McElhanney

MCSL File # 2511-00460-0
September 29, 2014

Mr. Jaison Van Tine
Technical Services Coordinator, Parks Canada
PO Box 900, Banff AB
T1L 1K2

RE: Revegetation Criteria for Rocky Mountain House National Historic Site-Rip Rap Works 2014

Dear Sir:

McElhanney is pleased to provide the following revegetation criteria to accompany the tender documents for the 2014 rip rap works.

Alberta Environment and Sustainable Resource Development has required the following:

(a) the rock rip rap is vegetated to a density of one woody planting or greater per three square meters; and

(b) the area between the top of rip rap and the top of bank shall be planted with a mixture of native willows, deciduous trees and coniferous trees.

As this planting is a permit requirement, the Contractor will be responsible for ensuring at least 80% survivorship for one year. It is critical therefore that planting be conducted by experienced personnel, and that appropriate beaver-proofing techniques be installed concurrently with planting. Beaver foraging is a common issue at this site.

Several site-specific constraints will dictate the distribution, species and density of the revegetation.

- For much of the site, there is a clay bench which is unlikely to support vegetation, and will be covered in rip rap
- Where moist soil cannot be reached through the rip rap for planting, stakes are not likely to survive.
- Much of the site exhibits unstable, collapsing bank characteristics, which are unsuitable for most plantings except for live stakes.
- For Section 1 (230m), most of the non-rip rapped area is already vegetated.

The prescribed density, as with most projects, should be an average of the entire rip rap area. Dense plantings in areas where conditions are favourable will offset areas where planting should not or cannot occur. No required density was given for the area between the top of the rip rap and the top of bank. However, specific recommendations are provided in the text below.

McElhanney recommends that live staking coincide with rip rap placement. At the discretion of the environmental monitor, stakes can be placed where moist soil can be reached by the base of the stake for root development, and where the stems will pass through the rock interstices. Where this is not possible, high-density planting and wattle placement above the rip rap will help to achieve the 1 plant per 3 square meters requirement. Geotextile must be cut to allow growth. Where suitable soil exists, efforts should be made to plant along the top margin of the rip rap, such that a continuous band of riparian vegetation grows. See Appendix A for live staking detail.

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Several areas midslope and at the base of slope within this project exhibit significant groundwater discharge. Dessication is often the cause of unsuccessful live staking, so efforts should be made to root the live stakes within these discharge areas for maximum success. These areas are ideal for willow wattle placement (also called live fascines), provided wattles can clear the rip rap.

There are benches in some sections that are nearly horizontal. These benches should be planted at a density of one plant per square meter, including one tree per 5 square meters. Areas that are grubbed for machine access may be planted with supplemental plantings at this target density as well.

Typical species for these areas would include:

- Prickly rose (potted stock)
- Alder (potted stock)
- Red-osier dogwood (potted stock)
- Douglas fir (plugs or potted stock)
- Spruce (plugs or potted stock)
- Paper birch (plugs or potted stock)

The above species may be substituted with any native riparian species currently found in the area. While it is anticipated that all locations subject to ice scour will be rip rapped, any exceptions should only be planted with live stakes.

As mentioned in the Basic Impact Analysis, only a single row of live stakes are to be planted below any areas where the nests of bank nesting birds are present.

Plants should be monitored regularly and watered as needed during the first year to ensure 80% survivorship by the end of the first year. If 80% do not survive **for any reason**, supplementary planting must be undertaken to reach the 1:3 ratio prescribed by Alberta Environment within the rip rap, and as prescribed above for the remaining bank area.

All planting should take place with minimal ground disturbance. No seeding as advised at this time, as the soil should contain sufficient seed base. If erosion control is needed, certified weed-free straw can be used to stabilize the soil temporarily.

In order to satisfy the aforementioned planting requirements from Alberta Environment, estimates of plant numbers were compiled by McElhanney, and are detailed in Appendix B. It was assumed that one meter of area above the rip rap would be plantable on average in Section 1. Given the steepness, it is assumed that only willow stakes would be appropriate in this section. Further, 100 square meters was predicted as a maximum area of impact for machine access.

For Section 2, approximately 170m had about 7m on average between top of bank and top of rip rap, while the remainder of Section 2 had approximately 2m of steep sloughing bank, which could be planted with live stakes. For the entirety of Section 2, we assumed at least 2 meters was steep sloughing bank that would best be planted with live stakes at one stake per square meter. The remainder is to be planted with trees and shrubs (one tree and four shrubs per 5 square meters).

Total estimates for required planting are:
2334 Live stakes
840 Shrubs
210 Trees (eg. Douglas Fir, Paper Birch, or Spruce)

These areas will be more specifically measured before and after works, to better estimate areas required to be planted in order to comply with Alberta Environment's requirements. These numbers should be considered a best estimate that may increase or decrease according to field verification. Unit pricing is

therefore recommended, and must include appropriate measures to protect the plants from beaver predation.

Yours truly

John Summers, PBiol, RPBio
McElhanney Consulting Services Ltd.

