greater than 4’ in depth

In no case will rock embankments be placed within 1’ of subgrade unless authorized

Rock embankment should be covered

Structures are located in Rock embankments there will be a minimum of 2’ cover of earth excavation or borrow before the placement of the rock embankments

Embankment Construction

Winter Construction

Frozen materials will not be placed in the core embankment

Construction of embankments may continue in cold weather as long as all frozen material is removed first.

If this procedure results in additional borrow the additional borrow will not be paid for.

Embankment Construction

When the temperature is below 30 degrees F all materials used in the embankment shall have a moisture content at the time of compaction = to or < than the optimum moisture content

Embankments will not be constructed on frozen material except when the total depth of the added fill, including bases + frozen material does not exceed 5’.

Embankment Construction

Frozen material may left in the embankment as long as they were compacted before freezing.

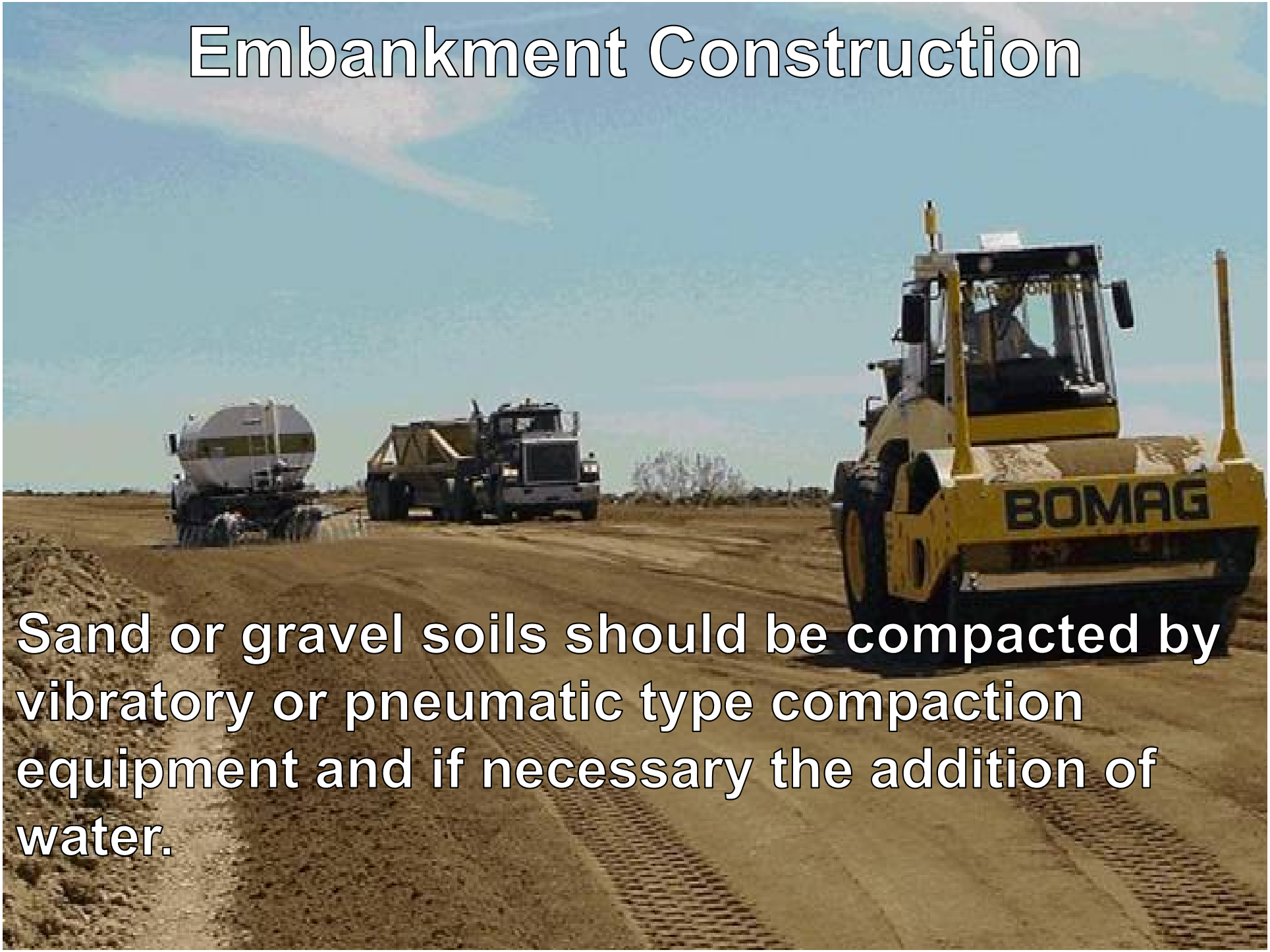
Contractor will not begin embankments again until all soils have thawed. If the Resident wants to have test holes dug to confirm the Contractor will dig, backfill and compact them at no expense to the Department.