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Site Photos:

Photo 1: Upstream view from midpoint of works. This is a suitable bench and upper slope for supplementary planting, where vegetation does not currently exist. The eroded lower bank may be staked with live stakes or willow wattles only.

Photo 2: Clay and gravel substrate at midpoint of works. This is an example where significant groundwater outflow exists. The margin above the clay would be suitable for staking or willow wattle placement.

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Photo 3: Downstream view of downstream extent of works location, from top of bank. This illustrates an eroding bank that is not suitable for potted plants or trees. This area should be planted with live stakes or wattles. Areas with bank nests are to be planted only with a single row of live stakes.

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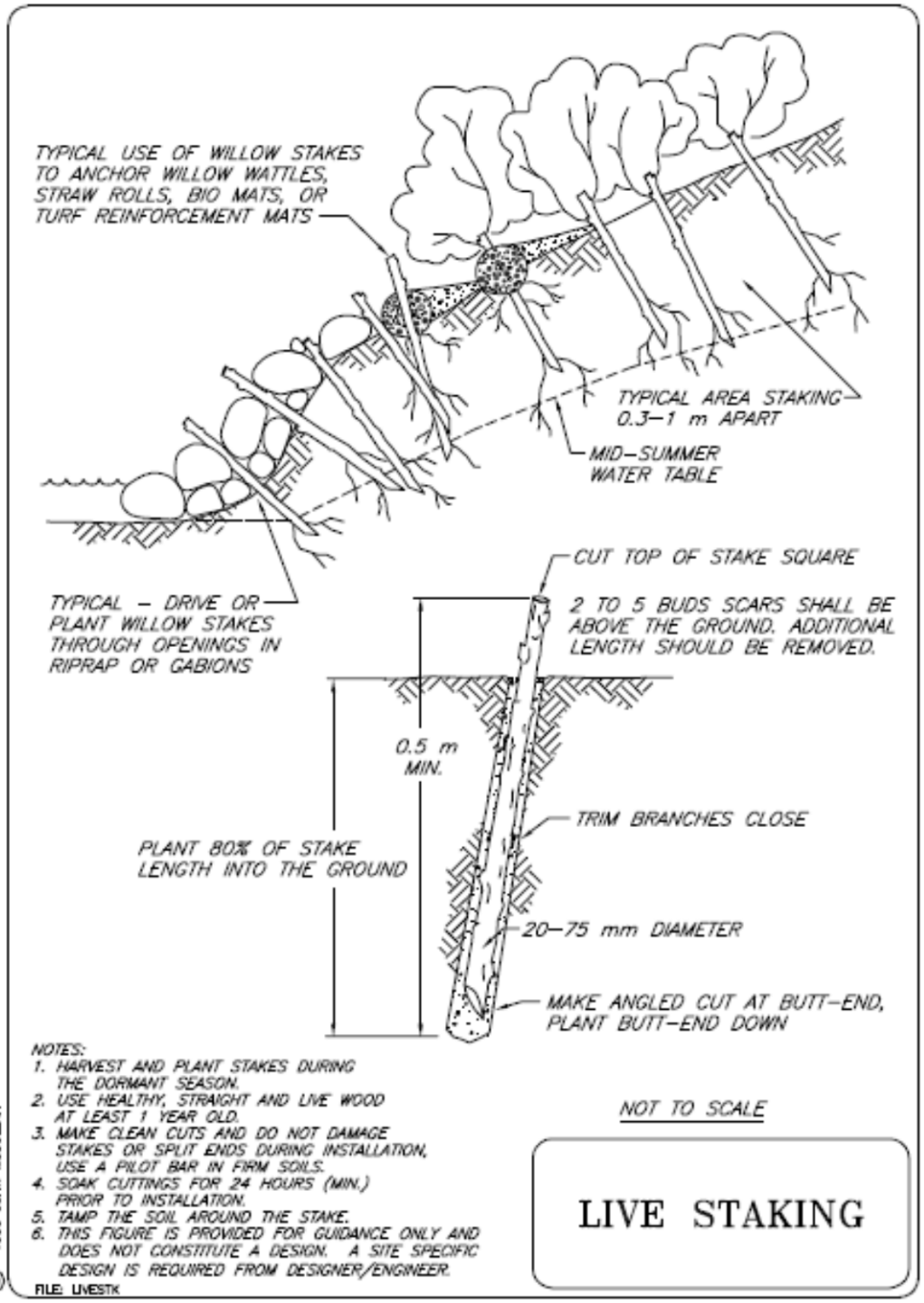
APPENDIX A: PLANTING REQUIREMENTS FOR LIVE-STAKING AND WATTLES



Drawing from Alberta Transportation, Erosion and Sediment Control Manual, 2011.