Embankment Construction

Clay or loam soils should be compacted by a sheepsfoot or tamping type roller.

On projects with considerable borrow the contractor should be encouraged to leave long fill areas several feet below subgrade and bring them up to subgrade with entirely borrow

Embankment Construction



Sand or gravel soils should be compacted by vibratory or pneumatic type compaction equipment and if necessary the addition of water.

Embankment Construction

Rock shall not be placed in the embankment in the last 4’ finished shoulder grade in guardrail areas

Rocks, concrete or solid materials in any portion of the embankment where pilings are to be driven or utilities are to be placed.

At the end of each day , the embankment shall be graded, crowned, smoothed, rolled and sealed against infiltration of water.

Embankment Inspection

Must obtain a proctor of all material that is going to be used in the embankment

Embankments will start at the lowest portion of the fill

Lifts should be checked for proper thickness, proper crown and proper widths for that layer.

If layer method is used than a “test strip” will need to performed. Inspector will need to document type of compactor and the number of passes.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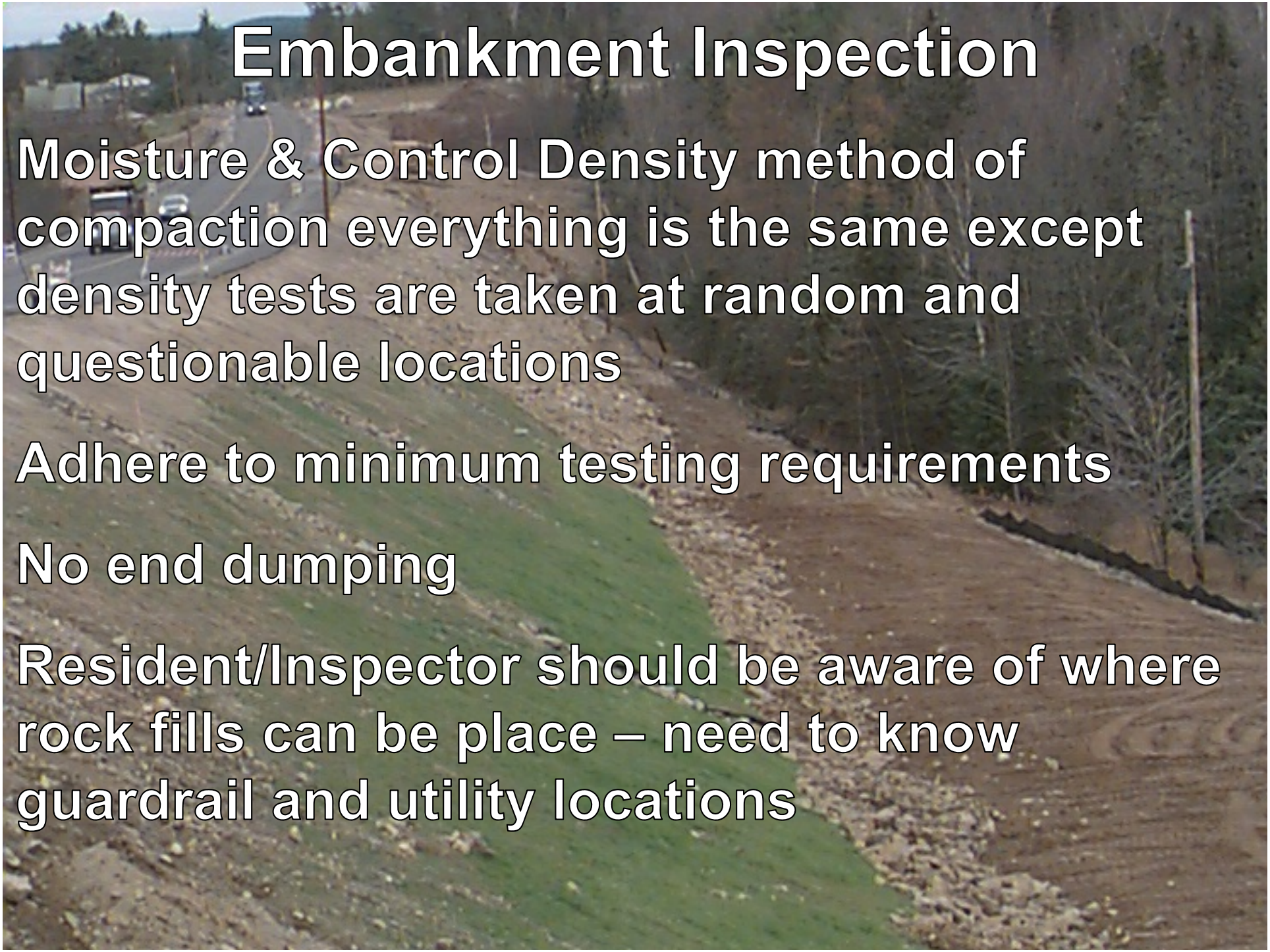
TROXLER



Embankment Inspection

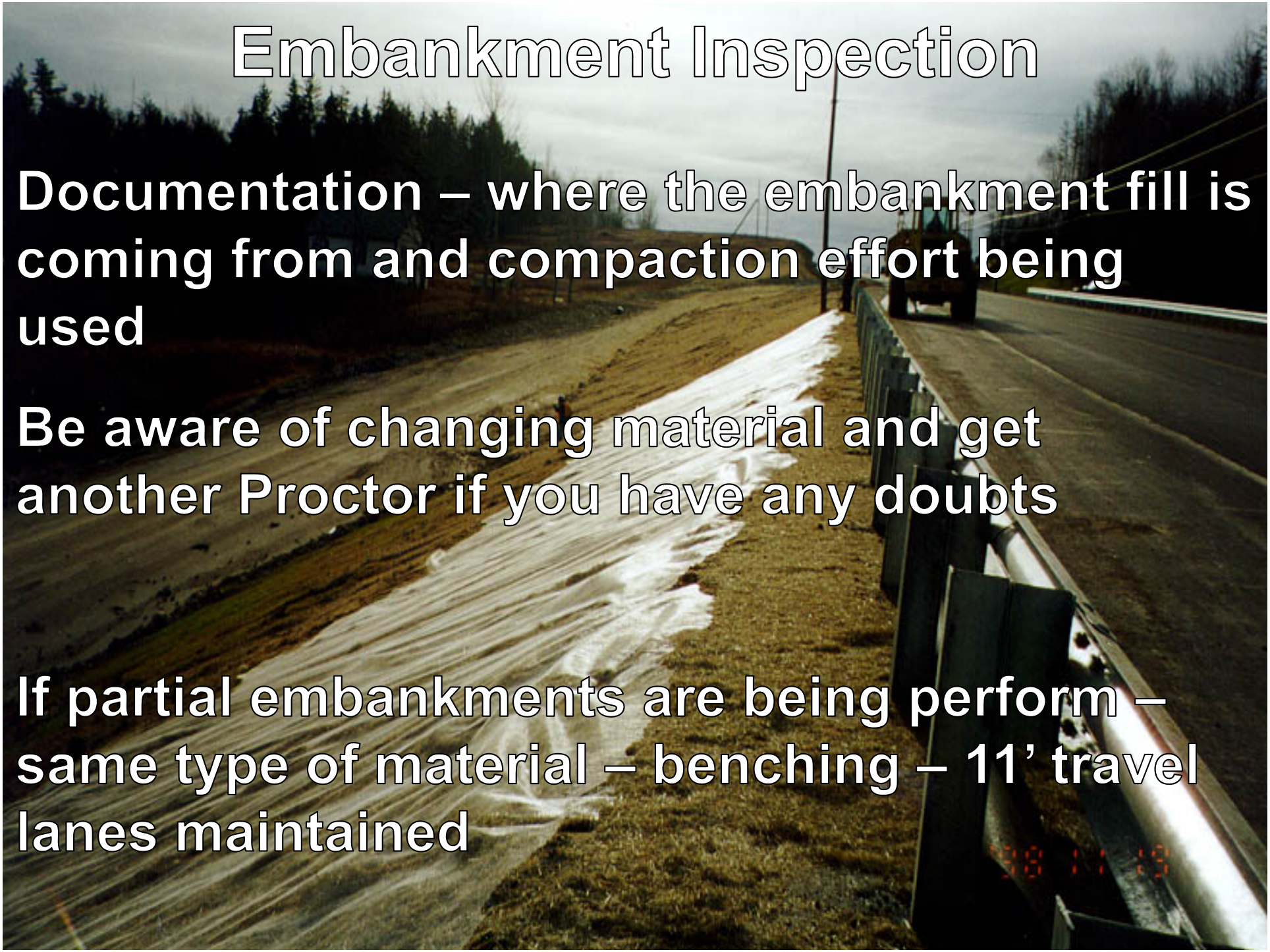
Moisture & Control Density method of compaction everything is the same except density tests are taken at random and questionable locations