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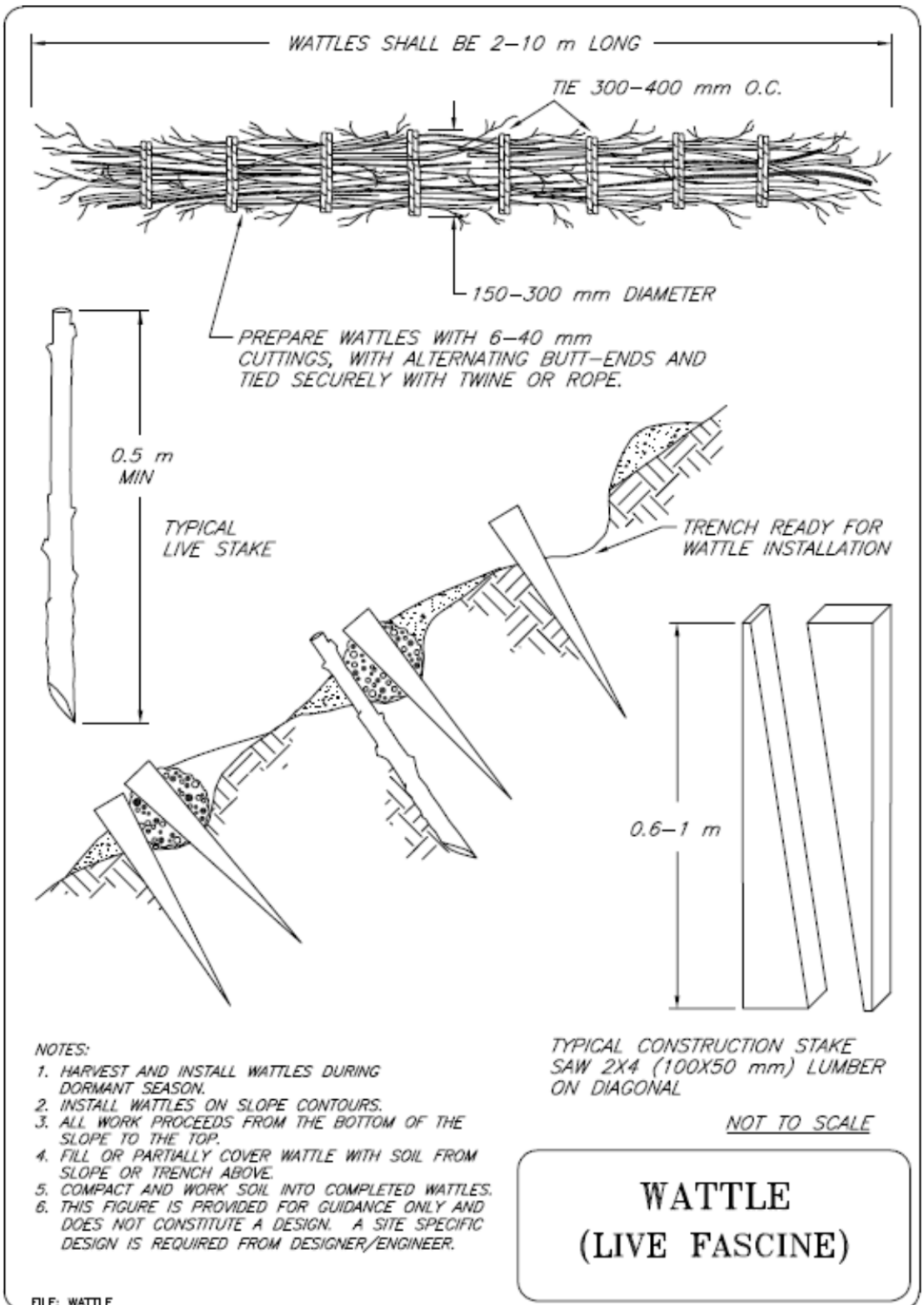

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Planting Recommendations for Installing Wattles:

1. Plants must be dormant at the time of cutting, averaging between 15 and 30cm in diameter;
2. Willow, red-osier dogwood and cottonwood should be used;
3. Excavate small trench a minimum of 15cm deep and 15cm wide across the width of the slope, perpendicular to the slope; starting at the toe and working up;
4. Space trenches 2 – 3m apart
5. Place wattles in the trench ensuring maximum contact; place wattles end to end in the trench to avoid any spaces;
6. Use a live stake or wooden stake, with maximum 1m spacing between stakes to anchor wattle in place; one stake should be placed through the middle of the wattle and the other on the downslope edge of the wattle to a minimum depth of 30cm;
7. Place soil from trench excavation of the upslope side

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APPENDIX B-PLANTING ESTIMATES

	Section 1	Access Restoration	**Section 2**	Access Restoration
Length (m):	230		430	
Est. surface area(m2):	780	100	2263	100
3:1 Live staking	260		754	
Est. Plantable area below TOB, above rip rap	460	100	1698	100
live staking 1:1	460		860	
Additional Area for trees and shrubs		100	850	100
Shrubs		80	680	80
Trees (1 per 5m2)		20	170	20
Total Live Stakes:	2334			
Total Shrubs	840			
Total Trees	210			

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