Adhere to minimum testing requirements

No end dumping

Resident/Inspector should be aware of where rock fills can be place – need to know guardrail and utility locations

Embankment Inspection

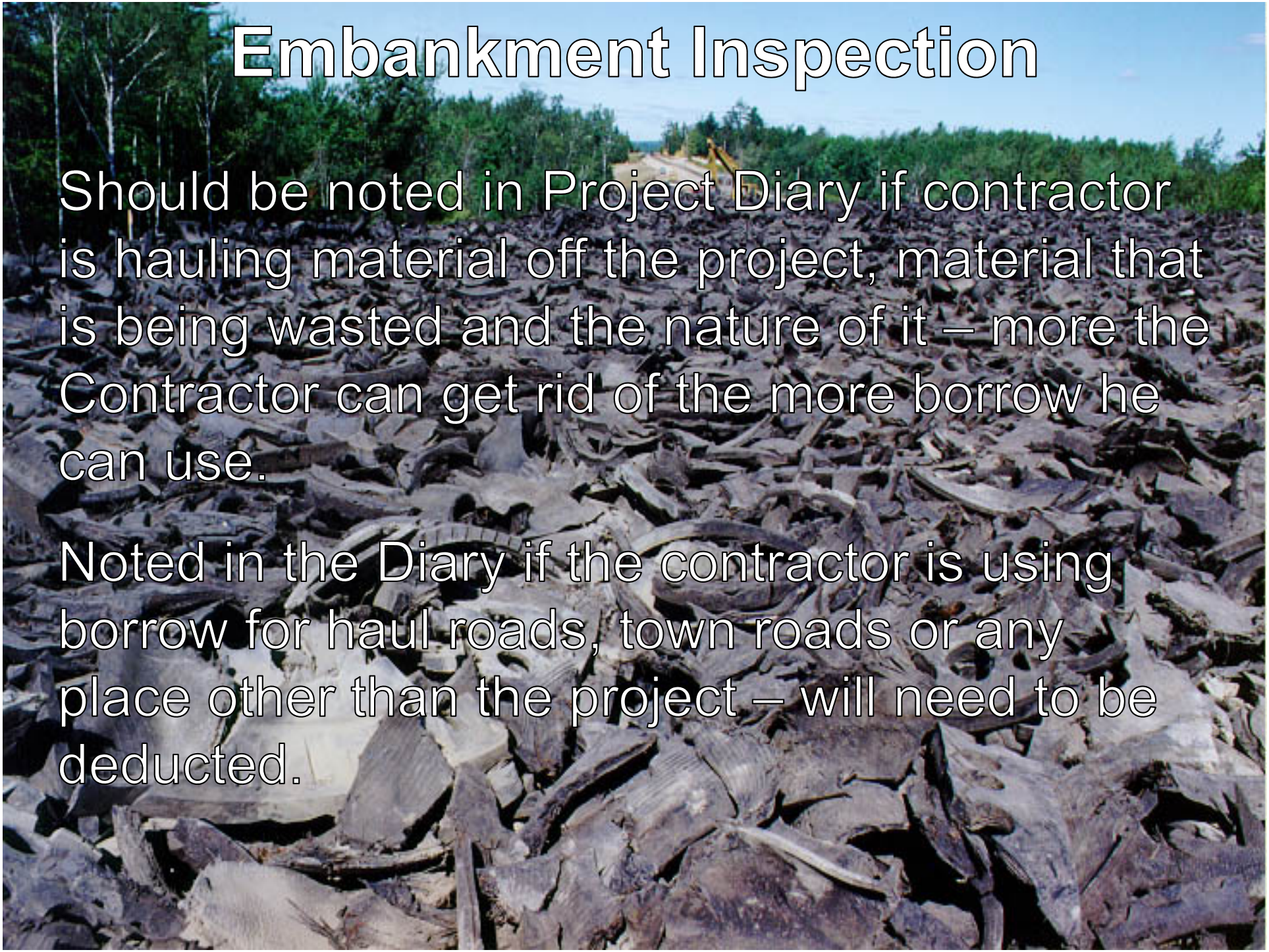


Documentation – where the embankment fill is coming from and compaction effort being used

Be aware of changing material and get another Proctor if you have any doubts

If partial embankments are being perform – same type of material – benching – 11’ travel lanes maintained

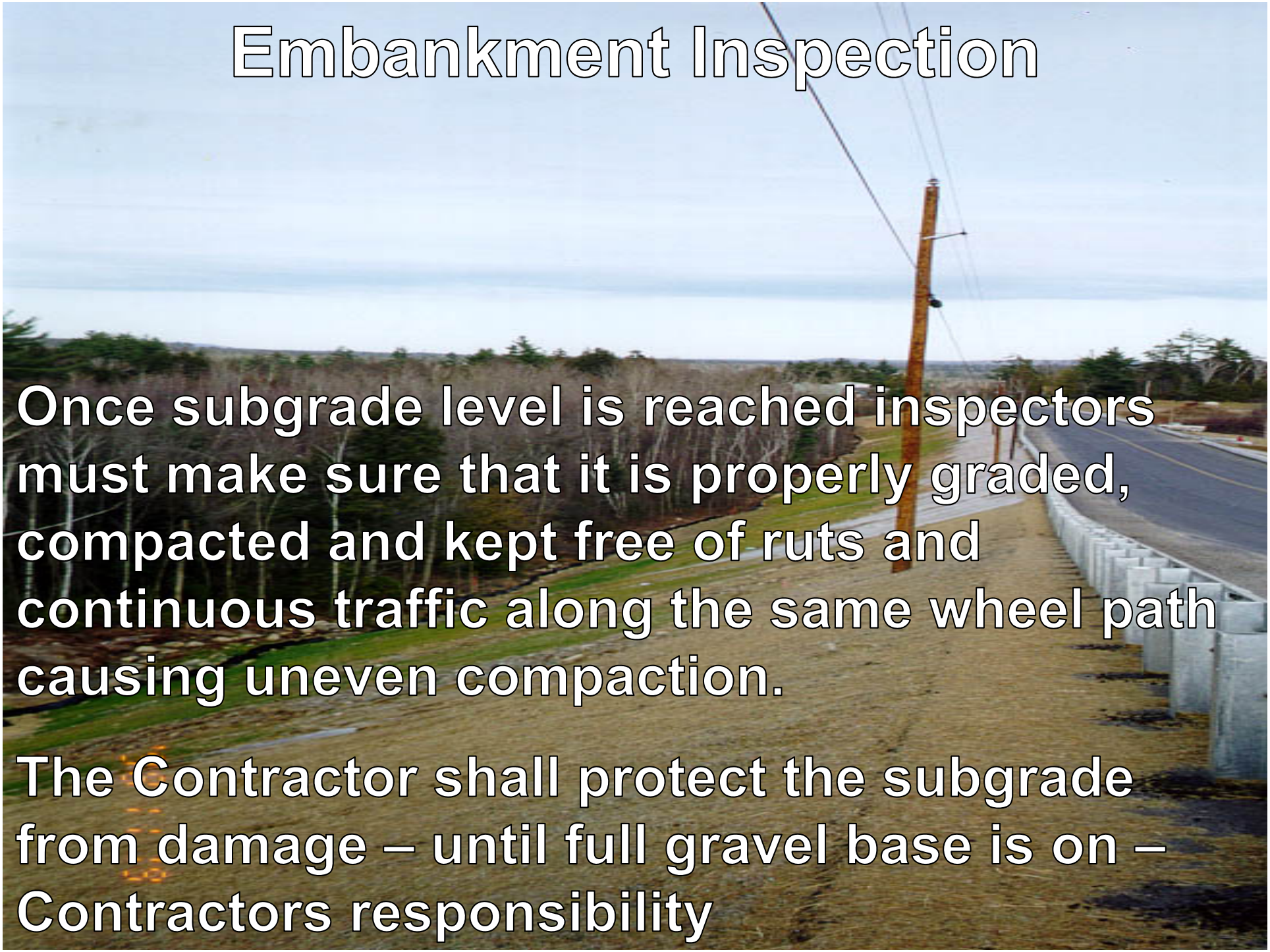
Embankment Inspection



Should be noted in Project Diary if contractor is hauling material off the project, material that is being wasted and the nature of it – more the Contractor can get rid of the more borrow he can use.

Noted in the Diary if the contractor is using borrow for haul roads, town roads or any place other than the project – will need to be deducted.

Embankment Inspection



Once subgrade level is reached inspectors must make sure that it is properly graded, compacted and kept free of ruts and continuous traffic along the same wheel path causing uneven compaction.

The Contractor shall protect the subgrade from damage – until full gravel base is on – Contractors responsibility

Embankment Inspection

- Embankments should be kept free of windrows unless water is being directed to a certain location
- Tolerances on subgrade is nothing high – 3” low as long as it drains.
- Document and record approved subgrade grade check book is needed

Subgrade Check 4874.01

T.O.S	Ditch 37.33' LT	Break 29.33' LT	20' LT	12' LT	CL	12' RT	20' RT	Break 29.33' RT	Ditch 37.33' RT	T.O.S
		-2.0%	-2.0%	-2.0%	**10+00**	-2.0%	-2.0%	-2.0%		
47'	61.33	37.33	35.00	33.00	30.00	33.00	35.00	37.33	61.33	45'
		-2.0%	-2.0%	-2.0%	**9+50**	0.0%	-2.0%	-2.0%		
47'	61.33	37.33	35.00	33.00	30.00	30.00	32.00	35.33	58.33	42'
		-2.0%	-2.0%	-2.0%	**9+00**	2.0%	-2.0%	-2.0%		
47'	61.33	37.33	35.00	33.00	30.00	27.00	29.00	31.33	55.33	42'
		-2.0%	-2.0%	-4.0%	**8+50**	4.0%	-2.0%	-2.0%		
48'	64.33	40.33	38.00	36.00	30.00	24.00	26.00	28.33	52.33	45'
		-2.0%	-2.0%	-4.0%	**8+00**	4.0%	-2.0%	-2.0%		
48'	64.33	40.33	38.00	36.00	30.00	24.00	26.00	28.33	52.33	45'
		-2.0%	-2.0%	-4.0%	**7+50**	4.0%	-2.0%	-2.0%		
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		-2.0%	-2.0%	-2.0%	**6+50**	2.0%	-2.0%	-2.0%		
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		-2.0%	-2.0%	-2.0%	**6+00**	0.0%	-2.0%	-2.0%		
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		-2.0%	-2.0%	-2.0%	**5+50**	-2.0%	-2.0%	-2.0%		
47'	61.33	37.33	35.00	33.00	30.00	33.00	35.00	37.33	61.33	45'

Subgrade Check 4874.01


Questions?